A Comprehensive Analysis of Infrastructure Linkages and Multipliers for Australia

Soroush Sedaghat

School of Systems, Management and Leadership
Faculty of Engineering and Information Technology
University of Technology Sydney

This dissertation is submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy (Infrastructure, Energy Policy and Planning)

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Dedicated to

My Beautiful Wife,

My Wonderful Children

and

My Dearest Grandson Koa Julian

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CERTIFICATE OF AUTHORSHIP/ ORIGINALITY

I certify that the work in this thesis has not previously been submitted for a degree, nor has it been submitted as part of the requirements for a degree, except as fully acknowledged within the text.

I also certify that the thesis has been written by me. Any help that I have received in my research work and the preparation of the thesis itself has been acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

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Soroush Sedaghat B.Sc. Engg. (Hons), M.Sc. Comp. (Hons)

Sydney, Australia

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List of Abbreviations and Acronyms

ABARE	Australian Bureau of Agricultural and Resource
ABIX	Australian Business Intelligence
ABS	Australian Bureau of Statistics
ACCC	Australian Competition and Consumer Commission
ACT	Australian Capital Territory
AEMC	Australian Energy Market Commission
AER	Australian Energy Regulator
ANAO	Australian National Audit Office
ANZSIC	Australian and New Zealand Standard Industrial Classification
APGA	Australian Pipelines and Gas Association
APPEA	Australian Petroleum Production & Exploration Association
ARCADIS	A global design, engineering and management consulting company
ASIOT	Alternative Scenario Input-Output Table
ATIC	Australian Trade and Investment Commission
AU	Australia
AUD	Australian Dollar
AWRC	Australian Water Resource Commission
BC	Base Case
BCA	Business Council of Australia
Bcf	Billion cubic feet
BCSIOT	Base Case Scenario Input-Output Table
BITRE	Bureau of Infrastructure, Transport and Regional Economics
BL	Backward Linkages
BL-CI	Backward Linkages Concentration Indices
BL-H2	Highest Contributor to Backward Linkages
BL-I	Backward Linkages Important Coefficients
BL-LI	Backward Linkages Less Important Coefficients
BL-MIC	Backward Linkages Most Important Coefficients
BL-PF	Backward Linkages Primary Factors
BREE	Bureau of Resource and Energy Economics
C-COV	Comparable Coefficient of Variance
CEDA	Committee for Economic Development Australia
CGE	Computational General Equilibrium
CL	Complementary Linkages
COAG	Council of Australian Governments
Col-MIC	Backward Linkages Most Important Coefficients
COM	Coal-to-Oil
ComLAW	Federal Register of Legislation
COV	Coefficient of Variation
CPI	Consumer Price Index
CPM	Carbon Pricing Mechanism
CSG	Coal Seam Gas

CSIRO	Commonwealth Scientific and Industrial Research Organisation
CSM	Coal Seam Gas
CTL	Coal-to-Liquid
CTRE	Centre for Transportation Research and Education
CW	Chenery-Watanabe
CWA	Climate Works Australia
DEA	Data Envelop Analysis
DEE	Department of Energy and Environment
DFAT	Department of Foreign Affairs and Trade
DGI	Data Gaps Initiative
DIIS	Department of Industry, Innovation and Science
DIRD	Department of Infrastructure and Regional Development
DITR	Department of Industry Tourism and Resources
DNRM	Department of Natural Resources and Mines
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
ED	Exports-Dominant
EIA	Energy Information Administration
ENA	Energy Network Australia
EPA	Environment Protection Authority
Eq.	Equation
ESAA	Energy Supply Association of Australia
ESOW	Equally-Weighted System of Weights
ESSR	Elasticity of Sectoral Supply Response
EU	European Union
FC	Financial Crisis
FDI	Foreign Direct Investment
FDI	Foreign Direct Investment
FD-VA	Final Demand - Value Added
FL	Forward Linkages
FL-CI	Forward Linkages Concentration Indices
FL-H2	Highest Contributor to Forward Linkages
FL-I	Forward Linkages Important Coefficients
FL-LI	Forward Linkages Less Important Coefficients
FL-MIC	Forward Linkages Most Important Coefficients
FRC	Full Retail Contestability
FTE	Full Time Equivalent
G-20 (G20)	Group of Twenty
GDP	Gross Domestic Product
GFC	Global Financial Crisis
GGAS	Greenhouse Gas Abatement Scheme
GGE	General Government Expenditure
GIIA	Global Infrastructure Investor Association

GSP	Gross State Product
GST	Good and Services Tax
GTAP	Global Trade Association Project
GVA	Gross Value Added
H1	Intra-Industry Trade Linkages
H2 to H6	Highest to Lowest Contributors to Linkage Magnitudes
HD	Harrod-Domar
HEM	Hypothetical Extraction Method
I	Important Coefficients
IA	Infrastructure Australia
IAQ	Industry Association of Queensland
IBRD	International Bank for Reconstruction and Development
IC	Industry Commission
ICA	Institute of Charted Accountant
ICOR	Incremental Capital Output Ratio
IDA	International Development Association
IEA	International Energy Agency
IEEE	Institute of Electrical and Electronics Engineers
IeIOM	Infrastructure-embedded Input-Output Model
IeIOT	Infrastructure0Embedded Input-Output Table
IFC	International Finance Corporation
IFGW	Infrastructure Finance Working Group
IMD	Institute of Management Development
IMF	International Monetary Fund
IMPLAN	IMpact analysis for PLANning
IO	Input-Output
IOFQLAF	Input-Output Four-Quadrant Linkages Analysis Framework
IOI	Infrastructure of Interest
IOT	Input-Output Table
IPA	Infrastructure Partnerships Australia
IPART	Independent Pricing and Regulatory Tribunal
LCA	Life Cycle Assessment
LCD	Least Developed Countries
LI	Less Important Coefficients
LNG	Liquefied Natural Gas
LPG	Liquid Petroleum Gas
LQ	Location Quotient
LSES	Linkage Strength Evaluation Score
MCE	Ministerial Council of Energy
MENA	Middle East and North Africa
MF	Market Forces
MIC	Most Important Coefficients

MRET	Mandatory Renewable Energy Target
MRVIO	Multiregional Variable Input-Output
MRW	Mankiw-Romer-Weil
NCC	National Competition Council
NCP	National Competition Policy
NEG	National Energy Guarantee Scheme
NEM	National Electricity Market
NETS	National Emission Trading Scheme
NI	Not Important Coefficients
NLECC	National Low Emission Clean Coal Council
NSW	New South Wales
NSWDPI	NSW Department of Primary Industry
NSWEPA	NSW Environment Protection Authority
NT	Northern Territory
NT	Net Trade
NTC	National Transport Commission
NWC	National Water Commission
NWI	National Water Initiative
NWIDF	National Water Infrastructure Development Fund
NWRC	NSW Water Resource Commission
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
PC	Productivity Commission
PEIM	Preservation Economic Impact Model
PF	Primary Factors
PF-FD	Final Demand Direct Purchases of Primary Factors
PIM	Perpetual Inventory Method
PNG	Papua New Guinea
PPI	Producer Price Index
PRRT	Petroleum Resource Rent Tax
Pub	Public
PV	Photovoltaic
Pvt	Private
PwC	PiecewaterhouseCoopers
Q1	Quadrant One
Q2	Quadrant Two
Q3	Quadrant Three
Q4	Quadrant Four
QLD	Queensland
R&D	Research and Development
R1	Recession 1, 1975

R2	Recession 2, 1977
R3	Recession 3, 1981-83
R4	Recession 4, 1990-91
RAS	Rows and Sums
REDM	Relative Employment Density Model
REMI	Regional Economic Models, Inc.
RET	Renewable Energy Target
RIMS	Regional Input-Output Modelling System
ROW-MIC	Forward Linkages Most Important Coefficients
RRT	Resource Rent Tax
RS	Renewable-Supreme
RST	Rest of the Sectors
S01	Sector Number One
SA	South Australia
SAM	Social Accounting Matrix
SME	Subject Matter Experts
SPIM	Simplified Perpetual Inventory Method
SSC	System of Sectoral Classification
T&D	Transmission and Distribution
TFP	Total Factor Productivity
TSOW	Traditional System of Weights
UBER	Utah Economic and Business Review
UCG	Underground Coal Gasification
UK	United Kingdom
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
US	United States
VIC	Victoria
VIO	Variable Input-Output
WA	Western Australia
WC-COV	Weighted Comparable Coefficient of Variance
WCI	World Coal Institute
WEF	World Economic Forum
WSAA	Water Services Association of Australia
WSOW	Weighted System of Weights
WSUD	Water Sensitive Urban Design
WW-I	World War One
WW-II	World War Two
$b	Dollars in Billions
$m	Dollars in Millions
$t	Dollars in Trillions

List of Appendices

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ABSTRACT

In view of the widely-recognised importance of infrastructure in promoting socio-economic prosperity, and prompted by the shallowness of our current understanding of the inter-infrastructure, and infrastructure-economy, linkages and (hence) their policy-usefulness - this research develops a comprehensive analyses of such linkages in the Australian context. For this purpose, this research has developed an integrated framework comprising two complementary models, namely, an empiric-analytic model and an Infrastructure-embedded Input-Output Model (IeIOM). Further, this research has analysed linkages, over the period 1975-2015, for 39 major sectors of the Australian economy, including 19 infrastructure sectors. The consequences of National Energy Guarantee Scheme (a major initiative of the Australian government) on the evolution of linkages, to the year 2050, are also analysed. The analyses suggest that the evolutionary trajectory of infrastructure-economy linkages has indeed been shaped by a complex web of interlocked influences whose internal and external logic resides in the economic, socio-cultural and political domains of the nation. The IeIOM has provided quantitative substantiation for these findings, and has established their policy connects. Some of the key findings of this research are that: 1) key sectors of the economy, i.e., sectors with most extended forward and backward linkages are electricity generation, transmission and distribution; gas supply; iron and steel; non-metallic and mineral products; wood products; and agriculture; 2) major sectors in terms of significant forward linkages include a combination of economic (mineral mining, coal, basic-non-ferrous metals, machinery, transport, and construction) and social (households, education, health, etc.) infrastructure; 3) 22 sectors (most notably, gas supply, electricity generation from natural gas, petroleum products, paper manufacturing, food, electricity transmission and distribution, and coal) exhibit highly inelastic sectoral supply and value added responses, thus presenting high risks for downstream production sectors; 4) highly profitable petroleum producing sector does not significantly contribute to value-added, because of its heavy reliance on imported inputs; 5) trends towards increased exports of natural gas, as compared with its use for domestic purposes, is likely to be detrimental to the economic well-being of the nation; and 6) National Energy Guarantee Scheme is unlikely to extend the reach of linkages, thus limiting its usefulness in the broader economic context. These (and other) insights of this research, through their elucidation of key policy-tradeoffs, and – more importantly – through their questioning of preconceived notions about infrastructure-economy linkages, should constitute useful bases for infrastructure policy development – an issue of utmost contemporary significance – as nations around the world endeavour to devise policies for provisioning infrastructure of the future, in the backdrop of rapidly transforming global technological, economic and social landscapes.

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1 INTRODUCTION

1.1 Background

Since the pioneering work of Aschauer (1989a) several studies have been carried out which have firmly established the importance of infrastructure for promoting economic growth and social uplift.

Infrastructure is a crucial driver of the economy; it provides nations' essential services like water, energy and transportation. The transport and communication infrastructure connects people and businesses within and beyond the national boundaries and markets for economic trade. Also, infrastructure generates employment and income locally as well as attracts labour and capital from surplus regions.

As such, the importance of infrastructure is globally recognised. For example, according to PC (2014) and OECD (2011), infrastructure leads to stronger market integration and competition, improved trade, dissemination of ideas and innovations, and access to resources and government services. According to OECD (2015) and Oxford Economics (2017), infrastructure contributes to a nation's prosperity because it is central to economic development and quality of life in developing, developed and transition economies.

According to Serven (2010), Estache & Garsous (2012), World Bank (2008a, 2008b, 2015), infrastructure is critical for transforming the lives of the citizens and improving prospects of the businesses in developing countries as roads and other forms of transport are developed and reliable electricity and water is supplied. Likewise, in developed countries, building new and renewed infrastructure would effectively lead to satisfying increased demand for infrastructure services, and to sustaining rapid economic growth (Oxford Economics 2017).

Also, infrastructure leads to long-term economic benefits, productivity improvements, increases in people's incomes and economic value added (Tarin 2007), while providing significant exogenous benefits too. For example, according to PwC & Oxford Economics (2016), improving transport infrastructure makes workers more mobile contributing to more efficient and productive labour markets.

1.2 Infrastructure: A National Priority

Because of the importance of infrastructure (as discussed above), countries around the globe have placed a high priority on its development. Significant investments have been made and elaborate institutional arrangements have been developed, to provision infrastructure, both in developing and developed countries. For example, according to the World Economic Forum (2013) and Manyika et al. (2016), it is estimated that the world invests each year between 3 to US$3.3 trillion in infrastructure. The United States, for example, allocated US$6.1 billion for infrastructure in 2015 for the next five years (Arcadis 2016); Canada allocated about US$1.4 billion in 2017 for the next 10 years (Reuters, 2017a). Further, according to Statista (2017a, 2017b), South East Asia invested around US$25 billion in infrastructure in 2016.

Also, with respect to developing countries, of the estimated yearly investments in the region, of US$790 billion to around US$1 trillion, majority was spent on energy, water and transport infrastructure (OECD 2015; World Bank 2014). Based on World Bank (2017a, 2017b, 2017c), the highest investment in 2016 were in energy by all IDA and IBRD countries, totalling US$46 billion (energy); water, in East Asia and Pacific countries (US$1.51 billion); and in transport infrastructure in Latin America and Caribbean (about US$11 billion). Table 1.1 shows global investments in infrastructure in the year 2016 (InfraDeals 2016, 2017; PwC & GIIA 2017).

Table 1.1 Global Investments in Infrastructure (2016)

	Renewable Energy	Electricity	Transport	Social	Telecoms	Environ-mental	Total $b (%)
North America	32.65 (39)	17.58 (21)	13.39 (16)	10.05 (12)	7.53 (9)	2.51 (3)	83.71 (21)
Australasia	5.59 (11)	10.17 (20)	21.35 (42)	9.66 (19)	0.51 (1)	3.56 (7)	50.83 (13)
Asia	12.26 (33)	8.92 (24)	12.26 (33)	0.74 (2)	0.74 (2)	2.23 (6)	37.15 (9)
Latin America	11.61 (24)	3.87 (8)	25.15 (52)	2.9 (6)	0.48 (1)	4.35 (9)	48.36 (12)
Europe	16.93 (28)	4.98 (6)	28.4 (25)	0.98 (35)	0.1 (1)	0.84 (5)	52.23 (13)
Middle East	7.86 (13)	32.39 (39)	14.77 (13)	0.14 (5)	0.72 (7)	3.86 (23)	59.73 (15)
Africa	26.6 (44)	10.8 (13)	26.13 (23)	0.28 (10)	0.41 (4)	1.01 (6)	65.23 (16)
World	113.5 (29)	88.7 (22)	141.44 (36)	24.75 (6)	10.51 (3)	18.35 (5)	397.25 (100)

Note: Numbers in brackets represent percent-share.
Source: This author's analysis based on InfraDeals (2016, 2017) and PwC & GIIA (2017) data.

Australia - the country of focus of this research - has traditionally placed a high priority on provisioning infrastructure. For example, the Australian Government, in 2012, spent about AU$3 billion on water services (Sewerage and Drainage) and about AU$4.8 billion on water supply infrastructure (BITRE 2013). In 2016, it spent AU$5.7 billion on industry specific infrastructure, and AU$5.8 on transport and communication infrastructure (The Conversation 2017). Further, it has allocated AU$7.9 billion to infrastructure for the next 10 years.

Overall, the Australian governments invested between 7 to 9% of GDP in infrastructure over the period 1960 to 1978 (see Chapter 2, for further details). The contribution however reduced to about 4% in 2006-07, demonstrating the maturity of the country's infrastructure in comparison to the earlier periods. Also, according to Manyika et al. (2016), the Australian governments spent 4.7% of GDP on infrastructure over the period 2008-13 to sustain economic growth. Further, according to BITRE (2014, 2016), infrastructure contributed nearly 10% to the GDP in 2016.

In addition to the Commonwealth infrastructure investments, the State governments also invest significantly in infrastructure development (see Table 1.2). For example, in 2017-18, the states committed about AU $38 billion for infrastructure. Overall, Australian governments investments stand at about AU$46 billion in 2017-18 (IPA 2017).

Table 1.2: Infrastructure investments by Australian Jurisdiction, 2011-2018 (AU$b)

Jurisdiction ($b)	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Commonwealth	8.48	3.92	7.23	5.05	7.13	7.56	7.96
QLD	9.10	7.73	6.82	5.56	4.65	5.13	5.74
WA	3.72	3.55	3.55	2.83	2.52	2.69	3.33
NSW	6.48	8.40	9.03	9.75	9.53	10.94	14.52
ACT	0.81	0.83	0.69	0.84	0.81	0.85	0.90
NT	1.04	0.72	0.60	1.03	0.76	0.87	1.13
VIC	4.68	5.49	4.29	4.67	5.54	7.96	9.43
SA	1.92	2.12	1.61	0.94	1.14	4.45	2.19
TAS	0.54	0.47	0.37	0.40	0.42	0.53	0.66
Australia	**36.78**	**33.24**	**34.18**	**31.06**	**32.49**	**40.99**	**45.86**

Source: Compiled by this author from IPA (2017) on 10 January 2018.
Note: IPA details are based on the total level of *general government sector funding* on Infrastructure.

Australia has also invested significantly in infrastructure during the crisis. For example, according to Kenway (2013), AU$2.5b of investments were made in urban water and wastewater infrastructure, in response to the "Millennium" drought in 2005. Or, according to OECD (2009g), the Australian Government invested an overall 0.82% of its GDP (AU$9.7b) - part of the stimulus packages of the late-2008, the post GFC period - funding road, rail, and housing to strengthen infrastructure and economic growth.

Further, over the years, Australia has made significant efforts to establish elaborate institutional and regulatory arrangements for provisioning infrastructure and to ensure its proper governance. In 2008, the Australian Government specifically established Infrastructure Australia and, under *Infrastructure Australia Act 2008,* defined its role as an independent statutory body responsible for prioritising and progressing nationally significant infrastructure.

1.3 Future Infrastructure Challenges

The importance of infrastructure is likely to increase in years to come, to support growing population, demand for improved living standards, rapid economic growth, industrialisation and urbanisation, emerging production technologies, and providing citizens improved services and modern resources.

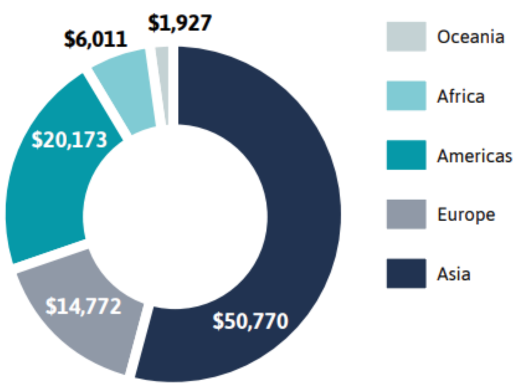
According to OECD (2015), the total global infrastructure investment requirements by 2030 for transport, electricity generation, transmission and distribution, water and telecommunications will be US$71 trillion (about US$4.8 trillion per year), representing nearly 3.5% of the World GDP. According to Oxford Economics (2017), infrastructure needs by 2040 are estimated to be around US$94 trillion (UD$3.7 trillion a year), with Asia accounting for around 54%, followed by US (22%). At the country level, China, USA, India and Japan will account for over 50% of future global infrastructure investment needs by 2040.

In the case of developing countries, the future infrastructure investment needs are estimated to be over US$700 billion a year in the coming decade (increasing to US$1 trillion a year by 2030), in order to sustain rapid growth rates (World Bank 2015).

It is widely recognised that Australia will need to invest more in its future infrastructure, mostly in transport, electricity, water, and communications - due to growing population, from the current 24 million to an estimated 30 million by 2030, or to nearly 40 million by 2055, an increase of 65% (DIRD 2014). According to BITRE (2016), at least AU$37b will be needed by 2030 to develop roads particularly in congested cities. Also, the Australian Trade and Investment Commission (2016) has estimated that rail freight transport will increase by 65% by 2030 because Australia is a major exporter of bulk commodities and other merchandise requiring rail freight transportation.

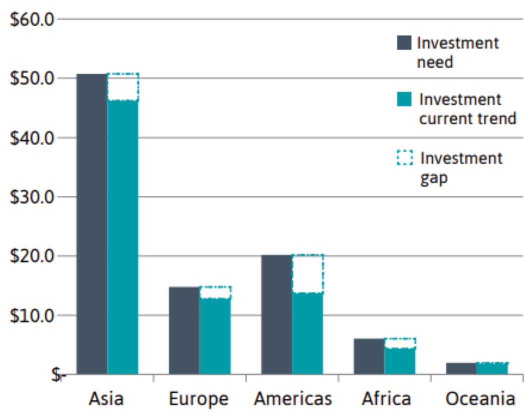
Provisioning of future infrastructure is going to be a challenging task, because it will require a very significant amount of funds, much beyond the capacity of developing countries, and may stretch the exchequers of developed countries very significantly. It will also require elaborate institutional arrangements to accommodate the needs arising from new types of technologies, new patterns of urban growth and different demand expectation. Further, effective policies will be needed to provision future infrastructure. Figures 1.1 and 1.2 shows total future global infrastructure investments needs and anticipated shortfalls. The infrastructure needs by country over the period 2016 to 2040 and their spending gaps are presented in Appendix 1.

Figure 1.1: Infrastructure investment needs by world region, 2016-2040 (US$m)



Source: GIH (2017)

Figure 1.2: Total infrastructure investment needs and gap by world region, 2016-2040 (US$t)



1.4 Infrastructure Linkages and Multipliers

Estimation of the adequacy of future infrastructure needs can be made by analysis of infrastructure linkages and multipliers. This viewpoint is based on the reasoning that the relationship between infrastructure and economic growth is not direct. The overall impact of infrastructure on economic growth represents a combined effect, extending much beyond the immediate (or direct impacts of infrastructure) - both on the input and output sides. The establishment of infrastructure sets into motion a chain of economic activities on the upstream (input) and downstream (output) sides, which collectively determine the impact on economic growth. These effects can be captured through backward and forward sectoral linkages in the economy.

Much of the existing emphasis of analysing infrastructure-economy linkages has been at the macro level. The traditional macro level policy discourses typically evaluate infrastructure investment returns, and justify this approach through traditional cost-benefit analysis of infrastructure projects. These approaches are however useful to a limited extent. Because, it is important to underrated the dynamics of economic growth at micro-level in order to clearly determine where the linkages effects are created so that proper policy and investment decisions can be made in areas with maximum linkage and multiplier intensity.

Moreover, current review of literature shows that multipliers are analysed at limited level. For example, outputs or value added multipliers are mostly considered while less attention has been placed to employment or income multipliers. Also, the direct, indirect and induced effects of the multipliers are not well understood. Additionally, these analysis predominantly concentrate on the rates of return on capital, which is the domain in which current infrastructure decisions are made. But what is needed is more detailed knowledge of infrastructure linkages and multipliers at the macro and micro levels.

The literature shows recognition for importance of micro-level analysis, however not much work is carried out. The section below discusses examples of such studies and their shortcomings.

1.5 Summary of the Existing Studies

Although there is a recognition that micro-level analysis of linkages is needed but not much analysis at adequate levels of depth and breadth has actually been carried out. A review of literature on the topic shows a fragmented approach to the study of linkages, where inter-sectoral linkages are rarely understood in the system of sectors in the economy. The analysis of linkages were either specifically targeted, in isolation from other sectors of economy, or focused on narrowly defined objectives of the industry or government, or confined to specific infrastructure sector, or to its selected elements and dimensions. For example, majority of the studies have focused exclusively on water or electricity or roads infrastructures, but have largely ignored the cross-sectoral linkages that exist with other sectors of the economy. Also, the influence of social, cultural, technological, political, geopolitical, and legal factors have rarely been considered. Moreover, majority of studies do not extend their analysis beyond the first quadrant of the standard input-output tables, and generally do not complement linkage-analysis with application of major linkages descriptors.

Below are examples of such studies that have analysed infrastructure linkages employing a variety of methodologies, e.g., input-output analysis, Life Cycle Assessment (LCA) methods, linear programming, surveys, or spreadsheet analysis.

Global Studies - Studies by Siddiqi & Anadon (2011), Kahrl & Roland-Holst (2008), Bekhet & Abdullah (2010) are focused on analysis of linkages between electricity and water, or energy and agriculture. Sovacool (2009), Dennen et al. (2007), Gray & McKean (1976), Yang et al. (2007), or Guan & Hunacek (2008) have analysed the water needs of electric utilities and the environmental risks at macro levels. Hu (2004), and Mukhopadhyay & Chakraborty (2005) focus on linkages of reforms, regulations and technical change on energy consumption in the Chinese and Indian economies, respectively - using input-output analysis. Linkage-analyses by Zakarias et al. (2001), Guilhoto et al. (2006), Bocoum (2000), and Narayan & Singh (2006) focus on either oil and gas, minerals, electricity, or other selected sectors of economy at macro level. In particular, they investigate linkages between electricity and renewable sources. Fukuishi (2009) analyses linkages between water and six selected sectors of the Japanese's economy. Zhang & Song (2011) examines water linkages of primary and secondary sectors of the Chinese economy, using input-output analysis. Stillwell et al. (2011) study linkages of electricity and water in term of policy implications for the American society. Some of the studies, for example, Velazquez (2006), focus on the analysis of linkages between water and environment, using input-output analysis and in-house developed models. Feng et al. (2011), and Wang & Wang (2009) study water sector linkages at domestic and international levels to determine the nations' virtual or volumetric water footprint at macro levels.

Majority of the above noted studies did not incorporate multipliers in linkage analysis. However, there were policy focused studies which utilised multipliers for estimating the overall change in the economy due to a unitary change in final demand. These studies however share the same limitations as discussed above. Some studies however analyse linkages and multipliers at detailed levels. Additionally, some studies estimate direct, indirect and induced multiplier effects too. Example of studies which included multipliers as part of linkage analysis are: Alauddin (1986), Breisinger et al. (2010), Cassar (2015), Deller et al. (1993), IFC (2015), Jensen & West (2002), Kelly et al. (2015a), Matallah (2007), Rolfe et al. (2011), and Tregenna (2008).

Australian Studies - The shortcomings (i.e., narrow focus) are equally applicable to the studies undertaken in the Australian context. For example, Polenske & Sivitanides (1989) just focuses on the analysis of linkages between the construction sector and other sectors; Lenzen et al. (2004)

focuses on Sydney households' energy requirements, using input-output analysis; Marsh (2008) and Marsh et al. (2007) focus on the linkages between water and electricity, exploring policy implications of the linkages for the State of New South Wales. In this study both linkages and multipliers were analysed at macro level. Amit et al. (2008), and Lenzen & Foran (2001) focus on water and electricity linkages in the context of policy implications for societies, using input-output analysis. Foran et al. (2004) studied linkages between eight sectors of the economy and the environment, using input-output analysis and Triple Bottom Line (Financial, Environmental, and Societal) approach to identify linkages. Whiteman (1999) examines electricity linkages in Australia using the Computational General Equilibrium (CGE) model; this analysis is however confined to just one sector and one year of data. Davidson & de Silva (2013) estimate multipliers just for the coal infrastructure at the macro level. Valadkhani (2003) focuses on employment multipliers, at relatively extended levels. The government departments such as Victorian Department of Treasury & Finance (2013), and the NSW Treasury (2009) have estimated multipliers at macro levels for economic development.

The limited focus of the above studies has understandable produced in turn limited knowledge of infrastructure linkages and multipliers for making informed policy decisions. Also, to the best of the knowledge of this author, no in-depth study of linkages and multipliers has been undertaken for Australia.

In order to advance the knowledge of linkages and multipliers, a detailed analysis of infrastructure linkages and multipliers is required to develop much deeper and broader insights into the nature of sectoral linkages. Hence, this research.

1.6 Research Objectives

The main objective of this research is to analyse infrastructure linkages and multipliers in the context of Australia with the view to provide insights that would contribute to the formulation of robust infrastructure policies and decisions.

Specific objectives include:

i. Establish the importance of infrastructure in the Australian context.
ii. Develop a historical profile of infrastructure evolution, with the view to understand the influence of underlying factors in this evolution.
iii. Develop a methodological framework that will enable a comprehensive assessment to be made of the nature of infrastructure linkages at macro and micro levels.
iv. Estimate linkages and multipliers through the application of above noted framework.
v. Demonstrate how such insights could contribute to the development of more robust infrastructure policies.

1.7 Research Methodological Framework

This research is multi-disciplinary, drawing knowledge from the fields of economics, econometrics, mathematics, statistics, analytics, engineering, policy, and social sciences. The methodological framework employed in this research is presented by Figure 1.3. This framework is composed of two major sub-frameworks, supported by appropriate models and analytical modules – as discussed below.

Qualitative linkages analysis framework

The purpose of historical analysis is to identify forces that have shaped development of linkages in the past. This analysis provides a contextual understanding of the linkages that prevail at the present time. The development of historical profile of infrastructure in Australia will assist with the development of historical profile of linkages. This historical analysis is carried out for the period 1788-2017, separated into five distinctive time phases, corresponding with prominent events in Australia (Figure 1.4 and fully discussed in Chapter 3). This historical profile provides a backdrop for analysis of quantitative linkages (as discussed before).

Quantitative linkages analysis framework

This framework assists with micro-level analysis of linkages and multipliers. A major components of this framework includes complex databases which provide the data intensive input requirement of the framework including supporting proxy and reference data used by the framework's sectoral disaggregation module. The disaggregation module breaks down the heavily aggregated sectors in the standard Australian input-output tables into infrastructures of interest (described in section 1.8) so that the linkages with the rest of the sectors are measured accurately. For example, the aggregate *Electricity Supply Sector* in the standard Australian input-output tables was broken-down into electricity transmission and distribution sector, and six generation sectors, powered by fossil and renewable sources.

This disaggregation is in recognition of their historical profile and the influence of technology, particularly the high voltage transformers, on development of electricity transmission and distribution sector; or, the disaggregation of the *Water Supply, Sewerage and Drainage Sector* into urban water supply, rural water supply, and water services (sewerage and drainage) - in recognition of their historical profile. That is, the rural has a focus on irrigation for agriculture while the urbanisation influences the development of urban water supply and sewerage and drainage services.

The disaggregation process was facilitated by using suitable proxy and reference data such as the electricity generation fuel mix, operating costs and revenue data, input and output product details, and their distribution rates to other sectors, and historical trends. Also, the disaggregation module

Figure 1.3: Methodological Framework for Research

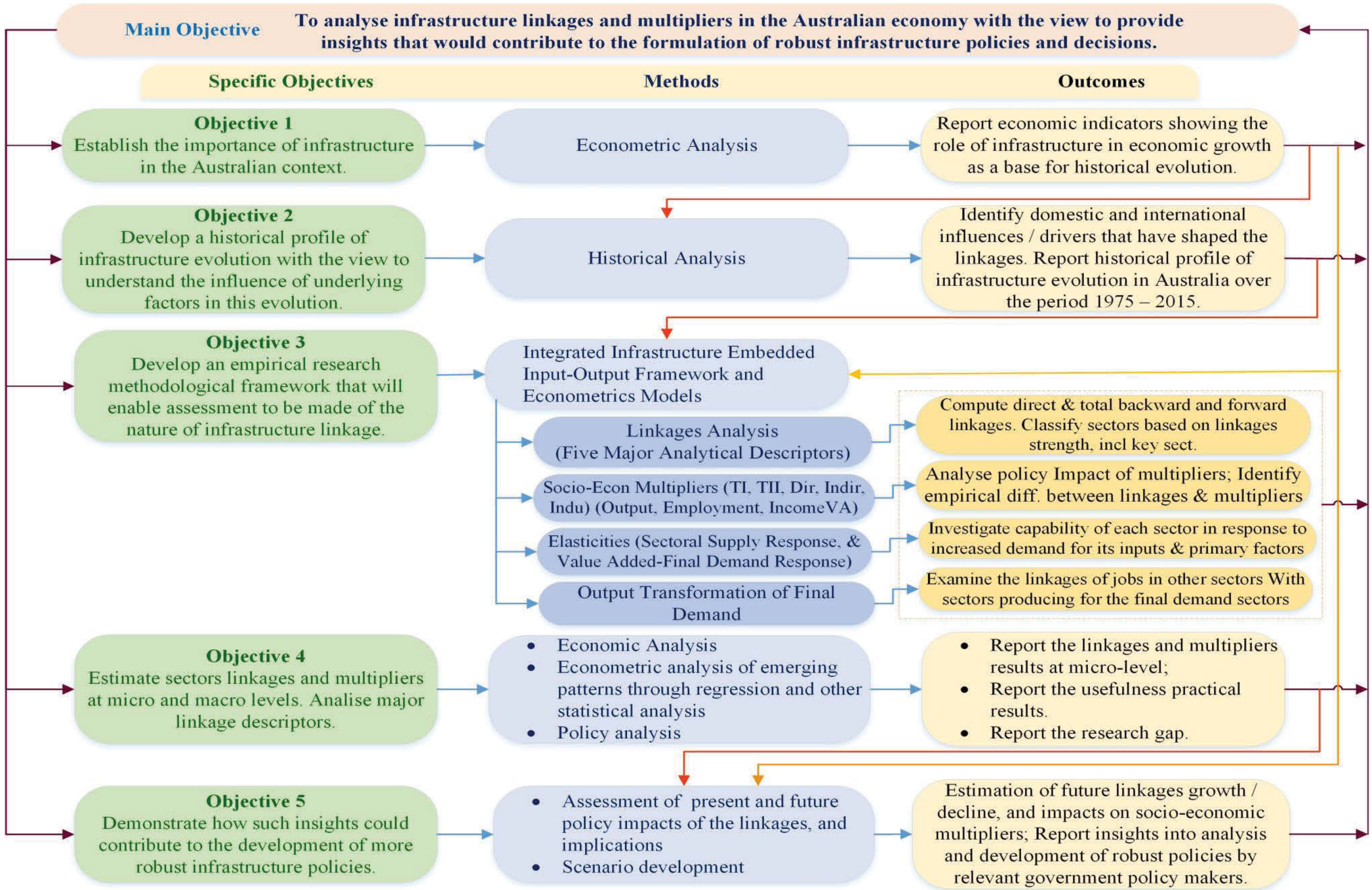
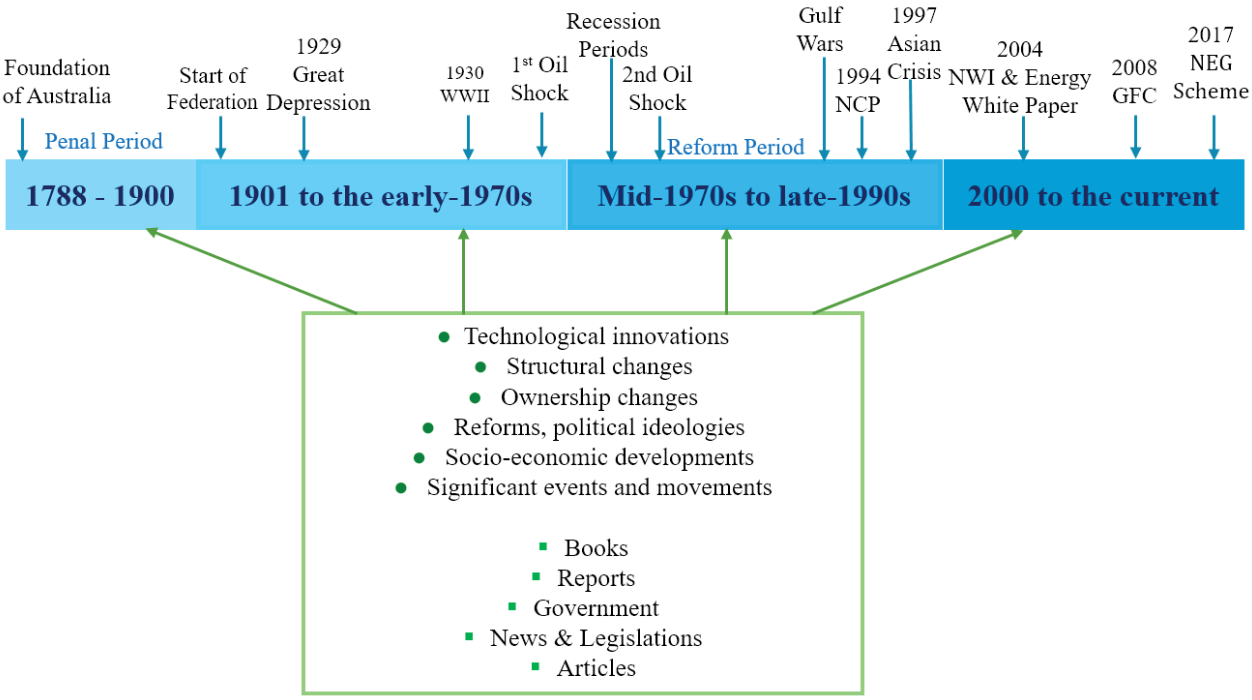


Figure 1.4: Historical profile[1] timeline of prominent events, 1788 to 2017



[1] See Chapter 3 for details. Source: This research.

helps with construction of input-output infrastructure embedded tables, which are the core input to all models in the framework. Details of the sectors in these tables are described in section 1.8.

Another important component of the quantitative framework is its mathematical module which forms the operational engine of the framework. This engine drives the linkage analytics module, for micro-level analysis of linkages and multipliers. The linkage analytical modules facilitate the estimation of direct and cumulative linkage (weighted and un-weighted), and multipliers, as a result of a unitary change in final demand of a given sector. Through multipliers analysis, the direct, indirect, induced, and total effects of a unitary change in final demand of a given sector through its linkages are estimated for the whole economy.

Another component of the framework is its forecasting model which allows investigation of the future of linkages under a set of scenarios. The scenario results are helpful for making informed policy decisions with futuristic impacts, as infrastructure development is intended to satisfy future needs. The quantitative framework has an output module as well which enables consolidation, tabulation, and graphical display of the results.

Proposed methods and formulations

Another feature of the quantitative framework is its operation on proposed and modified formulations, to more accurately estimate the linkages and overall sectoral strengths for the key sectors in the economy. These formulations also add value to input-output theory and practical applications as discussed in this thesis.

Forecasting Model

The forecasting model assists with the development of the base case and two alternative scenarios to investigate the future of sectoral linkages over the period 2015-2050. This model uses future data sourced from a variety of government sources to assist with analysis of future linkages. The scenario results provide inputs for recommending infrastructure policies with a futuristic view. This is discussed in details in Chapter 9 of the thesis.

1.8 Research Scope

Infrastructure in the context of this research

The infrastructure of focus in the context of this research is referred to as the Infrastructures of Interest (IOI) which is composed of four major groups:

i. The primary energy resources covering the Crude Oil (including condensate), Gas (including Nat Gas, LPG and CSG), Coal Mining, Other Mining, Exploration and Mining Support Service, Petroleum Products Manufacturing, and Coal Products Manufacturing;

ii. The electricity sectors as secondary energy sources, composed of electricity generation sectors powered by various fuels including coal, gas, oil products, hydro, renewables and others. Also, it includes electricity transmission and distribution. In this context, the latter can be referred to as electricity supply sector which receives generated electricity (less own-use and losses at the power plants) for final uses (less its own transmission and distribution losses);

iii. Water sectors including urban water supply, rural water supply, and water services (drainage and sewerage); and

iv. Other major sectors of the Australian economy which are linked with the above groups.

Geographic Coverage

In this research linkages are estimated at the national level for all IOI and major sectors of the Australian economy.

Historical Profile

The historical profile is comprises of four major distinct period as follows:

i. The period 1788 to 1900 - occupation of Australia until the beginning of federation;

ii. The period 1901 to the early 1970's - from the start of federation covering prominent events in the economic history such as the 1929 Great Depression, 1930 WW-II , and first oil shock;

iii. The period mid-1970's to the late-1990's - includes the recession period of 1975 to 1999, second oil shock, reform periods of 1973 to mid-1990s, the 1994 National Competition Policy and the Asian meltdown of the 1997;

iv. The period 2000 until 2017 - with major events such as 2004 National Water Initiatives and Energy White Paper, the 2007-08 Global Financial Crisis, and mining booms which started around 2003 and continued to the peak level in 2013.

Factors influencing development of linkages

To understand the linkages it is necessary to identify factors that have shaped their development. Therefore, the linkages are studied within the scope of economical, technological, political, reform, policy, institutional, regulatory, social, significant movements and events, international influences, and logical factors.

1.9 Data Considerations

As described earlier, the methodological framework daws on diverse fields of knowledge. As such the corresponding data requirements reflect the multi-disciplinary characteristics of the framework. Table 1.3 describes the data sources relevant to each objective of the research, provider sources, the data availability and the data gap and a brief reference to how the gap can be filled.

Quantitative Analysis Data

The analysis required a very large volume of direct and reference data which had to be collected from diverse sources. The collection task was very difficult requiring enormous effort. The difficulty was more prevalent for the pre-1999 input-output data and the water data which were not available in digital formats. The data for the period 1975 to 1998 were available in hard copy forms. This required manual entry in spreadsheets and formatting into a suitable digital format before being uploading into the research model.

An additional layer of difficulty was associated with the inconsistencies among various data sources, influenced by the underlying methodology and assumptions. Also, the Australian input-output tables, as the core set of data for the quantitative analysis model, had gone through several iterations of sectoral classification and codification standards over the period 1975 to 2015. Therefore, these tables required careful codification realignments so that the sectors can be compared properly.

In terms of disaggregating heavily aggregated sectors into the sectors of interest, relevant proxy and reference data were needed. Availability of this data was very limited, given the sector-dependent nature of the data. Considering that the econometric and model-based methods are

Table 1.3 Data Sources utilised by each specific objective

Specific Objectives	Data requirements	Data Sources	Data Availability	Data gaps	How data gaps filled
1	(a) GDP and sectoral growth data (b) Population growth forecasts (c) Net Capital Stock and Asset formation (d) Input output data for economic sectors (e) Infrastructure demand forecasts, efficiency improvements, infrastructure economic data (f) Comparative infrastructure data (g) Income, employment, output indicators	(a) ABARE, ABS, OECD, IMF (b) ABS (c) ABS, IPA, IA (d) Research papers, project reports, national input output tables (e) States and Federal Government reports, Infrastructure providers (gas, electricity, water, oil, petroleum, coal), Owen Inquiry Submissions, Government commissioned reports (f) OECD, IEA, IMF; IC, CEDA, BCA (g) ABS, CEDA, IC, BCA, OECD, IMF, IEA	Largely Available	Medium	N / A
2	- Information on historical events and formation of Australia - Infrastructure development in Australia - Economic and technological developments in Australia - Structure, ownership, regulatory arrangements - Reform philosophy, reform initiatives and supporting institutions - Water, electricity, gas, oil and petroleum products supply and use - Political ideology; Social and economic development paradigms - Globalization - Domestic and International Influences	- Books, journal articles - Legislation, policy papers - Governments publications - Interviewing experts in the area and personal accounts, - Heritage assessment reports; - Annual reports	Largely Available	Small	- Used significant sectors and years for which data is available - Used trend analysis in presence of a decreasing or increasing trends
3	- Existing linkages, focus areas, scope, applied methods, findings and relevance to the proposed research - Infrastructure functions - Linkages characteristics, dimensions and algorithms; - Input Output Tables for Australia - Elasticities, intensities and entropies - Policy impact analysis of linkages - Proxy data to disaggregate bundled sectors	- Journal articles - Policy papers - National and international research papers - Project reports - Interviewing experts in the area; - Input output tables	Largely Available	High	- Obtained expert advice and international data - Used Important sectors for which data was available
4	(a) GDP Price deflators 1975-2015 (b) National Input-Output Tables (c) Generation by furl type proxies (d) Direct and cumulative coefficients (e) Proxy Data (Op Exp., Op Revenue) (f) Percent electricity generation up-/downstream (g) ANZSIC sectroal Classification codes (h) Sectoral product details and distribution rate (i) Employment by sector FTE data	(a) ABS (b) ABS (c) IEA, ABARE, BREE, OECD,GTAP (d) ABS, Model esimation (e) NWC, WSAA, IBSWorld (f) 2007-2015 ABS IO Tables (g) ABS (h) ABS (i) ABS	- Largly Available - Proxy data very hard to obtain - Concistency issues	Medium to High	For missing proxy data used trends in presence of a declining / increasing trends
5	- Future sectoral growth / decline - Future GDP, population, final demand - Present and future policy directions - Alternative scenario development data - Global and domestic influences on technology (e.g. renewable energy, future technologies) - Employment, income and value added	- Sources as oulined for objective 3, plus: - Government economic development plans (e.g. energy policy white paper for Australia) - Government reviews (e.g. Finkle Review) - ABARE, BREE, IEA forecasts - Comparable international projection data models (e.g. UK Energy Model) - National Energy Guarantee Scheme (NEG)	- Very limited availability - Hard to obtain - Difficult to decipher -Inconcistent	High	- Obtained expert advice and international data - Used Important sectors for which data was available

ABARE: Australian Bureau of Agricultural and Resource Economics; ABS: Australian Bureau of Statistics; BCA: Business Council of Australia; BREE: Bureau of Resources and Energy Economics; CEDA: Committee for Economic Development Australia; GTAP: Global Trade Analysis Project; IC: Industry Commission; IEA: International Energy Agency; IMF: International Monetary Fund; NEC: National Water Commission; NEG: National Energy Guarantee Scheme; OECD: Organisation for Economic Cooperation and Development; UBER: Utah Economic and Business Review; UN: United Nations; WSAA: Water Services Association of Australia; IPA (Infrastructure Partnership Australia); IA (Infrastructure Australia).

very demanding in terms of data inputs, collection of such data was a challenging task. In particular estimating some of the missing values through regression necessitated high frequency and reasonably long time series so that the estimation is valid.

Similarly developing adaptive linkages and scenario analysis model to respond to the availability of more accurate and complete data, as they become available, was a challenging task. Also, the model needed a data validation and cross-validation module, to progressively and dynamically keeping track of correct data in the model. Other data challenges were related to obtaining valid forecasting (projection) data to develop the base case and alternative future scenarios.

Qualitative Historical Data

This research focuses on infrastructure linkages, it was considering necessary to investigate the historical evolution of various infrastructure sectors in Australia - in order to identify factors and trends that influenced the development of linkages. This task required extensive review of literature comprising secondary sources and contemporary accounts (books, reports, journal articles, legislation and policy papers).

Data Availability: Present and Future Challenges

The availability and quality of data has been a major challenge for developing this research. Some of such challenges include: the required data were not collected in the past because what is needed now was not known in the past, or if known, its collection was not a priority at the time. In Australia, collection of infrastructure data gradually expanded after the implementation of microeconomic reforms of the mid-1980 and subsequent waves of reform; data was collected but it was either incomplete or in a form that without manipulation and application of certain assumptions - which could affect the accuracy of data - was of no use; data is available but its release is treated 'confidential'; or its collection was influenced by the narrow scope for studies undertaken.

The need for diverse and accurate economic and infrastructure data is recognised at the global and Australian levels. At the global level, for example, IMF (2016) reports that the *G-20 Data Gaps Initiative (DGI)* has aimed at addressing the data and information needs and recommends "*evolving policy needs focus more on datasets that support the analysis of the inter-sectoral linkages across the economic and financial systems*". In Australia, the need for accurate and accessible sectoral data has been recognised and some actions taken to fill the gap. For this purpose, government departments have been given the responsibility of collecting and managing the required data. For example, the Australian Bureau of Statistics (ABS), or Bureau of Infrastructure, Transport and Regional Economics (BITRE) currently play a fundamental role in data provisioning.

1.10 Significance of this Research

Traditionally, the linkage analysis has only concentrated on the inter-industry quadrant of the input-output tables, for estimating backward and forward linkages in response to a unitary change in final demand. This analysis alone would not provide adequate insights for making informed policy and investment decisions. For example, it does not provide backward and forward estimates of a number of most important linkages that a sector has developed with other sectors of the economy, and mechanism to analysis their stability over time; it does not estimate the relative degree of sectoral specialisation, integration, or outsourcing; it does not inform the degree of sectoral responsiveness to supply of inputs to other sectors as a results of change in final demand; it does not characterise linkages by identifying the most contributing sectors to the overall sectoral linkage magnitudes. This information is needed to strengthen and maintain important links over time. Also, through standard input-output tables, it is not possible to analyse the linkages of the sectors which produce for final demand - particularly for exports - with other sectors in terms, for example, of new jobs created in these sectors. Additionally, there are analysis redundancies created by estimating output, supply, and value added multipliers. The latter estimates can be provided through backward and forward linkages using extended linkage-analysis formulations which are proposed by this research.

Therefore, a significance of this research, as further discussed below, is the development of a holistic approach to analyse linkages and multipliers with ‘new’ and ‘reformulated’ approaches. These approaches have contributed to overcoming the abovementioned shortcomings. Consequently, the policy significance of micro-level analysis has been enhanced.

Additionally, this research provides answers to practical policy and investment questions (discussed later in this section). In this respect, therefore, this research contributes to both input-output theory and practice.

Development of Holistic Approach to Linkage Analysis

The linkages are analysed holistically in this research. The linkages are considered multi-dimensional, where each dimension provides useful information which collectively would provide insights for developing robust policies and making informed investment decisions. The major dimensions are outlined below:

- Backward and forward inter-sectoral linkages;
- Intra-sectoral trade linkages;
- Non-industry backward linkages with primary factors of production;
- Non-industry forward linkages with sectors of final demand;
- Linkages as a result of direct purchases of primary factors by sectors of final demand;
- Linkages created based of the importance of direct and cumulative coefficients;

- Backward and forward concentration linkages, signifying the number of sectors that each industry buys from and sells to;
- Backward and forward entropy linkages signifying the degree of sectoral integration, specialisation, and outsourcing in the economy;
- Linkages of jobs in other sectors with production sectors producing for final demand;
- Sectoral linkages capable of generating new employment, new income, and new value added for alternative policy scenarios for economic development.

The literature review has revealed that the above noted array of linkage dimensions are neither fully recognised, nor their economy-wide policy impacts holistically taken into consideration. This oversight does not allow to comprehensively analyse major characteristics of the sectors with strong backward and forward linkages. These sectors are capable of inducing production in other sectors, generating new employment, and new income in the economy. Therefore, if the most important linkage dimensions are known then the "trade-offs" which otherwise could occur can be prevented.

Practical Answers to Policy and Investment Questions

This research, through detailed analysis of linkages and multipliers, provides practical answers to some major policy questions, by evaluating alternative policy scenario outcomes, select-examples of which are outlined below:

i. What are the multiplicative effects of an investment on capital rate of return?
ii. Which sectors should the government invest in, in order to maximize economic output?
iii. What are the impacts of infrastructure investments on employment, household income, development of quality life for citizens, and contribution to value added?
iv. Which sectors are competitive, and capable of inducing economic activities in other sectors?
v. How vulnerable is the economy to major financial and economical interruptions? How quickly can an economic sector recover from a crisis?
vi. What would be the impact of aggressive pursuit of policies (e.g. promotions of renewable energy) on economy?
vii. How will the trade balance of the country be affected by the presence of infrastructure linkages?

Contribution to the Input-Output Practice and Theory

This thesis has contributed to extending the theoretical and applicational domains of input-output framework by, for example:

1) Providing an in-depth understanding of the multi-dimensional nature of infrastructure linkages and multipliers in the Australian context, over the period 1975-2050, significantly overcoming the present narrow focus on linkage analysis;
2) Extending the traditional backward and forward linkage formulations beyond the inter-industry quadrant, covering all quadrants of the input-output tables; this, together with major linkage indicators, introduced in this research, should provide practical answers to policy an infrastructure questions (discussed earlier);
3) Proposing a new system of weights to better assist with policy decisions which require information about the relative importance of various sectors in the economy in terms of their share in value added, or share in final demand;
4) Developing a more detailed system of classifying the sectoral strengths through which the level of sectoral contributions to the economy can be estimated more accurately;
5) Developing a new method to identify variations across sectoral cumulative coefficients; this method provides a relative indicator of variability from which sectors could be compared against each other;
6) Holistically incorporating the aforementioned improvements and proposed approaches into a comprehensive Infrastructure-embedded IO Model (IeIOM) - to effectively capture a vast range of multi-dimensional linkages and to investigate their policy impacts at sectoral and economy levels.

Beneficiaries

While this research focuses on Australia, various methods, approaches and findings are equally relevant for other contexts. Some beneficiaries of this research should include:

Researchers who may wish to extend this research;

Public policy analysts and advisors for providing advice to policy makers, to better formulate policies;

Private sector to make informed investment decisions, by knowing the effect of linkages on such decisions;

Others interested in learning about the relationships between various infrastructures.

1.11 Thesis Structure

This thesis is structured as follows:

Chapter 2 *relates to the Objective 1*- It empirically establishes the importance of infrastructure in the Australian and global contexts through a detailed review of literature, and econometric analysis of major indicators such as contribution to gross domestic product. This chapter analyses the investment correlations between the IOI and other sectors of the economy through a developed GDP model.

Chapter 3 *relates to the Objective 2* - The historical profile of infrastructure evolution in Australia over the period 1788 (the beginning of the European settlement in Australia) to 2017 is developed and described. The purpose of profile is to develop insights into the underlying factors which may have influenced the evolution.

Chapter 4 *relates to the Objective 3*. This chapter describes the methodology used in this research to analyse linkages and multipliers. For this purpose, it introduces an integrated quantitative analysis framework, composed of an infrastructure embedded input-output model; supporting econometric modules such as sectoral disaggregation, linkages analytics, and data consolidation, tabulation and presentation modules; mathematical formulation (existing and proposed methods); and a forecasting model to study the multi-dimensional characteristics of future linkages. This framework guides all analysis are carried out by this research.

Chapter 5 *relates to the Objectives 3, 4 and 5*. This chapter proposes a new system of weights where both the traditional and the new methods are compared and the numerical outcomes of each are discussed. This Chapter discusses the relevance of weighted linkages to policy development and associated decisions. It concludes that estimation of both weighted and unweighted linkages play an important role in understanding the nature of linkages from technological, structural and policy perspectives.

Chapter 6 *relates to the Objective 3, 4 and 5*. It presents the foundational sensitivity analysis of the input-output coefficients and classifies coefficients into four sensitivity classes. The Chapter identifies the most important coefficients, and their role in linkage analysis. The results of this analysis are compared with the estimates obtained by unweighted linkage approach. This chapter also tracks technological changes over time, and determines the threshold beyond which the sectoral production would be affected.

Chapter *7 relates to the Objectives 3, 4 and 5*, this chapter presents the unweighted and weighted linkage estimates, beyond the traditional inter-industry quadrant, through the application of the proposed four-quadrant linkage analysis framework.

Chapter 8 *relates to the Objective 5*. In this chapter, the discussion on linkages is extended to various multipliers and their direct, indirect and induced effects; elasticity analysis; and the linkages between sectors which produce for final demand and other sectors.

Chapter 9 *relates to the Objective 5*. The policy impacts of a Base Case and two alternative scenarios over the period 2015-2050 are discussed, particularly, information about linkages, over the period 1975-2015 and 2015-2050, could provide insights for development of policies with futuristic impacts. Also, it recommends inputs for development of policies.

Chapter 10 *relates to all Objective 1 to 5*. It summaries the key research findings of this research, contributions to knowledge, and some recommendations for further research.

2 IMPORTANCE OF INFRASTRUCTURE IN AUSTRALIA

This chapter investigates the importance of infrastructure in the global and Australian contexts. This investigation is based on a comprehensive review of literature and available data on infrastructure spending over the period 1960 to 2017. The infrastructure-economy linkages are measured using a subset of data over the period 1998 to 2008 for which a complete set of data are available.

This Chapter is organised as follows: Sections 2.1 and 2.2 provide an overview of the importance of infrastructure in the global and Australian contexts. Section 2.3 identifies major indicators for measuring the importance of infrastructure in the Australian economy. Section 2.4 presents the trends in public, private and total infrastructure spending in Australia. Section 2.5 discusses infrastructure-economic growth linkages in the historical backdrop of the economic growth theories. Section 2.6 presents a GDP model developed in this research for analysing the infrastructure-economy linkages; and Section 2.7 presents the main findings of this chapter.

2.1 Infrastructure in the global context

Global Infrastructure Investments – The world has traditionally placed a great priority on infrastructure, because of its economic growth impacts. For example, Statista (2017c) reported that on average the world has invested between 2 to 8.8% of its GDP on infrastructure over the post-GFC period 2008-2013 (see Appendix II.B, Table II.B.6). Additionally, Foreign Direct Investment (FDI) flows in infrastructure, have continually increased over the years to complement public spending on infrastructure. For example, over the period 1990-2006, FDI in infrastructure worldwide increased nearly thirty fold, from about $25 billion in 1990 to $786 billion in 2006 (UNCTAD 2008). In 2007 alone, the value of infrastructure FDI was $1.84 trillion, or 29% of the world GDP, a significant increase in comparison with 1990s (Appendix II.B, Tables II.B.1 to Table II.B.5).

There is a heightened realisation about the importance of infrastructure in the past two decades both in developing and developed countries. For example, according to Fay & Morrison (2007) and World Bank (2008b), developing countries need to invest 7 to 9% of their GDP on new projects and maintain the existing infrastructure to achieve economic growth and meet poverty reduction goals. Also, according to IEA (2008b) it is estimated that to the year 2030, US$26 trillion (2007 dollars) will be required in the energy sector alone, comprising US$13.6 trillion for the power sector, of which $6.1 trillion will be required for electricity generation alone. Also, US$6.7 trillion will be required for the water infrastructure (OECD 2018, Winpenny 2015, UN 2015b) to respond to the world's population of nearly 9 billion by 2030 (UN 2015a). World Bank (2008a, 2008b) estimates that on average, developing countries actually invest 3 to 4% of their GDP in infrastructure annually.

Figures 2.1 to 2.3 show infrastructure investments in terms of total fixed capital, total public spending, and foreign direct investments (FDI) in developed countries. The key points are:

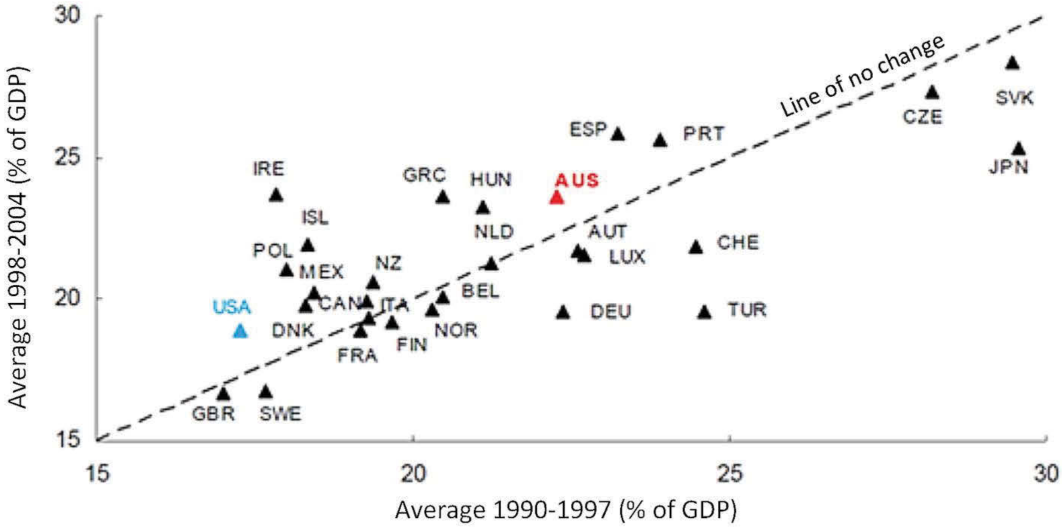
- According to OECD (2006b), total fixed capital infrastructure investment (public plus private) by developed countries was between 15 to 30% of each country's GDP over the period 1990 to 2004. Figure 2.1 shows the distribution of countries' investments above and below the line of no change. The countries above the line increased their fixed capital investments over the period 1998-2004 in comparison to the period 1990-1997. Countries with no change in investments over the two periods are located on the line;
- Public infrastructure spending as a percentage of GDP by developed countries was between 1.5 to about 7 percent of GDP over the period 1990 to 2004 (OECD 2006b). For majority of developed countries the level of public infrastructure investments remained almost the same over the periods 1990-1997 and 1998-2004 (below the line of no change) showing steady flow of public spending. Japan, Turkey, Iceland, Mexico and France were among the countries with the highest level of public infrastructure spending over the period (Figure 2.2);
- Also, developed countries boosted investments in infrastructure through foreign direct invest (FDI). For example, in 2007, despite the financial credit crisis, total FDI flow in developed countries reached their highest level ever ($500 billion) - a 21% increase over 2006 (UNCTAD 2008). The US maintained its position as the largest recipient country, followed by the United Kingdom, France, Canada and the Netherlands. The European Union was the largest host region, attracting almost two thirds of total FDI inflows into developed countries (Figure 2.3).

Infrastructure is particularly important at times of economic downturns as shown by the global experiences of the great depression in 1929 and the credit crisis of 2007-08. In these times, the governments of the world intensified investments in infrastructure to counteract the negative demand shock which created stress on the whole economy including the inter-linked system of sectors with which infrastructure interacts; also, according to Fournier & Johansson (2016), high government spending in times of crisis encourages economic growth in long run. Example of such investments in 2008 global financial crisis are: Europe ($300 billion/year), Brazil ($281 billion till 2010), China ($180 billion/year), and the US ($150 billion/year) (De, P. 2009).

2.2 Infrastructure in the Australian Context

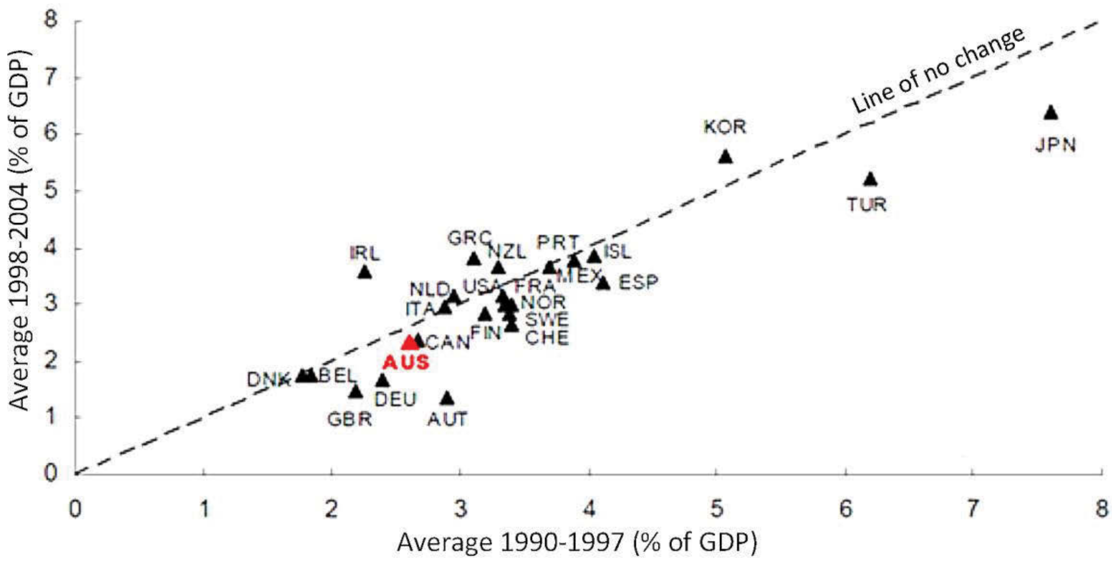
Infrastructure is particularly important in the Australian context, because of the country's climate; population distribution over vast areas, where cities are highly populated and small rural communities are locationally far apart; and its remoteness from the rest of the world (Gray 2009;

Figure 2.1: Total fixed capital infrastructure investment, developed countries, 1990-2004



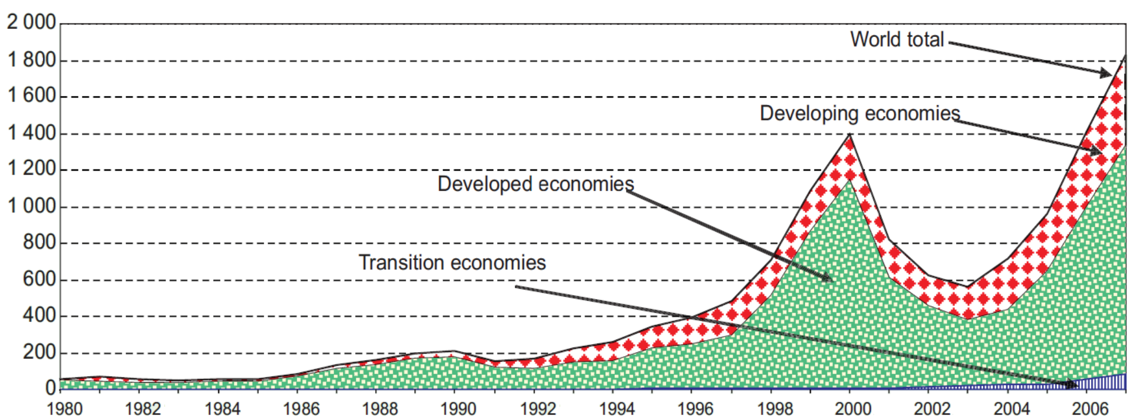
Source: Adapted from OECD (2006b), excludes Korea.

Figure 2.2: Public infrastructure spending in developed countries, 1990-2004



Source: Adapted from OECD (2006b), excludes Korea.

Figure 2.3: Global Infrastructure FDI inflows, 1980-2007 ($b)



Source: Adapted from UNCTAD (2008) FDI/TNC database

Blainey 1975). Infrastructure is also important in Australia to meet the needs of the country's growing population, which is expected to reach 30 million by 2030, and 40 million by 2055 (DIRD 2014; IA 2015). According to ABS (2016), about 67.1% of the population lived in capital cities in 2016, which is expected to grow from about 16.3 million in 2017, to nearly 25 million in 2046 (IA 2018).

Australia's distance from domestic and international markets has influenced development of transport and communication infrastructure which has significantly contributed to Australia's economic growth. According to the World Competitiveness Yearbook (IMD 2017), Australia's communication and connectivity infrastructure is ranked 54 and 49 (out of 63 surveyed countries) respectively. In contrast, investment in telecommunications as percentage of GDP is ranked 8th, demonstrating Australian governments' commitments to continued improvements of priority infrastructure.

The global competitiveness of Australia's infrastructure based on a 2017 survey of 63 countries is eighteen (IMD 2017), owing to the Australian governments' commitments to continued improvements of the country's infrastructure. Infrastructure has indeed been accorded a high priority by the Australian governments, for example: from 1960 to 2017, on average, a total of 10.2% of GDP (real terms, 2016 prices) was invested in infrastructure (this author's calculation based on ABS data). Also, in late-2008 infrastructure attracted 14% of the Federal Government economic stimulus spending to strengthen the economy in the aftermath of GFC. According to OECD (2009c, 2009f), Australia invested 0.82% of its GDP (A$9.7 billion) on stimulus packages funding road, rail, housing and education infrastructure in 2009. As a result, Australia's infrastructure developed further which was a major factor in continued economic growth of the country.

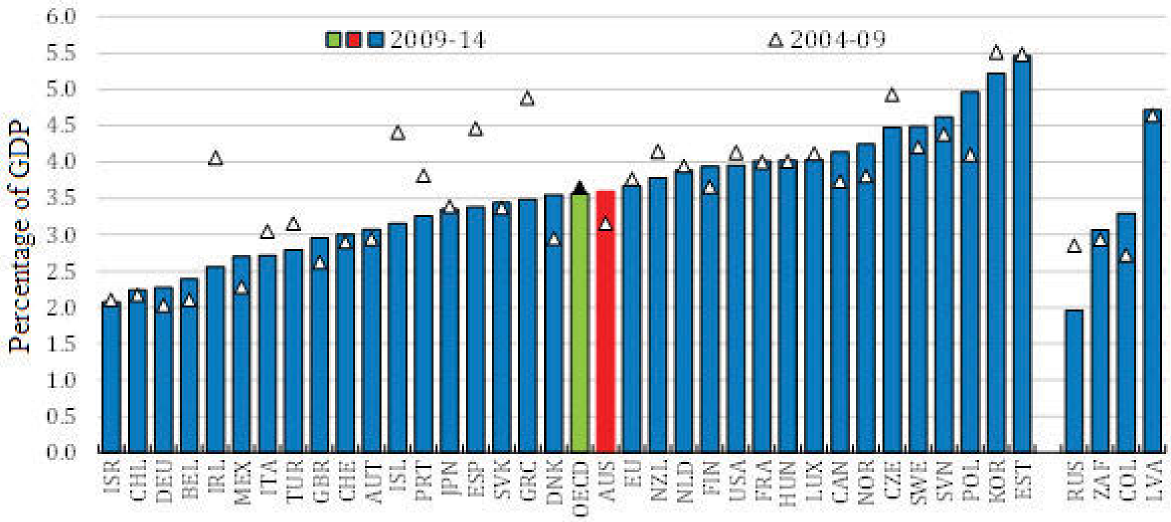
Figure 2.4 shows Australia's average public infrastructure investment position over the periods 2004-2009 and 2009-2014, in comparison to OECD average and other developed countries (OECD 2016). Australia's infrastructure spending over the period 2009-14 is slightly above the OECD average, and above its average spending over the period 2004-09, but lower than other developed countries such as USA, Canada, South Korea, and Estonia.

The importance of infrastructure in Australia, also arises from its geopolitics and security links. Consequently, the Australian government places significant priority to attract FDI as an important vehicle for promoting economic growth (DFAT 2017; DIIS 2015a, 2016). According to Trading Economics (2018), and DFAT (2017), Australian foreign direct investment in 2016 was $64.83 billion, 16% higher than in 2008.

Indicators for Measuring Importance of Infrastructure

Share of General Government Expenditure (GGE) - Infrastructure investment as a share of

Figure 2.4: Australia's public infrastructure spending, global comparison: 2004-2014



Source: Adapted from OECD (2016).

General Government Expenditure (GGE, defined as the sum of General Government expenses and General Government net acquisitions of non-financial assets) (IPA 2018a) is a popular indicator to measure the importance of infrastructure. Table 2.1 shows infrastructure investments as Share of General Government Spending in Australia at national and state levels. This method uses infrastructure spending plus financial leases data which are sought from the states and federal budget papers, and subsequently processed based on the variables applicable to each state and territory. For example, for Federal Government spending, the variable "infrastructure spending"; in case of state of NSW the variable "gross capital expenditure"; and for other states and territories the variable "purchases of non-financial assets" are used to calculate the infrastructure spending as share of government expenditure. Also, for financial leases, "acquisitions under finance leases and similar arrangements" are included in calculations (IPA 2018b).

Table 2.1: Infrastructure spending as share of GGE, 2005-2020

		State Governments Spending								Commonwealth Spending	Australia
	Year	NSW	VIC	QLD	ACT	SA	WA	NT	TAS		
Actual	2005/06	8.91	8.17	11.51	7.75	6.36	8.08	8.46	8.33	0.54	7.57
	2006/07	8.86	9.15	13.83	8.66	6.45	10.12	10.36	7.63	0.70	8.42
	2007/08	9.19	8.24	16.05	10.80	6.95	12.45	10.41	7.41	1.14	9.18
	2008/09	9.41	8.51	16.84	10.71	8.94	11.20	10.67	8.44	2.20	9.66
	2009/10	11.65	10.47	19.49	15.06	12.84	12.98	17.96	15.22	1.71	13.04
	2010/11	11.08	10.47	17.40	16.77	12.81	12.16	19.54	13.93	1.04	12.80
	2011/12	9.11	8.58	16.07	16.48	10.23	12.66	17.58	9.90	2.00	11.40
	2012/13	11.62	9.92	14.46	15.79	12.31	12.07	12.97	8.99	0.95	11.01
	2013/14	12.33	8.00	13.18	13.43	9.00	11.79	10.96	6.91	1.69	9.70
	2014/15	12.98	8.35	10.71	14.87	5.44	9.44	16.67	7.50	1.16	9.68
	2015/16	12.23	9.57	8.92	14.60	6.45	8.38	11.98	7.49	1.61	9.02
	2016/17	14.35	13.18	9.23	14.97	21.35	8.74	13.52	9.33	1.67	11.82
	2017/18 MID YEAR	16.81	14.71	9.86	15.29	11.55	10.27	16.61	10.72	1.71	11.95
Forecast	2018/19	18.55	12.79	12.51	18.11	9.54	7.86	12.78	9.93	1.27	11.48
	2019/20	12.42	10.99	11.57	10.71	7.59	5.58	7.78	7.03	1.00	8.30
	2020/21	9.37	11.67	10.51	9.75	7.45	4.20	7.12	6.01	0.79	7.43

Note: The Commonwealth Government provides funding to support State infrastructure projects.

Source: IPA (2018b). Data as at 11 April 2018.

Share of Gross Domestic Product (GDP) or **Share of Gross State Product (GSP)** – This is the most commonly used indicator because of data availability. It measures infrastructure investment in terms of the actual spending in real term annually as percentage of GDP or GSP. Also, it enables to compare different-sized economies. This method is used in this research because of availability data from Australian Bureau of Statistics (ABS).

However, this indicator as well as the Share of General Government Expenditure indicator, measure inputs which may not translate directly into productivity benefits which is dependent on quality of the investment. Assessment of investment quality is outside the scope of this research.

Total Fixed Capital - Figure 2.1 shows that OECD (2006b) has used the value of *total fixed capital stocks* of built assets as an indicator to show the importance of infrastructure investments and accordingly assess the adequacy of infrastructure provisioning by developed countries. However, because the economic life of the fixed capital stretches over the life of infrastructure - normally two to five decades (Maze & Green 2000) - the use of this indicator for assessing the adequacy of current infrastructure investment may not be suitable.

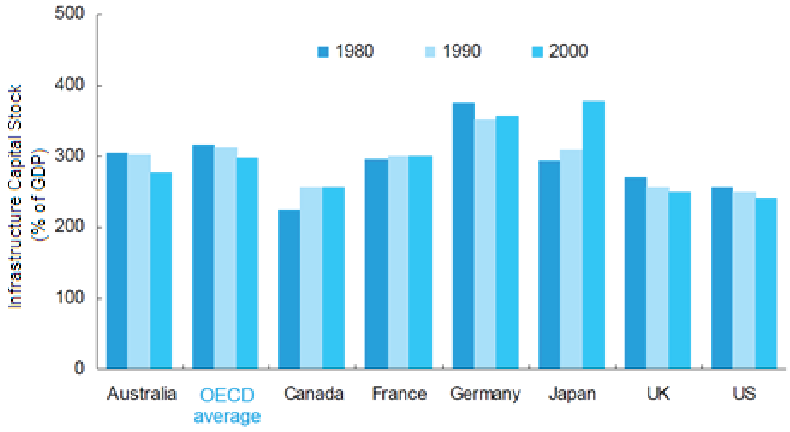
Capital Stock - An alternative indicator is to measure *capital stock* which takes into account the cumulative value of infrastructure investment over its life span minus the value of the capital which is used by the infrastructure for producing its outputs. This method also deducts the value of assets that have reached the end of their service lives. Research by (Maze & Green 2000) and Kamps (2004) shows the usefulness of this indicator in comparison to the total fixed capital formation.

Unfortunately, literature shows very little research on developing standardised methods for capitalising infrastructure assets. As a result, there are varying definitional, data collection, and estimation methods by different countries, which makes it difficult to compare results. For example see OECD (2017b) and ABS (2017a). To overcome the latter issues, the literature suggests application of *Perpetual Inventory Method*, PIM (Kamps 2004), and *Simplified Perpetual Inventory Method*, SPIM (OECD 2009e; Dadkhah & Zahedi 1986; Pyo 2008; Schmalwasser 2002) to measure Capital Stock. Figures 2.5 and 2.6 show the application of capital stock indicator for selected OECD countries including Australia.

The literature reveals linkages of production technology with investment indicators such as PIM and SPIM to more effectively measure the importance of infrastructure including investments in manufacturing and services sectors. Literature also confirms direct relationship between the level of investments and estimation of capital stock (Figure 2.6). See Kamps (2004) for details.

The Capital Stock methods are gradually implemented. However, total fixed capital is the most commonly used indicator by majority of countries including Australia. This research has applied total fixed capital formation indicator because of data availability in Australia.

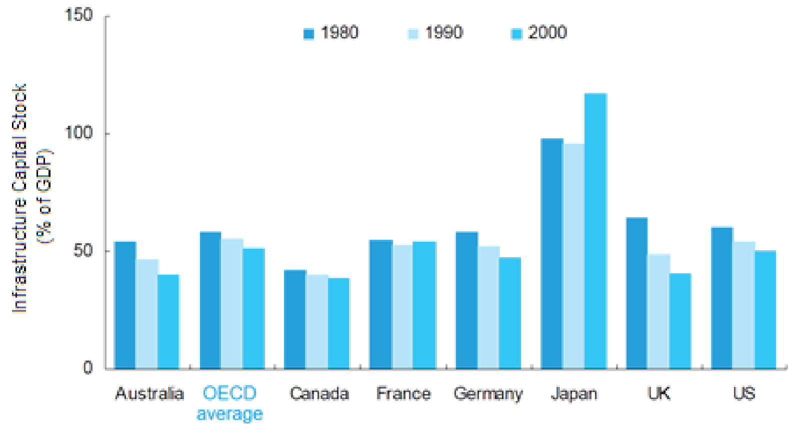
Figure 2.5: Total infrastructure capital stock, selected developed countries
(% of GDP, 2000 purchasing power parity, $US)



Source: Adapted from Kamps (2006) and Kiel Institute for World Economy (2006)

Similar approach is shown by Figure 2.6 for net public infrastructure capital stock.

Figure 2.6: Net public infrastructure capital stock, selected developed countries
(% of GDP, 2000 purchasing power parity, $US)



Source: Adapted from Kamps (2004)

Engineering Measurement of Condition of Infrastructure Assets – This method is used by some countries to base the value of infrastructure on the engineering condition of infrastructure and a system of infrastructure management to collectively assess importance of infrastructure in the economy, and to prioritise investments (Fraumeni 1999). For example, California Department of Transportation is used this method to capitalise bridges (Maze & Green 2000).

Level of foreign investments in infrastructure (FDI) - The level of foreign investments in infrastructure, also signifies the importance of a country's infrastructure as an appealing investment proposition to foreign investors (DFAT 2017; DIIS 2015, 2016; UNCTAD 2008). In this case, the relevant indicators are *inward and outward values for capital stocks and flows* and *FDI restrictiveness*.

2.3 Infrastructure spending in Australia

Infrastructure investment in Australia has contributed to economic growth by facilitating international trade, improving competition, and reducing longer-term costs of entry to larger markets or expanding the existing level of access to domestic and international markets. For example, investments in oil and gas pipelines, ports, roads, and other forms of transport infrastructure significantly improved access to international markets raising exports to $243 billion (15% of GDP) in 2014, placing the country in 21st position globally according to the economic complexity index, ECI (Australian Mining 2016). Investments in exports infrastructure is important in Australia, because Australia provides 35% of global coal (second largest exports after iron ore and ahead of gold accounting for 15% of overall exports), and 52 million tonnes of LNG (DIIS 2017) to the value of $22.3 billion to the world (Hutchens 2017).

Also, infrastructure investment has expanded the Australia's per capita infrastructure stock of built assets. The total value of infrastructure assets, according to Straub (2011), Romp & de Haan (2007), and Bom & Lighthart (2009) shows impacts of infrastructure investment on economic growth. For example, Arcadis (2015) estimates Australia's total value of infrastructure assets at about US$3.25 trillion in 2014 - about 10% higher than the 2012 level (Figure 2.7) - and the per capita value of US$138,523 (Figure 2.8). Australia is 6th country in the world with the highest per capita value of infrastructure assets in comparison to USA (US$115,987, ranked 15), and China (US$34,457, ranked 24) in 2014.

The effects of investments on economic growth depends on the size of present and future infrastructure investments, and whether the investments are aimed at developing new linkages or enhancing existing linkages between infrastructure and other sectors of the economy. For example, OECD (2009a) reports that a small addition - such as interconnection between two networks such as electricity and gas can have significant impact on efficiency and growth, but subsequent investments may have a much smaller effect. Additionally such improvements, raises the level of importance of infrastructure in the economy making it more attractive to investors, which in turn add value to economic growth (see Chapter 8, multiplier effects).

Infrastructure spending is directly linked to demand for infrastructure services influencing economic growth. As a result, policy makers are interested to know the impact of their policies on demand, infrastructure spending, economic growth, and returns on capital. For example, researchers have examined the relationship between electricity use and GDP, in particular the causality of relationship. They have found that increased electricity consumption led to higher GDP (Yang 2000); also, a change in electricity supply influenced by the level of investments had significant impacts on a change in real GDP (Morimoto & Hope 2004).

The relationship of infrastructure investment with returns of capital may not always be an important consideration, particularly in case of public infrastructure spending which is influenced by the social-welfare linkages of infrastructure. For example, public investment in roads and highways are extremely important in Australia because geographically population and economic centres are highly far apart; or investments in water and electricity are necessities of citizen's life.

Figure 2.7: Australia's total infrastructure stock of built assets, 2012-2014 ($US trillion)

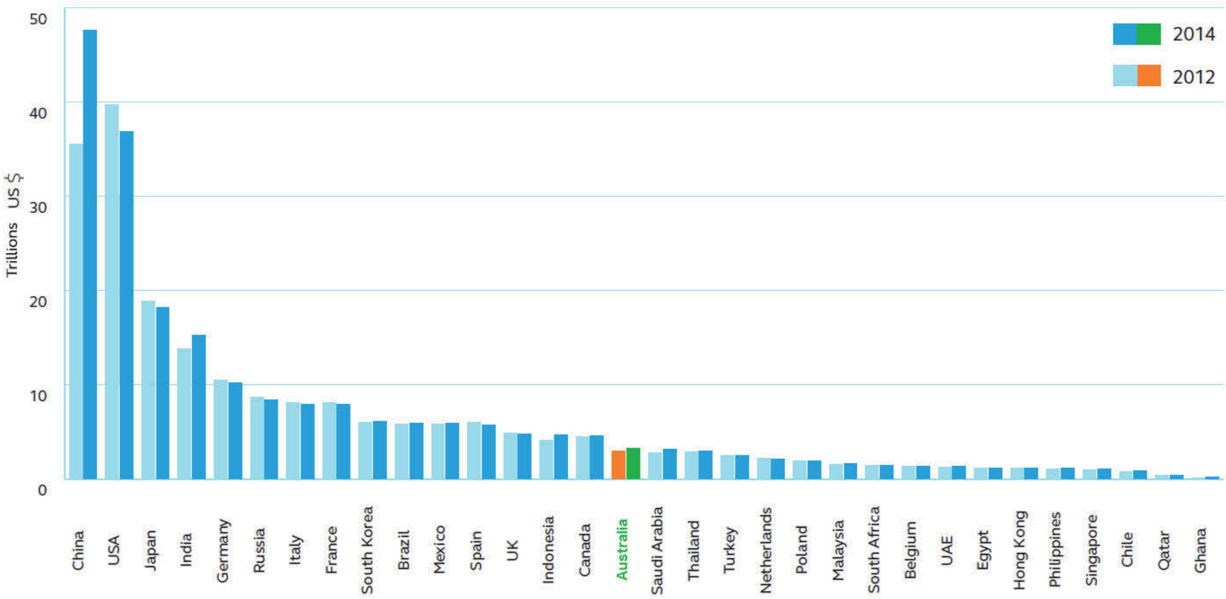
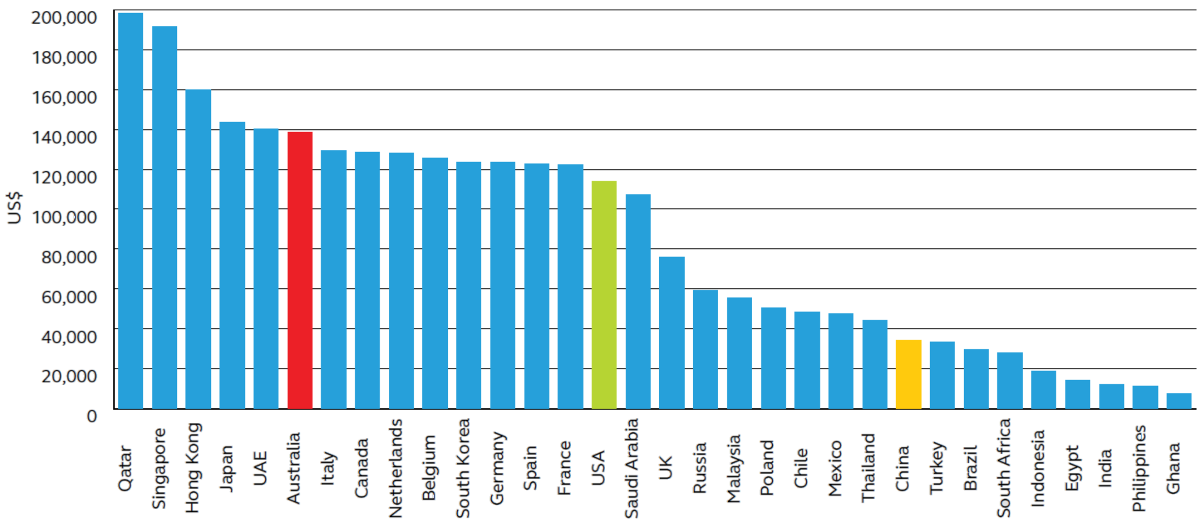


Figure 2.8: Australia's global position - infrastructure assets per capita, 2014 (US$)



Source: Adapted from Arcadis (2015) - Figures 2.7 and 2.8.

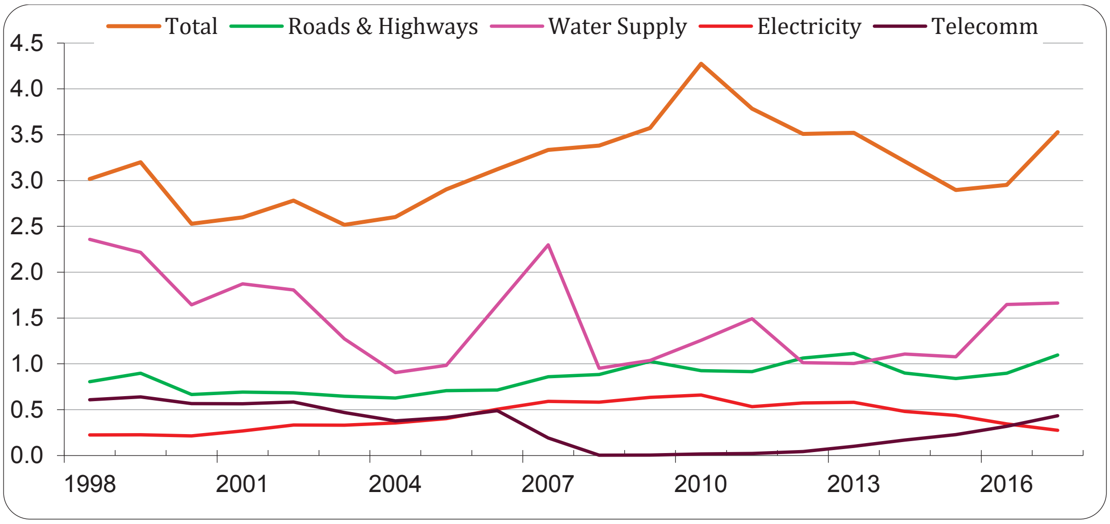
Additionally, areas receiving the infrastructure investment may benefit immediately or in the longer term depending on the nature of investment, either upgrading an existing infrastructure or developing a brand new infrastructure.

2.3.1 Public Infrastructure Spending

The highest investment by public sector from 1998 to 2017 was in water storage and supply infrastructure followed by roads and highways as shown in Figure 2.9. The total infrastructure spending decreased from 3% of GDP (real term, 2015-16) in 1998 to 2.6% in 2004. However, the spending pattern reversed from 2005 to 2010, from 2.9% to 4.3% in 2010 because of increased spending in water storage and supply, roads and electricity as major types of infrastructure services during the latter period. On the other hand, spending on telecommunication decreased by almost 40% (from 0.61% of the GDP in 1998 to 0.37% in 2004) in this period because of the

Government's plan to privatise the communication provider, Telstra. Public spending on telecommunication approached to almost nil (0.006% of GDP) in 2009. However, over the period 2011-2017 spending on communication increased by about 19 fold, because of implementing National Broadband Networks, and advanced mobile communication technologies.

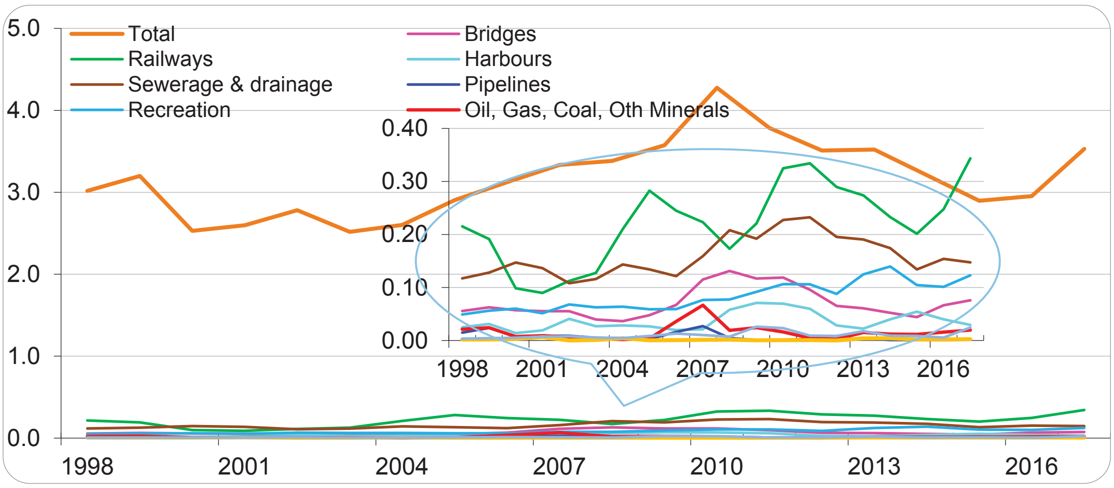
Figure 2.9: Infrastructure with the highest public spending, 1998 – 2017
(% of GDP, Real Term, 2015-16=100.0)



Source: This author's analysis based on ABS data (ABS 2017a, 2017c, 2018d)

In contrast, the lowest public infrastructure spending during 1998 to 2017 was in oil, gas and coal infrastructure, while spending on railways was among the highest in this group. Australian Government has no ownership stake in the domestic natural gas industry (EIA 2009a), however, the Australian Energy Regulator (AER) regulates the industry. Ministerial Council of Energy (MCE) coordinates the policy between the Commonwealth and States, and functions as director of natural gas policy. Other infrastructure which attracted lowest level of public spending is shown in Figure 2.10 during the same period.

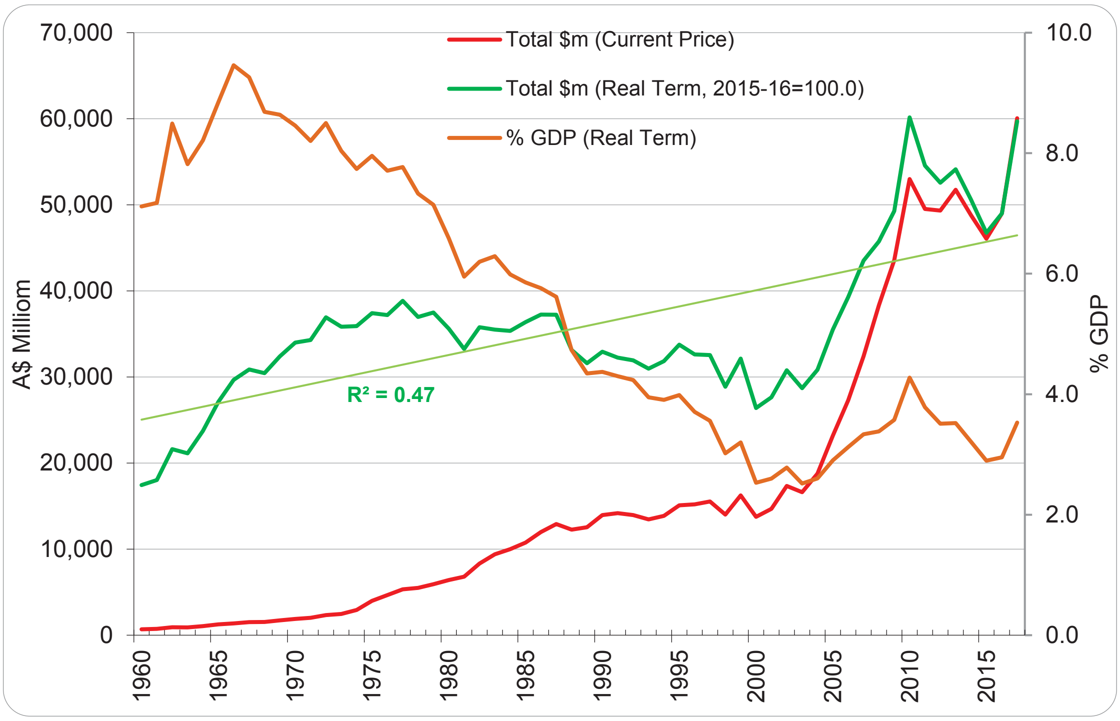
Figure 2.10: Infrastructure with the lowest public spending, 1998-2017
(% of GDP, Real Term, 2015-16=100.0)



Source: This author's analysis based on ABS data (ABS 2017a, 2017c, 2018d).

The analysis reveals that the overall public spending has decreased over the period 1960 to 2017 (Figure 2.11). The spending was at its lowest during the late 1990s to early 2000. However, during the late-1980 to late-1990s Australia's GDP growth had considerably outperformed the OECD average. This higher economic performance is partly due to infrastructure reforms of the mid-1980s underpinned by microeconomic reforms in Australia (see Chapter 3 for details).

Figure 2.11: Total public infrastructure spending, 1960-2017 ($m, and % of GDP)

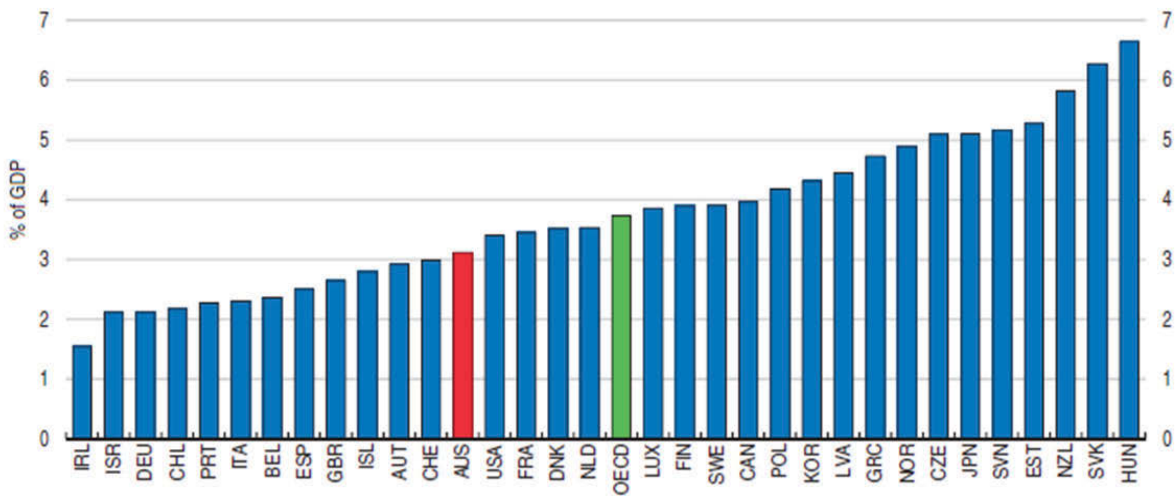


Source: This author's analysis based on ABS data (ABS 2017a, 2017c, 2018d)

The overall public infrastructure spending of 7.12% of the GDP in 1960 decreased to 3.53% in 2017 (real terms, 2016 dollars) in spite of the increase in the actual monetary amount of spending on all infrastructure from $17,440 million (real term, 2016 dollar) in 1960 to $59,698 million in 2017 nearly by 3.5 fold (Figure 2.11). This shows that proportional to the total size of the GDP in each year (the 1960 GDP of $245,051m in comparison to the 2017 GDP of 1,692,092m, about 7 times increase), the public infrastructure spending was not sufficient, as also confirmed by low regression coefficients. This finding is further confirmed by Figure 2.12 comparing the Australia's average public spending over the period 2015-17 (3.13%) with the OECD average of the same magnitude (OECD 2017c).

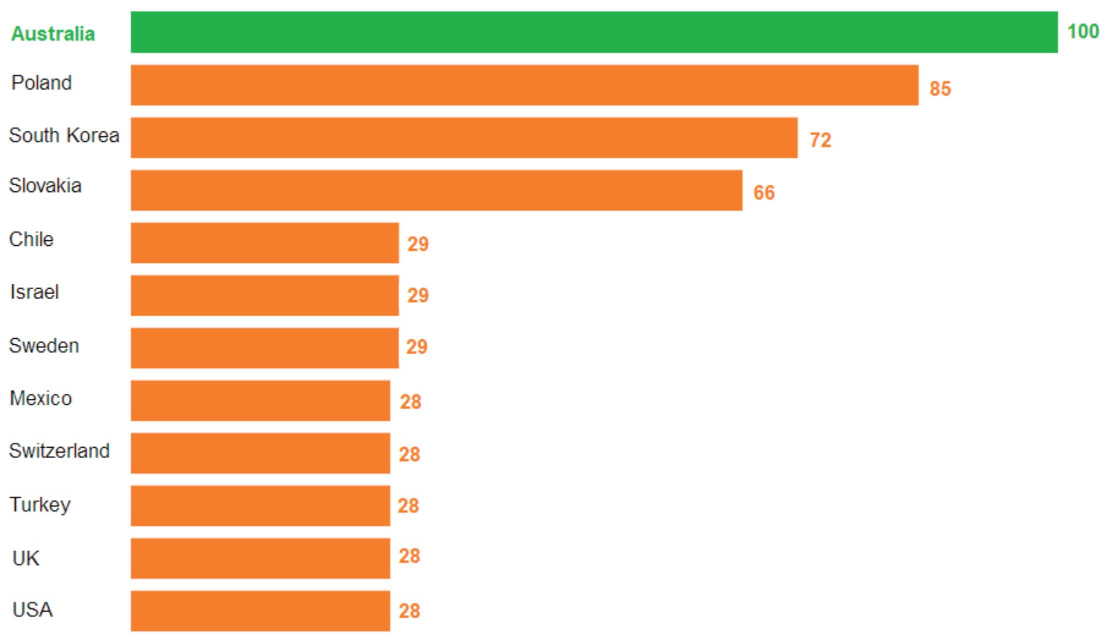
The reason for low level of public spending can be related to good economic performance in Australia, considering the 103 consecutive recession free quarters over the period 1990 to 2017 (see Figure 2.13 to 2Q 2016 for global comparison), alleviating the need for further spending by various sectors of the economy. However, based on the experiences of the 2008 economic crisis, experts asserted that in good economic times, governments should take advantage of the situation by adequately spending on infrastructure to further strengthen their economies as a safeguard for difficult economic times as well as to promote the welfare of their nations. For example see OECD (2017c) and Fournier & Johansson (2016).

Figure 2.12: Australia's public infrastructure spending, 2015 to 2017.



Source: OECD (2017c).

Figure 2.13: Australia's recession free consecutive quarters, 3Q-1991 to 2Q-2016



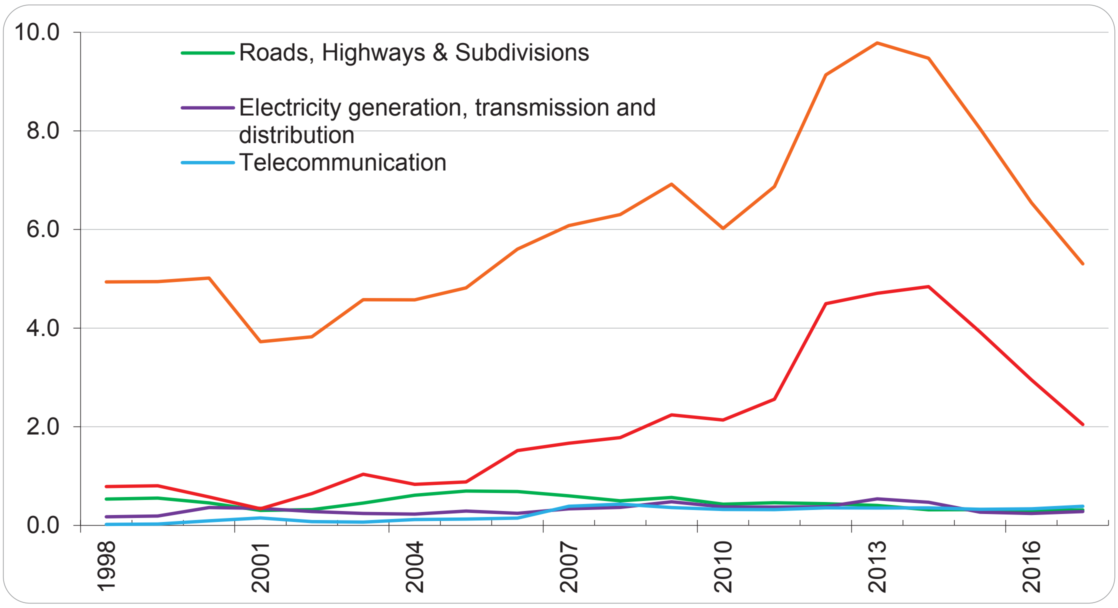
Source: Adapted from OECD (2016).

2.3.2 Private Infrastructure Spending

Figure 2.14 in comparison to Figure 2.11 shows that contrary to the public sector, the private sector invested in oil, gas and coal by nearly 127 fold (public 0.016% of real GDP, and private 2.038%) over the period 1998 to 2017. From 1998 to 2005, total infrastructure spending by private sector decreased, but this pattern was reversed from 2006 and continued to 2014. The latter increase was related to private sector's higher investment in oil, gas, coal, and telecommunication infrastructure because of attractive returns of capital. According to EIA (2009a), private investments in gas exploration in Australia has increased significantly since 2007, and continues to date (DIIS 2017). It is expected that the investment in LNG and Coal Seam Methane (CSM) increases over the coming years because of projects planned in Queensland and for NSW as well as planned LNG plants in Queensland with a combined capacity of 794 Bcf per year (COAG 2016; MF 2015; Queensland DNRM 2016).

Figure 2.14: Infrastructure with the highest private spending, 1998-2017

(% of GDP, Real Term, 2015-16=100.0)

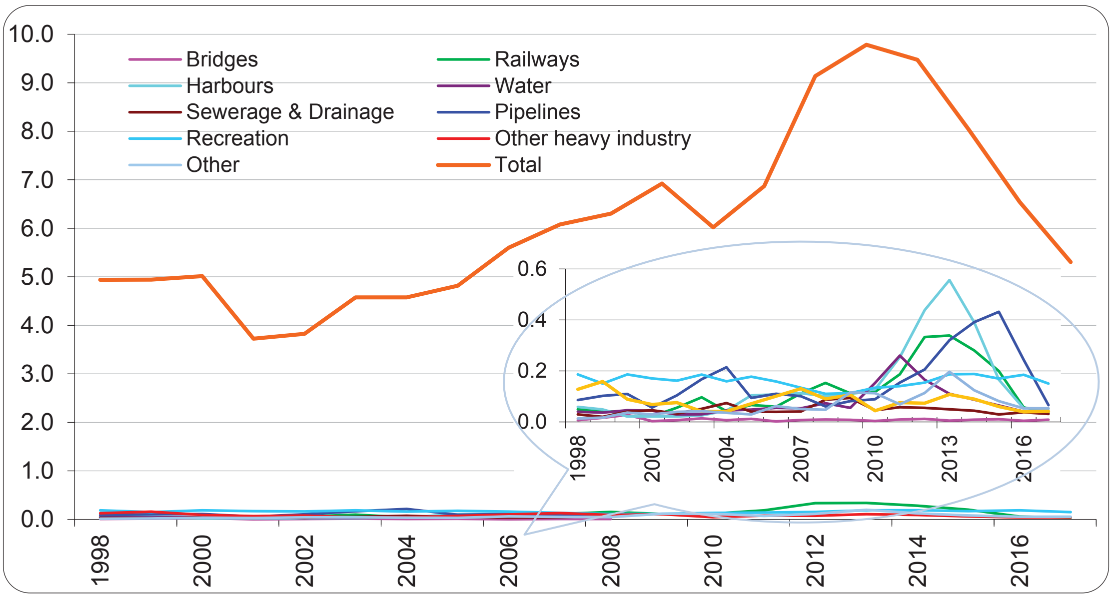


Source: This author's analysis based on data from ABS (2017a, 2017c, 2018c).

Infrastructures less attractive to private investors are shown in Figure 2.15, below.

Figure 2.15: Infrastructure with the least private spending, 1998-2017

(% of GDP, Real Term, 2006-07=100.00)

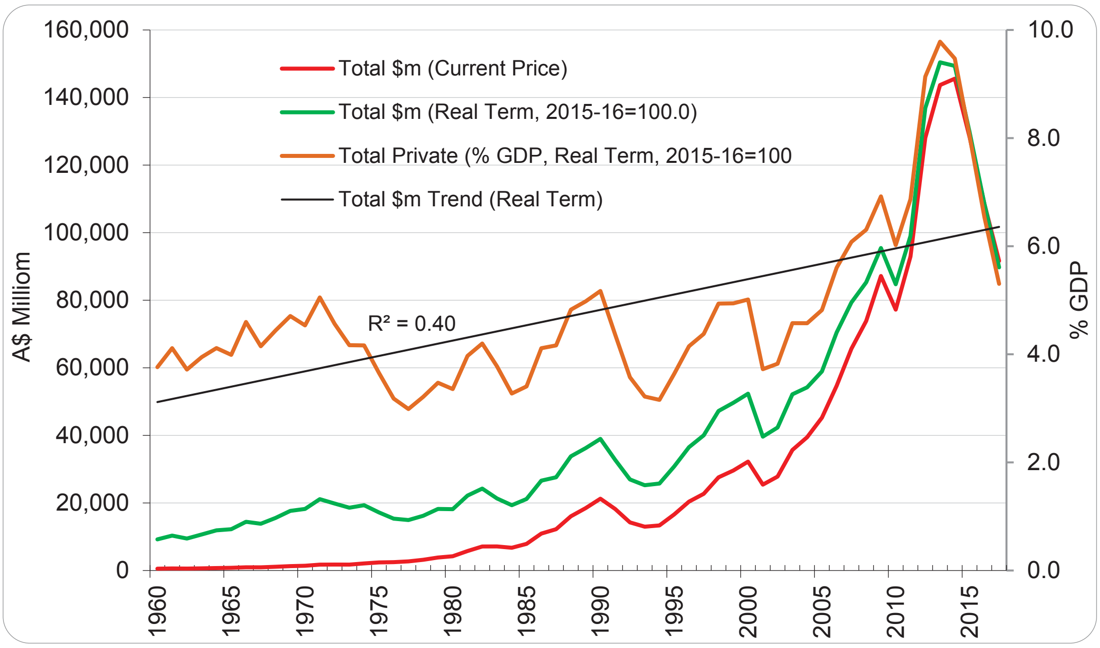


Source: This author's analysis based on data from ABS (2017a, 2017c, 2018c).

Initially, private sector was the provider of infrastructure in Australia, but it was not willing to invest in low return infrastructure such as water or electricity necessary for public consumption. Therefore, the government started investing in such infrastructure at much higher rates to ensure the nation's welfare. Nevertheless, private sector invested in the electricity generation, transmission and distribution infrastructure but at lower rate. Private sector's investment in water was the lowest (overall average of 0.07% of real GDP over 1998 to 2017), 30 times lower than the public spending (1.5% over the same period).

The total private sector spending trends (in $m and as % of GDP, real term) followed an increasing pattern over the period 1960 to 2017 (Figure 2.16). However, the regression analysis shows less significant increase in private investments over the period.

Figure 2.16: Private sector's pattern in infrastructure spending, 1960 to 2017



Source: This author's analysis based on data from ABS (2017a, 2017c, 2018c).

The private sector spending in real term (2016 dollar), particularly from 1990 to 2013, on average is about 62% higher than the public sector spending. But, overall, on average it is only by about 20% higher than the public investment over the full period of 1960 to 2017. Table 2.2 shows that overall, on average, private spending is lower than public spending by about 0.7% of GDP.

Table 2.2: Total public and private spending, 1960 to 2017 (%GDP)

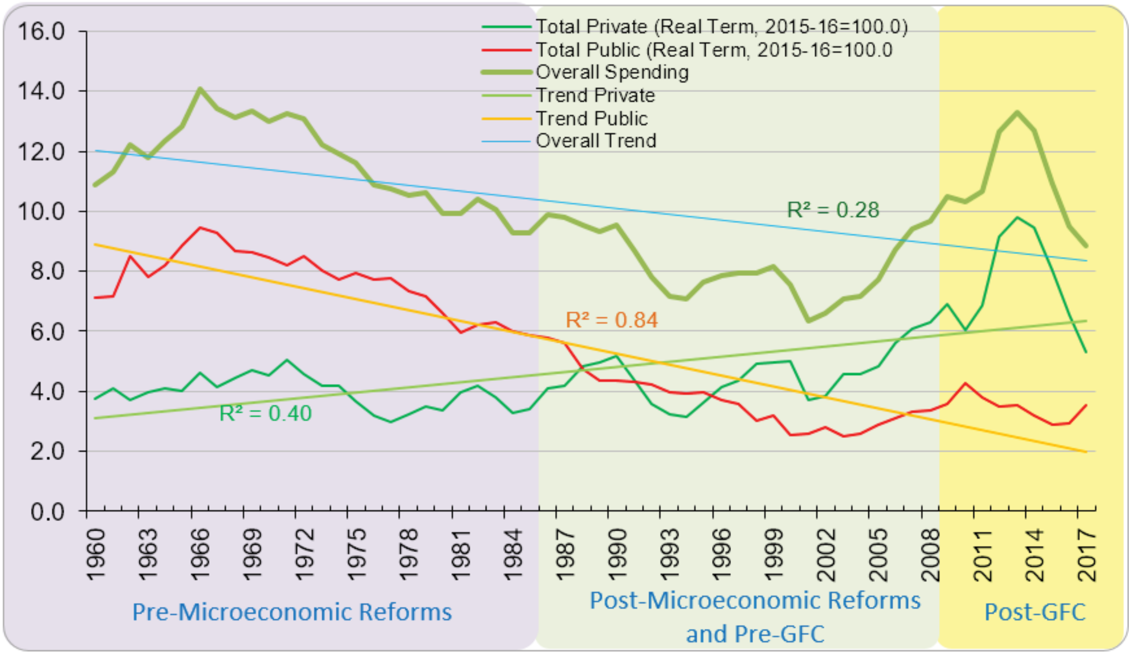
	Infrastructure Spending (% of GDP, REAL Term, 2015-16=100)		
Periods	**Public**	**Private**	**Total**
Pre-Microeconomic reforms (1960-1985)	7.67	3.94	11.49
Post-Microeconomic Reforms and Pre-GFC (1986-2008)	3.67	4.53	8.20
Post-GFC (2009-2017)	3.47	7.57	11.04
Overall (1960-2017)	5.43	4.74	10.17

Source: This author's analysis using ABS data (2017a, 2017c, 2018c and 2018d)

2.3.3 Total Infrastructure Spending

Figure 2.17 and Table 2.2 show the patterns of total infrastructure spending by private and public sectors over three distinct periods of: pre microeconomic reform; post-reforms and pre-GFC; and post-GFC. Throughout these periods, overall infrastructure spending decreased from the highest value of 14.1% of GDP (2016 dollars) in 1966, to the lowest (6.3%) in 2001. However, the efficiency gained through the post-microeconomic reforms, and the mining booms which started around 2003 and continued to the peak level in 2013, significantly overrode the impacts of the 2008 crisis reversing the pattern from 6.6% of the GDP to 13.3% over the period 2002 to 2013.

Figure 2.17: Total infrastructure spending (Public and private) 1960-2017 (% of GDP, Real Term, 2015-16=100)



Source: This author's analysis using ABS data (2017a, 2017c, 2018c and 2018d)

During this period, higher infrastructure spending was significantly boosted by the post-GFC economic stimulus as described earlier in this chapter. The total spending over the period 2014 to 2017 sharply declined because of the end of mining boom which started in 2014; and global economic uncertainty influenced by the 2016 Brexit vote as well as change of governments around the world. These events have negatively impacted Australia because of its trade linkages with Asian countries, mainly China, and others. Nevertheless, the overall average infrastructure spending remained at 10.2% of the GDP over the period 1960 to 2017 (Table 2.2).

Figure 2.17 shows a statistically insignificant decreasing pattern of overall spending, because sharp decreases in public spending are substituted by increased private spending. Private investment started to increase because the paradigm for infrastructure provisioning in Australia shifted from a centralized government policy to a market-based economic policy which encouraged more private investment. The infrastructure reforms of the mid-1980s underpinned by microeconomic reforms were mainly responsible for policy changes as further discussed in Chapter 3. During the post-reforms period, private sector's spending increased to an average of 4.5% of GDP in comparison to the public spending of about 3.7% (Table 2.2). The increased private spending pattern continued significantly in the post GFC period at an average rate of nearly 7.6% of GDP.

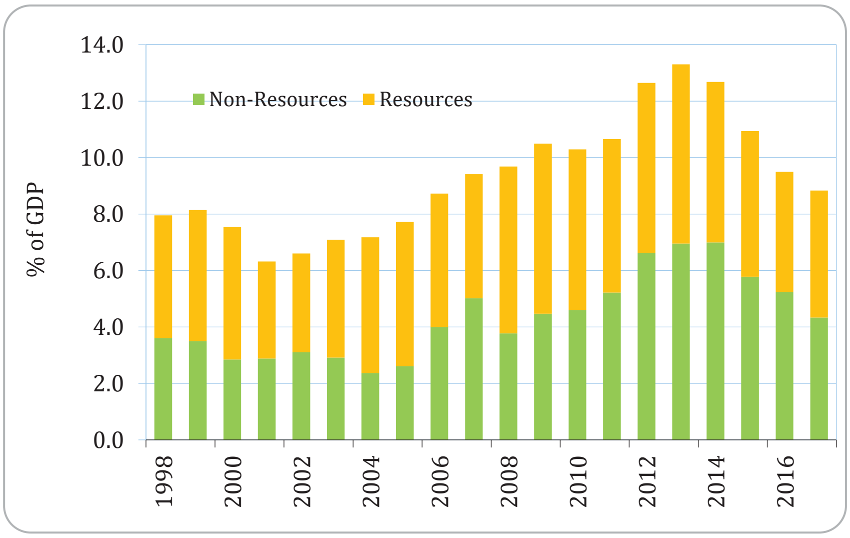
The overall findings reveal that on average public spending (5.43% of GDP) exceeded average private spending (4.74%) over the period 1960-2017.

2.3.4 Infrastructure Grouping vs Sources of Investment

In order to determine the share of infrastructure spending on broader infrastructure grouping, the economic infrastructure within the ABS data reporting structure of engineering construction and non-residential construction (ABS 2017c, 2018c, 2018d) are categorised into *Resources* and *Non-Resources* groups. In the context of this research, the Resources Group includes water supply and storage, electricity generation, electricity transmission and distribution, oil, gas, and other minerals. The remaining infrastructure defined as Non-Resources Group. Figure 2.18 shows that the total public and private spending on both Resources and Non-Resources groups is the highest in 2013, attributed to the peak mining booms, by about 6.4% and 7% respectively. Also, the spending on both groups over the period 2011 to 2016 was higher than other periods. The lowest spending on Resources group is observer over the period 2001 and 2002 before the start of mining booms in 2003being higher than Non-Resources group by 8% (0.6% of the GDP, real term).

Figure 2.18: Investments in Resources and Non-resources Infrastructure, 1998-2017

(% of GDP, Real Term, 2015-16=100.0)



Source: This author's analysis based on the ABS data (2017c, 2018c, 2018d).

The spending on Non-Resources infrastructure during the post-GFC period was higher than the pre-GFC period by about 2.3% of GDP attributed to governments record high economic spending over the period. In contrast, the investments on Resources group remained almost similar, increasing by about 0.9% over the same period. In 2008, about 61% of investments was on Resources infrastructure group.

The findings show significant linkages of infrastructure investments with major events in the economy such as mining booms and global financial crisis. During the period 2014 to 2017 the total infrastructure spending dropped from 13.3% of GDP to 8.8% respectively. Over the same period, the investment by private sector declined by about 46% while the public investment remained unchanged at 3.5% (Figure 2.17). Also, investments could be impacted more significantly by the non-renewable nature of Resources group. Therefore, these findings, together with the findings provided in Chapter 6 through the input-output entropy and concentration indices, suggests move to diversified infrastructure investments to further support economic growth. For example, oil and gas companies can also invest in electricity sectors producing electricity from non-renewable sources (see Chapter 6 and 9 for scenarios and further details).

2.4 Infrastructure-Economic Growth Linkages

This section discusses the infrastructure-economic growth linkages in the historical backdrop of economic growth theories. The findings of this section facilitates development of a GDP model for analysing the aforementioned linkages. The GDP Model is discussed in section 2.6.

Historical evolution of economic growth theory

Since the time of Adam Smith (1776) and his theory of economic growth, infrastructure development has been recognised as one of the important contributors to the economy. Adam Smith stated "…*no roads, no transport, no trade, no specialisation, no economies of scale, no productivity progress, and no development*...". Over the years, economic growth theory has undergone significant revisions leading to current belief that government policies and infrastructure provisioning impact on a nation's economic growth. The evolutionary history of economic growth theory leading to the current belief is described below.

The study of economic growth especially after the great depression in 1929 and subsequent introduction of Keynesian theory attracted the attention of economists like Harrod (1948) and Domar (1946) who independently applied a Keynesian model to analyse economic growth and then jointly introduced the Harrod-Domar (HD) growth model. This model was based on assumptions that the economy generates savings at a constant proportion of national income and that the planned investments equals planned savings and finally investment is determined by the expected increase in national income and a fixed technical coefficient, known as Incremental Capital Output Ratio (ICOR). However, there are issues with this model: first, the fixed technical coefficient implies that there is a fixed relationship between the capital and output, and second because labour input is not included, the assumption is made that labour supply is elastic (Siggel 2005). To correct these issues, Solow (1956) and Swan (1956) subsequently modified the HD model to incorporate labour and time varying effect of technology in economic growth and developed a collaborative model called the Solow-Swan or otherwise known as the *neoclassical growth model*. However, Solow-Swan model failed to explain how or why technological advancement occurs. Therefore, Arrow (1962) and Sheshinski (1967) incorporated *learning by doing* human behaviour to explain the increased productivity because of advancement in technology. Romer (1986) developed another model under the assumptions that the economy operates in a perfectly competitive market environment; and that an equilibrium rate of technological advancement can be determined under the compromise that the result of growth rate would not be Pareto optimal. But in reality, the market is not perfectly competitive. Therefore, the shortcomings of this model later led Romer (1987, 1990) to develop endogenous growth theory, in other literature referred to as MRW (Mankiw et al. 1992), which considered technological development of imperfect competition endogenously. This model gives importance to government policies and infrastructure provisioning among other economic parameters for stable economic growth.

Later, Stern (1991) by his growth theory determinants, Barro (1997) by his finding that government guides long-term growth, and Prud'homme (2004) further recognised the impact of infrastructure on economic growth. Barrow (1997) further expanded the Stern's work and concluded that adequate infrastructure as well as government consumption and the terms of trade are among a range of identified parameters which influence economic growth. These researchers also argued that overlapping infrastructure difficulties exert a compounding effect on a nation's economy causing it to rapidly decline. The following section defines the methods used by researchers to identify the impact of infrastructure investment on economic growth.

Methods to identify linkages of infrastructure with economic growth

Infrastructure investment could have a mixed effect on domestic growth. A positive outcome, may be achieved by public investment in times of economic recession. However, a negative impact may happen if public investment increases under conditions of full capacity, which causes increased demand for resources, and given full capacity, this may lead to increased costs of private investment, resulting in a fall in private investment, thus reducing economic growth.

Because infrastructure plays an important role in economy, researchers have used several different methods to find the relationship between infrastructure and economic growth, to the extent that the results become rather lost in underlying mathematics and hence unconvincing. The reasons could be application of non-standard methods and assumptions and possibly certain political or philosophical ideologies leading researchers to arrive to different research outcomes. A group of researchers believe that econometric problems such as unit roots and false correlation (Jorgenson, 1991), measurement errors of public capital (Cashin 1995), and measurement errors in the public capital proxies (Baltagi & Pinnoi 1995) are the reasons for arriving at vastly different results.

The analysis of the linkages between infrastructure investment and economy was reinvestigated in the late 1980s. For example, Aschauer (1989a, 1989b and 1989c) applied a Cobb-Douglas production function and used aggregated national time series data for the U.S. by expanding the conventional production function to include the public capital or its components to investigate the relationship between public infrastructure capital and economic growth. He found a very strong and high-level linkage between these two variables. Even the return on public capital was much higher than on private capital, which caused strong controversy (being criticised from many methodological points of view, ranging from inappropriate estimation techniques to the specific characteristics of the period analysed). However, by a similar approach, Munnell (1990a, 1990b, 1992, 1993) reached the same conclusion studying water and sewer and highway infrastructure. Fox (1990) has formulated a general regional economic model of aggregate supply and aggregate demand to analyse conceptual relationships between infrastructure investments and economy. The results of the studies provided an explanation of the slowdown in productivity growth in developed countries after 1973, which was caused to some extent, as reported, by the deficiency of public capital. Using different production functions, including Translog function, several other researchers have found high output elasticities for public infrastructure investment (public capital stock) (Fernald 1999; Dalamagas 1995; Lau & Sin 1997; Otto & Voss 1994; Ram & Ramsey 1989; Ramirez & Nazmi 2003; Wylie 1996).

Additionally, other researchers employed a cost function approach (Lynde & Richmond 1992; Morrison & Schwartz 1996; Nadiri & Mamuneas 1996; Khanam 1999). Cost function is suggested as being even better suited to this kind of analysis because it avoids the possible correlation between public and private capital (Gillen 1996). Interestingly, the studies using a cost function are more consistent in reaching the conclusion that infrastructure capital has significant and positive effects on economic growth.

The above group of researchers had shown that it is possible to empirically define the relationship between public infrastructure and economic growth and such relationship is strong and positive. However, another group of researchers found no or insignificant evidence to prove this positive relationship (Ford & Poret 1991; Holtz-Eakin & Schwartz 1995a, 1995b; Hulten & Schwab 1991; Sturm & De Haan 1995). Researchers: Hulten & Schwab (1991) estimated the relationship between public infrastructure and economic growth at the state and local levels in USA using sources of growth analysis[1] and concluded that public infrastructure does not significantly impact on economic growth because the investment (capital stock) is greater when the country is in its developmental stage or when the level of public capital stock is low, however, at later stages when the infrastructure matures then the level of subsequent investment would not be that high; hence, it does not play a significant role in economy. However, this view ignores the influence of major variables on infrastructure spending assuming a stationary state for "mature" infrastructure. For example, variables like increasing growth in population, new technologies, growth in per capita

[1] Sources of growth analysis is an equation of growth associated with the production function. It is estimated using nonparametric index number techniques, and the importance of the various inputs is measured as the percentage of the growth rate of output accounted for by each input (Hulten and Schwab, 1991).

income influencing demand for advanced infrastructure services; political environments locally and internationally; and increased competition.

Another argument towards insignificant impact of infrastructure investment on economic growth could be constructed on the basis that infrastructure spending forms a proportion of the GDP, therefore, it is possible that infrastructure project are affected by budgetary restraint and subject to funding-cut at times of economic difficulties. However, this conventional practice was not supported at the time of recent world economic downturn in mid-2008, when governments around the world decided to invest even more on infrastructure projects to revive their economies preventing their economies falling into a recession. Nevertheless, issues surrounding infrastructure funding remains which could lessen the contribution of infrastructure investment on economic growth. Nevertheless, Governments with adequate economic activities at both domestic and international levels as well as being successful in attracting private sector's investment can normally finance infrastructure projects with no difficulties through the life of the projects. Governments normally finance infrastructure from the net revenue generated from direct and indirect taxes (e.g. the controversial mining tax in June 2010 in Australia to fund roads, ports and other infrastructure required for the mining sector) or through retained income such as budgetary surpluses or through domestic and foreign borrowing if cut in other government expenditure is not considered.

Also, it can be argued that public infrastructure investment is mainly needed to increase social welfare of citizens or creating a balance in areas which are most needed while at the same time it encourages private sector to invest and hence contributes to the economy. Therefore, public investment may be viewed as a catalyst for attracting the private investment. The analysis of infrastructure spending in Australia further confirms the increased share of private infrastructure spending after the implementation of a series of infrastructure reforms in mid-1980s to early 1990s, highlighting the role of private sector in economic growth in Australia.

2.5 Infrastructure-Economy Linkages: A GDP Model

In this Section two major analysis are done. First, infrastructure-economy linkages are identified for the infrastructures of interest (IOI) in the Australian context; and second, a GDP model based on public and private investments in water, electricity, oil, gas, coal, and pipeline infrastructure is developed and its results are discussed. The outcomes will provide insights into the nature of infrastructure linkages useful for policy development and decisions.

Data and analysis method

The data was obtained from the Australian Bureau of Statistics (ABS), the Australian Treasury Department, OECD and IEA database for investments in water, electricity, gas, oil, and pipelines for both public and private Sectors from 1960 to 2017. The ABS data provides aggregated investment figure for gas, coal and oil. Also, because of the relatively low amount of investments in pipelines in comparison to other infrastructures, pipelines investment was added to the aggregate gas, coal and oil. The historical trends were determined over the latter period, however quantitative analysis of infrastructure investment data, at aggregated level for each infrastructure as well as their cross relationships, was carried out for the first quarter of 1998 to the last quarter of 2008. This timeframe encompasses a period economic stability followed by the global economic downturn in mid-2008, and also is a period for which a complete set of reliable proxy infrastructure data, and price indices were available for the infrastructures of interest.

The cross-relationships were investigated between each infrastructure (total private and public investment) and GDP, between private and public investment within same infrastructure, between one infrastructure and the other, and among all infrastructure types including the investment year and the GDP. The investment data for each infrastructure type was checked for normality and if required normalized for the analysis purposes.

To determine the impact of infrastructure investment on economic growth, the production or the cost functions were not used because of detailed processes being out of the scope of this research. Also, investigating other parameters such as the effects of fiscal constraints on infrastructure investment, at this stage of study is not of concern. Therefore, econometric analysis such as Auto Regression on investment data over 11 years and then linear regression were employed. The purpose of choosing these methods is to demonstrate the correlations between infrastructure and GDP, for which available literature has not provided much empirical analysis. This analysis provides insights into the nature of linkages, and also, the ability to predict future estimates through alternative regression formulations. This information will also assist public and private investors to make informed investment decisions by knowing the investment linkages between various infrastructure and economy. Linear regression was used based on the positive outcome of the normality test for the variables; the constant spread of data showing similar standard error across the range; the assumption that one year investment is independent of the previous year's investment; and the behaviour of data showing a positive relationship between the two variables.

To model GDP by investment in water, electricity, oil, gas, and pipeline by both private and public Sectors, multiple regressions were used for fitting the full model including all variables and the investment years. The null hypothesis for the model is constructed as: there is no relationship between investment and GDP. The reduced regression techniques were then used to prove or to reject this hypothesis utilizing the results obtained from the multiple regression techniques.

The final model was constructed for the period 1998 to 2008 for which all required data were accessible. The model tested for accuracy and results compared with the actual investment and GDP values reported by the Australian Bureau of Statistics.

Analysis and results

It is noteworthy that the social consequences of infrastructure investment are difficult to measure because of the unavailability of related data. Therefore, financial aspects of public infrastructure investment alone are analysed, however at the overall investment level for each infrastructure. The investment data at upstream, transport and downstream levels are not available at the time of writing this thesis.

The results of normality check for infrastructure of interest (IOI) is shown in Table 2.3, below.

Table 2.3: Results of normality and transformation - IOI

Variable	Normality Accepable	Transformation if not normal	Variable used for Modelling
Water_Pvt	No	1/Water_Pvt	1/Water_Pvt
Elec_Pvt	Yes		Elec_Pvt
Oil_Pvt	Yes		Oil_Pvt
Water_Pub	No	1/Water_Pub	1/Water_Pub
Elec_Pub	Yes		Elec_Pub
Oil_Pub	No	1/Oil_Pub	1/Oil_Pub
Water_Tot	No	1/Water_Tot	1/Water_Tot
Elec_Tot	Yes		Elec_Tot
Oil_Tot	Yes		Oil_Tot

Source: This author's analysis based on the GDP model developed in this research.

For the private water investments (Water_Pvt), p-value is < 0.05 (= 0.045), suggesting that the assumption of normality for variable "Water_Pvt" is not acceptable. So, this variable was transformed to achieve normality using Box-Cox Transformation. Hence, this variable was transformed to "1/Water_Pvt" for analysis purposes and subsequently its new p-value was calculated (p-value > 0.05 (= 0.159) proving that the assumption of normality for variable "1/Water_Pvt" is acceptable. Therefore variable "1/Water_Pvt" thereafter used in all analysis instead of "Water_Pvt". Likewise normalisation and transformation for gas, coal, oil and pipeline infrastructure investment (hereafter referred to as "Oil_Pub" suggested a new variable called "1/Oil_Pub" for analysis purposes.

Other variables were tested for normality and transformation, and the results shown in Table 2.4. Subsequently the correlation coefficient for variable infrastructure and GDP was calculated.

Linkages of infrastructure investments with Australian GDP

Regression analysis was done for the GDP vs investments for various infrastructures for both public and private sectors, results of which are summarised in Table 2.5.

There are strong positive relationship between GDP and the IOI, except for public investment in oil (Oil Public). The Australian governments do not invest in highly capital intensive oil, gas and coal infrastructure because of high risk involved in exploration and production; they prefers to administer and regulate these industries to protect the interests of current and future generations.

Table 2.4: Correlation coefficients for GDP and the IOI

Variable1	Variable2	R-Sq	Correlation Coefficient	Strength of Correlation	Direction of Correlation
GDP	Elec_Pvt	0.829	0.910	Significant Correlation	Positive
GDP	Oil_Pvt	0.879	0.938	Significant Correlation	Positive
GDP	1/Water_Pvt	0.801	-0.895	Significant Correlation	Negative
GDP	1/Water_Pub	0.831	-0.912	Significant Correlation	Negative
GDP	Elec_Pub	0.956	0.978	Significant Correlation	Positive
GDP	1/Oil_Pub*	0	0.000	No Correlation	
GDP	1/Water_Tot	0.854	-0.924	Significant Correlation	Negative
GDP	Elec_Tot	0.941	0.970	Significant Correlation	Positive
GDP	Oil_Tot	0.868	0.932	Significant Correlation	Positive
1/Water_Pvt	1/Water_Pub	0.822	0.907	Significant Correlation	Positive
Elec_Pvt	Elec_Pub	0.839	0.916	Significant Correlation	Positive
Oil_Pvt	1/Oil_Pub	0.053	-0.230	No Correlation	
1/Water_Pvt	Elec_Pvt	0.69	-0.831	Significant Correlation	Negative
Oil_Pvt	Elec_Pvt	0.65	0.806	Significant Correlation	Positive
1/Water_Pvt	Oil_Pvt	0.698	-0.835	Significant Correlation	Negative
1/Water_Pub	Elec_Pub	0.804	-0.897	Significant Correlation	Negative
1/Oil_Pub	Elec_Pub	0.037	-0.192	No Correlation	
1/Oil_Pub	1/Water_Pub	0.002	0.045	No Correlation	
Elec_Pvt	1/Water_Pub	0.881	0.939	Significant Correlation	Negative
Oil_Pvt	1/Water_Pub	0.721	0.849	Significant Correlation	Negative
Oil_Pvt	Elec_Pub	0.916	0.957	Significant Correlation	Positive
1/Water_Pvt	1/Oil_Pub	0	0.000	No Correlation	
Elec_Pvt	1/Oil_Pub	0.005	0.071	No Correlation	

* *"Oil" refers to Gas, Coal, Oil and Pipelines infrastructure.*

Source: This author's analysis based on the GDP model developed in this research.

Table 2.5, shows the average increase in GDP as a result of one unit investment in each infrastructure. For example:

GDP vs ElecPvt: there is a very strong positive relationship between GDP and electricity investment by private sector. For every unit investment in electricity by the private sector, GDP increases by 211 units on average; or

GDP vs OilPvt: There is a significant positive relationship between GDP and investment in oil, gas, coal and pipeline by private sector. For every unit investment in oil, gas, coal and pipeline by private sector, GDP increased by 32.1 units on average.

Table 2.5: Linkages of IOI with the Australian economy (GDP)

	Linkage Correlation			
Infrastructure Linkages with GDP	Strong positive	not significant	Average increase in GDP as a result of one unit investment in infrastructure	
Electricty Pvt	✓		211	
Electricity Public	✓		158	
Electricity Total (Pvt and Public)	✓		94.3	
Oil Pvt	✓		32.1	
Oil Public		×		
Oil Total (Pvt and Public)	✓		31.3	
Water Pvt	✓		GDP = 1.22E+09 - 1.11E+14*(1/WaterPvt)	(Eq. 2.1)
Water Public	✓		GDP = 1.23E+09 - 3.03E+14*(1/WaterPub)	(Eq. 2.2)
Water Total (Pvt and Public)	✓		GDP = 1.23E+09 – 4.26E+14*(1/WaterTot)	(Eq. 2.3)

Note: *"Oil" refers to Gas, Coal, Oil and Pipelines infrastructure.*
Source: This author's analysis based on the GDP model developed in this research.

Similar interpretations apply to other IOI except for water, where the average increase in GDP is estimated by relevant regression formulation as discussed below:

GDP vs WaterPvt: There is a strong positive relationship between GDP and investment in water by private sector. For every unit investment in water by private sector, on average GDP increases by the formula: GDP = 1.22E+09 - 1.11E+14*(1/WaterPvt). Similar interpretation applies for public, and total investments in water.

Linkages of infrastructure investments with each other

Table 2.6 shows cross relationships of infrastructure investments among IOI. There are no significant linkage correlation between investments in some IOI, for example between private and public investments in oil, gas and coal infrastructure (Oil Pvt vs Oil Pub shown by an "×").

However, there are strong positive correlations between the majority of IOI as discussed below:

WaterPvt vs WaterPub: There is a strong positive relationship between investment in water by private and public sectors. For every unit investment by public sectors, investment by private sector increases by 2.44 units on average.

OilPvt vs ElecPvt: There is a strong positive relationship between investment in oil, gas, coal, and pipeline infrastructure and Electricity by private sector. For every unit investment in electricity, investment in oil, gas, coal and pipelines increases by 5.46 units on average.

Similar interpretation applies for other infrastructures, except for those which the linkages are defined by a regression formulation as described below:

Table 2.6: Linkages of infrastructure investments among IOI

Linkages between		Linkage Correlation			
Infrastructure 1	Infrastructure 2	Strong positive	not significant	Average invertment increase in the first infrastructure as a result of one unit investment in the second infrastructure	
Water Pvt	Water Pub	✓		2.44	
Electricty Pvt	Electricity Public	✓		0.638	
Oil Pvt	Elect Pvt	✓		5.46	
Oil Pvt	Electricity Public	✓		4.51	
Water Pvt	Oil Pub		×		
Electricity Pvt	Oil Pub		×		
Oil Pub	Electricity Public		×		
Oil Pub	Water Pub		×		
Oil Pvt	Oil Pub		×		
Water Pvt	Elect Pvt	✓		1/Water_Pvt = 0.000007 – 2.0E-12*Elec_Pvt	(Eq. 2.4)
Water Pvt	Oil Pvt	✓		1/Water_Pvt = 0.000006 – 2.0E-13*Oil_Pvt	(Eq. 2.5)
Watr Public	Elect Public	✓		1/Water_Pub = 0.000003 – 4.0E-13*Elec_Pub	(Eq. 2.6)
Electricity Pvt	Water Pub	✓		Elec_Pvt = 3812518 – 1.35E+12*(1/Water_Pub)	(Eq. 2.7)
Oil Pvt	Water Pub	✓		Oil_Pvt = 19554084 – 8.24E+12*(1/Water_Pub)	(Eq. 2.8)

Note: *"Oil" refers to Gas, Coal, Oil and Pipelines infrastructure.*
Source: This author's analysis based on the GDP model developed in this research.

ElecPvt vs WaterPub: There is a very strong positive relationship between investment in electricity by private sector and investment in water by public sector. For every unit investment in water by public sector, on average, investment in electricity increases by the formula: Elec_Pvt = 3812518 – 1.35E+12*(1/Water_Pub);

WaterPub vs ElecPub: There is a significant positive relationship between investment in water and electricity by public sector. For every unit investment in electricity, on average, investment in water increases by the formula: 1/Water_Pub = 0.000003 – 4.0E-13*Elec_Pub.

Modelling GDP by Investment in IOI by both Private and Public Sectors

A full model using multiple regression was fit including all variables and subsequently reduced regression was applied to determine the final model as shown below:

GDP = 4.64E+08 + 32.1 ElecPvt + 8.75 OilPvt + 35309862 Yr (Eq. 2.9)

Year variable is a sequential index referring to the investment year during the period 1998-2008.

It is concluded that:

- investment in electricity and eil, eas, coal and pipeline by private sector and year of investment are significant predictors of GDP.
- For a given year, and fixed investments, in oil, gas, coal and pipeline by private sector, for every unit investment in electricity by private sector, GDP increases by 32.1 unit on average.

- For a given year, and a fixed investments in electricity by private sector, for every unit investment in oil, gas, coal and pipeline by private sector, GDP increases by 8.75 unit on average.
- For a fixed investments in oil, gas, coal and pipeline and electricity by private sector, for every year GDP increases by AU$35,309,862,000.
- The above results suggest significant and positive correlations between infrastructure and economic growth in Australia, highlighting the importance of the financial linkages of infrastructure. These insights can be useful for governments to decide on levels of investments in infrastructure.

2.6 Summary

The key findings of this chapter are as following.

- Globally, infrastructure is importance because of its impacts on economic growth. As such countries around the world have placed a high priority on infrastructure. Developed countries progressively invested between 2 to 9% of GDP over the period 2008-2013, and supplemented their public spending with foreign direct investments (FDI), to further promote economic growth. Also, developing countries will need to invest between 7 to 9% of their GDP against the current 3 to 4% actual spending on infrastructure to achieve growth and to reduce poverty. It is estimated that by 2030, US$59 trillion will be needed globally just for energy and water infrastructures, to respond to the world population of about 9 billion by 2030.
- Infrastructure is extremely important in the Australian context, because of the country's dry climate, the spatial dimension of Australia's demography, the remoteness from the rest of the world, and its growing population. Australian governments have accordingly given a high priority to infrastructure, spending on average a total of 10.2% of GDP over the period 1960 to 2017, increasing to 14% post-GFC. Additionally, governments considerably boosted public infrastructure spending through private and foreign direct investments to promote economic growth. As a result, globally Australia's infrastructure spending is ranked 18th in the global competitiveness rankings.
- Investments in Australian infrastructure have expanded the country's and per capita stock value of built assets, demonstrating the impact of infrastructure on economic growth. Globally, Australia ranks 6th in terms of per capita stock of built assets, ahead of USA (15th) and China (24th).
- There are several methods for empirically measure infrastructure-economy linkages, e.g. Capital Stock, Total Fixed Capital Formation, Perpetual Inventory Method (PIM), and the Simplified Perpetual Inventory Method (SPIM). However, due to lack of global agreement, each country reports importance of infrastructure differently making the usefulness of the results and interpretation difficult.

- The relationship between infrastructure investment and returns on capital may not always be an important consideration, particularly in the case of public spending which is influenced by the infrastructure-social-welfare linkages. For example, major public investments in roads and highways are extremely important in Australia because population and economic centres are extremely far apart.
- While public infrastructure spending (% of GDP - real term, 2016 prices) over the period 1960 to 2017 followed a sharp declining pattern, however the average spending size (dollars) over the period increased about 2.1 times. This shows that proportional to the annual size of the GDP, which on average increased about 3.3 times over the period, the public infrastructure spending was not sufficient, as also it was confirmed by OECD in 2017. The reason for less public spending on infrastructure can be related to good economic performance in Australia, considering 103 consecutive recession free quarters over the period 1990 to 2017, reducing pressure for more spending.
- Private investments in electricity, crude oil, natural gas, coal, pipeline and the year of investment have strong linkages with the Australian economy (GDP). As a result, investments in these sectors are significant predictor of GDP.
- For a given year and fixed investments in electricity by private sector, for every unit investment in oil, gas, coal and pipeline by private sector, GDP increases by 8.75 unit on average;
- For fixed investments in oil, gas, coal, and pipeline, and electricity by private sector, for every year GDP increases by about A$35.31 billion;
- There are strong investment linkages, or otherwise, between different infrastructure. Table 2.7 shows the impact of one unit investment in one infrastructure on the other in the economy.

Table 2.7: Cross-relationship of investing in IOI

Inter-Infrastructure Investment Linkages		Linkages Correlation		
Infrastructure 1	Infrastructure 2	Strong positive	not significant	Average investment increases in infrastructure 1 as a result of one unit investments in infrastructure 2
Wtr Pvt	Water Pub	✓		2.44
Oil Pvt	Electricity Public	✓		4.51
Electricty Pvt	Electricity Public	✓		0.638
Oil Pvt	Electricity Pvt	✓		5.46
Water Pvt[1]	Oil Pub[1]		×	
Electricity Pvt	Oil Pub		×	
Oil Pvt	Oil Pub		×	
Oil Pub	Electricity Public		×	
Oil Pub	Water Pub		×	

Notes: "Oil" refers to Gas, Coal, Oil and Pipelines infrastructure.

[1] no significant relationship between Investment in Water by Private sector and Investment in Oil, Gas, Coal and Pipeline by Public sector. Similarly interpreted for those with "O".

Source: Results obtained from the GDP Model developed in this research.

- The significant and positive correlation between infrastructure and economic growth, as demonstrated by this research, highlights the importance of adequate infrastructure investments.

- Infrastructure which attracted the least interests by the private sector, over the period 1998-2017, are railways, water, sewerage and drainage, recreation, bridges, harbours, oil and gas pipelines, and other heavy industry (classified as the Non-Resources Group in this research). In contrast, the Australian governments have invested in this Group to promote the welfare of the nation and to advance economic growth.
- The infrastructure with the highest public spending are: roads, highways, and associated subdivisions; water supply and storage; electricity; and telecommunication. Spending on communication over the period 2011-2017, for example, increased about 19 fold - compared to earlier periods, because of implementing National Broadband Networks, and advanced mobile communication technologies.
- There was 55.3% decrease in overall infrastructure spending (public and private) over the period 1966 to 2001. The observed declining trend is related to developmental phases of infrastructure requiring less spending as the infrastructure was approaching maturity; and the efficiency gained through microeconomic reforms. However, over the period 2002 to 2013, the pattern of infrastructure spending reversed changing at nearly 102%. This shows that the infrastructure spending is very much influenced by economic events. In general, in boom times, private sector invests more with the expectation of higher returns on capital, while at downturns (e.g. the 1929 great depression, the 2008 GFC) governments spend more to strengthen the economy.

3 Historical Profile of Infrastructure in Australia

This chapter presents a historical profile (evolution) of infrastructure over the period 1788 to 2017 in Australia with the view to develop insights into the nature of linkages across various types of infrastructure. This profile is developed for five time phases to coincide with the major developments in Australia. These time phases are Early Years (1788 to 1900), Consolidation (1901 to the late-1960s), Early Reforms (1970s to the early-1980s), Micro-Economic Reforms (the mid-1980s to the late-1990s), and The New Paradigm (2000 onwards).

This Chapter is organised as follows. Section 3.1 develops a historical profile of the Australian infrastructure, and describes domestic and global influences which have shaped its evolution. Section 3.2 identifies infrastructure linkages and classifies them into three distinct categories of upstream, transportation, and downstream in each time period. Section 3.3 summarises the main points.

3.1 Historical Profile of Infrastructure in Australia

This section describes the historical profile of water, coal, gas, oil, and electricity infrastructure for each of the abovementioned five time periods separately. The overall framework for historical analysis of linkages is shown in Figure 3.1.

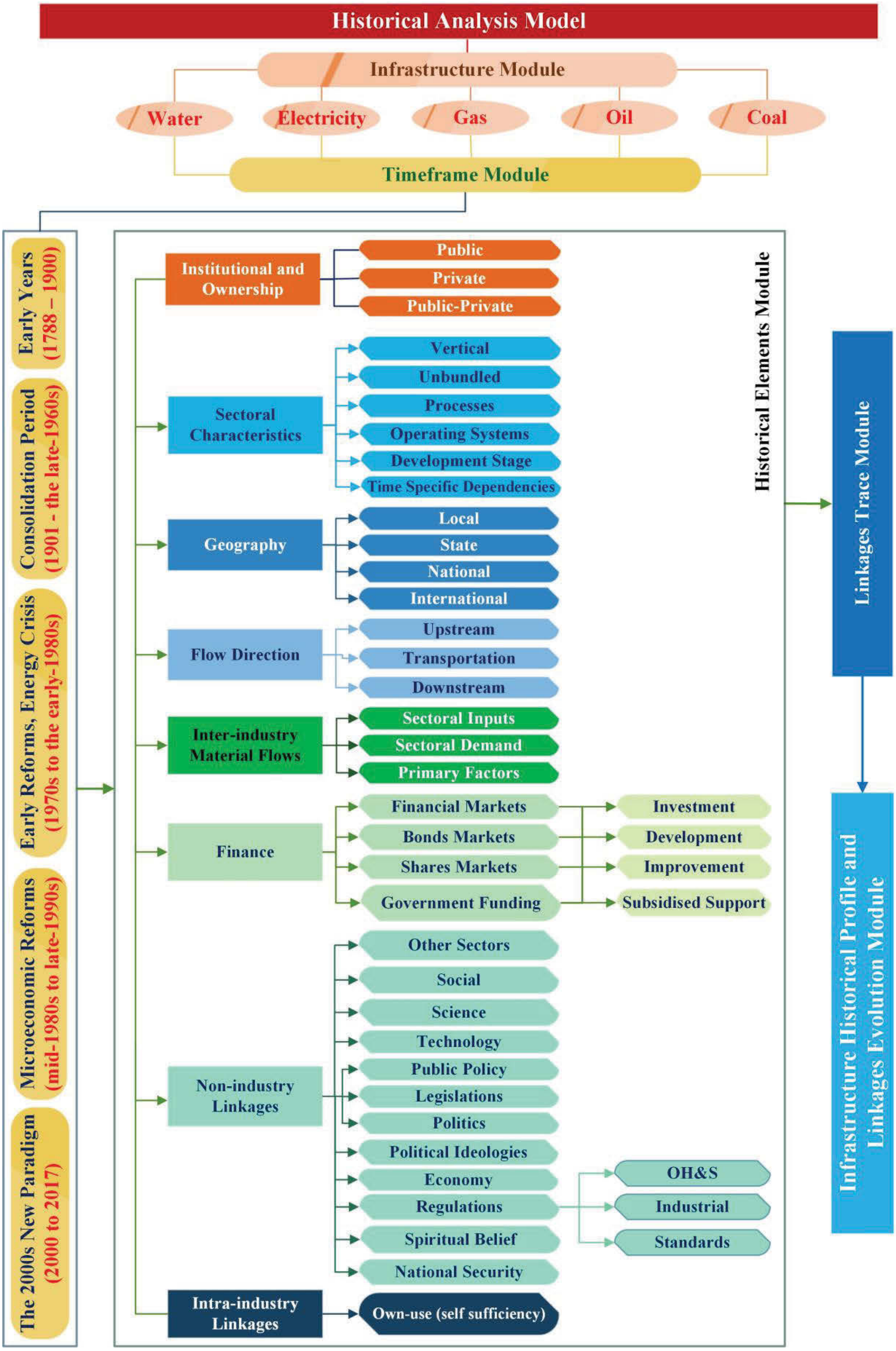
3.1.1 Water Infrastructure

Early Years (1788 to 1900)

Water has always been a commodity of intense interest for Australia (Shaw 1966; Cathcart 2009) ever since the time of Aboriginal settlement (Cathcart 2009).

The British settlement in 1788 introduced a new culture in Australia (Johnson & Rix 1993), one in which uncontrolled activities of infrastructure development started soon after settlement. This development broke the land, water, and environment linkages that were preserved by the Aboriginal people throughout history (Sveiby & Skuthorpe 2006; Smith 1998; Howell et al. 1993; Powell 1989). An issue contributing to this situation was the absence of the science of water at the time to help with the understating that water is a non-substitutable commodity and that its linkages are identifiable through hydrologic cycle which includes the environment within which water exists (Johnson & Rix 1993). The science of water started to take shape towards the end of

Figure 3.1: Infrastructure linkages Historical Analysis Framework



Source: This author, historical model developed in this research.

the eighteenth century in Europe (Sherwood 1942), which raised such awareness. Also, because water was used as a tool for developing the Australian colony, no political or no environmental considerations were given to water; rather water was exploited and managed in isolation, with bare minimum water policies (McKay 2002, 2010).

The initial source of water supply in 1788 was from 'Tank Stream', a term used for a freshwater source in Sydney Cove (Lloyd 1988; Cathcart 2009), whose operation was overseen by Capitan Phillip who pioneered establishment of the first water supply institution in the country. Later, water wells constructed privately (Sydney Water 2004a, 2004b), and from the 1880s, greater investments were made in locating potable groundwater to supplement surface water. According to Harris (2010) searching for potable water was very risky, often associated with a high cost. Also, together with colonial ownership, water was distributed by horse carts to settlers, and at downstream in retail aspects sold to end-users.

The structure of colonial water infrastructure replicated the Great Britain's governance model featuring government ownership, statutory monopoly, vertical integration and bureaucratic operation (Albon 2000), while allowing private operators to supply water by constructing water wells and distribute and retail water to settlers. Water infrastructure, in a more organised form, started to take shape when the Sydney Municipal Council formed in 1842 and the development of water supply and sewerage services was made one of its responsibilities (Golder 2001).

A review of literature suggests that linkages of water with the agricultural sector starts to assume shape by 1850 when water use accounted for 11% of GDP (77% of the total value of colonial exports) (Harris 2008). Also, the literature refers to efficient water use for agricultural production in the colonies, use of drought-tolerant crop to reduce water use and dry-land farming practices to use rainfall only for growing crops (Hallows & Thompson 1995; Oxley 1820; Eyre 1845). This identifies the linkages of water with the hydrologic cycle, agriculture industry and the agricultural technology.

The discovery of gold and coal during the late 18th to mid-19th century required water as an important input for mining (Shaw 1966), thus establishing the linkages of coal and mineral industry with water. Also, gold mining linked water to the pipeline infrastructure which started to develop in the late 1800s to transport water to the Coolgardie gold fields (APGA 2017). However, consumptive water use reduced the flow of rivers and streams, because private water rights for extracting water for gold mining took precedence over the common water rights for agriculture and public consumption (Harris 2008; Scott 2001). This situation, created political debates among settlers (Thompson 2008), thus linkages of water with politics and regulation.

The invention of steam engine towards the end of the 18^{th} century increased the demand for both coal and water, and also linked technology to heavy agricultural operations replacing animal and water power with stream power, and to pump water for the first time in water infrastructure in

Sydney in 1859 (Beasley 1988; Hallows & Thompson 1995).

Irrigation technology started in the late-1880s soon after Victoria, as the leading state, legislated its *Irrigation Act 1886*. Irrigation technology in South Australia, also became operational in the late 19th century on River Murray when expeditions did not find signs of an inland delta.

The linkages of water infrastructure with legal and policy settings were further expanded in the following years, for example, NSW based on the Lyne Royal Commission recommendation, replaced the riparian rights with a State legislated law; and in Victoria, water ownership transferred under the *Water and Conservation District Act, 1881.* The abolition of riparian rights by the NSW *Irrigation Act 1912* generated public-private interest in irrigation (Lloyd 1988). Linkages of water with water laws and policies become stronger for equitable distribution of water among settlers over the period 1850 to 1870 (Harris 2008) implying issues with applicability of the British laws to manage Australian water resources (Harris 2007). For example, in the 1880s, it was recognised that the riparian rights were not suitable for development of water resources in Australia, and later in the Victorian government legislated the *Irrigation Act, 1886*, which transferred the combined ownership of land and water to the Crown (Smith 1998; Powell 2002).

Consolidation (1901 to early 1980s)

During the 1900s the linkages of water with the construction sector expanded. First, to combat recurring and long droughts by building dams and water reservoirs (Beasley 1988) so that water could be provided for downstream end-use (Aird 1961); and second, the influences of post WW-II effect. The post-war development of water infrastructure linked the sector with urbanisation and construction sector further supporting housing, industry, and gardening (Beasley 1988).

Also, during these years, the linkages of water infrastructure with public water policies and management developed at the national level. First, because of the dependence on one State's water with neighbouring rivers (e.g. Murray River) and possible conflicts on water use. This linkage can also be considered as geopolitical linkage because in the case of major water conflicts can disrupt the economy; second, scarcity of country's water resources; and third, frequent droughts. Therefore, in the mid-1960s, states and federal governments decided to manage water at national level. As a result the linkages of water infrastructure with laws and institutions developed further. For example, the formation of the Australian Water Resources Council (AWRC) to oversee management of water resources; or establishment of River Murray Commission to oversee water sharing among States and to develop water infrastructure (Hallows & Thompson 1995; Olsson 2009).

During this period, the linkages of water with private sector developed further. In spite of government's public monopoly of all infrastructure, the only private monopoly which was in charge of water was the Broken Hill and District Water Supply over the period 1889 to 1915.

In this period, the linkages between water and agriculture, as well as the linkages of each sector with irrigation technology developed further. Also, the reciprocal linkages of water with electricity to run irrigation systems, and water to run and cool thermal turbines in coal-fired power plants evolved further (Worldometers 2011; IC 1992). However, irrigation damaged the linkages of water with environment because of raising the level of water table in some locations or bringing salt to the root zone (Proust 2008).

Early Reforms (1970s to early 1980s)

Towards the late-1970s, linkages of water with environment as well as environment's social linkages evolved further because of damages caused by irrigation technology to the land. As a result, the Australian Government conducted a comprehensive study of the future of water supply from 1980 forecasted to the year 2000. The findings of this study were released in 1983. As a result, the focus was shifted from building high capacity dams to integrated multi-purpose water management policies (Hallows 1995), which strengthened the linkage of the water with the policy.

During the 1970s, the linkages of irrigation technology with the environment were recognised by noting the side effects of irrigation on land and crops. Such environmental impacts were further recognized in 1975 when the Australian Water Resources Council (AWRC) released its water quality report. Two years later, the Federal Government implemented the National Water Resources Development Program to alleviate those environmental issues. Moreover, the River Murray Commission had resolved the River Murray Agreement in 1973 which its revised version came into effect in 1984 for controlling the River's water quality (Hallow & Thompson 1995).

Reforms in water infrastructure in Australia were focused on promoting efficiency and equity of water allocation by examining options of improving the allocation of existing water entitlements while protecting the environment. During the 1960s and the 1970s economists initiated a water pricing regime to promote efficiency and to reduce wastage of water but this idea did not progress in this time period (Tisdell et al. 2002).

By the late 1970s, the Australian governments recognised the role of the microeconomic reforms in improving the Australian economy. As a result, a series of reforms under the broad banner of the microeconomic reforms applied to water infrastructure in the 1990s.

Micro-Economic Reforms (mid 1980s to late 1990s)

In this phase, linkages of rural water, and water infrastructure as a whole with the environment; policies and politics; geographical location; irrigation technology; agriculture sector evolved further. Also, through microeconomic reforms, the linkages of water infrastructure with water institutions such as legislative bodies, COAG, water markets, water board, and water catchment authorities developed further. These linkages played an important role in the evolution of water infrastructure and agricultural sector and through institutional linkages their availability and quality improved as earlier discussed briefly in this section.

However, Graze (1998) argued that the application of market forces as drivers of microeconomic reforms may not fully apply to water infrastructure because water is closely linked with the hydrological cycle; ecology; social; cultural and religious belief and values. On the other hand Wolff & Hallstein (2005) defined water as a 'private good' and linked it with controlled competitive market pricing and market forces and argued that the water industry should be privatised. Proponents of privatisation also argued that the private sector deliver better services with higher efficiency (Prasad 2006; Robison & Hewison 2005). However, another group of researchers believe that private sector's performance came more through regulation than direct competition (Lloyd & Howell 1993) because under Clause 74 of the NWI 2004, water regulatory bodies are separate to water institutions (ACIL Tasman 2005).

New Paradigm (2000 onwards)

Over the period 2001 to 2003, and in 2007 Australia experienced severe droughts (ABS 2007a). This situation demonstrated the importance of the linkages of water with the environment and with the hydrologic cycle. State governments took measures to preserve water stored in dams, restrict garden watering, raise the price of water, recycle water, and considered desalination plans (Iemma 2007; ABIX 2007a, 2007b; NSW Government 2006a). Drought in 2007 significantly reduced water for both power generation by the Snowy Mountain Scheme and for irrigation purposes in surrounding agricultural areas. These actions linked water with water management policies; price; and technology, which aimed at supplying water from renewable sources, ocean.

During the drought, the Australian Governments continued with the Water Reform Agenda. In 2003, COAG suggested a new water framework with embedded pricing and institutional reforms as part of a large spectrum of reforms in the sustainable management and use of water resources in Australia in order to further increase water productivity and efficiency gains in the country (COAG 2003; ACIL Tasman 2007). As a result, a new Intergovernmental Agreement on the National Water Initiative (NWI) 2004, with an accompanying *Water for the Future* implementation blueprint, was developed to better balance the water needs of communities, farmers and the environment (Wong 2008; DSEWPC 2010; NWC 2004).

On 5 April 2002 COAG noted that there were several impediments to full implementation of its 1994 water reform framework. COAG drew particular attention to the need to clarify water property rights, especially to deal with the tension between establishing certainty for water users and the need for adaptive management to address environmental needs (Henderson 1995 in Carroll, P. and Painter, M. 1995).

The National Water Commission (NWC) was established in December 2004 as an independent statutory agency for overseeing national water reform, implementing the National Water Initiative, and investment in the Australian Water Fund. Because of the linkages of water with legislations and policies, the water management and allocation plans were changed through post-2000 regulation, policy and plans. For example *Water Act 2007 (Cth)* was the most extensive Commonwealth intervention into water resource management in Australia since Federation.

The linkages of water with pricing as a driver to encourage water conservation, economic efficiency in service delivery, investment, and water use has progressed towards the initial aims of the reforms, achieved reasonable results, and has evolved over time from the 1994 Council of Australian Governments (COAG) Water Reforms Framework to the 2004 NWI best practice pricing and institutional arrangements, and the 2010 NWI pricing principles (NWC 2011a). However because of the prolonged drought and water scarcity, the Australian Government has intervened in water planning and investment decisions, which the NWC believed may affect industry incentives to investment at optimum level. The reason was the Government subsidisation of urban and rural water infrastructure which deemed a step backwards from the commitment to price water according to the true cost of the resources, capital, and service delivery (NWC 2011b).

In 2015, the Australian Government announced the establishment of the National Water Infrastructure Development Fund (NWIDF) following the 2013 election commitment to develop water infrastructure by building new dams, pipelines, managed aquifer recharge projects, water treatment, capture and reuse schemes to improve secure water supplies, deliver regional economic development benefits for Australia, while protecting the environment (ANAO 2018).

3.1.2 Coal Infrastructure

Early Years (1788 to 1900)

Coal is closely linked with the Industrial Revolution of the late 18th and early 19th centuries, and the early iron and steel production industries. However, the invention of the steam engine in 1769 (WCI 2009) linked coal with steam technology and emerging steam-powered transport industries (steamships, railways), which influenced international trade (Windsor & Ralston 1897; WCI 2009). Subsequent to inventions of steam turbines in 1844, and the first steam-electric plant in 1882 to produce electricity for street lighting in New York (Casazza & Delea 2003), the linkages of coal with the early electricity industry and related technologies were established (coal-fired boilers, electrostatic precipitators, scrubbing, automatic underfeed stokers) (Wilson 1980).

Also, the upstream linkages of coal infrastructure with upstream dams and water infrastructure was formed because of water requirements to wash away coal impurities (*coal beneficiation* or *coal washing*), and subsequent disposal of waste water (Singh 1987; WEC 2009; WCI 2009).

The central drivers for coal mining and coal energy in Australia were establishment of colonial settlement in 1788 (Knights & Hood 2009). The historical highlights of the coal discovery, which created foundation of present country is shown in Appendix III, Table III.1.

Coal industry in Australia started as a public monopoly in NSW in 1798 (EANSW 1986).

However, in 1830, private Australian Agricultural Company (ACC) took over its operation (Saddler 1981), resulting in an increased coal production from 4,000 tons in 1830, to 40,000 tons in 1847 (EANSW 1986; Windsor & Ralston 1897).

The change in coal's institutional structure and ownership was linked to government policies and legislations to involve initially two incorporated private companies (ACC and Van Diemen's Land Company); use skilled labour while convicts as a source of free labour were allocated to road construction; and making investment appealing to private sector by granting both the surface of land as well as mineral rights based on pre-1825 land grant policy. But, in today's Australia the land title only covers the land surface while minerals belong to the Crown (Saddler 1981)

According to Knights & Hood (2009) from the early-1880s, the coal infrastructure was linked to mining technology, reaching relative maturity by producing coal at significantly high levels for domestic use and exports. The technology improved towards the end of the nineteenth century when pneumatic drills and dynamite were introduced to the industry - associated with pulmonary health complaints (Walker 1945; ATUA 2002). As a result, the linkages between coal and safety (OH&S) and industrial relations were formed. Table 3.1 shows the impact of technology on coal production in the late-1880s.

Table 3.1: Coal production in Australia in the late-1880 (tons)

Year	New South Wales	Victoria	Queensland	Western Australia	Tasmania	Total
1881	1,769,597	-	65,612	-	11,163	1,846,372
1891	4,037,929	22,834	271,603	-	43,256	4,375,622

Source: ABS (2009a)

Since 1797 coal was gradually discovered in Australian states, however because of its linkages with demand and exports, and population and human workforce (Hargraves 1993), as well as availability of ports, roads and rail infrastructure to transport coal (Ellis 1969) production did not start until the late-1800s (ACA 2008, EANSW 1986, Knights & Hood 2009) when railways and steamships developed as means of primary transport of coal.

Linkages of coal with gas infrastructure emerged when the Australian Gas Company (AGL) developed reticulated coal gas for street lighting in Sydney in 1844, and in subsequent years for domestic purposes like cooking (Broomham 1987), which from 1891 onwards were replaced by electric lights (Jobson 2004).

Linkages of coal with politics were very important too. For example, electing a labour member in the coal-mining electorate of Bundamba in Queensland in 1888 (Bowden 1997); or, the Victorian government import policy of 1860 to restrict import of black coal from Newcastle to support consumption of low quality brown coal produced in Victoria (Knight & Hood 2009).

Consolidation (1901 to the late 1960s)

Coal transport linkages improved in this period leading to higher production, from about 6 million tons in 1901 to more than 10 million tons in 1908 (ABS, 2009a). Also, the steam-powered rail industry in this period was highly dependent on coal before the introduction of diesel locomotives in the 1950s (Knights & Hood 2009; Saddler 1981) establishing shared linkages between the coal and rail industry. However, because of different railway track width in each state of Australia (ARTC 2009), the inter-state coal transportation was difficult. It was not until 1930 when the standard gauge (width) line between Brisbane and NSW improved coal transportation between the two States. Between 1951 and 1965, the Federal government tried to standardise railway gauges between the capital cities (except Darwin) and this program was finally completed in June 1995 (ARTC 2009) showing the important role of coal industry in development of the rail sector in Australia. However, when most important railway lines were electrified in the country, further dependence on coal was created to produce electricity (Saddler 1981).

The linkages between coal and oil started to take shape during the 1960s when coal was substituted by oil as an energy source. Until the 1960s, there were strong linkages between coal and railways, electricity, gas, manufacturing, coke production and commercial and residential sectors (Knights & Hood 2009). This shows that coal was an important energy source of the post-Federation Australian industries, which grew significantly during WW-II for the production of war related materials. During the 1950s, demand for coal by the electricity sector (to run coal-fuelled power plants), and steel manufacturing (using coking coal for steel production) was strong. Also, coal demand by the export market started to increase influenced by the opening of large open-cut export oriented coking coal mines in QLD (Saddler 1981).

During this period, the coal industry established important linkages with economic policy settings. For example the Coal Commission was established to control coal production and distribution to build the post war economy; the *Coal Mines Regulation (Amendment) Act, 1941* made further provisions for the management and regulation of coal and shale mines; and government amended the *Coal Mines Regulation Act, 1912-1931*; and in 1949 the *Joint Coal Board and the Coal Industry Tribunal* was established by the Federal and NSW governments to regulate and plan for the expansion of the coal industry.

Early Reforms (1970s to the early 1980s)

The upstream linkages of coal with oil developed in 1972 and continually strengthened thereafter. The first oil price shock in 1973 increased price of oil and continued until the second price shock in 1981. As a result the global share of oil production in primary energy mix (45% in 1971) started to decline, prompting a substitution of coal for oil as a second affordable source of energy (OECD 2010). Coal substitution created four coal production events (OECD 2010). The first event occurred over the period 1972 to 1981 when coal production increased globally by 26% to substitute oil. Likewise, the production of both black and brown coal in Australia increased by 31.3% over the period 1973 to 1980 (IEA 2009; IEA 2010d). Because of the linkages of coal with the coal consuming industries, the majority of coal production was used for domestic use while only 18% was sold to international coal markets (WCI 2009). In Australia, 43% of the NSW coal production and about 76% of coal production in Queensland was exported in 1978-79. In this period, Japan consumed about 78% of Australia's exports, Europe 19% and local Asian markets 3% (Saddler 1981). Other coal production events are discussed in related periods in this chapter.

Coal maintained its place as the dominant fuel for electricity generation in Australia over this period and since then to date. However, coal share declined marginally in the early 1970s due to comparatively favourable economics of oil-fired generation at the time. Coal share again increased because of construction of new coal-fired plants, conversion of oil-fired plant to coal-fired, and the relegation of base-load oil fired-plant to peak or intermediate load duty (Ives 1983).

Increased coal production for domestic and export markets made the linkage between coal and transport infrastructure stronger. For example, coal was mixed with water to form slurry to facilitate transportation through pipelines which created a new dimension of the linkages of coal with water and coal technology. Similar to the past, the cost of coal transportation accounted for up to 70% of the delivered cost of coal (WCI 2009; Knight & Hood 2009).

Also, in this time the linkages of coal with technology improved. For example, the Coil-Oil Mixture (COM) technology was developed to pulverise coal in oil to use the mixture as a fuel in oil-fired furnaces and boilers.

In this period concerns were raised about two aspects of the coal sector: the size of foreign ownership and the profits made. For example, in 1977, the US-based Utah International Inc. was the biggest ever profit maker in Australia. This prompted the Government to review its national energy policy to control the exploitation rate so that the future generation is also benefitted.

Micro-Economic Reforms (1980s to late 1990s)

The linkage of coal production with oil price remained strong over this period which influenced the start of the second and third coal production events. The second event (1982-1991) relates to increase in coal production by 40%, and subsequently to 47% during the third coal production event (1992 to 2002) (OECD 2010). Further increases in coal production as well as oil production increases by Saudi Arabia in 1986 plummeted the oil price. During the low oil price period, coal was substituted by oil as a cleaner source of energy; hence the demand for coal reduced. The 1990 first Gulf crisis, and the 1999 OPEC's decision to reduce oil production, once again increased demand for coal but price differences were not significant enough to encourage fuel substitution.

In this period, coal mining continued to play a leading role in economic growth. Between 1967 and 1999, for example, mining industries built at least 25 new towns, 12 new ports, 20 airfields and 1,900 kilometres of rail line in Australia (ABS 1999).

During this period global and local concerns were raised about polluting impacts of coal and other fossil fuels on environment. As a result, the international treaty Kyoto Protocol (Accord) on climate change was adopted in 1997 (UN 1998) for reducing carbon emissions. Australia is a party to the Protocol, and agreed to set targets for reducing carbon emissions through the use of renewable sources for electricity production. Therefore, the linkages of coal with low emission technologies emerged and the linkages with environment evolved further.

New Paradigm (2000 onwards)

The linkage of coal and oil shaped the fourth coal production event (2003-2009) where coal production globally reached to 82% (OECD 2010). The reason for high production was expectations of war in Iraq from 2003 onwards; 2005 hurricane Katrina in USA; and the impact of GFC which started in the fourth quarter of 2008 forcing reduction in oil prices and leading to substitution of coal for oil as a major strategy. As a result, coal production was highly linked to volatile oil, and global expansion of coal consuming industries. Nevertheless, the linkages between Australian coal and global markets evolved irrespective of its linkages with prominent economic events. This is demonstrated by recent high investments in new coal mining despite downturn of mining boom since 2014. For example, according to IEA (2016) currently sixty three new coal mining projects are proposed in Australia some of which are committed.

The linkages of coal with environment strengthened in this period, through actions such as introduction of clean air technologies, legislation, policies and political approaches by states and Commonwealth governments aimed at reducing greenhouse gas emissions. For example, at the state level, the *NSW Clean Coal Administration Act 2008* was legislated to establish the *Clean Coal Fund* to finance clean coal technologies; and at national level, the *National Low Emission Clean Coal Council* (*NLECC*) was established (NSWDPI 2011a; NSWDPI 2011b). These actions resulted in funding R&D into low emissions coal technologies and commercialisation, and increased public awareness and acceptance of reducing gas emissions through low gas emission technologies (AustLII 2011; NSW Legislation 2011; NSWDPI 2011c). Further, in this period, the second commitment period of the Kyoto protocol (2013-2020), referred to as Doha amendment, was adopted to sustain actions to lower gas emissions.

Overall, this time period posed several challenges for coal infrastructure, regardless of coal being relatively the cheaper source of energy in Australia. First, it needed to implement advanced technologies to reduce or prevent carbon and methane emission to atmosphere to free itself from environmental issues, and associated government penalties and taxes; second, to survive, the industry should externally compete with alternative sources of energy such as renewables; third, the coal industry may face difficulties to maintain its preferred rank as the main supplier of energy to the steel industry, if improvements in technology for alternative steel making methods could successfully proceed; and fourth, because of coal linkages with transport infrastructure (railways and ports), its ability to export may become limited if transport capacities were not expanded or new infrastructure was not developed. This analysis shows the importance of evolving nature of coal linkages with advanced technologies, government policies and political ideologies, environment, and the economy as a whole. Also, these linkages influence the coal infrastructure's survival, which in turn would impact other infrastructure and other sectors of economy too.

3.1.3 Gas Infrastructure

Early Years (1788 to 1900)

Attempts to discover natural gas in Australia began in the early 1800s, and gas was discovered in 1900 in Roma in Queensland (Kimber 1984; Wilkinson 2005) while government was expanding Roma's water supply (Wilkinson 1988). Subsequent discoveries were made by the private sector, under government regulation. The ownership of the gas resources in Roma was with the government, because from the mid-1870s to the late-1890s the Australian colonies changed the early land grants policies by excluding ownership of all minerals and petroleum through land grants. These arrangements created linkages with upstream gas exploration and production and shaped the institutional and ownership arrangements of the future gas industry.

However, it was not until 1930s that natural gas became a source of energy for various purposes (Devold 2006; Globaldrill Bay 2007), thus linking the early gas infrastructure with the market - the gas consuming industries, and the gas reserve capacity.

Consolidation (1901 to the late 1960s)

In the early 1900s, the Australian States passed legislation declaring that all petroleum irrespective of the ownership and location belongs to the government (Crommelin 2009). This move linked gas with government policies and legislations which would change over time.

After WW-II, technologies such as welding techniques, pipe rolling, and metallurgical advances linked the gas infrastructure with the pipeline infrastructure for construction of reliable long distance pipelines. The first pipeline for oil and gas transportation was built between Moonie and Brisbane in 1964 resulting in a natural gas industry boom (AGPA 2017).

The advancements in drilling technology and exploration machinery improved in the 1950s, demonstrating strong dependency of the oil and gas infrastructure on the science of petroleum and drilling technologies.

Offshore gas exploration also started in 1964, for the first time by Esso/BHP off the Gippsland coast and gradually in other offshore locations such as Marlin, outside Lake Entrance (Wilkinson 1988). These two successful discoveries proved that Bass Strait was well capable of supplying gas in years to come, shaping the structure of gas infrastructure at upstream as a joint venture of private oligopoly or monopoly companies. The Australian government had no ownership stake in the natural gas industry because of the high level of investment and risks involved. The upstream and transportation streams of the industry were owned by the domestic and international petroleum companies operating in Australia while the gas resources belonged to the government. Both Federal and State governments were involved in petroleum licensing schemes for exploration and production of petroleum resources.

Early Reforms (1970s to early 1980s)

The transportation stream of the gas industry which was closely linked to technological advancements of the 1970s improved significantly in this time period (Devold 2006).

Over the period 1973 to 1977, the gas industry was influenced by the Australian Labour Government's political ideologies and nationalistic policies, which discouraged private oil and gas industry. This unfavourable political environment also affected gas production from successful gas discoveries during the time of the Conner's Labour Government.

The transportation phase of the gas (LNG) industry, from offshore sources to international destinations, started to take shape in the late 1970s when in 1978, Woodside consortium gained support of Queensland government to export gas to eight gas utilities in Japan as well as to the State Energy Commission of Western Australia for domestic supplies although the actual LNG export was not started to Japan until the mid-1980s. The transportation phase of the gas industry further developed in 1983 when Exoil was able to bring the gas which was initially discovered in 1965 in Palm Valley through pipelines to Alice Springs power stations and then in 1987 to Darwin. Therefore the link between gas and electricity generation was established too.

Micro-Economic Reforms (1980s to late 1990s)

During this period the linkages of gas with competition policy were developed further. The National Competition Policy specified the necessary changes to enable free and fair trade in natural gas from 1 July 1996. To enable competition, restructuring of the vertically integrated gas industry started in the early 1990s and separate business units formed to undertake various stages of distribution and other activities. Increasingly, competition was introduced along the various stages of the distribution and retail chain with the entry of new businesses.

The linkage of gas industry with the export market was formed in 1989 when the North West Shelf Venture made its first LNG shipment (APPEA 2011a). In the same year, the Australian Government announced its intention to deregulate interstate gas trade.

In this period, the Australian Energy Regulator (AER) regulated the gas markets and gas transmission in all States in Australia except Western Australia. This allowed a near close consistent national approach to regulation in the Australia’s energy markets. Therefore, the linkages of Gas sector with legislations (e.g. *Gas Pipelines Access (South Australia) Act 1997* and mirror implementation in other states) was developed further (NCC 2013).

New Paradigm (2000 onwards)

New gas discoveries in Australia including natural gas, Coal Seam Gas (CSG), and shale gas continued in this period.

In 2008, the linkage of the gas industry with the microeconomic competition policies and legislations - *National Gas (South Australia) Act 2008* and mirror application in other states as a new national gas law replaced the *Gas Pipelines Access (South Australia) Act 1997* (*Gas Code*) - spread further throughout Australia. The legal restrictions to Full Retail Contestability (FRC) which was mandated by the *1997 National Gas Pipeline Access Agreement* legislated in Tasmania in December 2000, and introduced in NSW and the ACT in January 2002, and in Victoria in October 2002. Western Australia introduced market reforms in the retail gas market in May 2004, and in spite of introduction of the new National Gas Law in January 2010, it retains its own local regulations and gas dispute arbitration instead of the Australian Energy Regulator.

In this period, the linkages of gas with electricity infrastructure in Western Australia (WA) becomes stronger providing 60% of its energy requirements (Hohnen 2007). As such, any changes in the availability and price of gas would directly impact the WA's industry and households. Because of extensive application of gas in WA, a new State legislation in 2009 allowed a greater range of gas to be used in the domestic market enabling development of the offshore gas which was discovered by BHP in 1992 (APPEA 2011a). Also, to facilitate Macedon Gas Field extraction, the WA Government changed its gas delivery standards to match new gas pipeline standards. This gas field was blocked from supplying customers in Western Australia because it did not meet the tight specifications for delivery into the Dampier-to-Bunbury pipeline system which were designed in 1980s (Pipeliner 2011). These developments show the linkages of the upstream gas resources with gas transportation standards; with downstream end-uses; with legislations; and with government policies before gas resources could be utilised.

Australia-wide, the transportation stream of the gas industry has progressed further since 2000 including construction of new pipelines as well as accessing international gas markets through advanced pipeline systems. For example, the development of Eastern Gas Pipeline between Longford and Sydney in the early 2000; and the construction of gas pipeline from Bayu-Undan field in Timor Gap to Darwin (APPEA 2011a).

The linkage of gas industry with the exports market influenced development of LNG plants and expansion of LNG export facilities. The export market further expanded in 2007 following the announcement of Australia's first CSG-LNG plans in that year. Soon after, international gas companies operating in Australia established more new LNG plants which impacted the expansion of the gas exports market (APPEA 2011a).

In the late 2010 the growth of CSG infrastructure in NSW raised concerns about potential contamination of prime agricultural land, and water resources (Roth 2011) because of chemicals used in the process of hydraulic fracturing ('fracking') for enhancing the flow of gas (NWC 2010). These debates demonstrated the linkages of gas infrastructure with agriculture, surface and underground water, environment, and government regulations resulting in introduction of tougher rules for CSG exploration including rigorous community consultation and much tighter environmental controls (NSWRE 2011; NSWEPA 2014).

3.1.4 Oil Infrastructure

Early Years (1788 to 1900)

Oil discoveries in Australia covered both oil shale and petroleum (liquid oil). The first sighting of oil shale was reported in 1802 in Blue Mountains in New South Wales by members of the French Government-sponsored World Scientific Voyage of Discovery. Later, oil shale was found in other parts of the country too. However, despite its rich oil contents, large scale development of Australia's shale did not proceed because of the high cost of low temperature 'oil-from-shale' extraction process patent (Wilkinson 2005). Nevertheless, according to ABS (2001a, 2001b), during the 19th century, the oil shale was one of the oldest industries in Australia which produced 'kerosene shale', as the only petroleum-related commodity produced in Australia in 1868.

Attempts to discover crude oil in Australia started in 1825 in south-east of South Australia - thirty four years before the first oil discovery in Pennsylvania - but unsuccessful (Wilkinson 1998). Also, oil in the form of crude bitumen, was first reported near the Western Australia-Northern Territory border in 1839. The first successful discovery of gas and condensate (light oil), which marked the real beginning of the petroleum exploitation in Australia, occurred in 1900 in Roma by the Roma Mineral Oil Company which significantly increased the company's share linking oil and gas industry together, and to the share markets (Wilkinson, 1988).

The ownership of land and underground oil resources followed the same policies of colonial and subsequent state government governments as described earlier for coal and gas (Crommelin 2009) showing the linkages of oil with government policies which would change over time.

Consolidation (1901 to the late 1960s)

From 1901 to the late-1940s oil was extracted from shale deposits discovered in Australia, while attempts to discover carbohydrate were progressing in parallel. During WW-II the NSW shale industry produced nearly 3% of Australia's petroleum needs, however the industry did not survive the post-war period because of production volume and closed in 1952 (Wikinson 1988).

In 1924, the first discovery of crude oil was made at Lake Bunga in Victoria (ABS 2001) but oil pressure and oil quality was very poor and found to be unsuitable for commercial production.

However, in Australia, and world-wide, the linkages of oil with technology significantly evolved over the period 1950s to 1960s because of advancements in science of petroleum, drilling and seismic wave technology to identify and extract oil from underground reservoirs (Shafiee & Topal 2008), which enabled exploration and production of oil at commercial level in 1960s and beyond. By mid-1963 new discoveries in Mooni in Queensland produced good oil flow rates leading to development of the first pipeline for transporting oil from Mooni to Brisbane in 1964. The news of discovery raised interests of the international and local investors and encouraged oil discoveries across Australia. These developments formed the linkages of oil with water, level of local and foreign investments, technology, and transportation stream of the oil sector in Australia.

These successful discoveries made Australia 70% self-sufficient in oil production over the period 1961 to 1970, developed the transportation stream of oil industry to move oil for end-use to refineries for end-users, and established linkages between petroleum industry, politicians, legislations, policies, economy and stock markets, and the general population (Wilkinson, 1998).

In the early twentieth century oil began to substitute coal as the primary source of fuel for shipping and in the early 1950s, railways which were operating on coal energy converted to diesel (Saddler 1981). Australia was importing oil and bitumen for domestic purposes which was cut off by the two Wars prompting either its substitution or production locally (Jay 1999).

The institutional structure of the Australian oil infrastructure formed during first half of the 20th century composed of giant international monopolies forming parent and child structure. The linkages of oil with OPEC established in 1960 for controlling oil price overruling the influence of international oil cartels. Formation of OPEC influenced oil production worldwide and created linkages with politics at local and international levels, which in turn linked oil with price and policy. Eventually OPEC took control of world oil price in 1973.

During this period, the political and legislative linkages of the petroleum industry were created by close interaction between the Federal and State governments over exploration and production of petroleum resources as well as controlling, acquiring or taxing State petroleum resources (Crommelin 2009). Federal and State governments managed petroleum resources as the owner and regulator of these resources by administering the statutory licensing and royalties while they left all upstream operational activities to the private sector. Moreover, the onshore licensing covered by each State's statutory licensing scheme covering exploration, production and retention. The offshore petroleum regulation was covered by the *Petroleum (Submerged Lands) Act 1967*, administered by joint State and Federal authorities, and contains the same three components. As a result, the linkages of the oil with both State and federal legislations and policies, politics, economy, land (Aboriginal Rights), taxes and royalties evolved in comparison to the early 1900s.

Also, the linkages of oil with federal government revenue was established through five fiscal instruments from both onshore and offshore: royalty; crude oil excise; Petroleum Resource Rent

Tax (PRRT); and in case of offshore only: cash bonus bidding to grant exploration licenses in rare occasions; and small annual fee (Crommelin, 2009). Also, the Federal Government received part of its income from both onshore and offshore petroleum production based on income tax and Good and Services Tax (GST) while allowing the fiscal instruments to be taken into account as expenditure while calculating the income tax. Therefore, the oil and gas industry at upstream level was linked to government taxes and charges producing revenue for the government.

Early Reforms (1970s to early 1980s)

During this period, the global, oil infrastructure was closely linked to the international markets as one of the most important events of the 1970s affected by the oil price shocks in 1973, 1979, and 1981 (ABARE 2010b; OECD 2010; Globaldrill Bay 2007)

In Australia, the first two years of the 1970s were spent on consolidation of the discoveries made in the 1960s while new oil discoveries were gaining momentum by the success of earlier discoveries.

In this period, oil discoveries were linked to government drilling subsidies and tax concessions until 1972 which were removed following success of the oil discoveries in the Bass Strait. This government action and the environmental concerns of the 1970's brought drilling activities to halt for the subsequent six years (Wilkinson 1988). Another reason for the mid-1970s decline in drilling activities was also due to the linkages of oil infrastructure with political ideologies of the government of the time proposing that the Australian Government should take charge of the whole oil and gas industry including exploration, creating uncertainty among private oil companies.

During the early 1970s, the linkages of oil infrastructure with more advanced dynamic positioning drilling and seismic wave technologies assisted to better identify the location of oil reservoirs. These technologies enhanced Australia's capability to extended oil and gas exploration to offshore deep water (1000m to 3000m deep). However, the technology to exploit gas and bring it to the surface from such great water depths was not available then.

Micro-Economic Reforms (1980s to early 1980s)

In this period, the linkages of oil industry with oil price and with exploration activities, impacted new explorations and petroleum development plans in Australia when the price of oil plummeted on world markets in 1986 to below $US10 per barrel (APPEA 2011a). Also, continuous oil price change from 1987 to 1999 influenced strategic policy directions different to existential struggles for access to oil as it was predicted during 1970s and 1980s (Maugeri 2008).

Due to the linkages of the oil industry with technology, that had introduced more sophisticated drilling and exploration technologies in the 1980s, and because of the linkages of oil with national security, economy and politics, Australia aimed to find moderately large sized oil reserves during the 1980s and 1990s to maintain high independence from imported oil into the next century.

However, little progress was made due to linkages of oil reserves with the very aged geology of Australia demanding continual increase in the drilling rate so that new prospects can be tested. To fund exploration activities, according to Wilkinson (1988) Australia was too much dependent on the stock market and on the general economic situation of the country which as such, did not comfortably allow explorers to discover oil in probable locations such Carnarvon Basins, Cooper, the Timor Sea, and Bass Strait.

The linkages of oil and gas with the land, especially in relation to new discoveries, led the Australian Government to introduce the Resources Rent Tax (RRT) to offshore 'greenfield' areas in 1985. In 1990, the Federal Government extended the RRT regime to all Bass Strait oil and gas production. It also extended the RRT deductibility to all offshore areas within the regime (APPEA 2011a). These actions of the Government placed the linkages of oil with taxation laws in focus.

New Paradigm (2000 onwards)

By the start of the twenty first century, oil had become the centre of political and strategic concern by world governments because of the fear that the world's oil reserves are facing depletion which could lead to the collapse of the global economy if an alternative is not found in time.

Because of the global linkages of oil, and wars in some parts of the Middle-East, the price of oil increased sharply in this period. Although the oil price started to drop in 2008, yet it has not reached any closer to the pre-2000 prices. The 2008 global financial crisis further influenced foreign policies when total primary energy supply, especially in OECD countries, was reduced by 1.2% in 2008, followed by a decrease of 6% in 2009. According to IEA (2010a), the reduction in energy supply lowered the world GDP by 2.4%.

In this time period, the Australian governments and petroleum industry including oil and gas administrators and regulators made key decisions about the present and future of the oil industry. Some of the highlights (APPEA 2011b) are: in relationship to market directions, the Council of Australian Governments (COAC) established a Ministerial Council on Energy in 2001 and initiated a review of energy market in the country; in 2003, the Australian Parliament created National Offshore Petroleum Safety Authority; In 2004, the Council of Australian Governments (COAG) signed the Australian Energy Market Agreement to streamline and improve quality of regulation in national energy market; from 2004 onwards, the Australian Energy Regulator replaced 17 State-based regulators; in 2006, the Australian Government and the Australian Petroleum Production and Exploration Association Ltd (APPEA) jointly launched strategic plan to boost Australian indigenous oil production, and increased both domestic gas usage and LNG exports; in 2007, Productivity Commission released a reported suggesting that for achieving optimal efficiency in energy resources, the regulatory approval processes must be streamlined; in relation to trade and Australia's self-sufficiency in oil, APPEA released its research report in 2008 recommending expansion of Australia's oil resources through new discoveries. The report projected that without major new oil discoveries the country will be only 32% self-sufficient in oil by that time; to expand oil and gas discoveries, in the same year, the UN permitted Australia to extend its continental shelf area by 2.5 million square meters; also, because of the linkage of petroleum industry with fuel emergency and associated legislations, the government updated the *Federal Liquid Fuel Emergency Act 1984* in 2007 (Robison 2011).

Also, the linkages of oil and petroleum industry with the environment led to development of related legislations and policies by States and Commonwealth governments. For example, WA was the first state to create a legislatively-backed carbon trading scheme (APPEA 2011b); establishment of Clean Energy Regulator in 2012; *Offshore Petroleum and Greenhouse Gas Storage Regulatory Levies (Consequential Amendments) Act 2011* (ComLaw 2011).

3.1.5 Electricity Infrastructure

Early Years (1788 to 1900)

In the colonial time, electricity in Australia was at an experimental stage with some developmental work starting in 1831. The first application of DC electricity in Australia was for a telegraph system operated between Melbourne and Williamstown in 1854 (Powercore 2006) while for the lighting purposes it was confined only to short distances close to the power plants. For example, for the first time electricity used at the Sydney Observatory in 1863 to commemorate the wedding of the Prince of Wales (IEEE 2007; Burger 2006). Power supply and electrification of cities in Australia started in the1880s with Queensland being the first British colony with a public electricity power supply (IEEE 2007). However, the first supply of electricity to the public at large started in Tamworth and Young in NSW in 1888 and 1899 respectively (Electrical Trades Union 2003; ASTHC 2000) as part of the centenary celebration of European settlement in Australia (Energex 2010). In these two cities, electricity was used for incandescent street lighting and then connecting electricity to shops, offices and homes close to the main electricity line. Later, Penrith, Moss Vale, Broken Hill and Redfern used public lighting. However, Sydney in spite of passing the *Electric Lighting Act in 1896* was the last city electrified in 1904 (Jobson 2004). The reason was the earlier investments made in gas lighting (Brady 1996; Energex 2010) highlighting the linkage of coal seam gas with the public lighting industry as earlier discussed in section 3.5.

High voltage transmission technology in the late 1880s and subsequent improvement in 1891 played a great role in development of electricity in Australia enabling long distance transmission far from the point of generation source (Powercor 2006).

During the 1800s, electricity as a secondary source of energy was linked to coal to run a heat engine for generating electricity in majority of the Australian states (ASTHC 2000); and to water to drive a water-turbine (in Tasmania) (IEEE 2007). By the turn of the 19th century, all Australian States had electricity except Northern Territory, which was not supplied with power until 1923.

Besides street electrification, electricity was linked to transport in 1890 for running electric trams which initially was operating in Melbourne. However, by the turn of the century, trams were used in other states of Australia too (Powercore 2006). Also, electricity was used in the early metallurgical and aluminium smelting industries as well (Brady 1996).

In this time period electricity was linked with the institutional and ownership arrangements and with government policies. According to Brady (1996) electricity industry was a private entity before the 1890s while the colonial state-owned electricity enterprises were used by State Governments as an instrument of policy to deliver electricity to the outback Australia.

During the 1890s, legislators decided to regulate the industry and put in place standards of supply, installation and maintenance. For example, the Victorian state parliament passed the *Electric Light and Power Act in 1896* (Powercor 2006). However, in states of NSW and Queensland, during the 'first time period' electricity regulation was under the Local Government Act (Brady 1996), a preference termed "municipal socialism" preferring to engage the private sector with interests common to the government (Thomis 1987).

Towards the end of the nineteenth century (1880s to 1890s), electricity was linked very closely with political ideologies of state governments to the extent that because of conflicting political ideology in supply of electricity they could not reach to an agreed response for being included in the Australian Constitution of 1901. As a result, electricity remained a legislative function of each state government in Australia (Crommelin 2009).

Consolidation (1901 to the late 1960s)

The high cost of electricity infrastructure led the state governments to be fully in charge of the entire electricity supply in Australia (Saddler 1981). In the early 1900s, industrial and residential consumption of electricity was low. By 1927 about 34% of homes in Australia were connected to electricity (Energex 2010) which increased the number of electric household appliances. As a result, electricity consumption increased substituting natural gas. The post-war arrival of European migrants over the period 1950s to 1960s increased electricity consumption. In the 1960s, a variety of electrical appliances and improved living standards further increased electricity demand in Australia (ESAA 2003).

The high voltage transmission started in Tasmania in 1961 because of advancements in electricity transmission technologies (Brady 1996) which solved the problem of distance and enabled relocation of mainly coal-fired electricity plants from cities to coal sites (McColl 1976). This relocation activity significantly reduce the cost of transporting coal to the power plants (Booth 2003) and reduced air pollution in cities (Powercor 2006) highlighting the linkage of electricity with the environment although it was not recognised as such in this time period.

The Commonwealth Government influenced development of electricity infrastructure in Australia after WW-II by starting the Snowy Mountains Scheme jointly with the NSW and Victorian state governments in 1946 (Lemmon 1949; Butcher 2008).

Development of electricity generation over this time period further linked electricity with aluminium smelting industries by attracting international and domestic private investments. Also, in 1948, the Federal Government invested in this industry to ensure adequate aluminium supply in Australia in case Australian imports may suffer during the cold war years. Such activities influenced evolution of electricity infrastructure and production of reliable electricity in Australia in particular in 1950s when black coal became the main base load energy source influencing development of coal-fired electricity plants in Australia (Brady 1996; Davies 2006).

Linkages of electricity infrastructure with the oil and gas and pipeline infrastructures started in 1960s for electricity generation when the gas reserves were discovered in Cooper Basin; and a large oil refinery was built in Kwinana, near Perth. Also, to alleviate droughts in Tasmania, the Hydro-Electric Commission (HEC) of Tasmania decided to build an oil-fired thermal power station to provide emergency backup in 1960. This activity further strengthened the linkages of the electricity infrastructure with oil and gas (Saddler 1981).

Electricity regulation further developed for provisioning of reliable, cheap, safe and efficient electricity supply to the public. For example, in 1918 Victoria legislated to appoint commissioners to regulate and supply electricity, and in 1921 created the State Electricity Commission of Victoria (SECV) responsible generation, transmission and distribution (Powercor 2006). NSW state government started regulating electricity in 1919 after local governments ceased control. In South Australia, Victoria, and Tasmania electricity was developing politically easier (Brady1996).

Early Reforms (1970s to early 1980s)

The Snowy Mountains Hydro-Electric Scheme which had started in the previous time period completed in 1974 (McColl 1976) for reliable supply of electricity as well as providing water for irrigation in surrounding agricultural land (Collis 1990; Butcher 2008). This large-scale development linked electricity with water, formed linkages with agriculture and other water-dependent industries, created strong linkages with technology, established social linkages by attracting migrants to Australia to shape the Australia's multicultural identity.

Throughout 1970 to 1982 electricity supply increased significantly (Ives 1983) and developed energy-intensive industries such as existing and new aluminium smelting industries, copper and zinc refining, titanium processing industries, manufacturing, mining industries, and construction which heavily relied on cheap electricity; and improved living standards further. Also, because of oil price shocks of 1970s used as a substitute for oil as an alternative source of energy (Ives 1983).

By the late 1970s, the interconnectivity of large scale power plants turned into a state-wide network requiring changes to the structure of the electricity infrastructure while preserving the monopolistic nature of the electricity generation and distribution until the mid-1980 when microeconomic reforms were introduced.

The oil price shocks of the 1970s and early 1980s influenced conversion of all oil-fired plants in Australia to coal-firing to prevent electricity price hikes, which reduced dependency on oil by about 20% in 1977 (Saddler 1981). Since 1970s, the share of oil for electricity generation has significantly reduced to the extent that today oil is rarely used in a base load generation in Australia. In contrast, gas is used in gas-fired plants for base and intermediate electricity load.

Additionally, the oil price shocks of the 1970s influenced evolution of electricity linkages with energy policy, states' legislations, and development of local energy resources plan aimed at producing electricity independent of fuel outside each State borders. These linkages were demanding inter-state cooperation, and together with environmental concerns of the time and concerns for the electricity infrastructure's inefficiency because of electricity price rises, cost of fuel, labour and capital were building up pressure for electricity reform in the late 1970s.

Micro-Economic Reforms (1980s to late 1990s)

To early 1990s, the electricity was provided by public monopolies where the operation of the electricity infrastructure was linked to the political framework and objectives of the electricity authority, which in turn was linked to the legislation which brought the authority into existence. However, since 1991, governments in Australia, and other parts of the world, have undertaken restructuring and reforming of the electricity industry because of increased concerns about inefficiency of monopolistic approach (Chand et al. 2002; Jayantilal et al. 2001; Siddiqui et al. 2001; Cheung et al. 1999; Roarty 1998; Alba et al. 1996).

As a result of microeconomic reforms in the mid-1980s in Australia, the National Competition Policy (NCP) (Hilmer Committee 1993) specified necessary changes to allow a competitive electricity market to commence from 1 July 1995 or as soon after. The vertical structure of State owned electricity infrastructure was changed to vertically disaggregated structure to create market competition (IEEE 2007). In 1994, the competitive wholesale and retail electricity markets were introduced which resulted in trading across the State borders as well. Such introduction completely changed the 1980s and earlier situation where most electricity and gas markets in Australia were just State-based and weakly linked (Smith 2005). The central element of the reforms was the establishment of the National Electricity Market (NEM) in December 1998 (ABARES 2010b), which subsequently linked the ACT, NSW, VIC, SA, QLD and TAS (Energy Future Australia 2009). WA, also experienced the effects of privatisation but is not part of the NEM, for reasons of geography. The National Energy Market (NEM) showed impediments to appropriate investments and efficiency in all parts of the value chain details of which are beyond the scope of this research. In 2001 extended drought period influenced wholesale price of electricity in NEM. This drought impacted electricity plants across the country which were using water to cool their turbine engines and severely affected the hydro-electric power plants. The drought, significantly influenced both investment decisions in electricity industry and the electricity prices in the NEM. This shows the linkages of electricity with hydrologic cycle influencing the price of electricity and the economy.

Partly as a result of the developing NEM, the concept of state bounded electricity infrastructure lost its relevance. With the partial exception of privatisation, which was rejected in several states, these reforms were almost completed in 2000 (Quiggin 2001). Deregulation has allowed new entities to the market, compete for customers and some leave the market (Douglas 2014).

New Paradigm (2000 onwards)

In 2001, following general dissatisfaction with the original governance arrangements for the NEM, the COAG introduced a national energy policy framework and established the Ministerial Council on Energy (MCE) to continue with reforms in the electricity sector in Australia. COAG assigned MCE with key functions such as investigating possibilities for national regulatory arrangements, opportunities for increasing interconnection and system security for electricity and gas, and examining future energy scenarios in Australia (COAG 2001).

In 2004, the Australian Government released *Securing Australia's Energy Future* policy to strengthen the benefits of the NEM and in particular, signalling electricity prices for new investments in the electricity sector and increasing energy efficiency. As a result of this policy, two energy institutions, the Australian Energy Market Commission (AEMC) and the Australian Energy Regulator (AER) were established to progress the policy objectives (Energy Taskforce 2004; Energy Futures Australia 2009). Effective in 2005, these institutions were created under the *National Electricity Law* to regulate energy industry in Australia.

Besides the institutional arrangements, the linkage of the electricity industry with the environment (greenhouse gas emissions) resulted in both Australian and State governments introducing green energy policies in 2001. The Australian Government introduced the national *Mandatory Renewable Energy Target* (MRET) under which, two percent of electricity must be generated from renewable energy sources by 2010 (Commonwealth of Australia 2003, 2011). In 2007, COAG mandated that by 2020 twenty percent of electricity must come from renewable energy sources (Commonwealth of Australia 2008b; Smith 2007). These actions emphasis the evolution of the electricity linkages with policy which in turn has evolved the electricity infrastructure.

A review of the literature shows that the market-based structures which were introduced by reforms have emphasised the economic dimension of the sector at the expense of other dimensions such as social and environmental (Sharma 2003). Nevertheless, the National Competition Council (NCC) argues that matters of public interest such as social welfare and environment were considered when developing market-based competition legislations (NCC 2007).

The linkages of the electricity sector with technology; and with the generation capacity were reviewed in this time period. For example, the NSW Government commissioned the *Owen Inquiry* into the electricity industry in 2007 whose findings recommended improvements in the investment and policy signals to encourage private investment in base-load generation in particular from 2013-14 (NSW Government 2007; Owen 2007). In future years the Australian Government commissioned other reports such as Finkle Report on future security of the national electricity (Finkle 2017). The latest electricity policy for Australia, as a preference to Finkle Report, is the National Electricity Guarantee (NEG) Scheme which was released in October 2017 (Turnbull 2017) for reliability of supply and emissions reduction guarantee.

During this period, the Kyoto Protocol entered into force in 2005 in response to environmental concerns caused by the use of fossil fuels and by coal-fired electricity generation plants. To respond to this treaty, the Australian Government set the Mandatory Renewable Energy Target (RET), which was operational since 2001 (CER 2016). This target in 2009 increased to 20% electricity generation by renewable sources by 2020 (Knight & Hood 2009). To reduce emission, Labour Government introduced Carbon Pricing Mechanism (CPM) as part of the Clean Energy Future Package (CEF) commenced in 2011 which was repealed by the Liberal Government in 2014. In 2015 the *Renewable Energy (Electricity) Amendment Bill 2015* passed by the Australian Parliament to adjust component targets of the RET for achieving the overall target of 20%. According to CER (2016) since beginning of the RET, the number of installations of small-scale renewable energy systems increased, also investments in the renewable energy increased. In 2017, the Australian government introduced the National Energy Guarantee (NEG) Scheme which set the renewable energy target to 36% (Turnbull 2017). As a result of commitments to reduce carbon pollution, the linkages of electricity sector with renewable energy sources evolved further, and the linkages of coal with environment in terms of pollution control strengthened.

3.2 Infrastructure Linkages - Upstream, Transportation and Downstream

Early Years (1788 to 1901)

This period marked the beginning of early development of the water, coal, gas, oil and electricity infrastructure in colonial Australia and formed a base for their subsequent development. In this period, oil and gas remained at the discovery phase providing experience to assist with later developments.

Upstream

The infrastructure was generally provided, operated and maintained by the private sector at upstream level in all States except for the coal industry during the period 1798 to 1828 in NSW when the British colonists were involved in exploration and production. However, from 1828 to 1847 the NSW colonial government handed over the coal industry to a private monopoly (the

Australian Agriculture Company) and from 1847, to other private companies. Colonial State-owned enterprises, in particular electricity, were used by state governments as instrument of policy to deliver electricity to the outback Australia, or in case of water, to provide an essential service to the public. In relation to water, it influenced important elements of the colonial government policy such as location of water, land use, early convict and subsequent European settlements, urban and rural development, mineral exploration such as gold and coal, ecology and soil conservation, agriculture and pastoralism. The provision and maintenance of water was quite often controlled by one authority; the government later on allowed limited control of maintenance by the private sector. The involvement of private sector was more visible in oil and gas discoveries and exploration because of high risks and the need for high investments while governments administer matters related to exploration and production permits, and policies related to the ownership of petroleum in this period. During 1890s, the electricity industry, in some states (e.g. Victoria) were placed under strict government regulatory control because the provision of services was very poor and the government realised that lack of intervention in the electricity was costly, inefficient and dangerous. The early infrastructure was also influenced by the British laws as well as colonial governments' policies, legislations and political ideologies in particular during the period 1880s to 1890s when debates on federation was in progress.

Transportation

The delivery of infrastructure to downstream end-use was an important consideration in particular for the coal industry. Coal mining was strongly linked to roads, railways and ports to export coal to domestic and international destinations. Lack of transportation significantly delayed coal production to the mid-1850 to the late-1880s in some regions. Development of steamships and railways influenced coal transportation and coal export.

Water was influenced by steam technology for transportation in particular for dewatering of coal mines as it co-existed with coal running into the coal mine during coal extraction. Also, water was brought to surface in inland Australia from the artesian bores for agriculture and other domestic use. During the early days of the colony water was transported by carts from the 'Tank Stream' and later from water wells drilled for town water supply.

Downstream

Water at downstream end-use was subsidised by the government for domestic and industry use, in particular in NSW. However, the manufacturing industry was demanding more reliable water because of interruptions in supply which affected production. Water at downstream was affecting the environment causing soil erosion and damaging the ecosystems. To assist with easier access to coal at downstream, electricity plants were built in coal sites to reduce delivery costs. Before development of high voltage electricity transmissions, electricity plants were built in cities so that electricity at downstream end-use be accessible close to load centres.

Gas infrastructure in 1900 although encountered while deepening a water bore, it was an unknown resource which nearly six years after production did not find an end-use. When in 1906 gas reticulated to town centre in Roma for end-uses like street lighting, the supply would run out prompting the linkages of gas with the reservoir capacity at upstream.

Consolidation Period (1901 to the late 1960s)

During this period significant national and international developments took place which influenced the evolution of infrastructure in Australia.

Upstream

Electricity and water industries were closely linked together because many power plants were using steam engines to generate electricity or those coal-fired power stations required water for cooling purposes. Development of hydro-electric plants in the early 1900s in Australia was influenced by hydropower generation innovation in UK. Therefore, for electricity generation as well as for supply of reliable water because of the forces of drought and settlement in Australia, construction of dams and water reservoirs started during the 1900s in NSW, Victoria and Tasmania. Building of dams was considered socially as a sign of progress and modernisation linking water with the social dimension. Electricity was reciprocally linked to intensive energy demanding industries such as the aluminium smelting, copper and zinc industries which required low-cost electricity to operate. As a result, these industries were instrumental in the development of the electricity industry in Australia over this time period. The development of water and electricity industries was also influenced by the Federal Government immigration policies of post-war such as: the Australian Soldier Settlement Schemes after WW-I; and the British and European Soldier Settlement Schemes of post WW-II. In particular such settlement policies influenced development of water industry to support post-war housing as well as development for irrigation in inland Australia. Development of irrigation expanded agriculture and increased demand for energy which in turn increased demand for water to produce the energy or to cool thermal turbines in coal-fired power plants. The national management of water which first started in 1964 in France influenced Australia's water management at the national level in 1965 which required collaboration of Federal and States governments because of drought and water scarcity in Australia. Also, water is linked at upstream with oil, gas and coal because it co-exists with these resources in earth profile. In turn it is linked with water treatment plants after 'dewatering'.

With respect to coal, it was highly linked to politics, policy and legislation, labour movement in Australia, economy, and unionism to the extent that miners' strikes of 1949 removed Chiefly labour government from power at the end of the same year; or prior to that event, the Curtin Labour Government formed a Coal Commission to control coal production and distribution in the post WW-II period because of the linkages of coal to the Australian economy.

Technology influenced upstream operations in petroleum industry significantly during the 1950s and in particular, the 1960s linking this industry with economy through governments' revenues and incomes as well as to the international and national stock markets. Likewise, in electricity industry, construction of power plants with higher base-load capacity started in the 1930s in NSW. Technological development also influenced the coal industry enabling production of Syngas, Coal-to-Liquid (CTL) and methane gas to substitute natural gas.

Transportation

Overseas technological developments to produce high voltage electricity significantly influenced establishment of the transportation stream of the electricity sector in Australia in 1916. This technology assisted to overcome Australia's late-1880s difficulty to transport electricity to places far away from the load centres. The high voltage technology enabled construction of electricity networks which supported irrigation development by providing energy for running water pumps to extract water from wells or nearby rivers.

Regarding coal, the development of new transport infrastructure in this time period, or extension of existing railways, enabled coal mining in places where production was postponed because of unavailability of transportation to deliver coal to domestic and international markets.

The transportation stream of the gas and oil industry established over the period 1961 to 1970 to move oil to refineries and in turn to end-users. The overseas technological advancements of 1960s in petroleum industry enabled access to underground carbohydrate reservoirs at commercial levels which in turn influenced the development of onshore and offshore gas transportation in Australia for the first time in 1969 and 1970 respectively. Likewise the onshore pipeline transportation of oil first started in 1964 following successful oil discovery in Mooni in Queensland. Offshore oil transportation using pipelines and oil tankers started in 1967 when commercial production declared viable in Barrow Island.

Water extraction inland was influenced by same drilling technologies used in oil and gas exploration especially during drought periods. Pumps were used to transfer surface water and to extract water from wells. These pumps were normally operated by electricity but to save electricity in States like NSW the Board of Water Supply used steam engines in winter times from 1931, which affected the price of water based on the type of energy used.

Downstream

From 1901 to 1940s oil was extracted from shale deposits and used for medicinal treatment and for lighting purposes. However, its end-uses significantly changed from the 1960s onwards when production of oil shifted from shale to carbohydrate discoveries.

End-use demand for water, coal, gas, oil and electricity increased in 1950s onwards when they were more widely made available in Australia.

In the early twentieth century oil began to substitute coal as a primary source of fuel for shipping and in the early 1950s, railways which were operating on coal energy converted to diesel.

With respect to water it was used for various end-uses by people, watering stock, agricultural, electricity production, extracting oil and gas, and treating and recycling of water which was pumped out of coal and oil mines for irrigation or mining operations. In the early 1900s manufacturing industries were using steam power. As oil and electricity were becoming available they were substituting steam power.

Electricity demand began to increase in the 1950s when Australia's population picked up and diverse range of electrical appliances was made available to households and premises supplied with electricity.

Early Reforms (1970s to the early-1980s)

In this period, infrastructure while on its evolutionary path, expanded swiftly across the country, because the Australian Government was continuing with its national development programs. The infrastructure linkages of this period was influenced by oil price shocks of the, international and domestic energy policies, improved technologies, increased population, drought, government ideologies, politics and legislations, taxes, government subsidies, and environment.

Coal, oil and gas infrastructure were mainly operated by the private sector with government ownership and regulation, while water and electricity infrastructure were monopolies solely owned, operated and centrally controlled by the state governments. Importantly, in 1978 the ownership of the petroleum resources in Northern Territory changed to government ownership.

The major environmental concerns of the 1970s, was related to the environmental performance of the coal-fired electricity industry which attracted the Australian government's interventions and investigations producing favourable environmental outcomes (Doyle 2000). Also, to recognise the linkages between water and the environment the Federal Government established the *National Water Resources Development Program* and the *River Murray Agreement 1973* to address the environmental and water quality problems (Hallows & Thompson 1995).

Upstream

Completion of the Snowy Mountains Hydro-electric Scheme in the mid-1970s strengthened the linkages between water and electricity. This major infrastructure project provided affordable electricity to States of NSW, ACT and Victoria, provided irrigation water to NSW and Victoria (McColl 1976), and influenced Australia's economic growth by attracting foreign investment in the aluminium smelting industry as well as by expanding manufacturing and mining industries which relied on affordable electricity. This created technological and social linkages and influenced migration and population growth in Australia, thereby establishing linkages with human welfare; and increased living standards in the country.

The high voltage transmission technology as well as technological developments in large scale electricity generation shifted State governments' investment from city-based power stations to high-voltage large-scale power plants constructed close to fuel sources. As a result, the demand for local water which was used for agriculture and domestic use increased in order to cool turbines. Additionally, because of coal mining, dewatering of coal mines raised concerns about environmental contamination of the local water. Oil and gas production significantly increased because of advancements in drilling and exploration technologies. Likewise coal technologies such as Coal-to-Liquid (CTL) or Coal-to-Oil (COM) were developed to assist substitution of petrol and oil by coal. Also in the early 1970s the old Underground Coal Gasification (UCG) technology re-started to remove the need for the underground coal mine labour force as well as to reduce environmental problems that arise in surface processing plants. In the oil and gas industry, drilling technology and seismic wave technologies assisted to identify the location of gas and oil fields with more certainty, as a result the percentage of dry wells reduced. Technologies such as big dynamic positioning drillship became available in Australia in 1979 which enabled drilling in deep offshore water. Also, oil and gas drilling technologies were applied to the water industry which assisted supply of water to inland Australia more effectively.

Upstream electricity generation was linked closely to each state's energy resources as appropriate fuel sources; to the price of the fuel; and to the cost of installed capacity. Although NSW and Queensland benefitted from their coal resources to produce electricity, Victoria could not take advantage of its abundant brown coal because of the high cost of installed capacity. The oil shocks of the 1970s influenced immediate conversion of oil-fired power plants to coal firing to prevent a rise in the price of electricity, and to reduce dependency on expensive oil. Nevertheless, high cost of factors such as labour and capital influenced the price of electricity to increase to the extent that efficient operation of the industry was queried and reforms of the industry demanded.

The international influences of the oil shocks of the 1970s, linked electricity, coal, oil and gas resources with energy policy and planning such as development of local energy resources in Australia and electricity legislations aimed at producing electricity independent of the fuel from outside each State border. In particular the linkage of coal with oil developed and strengthened in 1972 and thereafter. The reason was the decline in the share of oil in energy mix of the world and substitution of oil by coal because high oil prices. This linkage created four global coal production events, first of which occurred over the period 1973 to 1980.

The linkages of water with Australian economy shaped when the Australian Government as the main supplier of water (IC 1998) placed water reforms in the Australia's macroeconomic reform agenda in the early 1970s while in the late-1970s considered to implement water reforms at the microeconomic level in future years (Tisdell 2002). The water reforms in Australia were influenced by the 1973 water reforms in UK where publicly owned water institutions were formed in England and Wales (Johnson & Rix 1993; van den Berg 1997; Gleick et al. 2002). Moreover the water regulatory arrangements in most parts of the world, including Australia, established in 1970s to deal with different impacts of water industry on economy and environment at national and local levels in coordinated manner (McDonald & McKay 1988) by improving the efficiency and equity of water allocation in Australia.

Oil and gas discoveries of this period were linked with government drilling subsidies; tax concessions; government ideologies; government policies; politics and environment. In 1972 government withdrew its drilling assistance and tax relief which together with the environmental concerns of the time significantly slowed down oil and gas discoveries. Moreover, over the period 1973 to 1977 the oil and gas industry was influenced by the government ideologies and politics unprecedented in the history of this industry in Australia, when Rex Connor the Labour Minister for Mineral and Energy expressed the view that the whole operation of oil and gas industry in Australia is suspicious. This government ideology created an unfavourable political environment, the worst in the history of the gas and oil industry in Australia, which suspended exploration activities. But when Fraser's Liberal/NCP coalition government with a different political ideology succeeded the Labour Government in 1976, the oil pricing scheme in Australia was gradually brought towards world prices for oil. This action of the government provided incentives to oil and gas companies which did not leave Australia to continue exploration activities. In 1979, the Australian Government's oil pricing policy changed excluding any levy or excise. That is, oil produced from new fields was qualified to receive full import parity price otherwise a price cut of $2 per barrel was applied.

The linkage of the oil industry with international markets was one of the most important events of the 1970s which significantly influenced the price of oil which ultimately linked oil and gas industry with energy policy and planning and created the geopolitical linkages with the industry.

Transportation

Relocation of city-based electricity generation plants to locations near energy sources as well as legislations to confine electricity production within State boundaries, significantly reduced the cost of transporting coal and minimised unreliability of NSW coal to Victoria and South Australia.

Gas transportation stream which was closely linked to technology improved significantly in the 1970s enabling the industry to boom. The gas transportation through pipelines to Adelaide started in this time period when large gas consuming power plants were built near Adelaide. Additionally, in 1978 the transportation phase of the gas industry from offshore sources in Western Australia to international destinations such as Japan started to shape, however it was not until the mid-1980s that LNG export to Japan started. Also, in 1983 gas was transported from Palm Valley (which was discovered in 1965) by pipeline to Alice Springs and then in 1987 to Darwin, which established the link between gas and electricity generation in the Northern Territory.

The transport infrastructure in this time period expanded further particularly because of the increased coal production for both domestic and international markets. Technology enabled the mixing of coal with water to form a semi-liquid mixture for transporting it through pipelines creating a new type of linkage of coal with water. Coal transportation was strongly linked with transportation cost accounted for 70% of the total delivered coal of coal for end-uses.

Downstream

The farming communities in NSW and Victoria used the irrigation water supplied by the Snowy Mountains Hydro-electric Scheme at a subsidised rate (through sale of electricity) for agricultural purposes. Although the water rate was not reflective of the true value of water for agriculture, end-users were only charged a water-usage fee calculated by meters installed at farms (Lloyd, 1988). The Federal Government was supplying water and controlling downstream water-use in ACT and NT with other States' governments managing their own. However, constitutional and legislative changes in 1980 influenced water management in ACT and later in 1987 in NT bringing them at equal footing with other States in Australia.

In the 1970s the demand for energy, in particular for gas and electricity increased significantly because of the development of resource-based energy-intensive industries like aluminium smelting and mining, expansion of the housing industry to accommodate growing population, improved living standards and the demand for more energy by the agricultural sector. Consequently, production of more electricity impacted water resources which were normally used for agriculture, human and animal consumption and for other industrial purposes.

Additionally, in the 1970s, the concept of energy substitution had emerged because of oil price shocks of the period affecting energy consumption when oil was substituted by coal, electricity, gas, and renewable energy for end-uses. Electricity substitution intensified impacts on coal, water and environment for generation of more electricity.

Most of the coal which substituted oil and produced in this time period was used for domestic use. Globally, only 18 per cent of coal was sold to international markets. In Australia, 43 per cent of NSW and Queensland coal was exported to international markets in 1978-79 while the rest was dominantly used for electricity production in the country.

In the mid-1975, the downstream linkages of oil and petroleum industry with the automotive industry and with the environment prompted governments such as US and Japan to set fuel efficiency standards for new cars and to introduce cars with catalytic converters requiring unleaded fuel for reducing CO2 emissions. For this purpose, US Government legislated the *Clean Air Act of 1970* specifying CO2 emission standards and the *Energy Policy and Conservation Act of 1975* for setting fuel efficiency standards. The influence of such forces reached Australia and transformed the car industry in Australia too. Additionally, towards the late-1970s when oil price raised significantly for the second time, other energy efficiency measures such as development of more energy efficient home appliances and home insulations technology were introduced.

Micro-Economic Reforms (1980s to 1990s)

Through a series of economically focused reforms the operational environment, governance system, and functional structure of the infrastructure significantly changed in Australia during this period. The State-based infrastructure reforms of the late-1970s and the 1980s were later absorbed into the Federal government's microeconomic reforms, which gained momentum by release of the National Competition Policy (NCP) in the-early 1990s. The reforms formulated and approved by COAG while their incentive-based implementation left to State governments.

Upstream

As a result of globalisation, the Australian government recognised that the linkages of the country's infrastructure with the post WW-II protectionist policies, state politics, restrictive policies and a regulatory regime internal to the infrastructure sector were the major reasons for the poor performance of Australia's infrastructure. Consequently, through a series of microeconomic reforms, from the mid-1980s onwards, infrastructure was linked to new economic and political ideologies and related policies to support grounds for higher efficiency and performance. The integrated commercial functions and regulatory arrangements of infrastructure were separated according to the 1993 recommendations in the Hilmer Report and associated National Competition Policy (NCP) in order to facilitate market-based competition. As a result infrastructure was linked on one hand to regulatory institutions such as the ACCC and the NCC to oversee the implementation of the NCP, and on the other to state funding and its tight Commonwealth control, under the Constitutional provisions, to ensure that the incentive-based implementation of reforms were working according to the plans in each state. Because, not all aspects of the NCP were equally implementable to each type of infrastructure, a more centralised structure was required for the water industry.

At state boundaries, infrastructure such as water, gas, oil and electricity were coordinated by state governments in recognition of the cross border geopolitical linkages. However, cross border linkages of infrastructure created resource sharing issues such as sharing water resources during drought periods; or extraction from water resources such as rivers for generation of electricity and impacts on downstream use such as irrigation or domestic applications. These issues together with environmental concerns linked water infrastructure more strongly with water pricing regimes, water management, technology, agriculture industry, legislations and policies such as requirements for water allocation or separation of land and water entitlements for equitable access to water. The legislative linkages proved particularly useful in cases of Murray-Darling Basin and Snowy Mountain Hydroelectric Scheme which water crosses several state boundaries.

To preserve fresh water in urban areas, upstream water technologies such as water recycling technologies developed to treat effluent water for gardening, washing cars and flushing toilets.

The upstream linkages of electricity infrastructure were impacted by the predicted mineral boom in the 1980s, led to over-investment in the generating capacity to satisfy the projected demand for electricity. However, the predicted boom did not happen and as a result the price of oversupplied electricity dropped significantly. Over-expenditure, low electricity prices and inadequate collaboration between states to expand the electricity industry were recognised as reasons for inefficiency in electricity industry. Also, industrial issues of the mid-1980s caused power shortages and price increases in Australia, which further highlighted the performance issues in the electricity industry. These issues prompted State governments for implementing the first wave of reforms in the 1980s followed by the COAG's microeconomic reforms in the 1990s.

The upstream coal production was directly linked to the price of oil, a pattern which remained unchanged since the early-1970s when price of oil started to rise. Increased coal mining was linked to development of new towns, new ports, and extension of railways and airports.

Oil exploration activities in Australia were also linked to the price of oil, to drilling technologies, and to the very old geology of the country.

Because of linkages of oil with national security, economy and politics, in the light of availability of more sophisticated drilling and exploration technologies since 1980s, Australia decided to find large, or moderately sized, oil reserves from 1980s onwards to be less dependent on imported oil into the next century. However, the very old geology of Australia has made the progress slow.

The gas upstream export markets were formed in 1989 and in the same year deregulation of interstate gas trade started. Gas was linked to national regulatory bodies such as AER except in WA where *Economic Regulation Authority and Gas Dispute Arbitrator* is the regulator instead.

On environmental linkages, the global concept of sustainable development to protect the interest of current and future generation, or development of Kyoto protocol made the linkages of infrastructure with environment stronger worldwide and in Australia.

Transportation

Transportation of water, either by surface transfer or by bringing groundwater to the surface, is linked with electricity to provide energy to water pumps for moving water. Therefore, transportation cost is directly linked with the cost of electricity which could increase because of the drought and environmental factors as discussed earlier in this chapter.

Unlike electricity, the transportation stream of water infrastructure could unlikely change technologically especially in big cities like Sydney and Melbourne because the water has to be transported over a long distance from upstream sources to places of demand which are located far apart. Hence, the transportation cost would increase as further developments would take place.

With respect to other infrastructure, improved pipeline technologies for oil and gas as well as improved rail, and port infrastructure for coal contributed to improved transportation of these commodities to domestic and international markets.

Downstream

With respect to water, frequent droughts have reduced water levels in dams and influenced downstream water use by implementation of tight water restrictions to preserve fresh water. Additionally, water recycling technologies and treating effluent water have provided additional sources of water for gardening and washing cars in urban areas. Moreover, power plants in the vicinity of coalmines took advantages of treating coalmine water as well as tapping into river water reserved for periods of low flow, to assist with electricity generation. Also, coalminers used treated coalmine-water for washing and separating coal. The choice of technologies, particularly water treatment technologies and the purposes they are used for, determine the amount of electricity consumption which in turn is linked to government water supply policies, environmental protection strategies, and government political ideologies.

Water reforms which have considered implementation of water pricing schemes, water allocation schemes, and extraction of the potable groundwater for consumption in areas of the most need have assisted to preserve water which otherwise could have been wasted at downstream end-use. Water sharing for downstream use in places where water crosses several state boundaries, has been an issue for a long time, especially at times of drought, or when power plants were accessing upstream water for generating electricity. Governments have linked water use with legislation to assist with such issues.

In terms of electricity downstream use, as discussed earlier, the over-expansion of the electricity sector in 1980s led to cheaper electricity prices. However, factors such as reasonably priced gas; increasing interest rates; increasing cost of capital and civil work; and investing in larger capacity generators to bring about economy of scale reversed the declining pattern of the electricity price and improved demand. The industrial disputes of the 1980s which created electricity shortage and higher prices let electricity to be substituted by cheap gas at downstream end-use. Also, fuel substitution was an alternative at the time of drought which caused the electricity price to increase.

Similarly, the 1970s oil price increases influenced substitution of oil by coal as an alternative cheaper source of fuel for industries and for power generation. However, during low oil price periods the fuel substitution pattern was reversed in favour of oil being a cleaner source of energy. Likewise, natural gas was substituted for coal and oil in this period and in fact higher oil prices caused conversion of power plants to gas to get benefit of cheaper and cleaner fuel.

The 2000s New Paradigm (2000 to 2017)

The microeconomic infrastructure reforms advanced post-2000. Particularly, the linkages of infrastructure with the environment further evolved in this period by implementing the mandatory Greenhouse Gas Abatement Scheme (GGAS) over the period 2003 to the mid-2012 in NSW which subsequently replaced with the Federal government's carbon tax as part of the

Commonwealth's Clean Energy Futures package (IPART 2013). In 2017 the Liberal Federal Government announced the National Energy Guarantee (NEG) Scheme whose one of the two major objective is focused at reducing carbon emissions in alignment with Australia's obligations under the Kyoto Accord (Turnbull 2017). The evolution of environmental linkages strengthens linkages between water, electricity, natural gas, and renewable energy production technologies.

Upstream

The COAG's establishment of Ministerial Council for Energy (MCE) in 2001 and later the COAG Agreement on the National Water Initiative (NWI) in 2004 have set new directions for reforms in coal, gas, oil, electricity and water industries in order to achieve a nationally compatible market and regulatory regimes; to provide opportunities for increasing interconnection and security for electricity and gas nationally and for water across State boundaries; and to examine future water and energy scenarios for welfare and national security. These new directions led to establishment of new legislations, policies and institutions for infrastructure details of which described earlier.

From 2004 to date, the NWI, together with an implementation blueprint *Water for the Future* steered direction of water reforms towards achievement of a nationally compatible market, regulatory, and planning model for management of surface and groundwater resources in rural and urban areas to preserve water, to protect environment and to gain more favourable social and economic results.

The early 2000's concept of Water Sensitive Urban Design (WSUD), which is aimed at keeping water balance in urban areas close to pre-development value, linked water management with urban design, landscape and architectural considerations to save water and protect the environment.

In rural areas, water management through pricing and water allocation schemes, which progressed further in the first decade of 2000s, assisted to protect environment, to prevent land degradation, and to preserve water for drought periods.

With respect to upstream gas, the gas infrastructure and gas market has developed and evolved significantly with new discoveries; new upstream sources of gas supply; streamlining of gas function; the introduction of full retail contestability (FRC) which started to take shape since 2000; and increases in gas-fired electricity generation. The 2012 Federal government's carbon tax, and the 2017 NEG Scheme have strengthened the gas infrastructure linkages with legislation and energy policies.

With respect to oil, apart from volatile oil prices as a result of the international influences and events, oil has become the centre of political and strategic concerns by world governments beyond the price level because of non-renewable nature of the oil. These concerns led the Australian Government to make key administrative and regulatory decisions about the present and future of oil in the country by creating institutions, for example, MCE, National Offshore Petroleum Safety Authority, Australian Energy Market Commission (AEMC), AER and AEMO to name a few.

Transportation

Advanced gas pipeline infrastructure to transport gas to domestic and international export markets has progressed further since 2000. The linkage of gas industry to export markets influenced development of LNG and CSG-LNG plants and expansion of export infrastructure. The reason for such development has been due to stability of domestic gas market which in turn has been linked to steady financial returns to producers and developers over the past 20 years. Analysis of literature shows that the increases in production and export of LNG may introduce price parity with natural gas which could divert investment in future domestic natural gas supply.

Significant new pipeline infrastructure is likely to be constructed to link the South Eastern Australia grid to future sources of gas supply. This will result in a more interconnected transmission grid and increased system security. PNG, North West Shelf and the Timor Sea have all been identified as possible new sources of supply. Greater interconnection between Queensland and the remainder of the Eastern Gas Market is also anticipated consistent with increased sales of Coal Seam Gas (CSG).

Downstream

One of the two main objectives of the water reforms has been management of downstream end-use in both urban and rural areas. Water Sensitive Urban Design (WSUD) assisted to save fresh water at downstream end-use. Likewise progress with water reforms in the first decade of 2000s assisted to minimise wastage of water in rural areas by managing downstream water use through water pricing and water allocation schemes.

With respect to coal, oil, and gas end-uses, the post-2000 significant increases in the price of oil prompted substitution of coal for oil and gas for oil showing that downstream end-use is closely linked to the domestic and international economy and to markets which dictate the demand.

Downstream use of renewable energy particularly the domestic roof-top photovoltaic (PV) solar panels in the recent years have encouraged advancements in the renewable energy technology evolving the linkages of the electricity sector with the low-emission generation technologies. The number of gas-fired power plant has almost doubled from 1997 to 2005 with the expectation of further increase as a result of implementing the 2017 NEG Scheme. However, recent studies have challenged the wisdom about low-emission fuels such as gas asserting that using more gas could 'slightly accelerate' the rate of global warming until at least 2050 (Wigley, 2011).

3.3 Main Points

- Historically infrastructure linkages played an important role in the evolution of infrastructure but these linkages were not formally considered. Hence the linkages were implicit.

- Coal, oil, gas, electricity and water infrastructure are historically interlinked; practically one is required either for development of the other or for processing requirements of another.
- In the formative years, gold rush and subsequent events, industrial revolution, formation of federation, political change, wars, economic downturns, evolving technology, and growing number of early settlers played important role in the development of infrastructure in Australia. In the early years, water, coal and electricity went through their developmental phases while oil and gas remained at discovery stages yet providing experience to assist with later developments.
- The dominant linkages of the Aboriginal spiritual belief with water, land and environment preserved the linkages between the latter elements throughout the history. However, because of lack of awareness of these linkages, they were broken during the formative years of developing infrastructure in the Australian colony. The linkages with science of water started to take shape towards the end of 18th century leading to the early recognition of the linkages of water with environment in the beginning of the 19th century.
- Historically, the evolution of infrastructure is linked with public funding, institutional and governance structures, government's political ideologies, legislations, public policies, regulation and reforms, technology, social-welfare, economy, and the environment. Moreover, it is observed that international influences played significant roles in the evolutionary processes at the domestic level. Also, it is noted that infrastructure and associated linkages have not always evolved by forces of the same kind, rather cross-forces have been instrumental too. The independent and cross-evolutionary influences have been the case for technological, political, economic, environmental and social-welfare linkages.
- By discovery of the steam energy, the linkages of water with steam and pumping technologies and later with electricity infrastructure for production of electricity were established. Also, electricity assisted with transporting water shaping the linkages of water with the early pipeline infrastructure, for mineral mining, expanding water supply, sewerage and irrigation systems. The linkages of water with coal, oil, and gas were developed because water, gas, oil and coal not only must be separated in production processes, they are required as fuel sources for generation of electricity. Also, water and gas specifically are needed to assist with extraction of oil. Therefore, one infrastructure is linked with the other and facilitates the development and operation of the other linked infrastructure.
- Because of the role of electricity as a multi-sectoral catalyst, there are reciprocal links between the electricity and the growth of electricity consuming industries. The industries such as street lighting, electric trams, electro-metallurgical and aluminium industries which formed during the late-1880s and turn of the century, were significantly instrumental in the development of the electricity industry during this period.
- Infrastructure development in Australia which started in the colonial times has since then

undergone significant transformation, especially since the 1980s. The early infrastructure development was confined to water, agriculture, and coal, typically managed and owned by both small private sector and the colonial governments. However, development of the coal infrastructure gradually given to the private sector under government ownership and regulation. After the gold rush of the mid-1800s and arrival of migrants, infrastructure development was highly accelerated and the need for various infrastructure including electricity emerged. The British government provided finance and technical expertise to the colonial government. As a result, infrastructure provision, and the political, legal and economic institutions replicated the UK model. Typical features of infrastructure include: government ownership, statutory monopoly with internalised regulation, vertical integration and centralised public governance.

- In the post federation period, large scale infrastructure development with government ownership continued at the State level following the British model. It was only in the early 1900s, with the discovery of gas in Roma, that oil and gas industry began to evolve in Australia. Coal, oil and gas infrastructure while owned and regulated by the government were developed by the private sector willing to invest in these highly capital and cost intensive sectors with expectation of high returns. Also, the steam, coal, oil and gas technologies influenced the evolution of electricity infrastructure. After the WW-II period, Federal and State governments jointly managed water and electricity infrastructure because of the importance of socio-economic and geopolitical linkages with these industries, for example, development of Snowy Mountain Hydro-electric Scheme, and water management along Murray River where one State's water supply was dependent on neighbouring rivers. However, in the period of micro-economic reforms, the centralised system of infrastructure governance shifted to a liberalised market-based system where competition was encouraged. This institutional changed once again required continued cooperation of the Federal and State governments. Establishment of the Council of Australian Governments (COAG) assisted in implementing the objectives of the microeconomic reforms including development of water and energy markets, and infrastructure regulatory bodies with the national scope.
- The social-welfare dimension of infrastructure in Australia has been formed from early settlement days and continued its evolutionary path throughout history to date as is evident from the post WW-II development of Snowy Mountain Hydro-electric Scheme. Government migration and settlement policies have further evolved water, electricity, petroleum products and gas infrastructure in the country for domestic and industrial downstream uses.
- Government political ideologies, legislations, policy, and reform linkages were paramount in development of infrastructure in Australia. In fact the expansion of water and electricity infrastructure in particular accelerated because governments realised their welfare impacts and electoral appeal. Other examples relate to the discovery and exploitation of coal mines and even choice of coal-fired technology; oil and gas exploration and production; and development of

gigantic Snowy Mountain Hydro-electric Scheme. These linkages have been very influential in evolution of infrastructure and building of today's Australia.

- There is a direct relationship between the price of one type of infrastructure and the price, production, demand and downstream use of another infrastructure. For example, high price of oil in the 1970s and early 1980s encouraged increased coal production and use as a major source of energy, and promoted fuel substitution where coal and gas replaced oil. As a result, four globally distinct coal production events occurred over the period, which attracted more private investments in the coal production technology in Australia developing the coal sector further.
- Technological developments, also, played a great role in the evolution of infrastructure in Australia. Each infrastructure is linked to various technologies which when optimised would increase production and higher performance of the infrastructure. For example, the invention of high voltage transmission technology overseas influenced development of electricity sector in Australia by enabling transmission of electricity to locations very far apart. Also, it enabled to relocate power plants from cities to places near coal and gas resources which not only reduced air pollution, it also reduced coal transportation cost to power plants; or coal-fired electricity generation technology enabled utilisation of abundant inexpensive coal in Australia for electricity production; or hydro-electric technology, which was initially developed in UK, influenced development of hydroelectric power plants in Tasmania where water is amply available. Also, the availability of electricity in rural areas linked drilling technology to access inland artesian water; and with pumping technology to extract the potable groundwater linking technology to drinking water and agriculture sector for food production, which in absence of inadequate water it was impossible. Therefore, an overall linkage of technology with infrastructure, and in turn with human life through social-welfare linkages is established.
- Natural events such as drought, and its frequency as observed across all five time periods, also influenced evolution of water infrastructure in Australia. For example, drought prompted investments in secure water supplies which primarily reflected in construction of dams and water reservouirs, particularly over the period 1901 to the late-1960s, and subsequently through water management practices and technologies such as water saving, water treatment and recycling, rain water tanks, and desalination plants. Also, the linkages between water, electricity, and coal infrastructure developed further. For example, the linkages of water with upstream groundwater and with midstream water transport technologies enabled extraction of potable water, and transport it to locations far apart. On the other hand the downstream linkages between water, electricity and coal were impacted the operation of these infrastructures because of competition for water use. As a result, technological linkages of water evolved through water treatment and recycling technologies enabling treatment of coalmine-water for use in electricity generation plants and agriculture. However, the energy-intensive nature of these technologies affected the linkages of water with environment contributing to carbon emissions.

- The linkages of infrastructure with environment have evolved over the years influenced by various domestic environmental protection laws and legislations and global protocols such the Kyoto Accord. Environmental linkages took shape by awareness of the linkages of water with environment in the early 1800s. It was not until the mid-1850s that environmental damages to water and impacts on public health were investigated. The first environmental laws passed in the 19th century concerning exploitation of natural resources. In the late 20th century global concerns were raised about polluting impacts of coal and other fossil fuels on environment leading to adoption of the 1997 Kyoto Protocol for reducing carbon emissions. In response to climate change, since 2000, the NSW and Western Australia pioneered by legislating carbon trading schemes in 2003 and 2005 respectively; the Labour Federal Government legislated the national Carbon Tax law as a climate change mitigation strategy in 2011; and the Liberal Federal government through National Energy Guarantee (NEG) Scheme in 2017 set targets to reduced emissions level. The evolution of linkages of infrastructure with environment has encouraged development of clean energy technology, and provided incentives to coal consuming sectors to migrate to cleaner fuel options such as gas or renewable energy sources.
- International economic events such as the 1929 global recession, the 2007-08 global financial crisis, and the economic booms played an important role in development of infrastructure. During the crisis and their aftermaths governments invested largely in infrastructure through economic stimulus packages which developed infrastructure significantly. Also, in the boom times, for example the Australian mining boom over the period 2003 to 2014, attracted private investors which developed the infrastructure and contributed to the economic growth.

Figure 3.2 presents a historic snapshot of the major infrastructure and linkages.

Table 3.2: Profile summary of infrastructure linkages evolution in Australia 1788-2017

Sector	Stage	Period 1: 1788-1900 ⓪ ❶	Period 2: 1901-1969 ❶ ❷	Period 3: 1970-1980s ❶ ❷ ❸	Period 4: mid-1980s to late-1990 ❸ ❹	Period 5: 2000-2017 ❹ ❺
Water	U		Electricity, A	Agric, Coal, Elect, Oil, Gas, Envir	(all sectors)	Elect.
	T					
	D					
Coal	U	(1798-1828) (1847-)	Water,	Oil, Gas, elect.	Oil, other indu	Water, Elect, Oth
	T		A			
	D					
Gas	U	A	Water, Wtr Treatment Plants			
	T					
	D	$				
Oil	U		Water, Wtr Treatment Plants A			
	T					
	D					
Electricity	U		Water, Coal,	Water, Coal, Oil, Gas		Water,
	T					
	D					

Legend:

- Tech (Irrigation)
- Tech (Steam Engine)
- Tech (High Volt Trans)
- Tech (Elect Gen Coal)
- Tech (Elect GenHdro)
- Tech (Elect Gen Oil)
- Tech (Elect Gen Renew)
- Tech (Drilling, basic)
- Tech (Drilling, advanced
- Tech (Siesmic Wave)
- Tech (Explor Machine1)
- Tech (Explor Machine2)
- Technology (Coal)
- Technology (Other)
- Tech (coal low emission
- Pipeline Tech
- Political (gov't ideology
- Colonial Policy, Legislation, Reform
- State Policy, Legislation, Reform
- C'wealth Policy, Legislation, Reform
- Geopolitical linkages
- Institutional (Private)
- Institution (colonial Pub Monopoly)
- Institutional (statel Pub Monopoly)
- Institutional(Public-Private)
- Institutional (Unbundelled)
- Regulatory Reform Inst.
- Int. influences (Wtr Mgmt France)
- Kyoyo, Emissions Control
- Security, National Security
- Safety (OH&S)
- Finacial (Investments, Funding)
- Population, Family)
- Geographic
- Sectoral link

Linkages Development Phase

- ⓪ None
- ❶ Weak
- ❷ Moderate
- ❸ Developed
- ❹ Advanced
- ❺ Very Advanced
- No Linkages Formed
- ⓪ Experiment
- Domestic Markets
- International Markets
- Exploration
- Production
- Final Uses
- U Upstream
- T Transport (Midstream)
- D Downstream
- Water Treatm't Desalination
- A Aboriginal Land Rights
- $ Share Markets
- Transport (Railways)
- Transport (Pipelines)
- Transport (Trams)
- Transport (Roads)
- Transport (Ports)
- Transport (Highways)
- Transport (Cart)
- Transport (water wells)
- Communication Linkages
- Social-Welfare Linkages
- Economical Linkages
- Environment Linkages
- Other Industry Linkages
- Hydrologic Linkgaes
- Govt subsidies, Tax Conc.
- Fiancial Linkages
- Economic Events (Crisis)
- Economic Events (Booms)
- Economioc Events (Gold Rush)
- Economic Events (Recessions)
- Econ Events (Oil Price Schoc
- Wars
- Linkages with price
- Exports Linkages
- Construction (Dam, Hsg)
- Agriculture
- Aluminium Smelting
- Copper, Zinc

Source: This author's summary based on the discussions in Chapter 3.

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4 A Framework For Quantitative Analysis

This chapter develops an analytical framework for quantitative estimation of infrastructure linkages and multipliers to assist with micro-level analysis. This chapter is organised as follows. Section 4.1 reviews existing empirical studies that focus on estimation of infrastructure linkages with specific emphasis on understanding the underlying analytical methodologies. Section 4.2 discusses key shortcomings of these methodologies. Section 4.3 develops the analytical methods employed in this research to estimate the infrastructure linkages and multipliers, and finally Section 4.4 presents the key features of the methods.

4.1 Reviews of Analytical Methods

The review of studies focusing on analysing infrastructure linkages suggests that analytical methods can be broadly grouped into nine major categories namely: input-output (IO) models, Computable General Equilibrium (CGE) models, integrated models, Non-IO models, Life Cycle Assessment (LCA) method, shortcut models, Data Envelop Analysis (DEA), the Bayesian models, and commercial models. The salient points of these models are summarised in Table 4.1, and discussed as follows.

1) Input-Output Models

Input-Output models are comprised of Leontief static and dynamic models, Ghosh supply driven model, and mixed Leontief-Ghosh IO models. Each of these models are briefly discussed below.

Leontief Static Input-Output Models - The majority of the studies used standard static input-output models for analysis of linkages and multipliers. See, for example: Bravo et al. (2015), Freytag and Fricke (2017), Foran et al. (2004), Lenzen & Foran (2001), Lenzen et al. (2004), Marsh (2008), Minh Do (2011), Santos & Haimes (2004), and Tounsi et al. (2013).

Some of the main reasons for using this method include the ability of the input-output model to represent the complex nature of the economy adequately in a simple and understandable form; provide detailed information about sectoral linkages; and show equilibrium flow of materials and services. Further, the 'misconception' of fixed technological coefficient of production, limiting its ability to incorporate price effects and to undertake long-term analysis, as clarified by Rose & Miernyk (1989) - "*it is not as restrictive as many critics have suggested*" - is therefore no longer an issue. However, the application of this model alone is considered inadequate for this research. This is discussed further in section 4.3, the model's underlying IO engine.

Table 4.1 Salient points of the existing major empirical methodologies

Author	Method	Specific Methodology	Strength	Weakness
Bravo et al. (2015), Freytag & Fricke (2017), Foran et al. (2004), Lenzen et al. (2001), Lenzen et al. (2004), Lenzen and Foran (2001), Marsh (2008), Minh Do (2011), Santos & Haimes (2002), Tounsi (2013)	Input-Output	Leontief Static Input-Output Model	• Transparent and simple; • Excellent for linkages analysis (direct, indirect, total) • Detailed to aggregate levels analysis • Shows complex structure of an economy; • Linear model swift calculations and analysis; • Show the ripple effect of change in final demand; • Suits short- and long-term analysis (economic stimuli studies) • Based on IO relationships informs policy decisions	• Data intensive, complex to build and costly; • 'Misconception' of fixed technical coefficients'; • Non-linear behaviour; • Overstate results not taking complementary IO variables; • Fixed equilibrium structure at a given point in time; • Inflexible to market disequilibrium; • Unable to respond to resource limitations; • 'Perceived' inflexibility to price changes (i.e. zero price elasticity); • Operates on restrictive assumption.
Wu et al. (2016), Augustinovics (1970), Antras et al (2012)	Input-Output	Ghosh Input-Output Model	• Complement a few limitations of Leontief IO; • Best for measuring forward linkages; • Useful for economies with supply constraints (a small region depending on other regions); • Demand shift analysis in centrally planned economies; • Useful for monopolistic economies; • Suits studies into shortfall of energy under limited substitution; • Suits economies with scarcity of inputs • Acts as a "Leontief price-model" (change in outputs because of change in price).	• Assumes the local economy or investment perfectly react to any change in supply; • Elastic final demand; • Economic interpretation in terms of quantities; • Not suitable for long-term studies;
Praktiknjo (2016), Gallego & Lenzen (2005), Bjerkholt and Kurz (2006), Rueda-Cantuche & ten Raa (2013)	Input-Output	Mixed Ghosh + Leontief	• Best for measuring forward linkages; • Best for measuring backward linkages; • Same strength as outlined for Leontief and Ghosh in above	• Require matrices set up to suit both Ghosh and Leontief; • More data and process intensive; • More complex and time consuming
Rose (1995), Halkos & Tsilika (2015), Wolff (2011), Liew (2000)	Input-Output	Dynamic Input-Output Model	• Incorporate explicit periods of time into the model; • Trace economic analysis over a set period (base to target); • Ability to measure linkages dynamically; • Technical coefficients can represent change in technology; • Suits analysis of environmental issues	• Not commonly used for linkages analysis; • Requires a series of consecutive input-output tables to build; • Complex to construct and to analyse; • Data and maths intensive (need investment/ capital coefficients and price data matrices at time ***t***); • Could poorly represent energy technologies
Roson (2014), Bak et al (1993), West (1995), Gabaix (2011), Rose (1995), Dixon (1992), Duchin (2007), Wing (2004), Whiteman (1999)	Computable General Equilibrium	CGE	• Based on a set of detailed social accounts; • Incorporate resource constraints; • Allow input substitution; • Has a strong price-quantity integration (respond to variable changes in IO - price changes, sectors can change input or output when market shifts); • Can model micro/macro impacts/sensitivity analysis • Reveal capital requirements of a given final output in present & in future; • Reveal future growth path of economy year by year; • Inform fiscal, gov't econ, int'l trade policies & microeconomic reform; • Based on market equilibrium; • Provides evidence to support claims.	• Not common for linkages analysis; • Extremely data intensive; • Very difficult to use & time consuming; • Not used for short-term analysis; • Results are ultra-tuned because of its flexibility; • Difficult to distinguish direct and indirect effects; • Assume perfect data and entered to the model; • Not validated empirically; • Strong theoretical assumptions.
Amores & Rueda-Cantuche (2009), Zhu (2003)	Data Envelop Analysis	DEA	• Explicitly measures backward and forward linkages for multiple dimensions into "DEA Scores" (output, income, employment, CO2 etc.); • Key sectors are identified based on strength on most of the dimensions; • Can measure variables in different units • Can use weighted parameters;	• Mathematically complicated; • Requires specific expertise to develop;
Temurshoev (2015), Lugovoy et al (2014), Chick (1997)	Bayesian -based IO	Bayesian	• Useful to represent uncertainty in IO analysis; • Useful to update IO matrix / Social Accounting Matrix, (SAM); • Useful for simulation of IO in a stochastic or unknown sys. • Useful for IO matrix aggregation / disaggregation.	• Non-standard approach to IO analysis • Robustness is questionable (not used much) • Need a lot of data, computationally intensive; • Need advanced maths and computer coding skills;

Source: This author's summary based on review of studies focused on methods of analysing infrastructure linkages.

Table 4.1 (cont'd)

Author	Method	Specific Methodology	Strength	Weakness
Yang et al (2007), Deng et al. (2014), Flegg & Tohmo (2013), Lehtonen & Tykkylainen (2012), Jahn (2015)	Integrated Models	Input-Output + LQs	• Useful for identifying region specific parameters (e.g. the industry that makes the region distinct); • Useful for estimating IO coefficients at regional level	• Robustness is questionable (not used frequently); • Not suitable for large scale linkages analysis
Velazquez (2006), Minh Do (2011)		Input-output + Energy Models	• Useful to represent various energy technologies • Detailed linkages results for economy and energy sectors; • Overcomes CEG's poor energy representation.	• Data intensive and computationally demanding • Might not be adapted to various economies/regions;
Kahrl & Ronald-Holst (2008), Feng et al. (2011), Zamagni et al. (2008)		Input-output + LCA	• Suits study of environmental linkages with economy; • Provide a matrix to represent process models of life-cycle stages similar to IO model or in combination with it; • Strongly useful for energy intensive water projects (provides policy makers with less energy intensive water provision options).	• Not flexible for analysis of linkages; • Direct & indirect effects are not distinguishable • Suffers from truncation error placing boundaries around processes in the form part of the model; • Only useful for study of one dimension of a specific link only (technology dimension)
Peavy (2007)		Input-output+ Econometrics	• Strength of IO model supported by econometrics models; • Useful for analysis of linkages and multipliers, and interpretation of results; • Incorporate strong model validation techniques; • Incorporate uncertainty; • Incorporate and respond variable changes in IO (price changes) • Strong in forecasting and scenario analysis;	• Extremely data intensive particularly for forecasting; • Time consuming to build the model, and to test both IO and econometric dimensions; • Requires expertise to link supporting modules & events; • Requires detailed knowledge of interpreting results;
Wattana (2010)		Input-output + DEA	• Combined strength of abovementioned IO and DEA.	• Combined weaknesses of abovementioned IO and DEA.
Siddiqi & Anadon (2011)	Non-IO Methods	Spreadsheet	• Useful for regional analysis where no IO tables are available; • Responds to data validation techniques;	• Not commonly used for linkages analysis; • Data intensive to produce meaningful results; time consuming and prone to errors
Bard (2014)		Algebra-Based Input-Output	• Suitable for IO analysis in absence of computers;	• Manual, tedious, no good for large data, error-prone;
Dennen et al (2007)		Numerical + Scenarios + a Web Tool	• Useful for regional analysis with limited data availability; • Suitable for electricity and water use projects.	• Not a standard approach for linkages analysis; • Time consuming, error-prone, inconsistent results.
Adams & Shachmurove (2008), Gan & Zhidong (2008), Lee & Chang (2008), Stern (2007), Narayan & Singh (2006), Stillwell et al. (2011)		Econometrics	• Suitable for capturing specific link; • Useful for engineering and scientific with no or limited assumptions, and availability of accurate data.	• Require extensive assumptions and data manipulation in economic and policy related cases; • Cannot capture multiple linkages.; • Significant focus on technological-scientific dimensions.
Hendrickson et. al. (1998), Zamagni et al. (2008)		Life-Cycle Assessment (LCA)	• Suitable for study of specific link (e.g. tech. dimension); • Suitable for energy and water projects.	• Not suitable for analysis of sectoral linkages; • Truncation error and boundaries around processes;
Bromley (1972), Burford & Katz (1981), Drake (1976), Harrigan (1982), Katz & Burford (1981), Lieu (1983), Mattas et al (1984), Pagoulatos et al (1986), Phibbs & Holsman (1980)	"Shortcut" Methods	Shortcut	• Low developmental cost, easy to build and work with; • Useful for regional analysis where no IO table exists. • Works well with minimal data; • Provides essential information for policy decisions and economic planning; • Only need to include sectors with the largest indirect effects;	• Some loss of information because of minimum level of data usage; • Can only show the unitary impact of change in final demand of a sector on aggregate regional output (not on the sector itself as well as on each other sectors of an economy)
Rickman & Schwer (2015), US Department of Commerce, Rutgers University Center for Urban Policy Research and the National Park Service	Commercial IO Models	IMPLAN, RIMS II, PEMI, REMI	• Places focus on results rather than building a model; • Suitable for repetitive analysis; • Suit multi-regional, highly multi-sectoral linkages analysis • Built-in error checking ability; • In-built formulations for various analytical tasks; • Useful as a management tool.	• Requires extensive data in specific format and order; • Could divert the research objectives; • Some with high license fee; • Require training and experience to use; • Inflexible to local modifications; • Leave behind dependency on model developers.

Dynamic Input-Output Models - The *Dynamic IO Model* was originally formulated by Leontief (1953, 1970) as an extended version of his static model, which was subsequently adopted by researchers. For example, Rose (1995) extended the Leontief static IO model to a dynamic model for economic analysis; Halkos & Tsilika (2015) applied dynamic IO model to analyse environmental issues such as CO_2 emissions and improper use of natural and economic resources. Also, the model is well suited for studying technology impacts on economic sectors and the economy as a whole, because of its ability to compute variable coefficients (e.g. technological change). For example, Wolff (2011) has applied the dynamic model to investigate the linkages of technology; R&D spillovers; and the impact of technology on Total Factor Productivity (TFP) for 68 sectors of the US economy. Dynamic IO models are also commonly used to investigate the impacts from infrastructure failure (see, for example, Kelly et al. 2015a), because it requires a time-dependent analysis to inform how the economy responds and recovers from a disaster over time.

Liew (2000) developed a purpose-build Dynamic Variable IO (VIO) Model to extend the static single regional version of the Multiregional Variable IO (MRVIO) Model, which is a general equilibrium model applied to the Leontief IO model. The purpose of this Model was to derive information by evaluating the long-term economic effects of spending through its dynamic multipliers module. In this Model, investments were directly linked with profit maximizing behavior of the economic sector. Also, both technical coefficients and capital stock coefficients include price terms forming variables instead of being fixed - because dynamic IO is responsive to some price effects as opposed to static model with no price effect capabilities. Liew described that the Dynamic VIO by its time dimensions represented the real situation more accurately.

The dynamic IO model is strong in handling non-linear functions; being suitable for long-term analysis and forecasting; and unlike static model accepting both wage and non-wage income. One of the major weakness of dynamic IO models is that as the dimensions of the impact analysis are extended, the models become extremely large and mathematically too complex (Table 4.1).

Ghosh Input-Output Model - Ambica Ghosh (1958) introduced a supply-driven IO framework, which is significantly different from the Leontief demand-driven IO model. The Ghosh Model is particularly suitable for economies with monopoly characteristics, economies constrained by scarcity of inputs, short period economic studies, and in cases where a small region depends considerably much upon other regions. Under such circumstances, it appears that the task of allocating output would be complicated. Literature suggests that since the inception of the Ghosh Model, it has been used extensively (Guerra & Sancho, 2010) - either on its own or as a *Mixed Leontief-Ghosh input-output model.* The validity of this model as an open model was however questioned in the earlier years. See for example, Oosterhaven (1988), Deman (1988), Dietzenbacher & Hoen (2006), Oosterhaven (1989, 2012), Jones (1976), and de Mesnard (2007, 2009). In response, several improvements were made to this model, which established its analytical credibility. See for example, Dietzenbacher & Van Der Linden (1997), Miller & Blair (2009), Lahr & Dietzenbacher (2001), and Guerra & Sancho (2010). Specifically, Miller & Blair (2009) and Lahr & Dietzenbacher (2001) and Bjerkholt & Kurz (2006) recognised Ghosh's suitability for measuring forward linkages in an economy (this aspect is further discussed in Chapter 7). Also, Dietzenbacher (1997); Dietzenbacher & Hoen (2006); de Mesnard (2007, 2009); Guerra & Sancho (2010, 2011) have confirmed the plausibility of this model for use in economies that are not facing supply constraints. According to Kelly et al. (2015) and Oosterhaven (1988), Ghosh Model can overcome some of the most notable limitations of Leontief Model, for example the absence of substitution between inputs; constant returns to scale, the absence of capacity constraints; and price elasticity's of zero. Ghosh Model can be applied to estimate the strength of forward linkages in an economy; to estimate the impact of specific supply shortages on various levels of outputs; and in centrally planned supply-constrained economies.

The studies by Wu et al. (2016), Augustinovics (1970), and Antras et al. (2012) are examples of IO methods, which are wholly based on Ghosh Model. However, there are studies for example by Praktiknjo (2016), Gallego & Lenzen (2005), Bjerkholt & Kurz (2006), and Rueda-Cantuche & ten Raa (2013) which are based on mixed Leontief-Ghosh input-output models.

2) Computable General Equilibrium (CGE) models

CGE models are another class of models that can be used to analyse infrastructure linkages. These models are more flexible and sophisticated for modelling economic behaviours. CEG can be used for analysing complex linkages and 'what-if' type scenarios, and for providing insights into economic policy and planning decisions. According to West (1995) and Gabaix (2011), CGE models on one hand are conceptually innovative, but in the other hand are very hard to work with both from the theoretical and empirical aspects. Moreover, CGE modelling require expert knowledge and skills for both developing them and analysing the results. Accordingly, they incur high developmental costs. These models are not commonly used for linkage and interdependency analysis, which can be done adequately by the mainstream static input-output models. Some example of the use of CGE modes include Roson & Sartori (2014) - to perform IO linkage analysis; Bak et al. (1993) - for linkages analysis to demonstrate that fluctuations in aggregate economic growth stemming from a multitude of small independent shocks to individual sectors.

Rose (1995) and Dixon (1992) argue that CGE is predominantly based on an input-output framework where IO tables provide major input to the CGE models. The fundamental difference between CEG and IO models is that CEG is based on market equilibrium conditions but IO model is based on technical input output relationships (also see, Table 4.1).

3) Integrated Models

Several studies used various *integrated models* for analysis of infrastructure linkages. These models use standard IO model (normally static model) plus one or more analytical technique(s) to support linkages analysis. Some of the major *integrated models* are discussed below:

Integrated Input-Output Framework and Location Quotient (LQs) Technique - this model was used by Yang et al (2007) to identify the types of industry that make the region under study distinct. Yang applied this integrated framework for both backward (demand-side) and forward (supply-side) linkages analysis. Using this model, the author concluded that forward linkages are inherently less effective than backward linkages. This conclusion is no longer valid since the time that IO experts like Miller & Blair (2009) and Lahr & Dietzenbacher (2001) have recommended measurement of forward linkages based on Ghosh input-output framework. Previously, credit was given to backward linkages (which are measured from Leontief matrices) than to forward linkages because it was believed that backward linkages trace the ripple effects implicit in the underlying technology. The reason for this credit, of course, was that the Leontief quantity model has a clear technological interpretation strongly developed in production theory. However, by applying the new method of measuring forward linkages as well as following Dietzenbacher's (1997) reinterpretation of Ghosh Model, both backward linkage and forward linkages gained similar importance in economic interpretations. The reason is that, on the one hand, *backward linkages* can be interpreted as *the change in the output for a unitary change in the final demand assuming prices constant and with other conditions remaining the same* (Leontief quantity model); and on the other hand, *forward linkages* are interpreted as *the potential change in the output by a unitary change in the value added assuming the use of factor inputs constant with other conditions remaining the same* (Ghosh price model). Therefore, by the reinterpretation of Ghosh Model as a '*Leontief price-model*[1]' as discussed in the above, it is concluded that the quantitative Leontief Model and the Ghosh Model are complementary. As a result, forward linkages gained the same credit as the backward linkages.

According to Deng et al. (2014), the integrated IO model and LQs technique is used for estimating IO coefficients at regional and inter-regional levels. For example, Flegg & Tohmo (2013) used this method to estimate regional input coefficients and multipliers in Finnish economy. The authors found that the method provides a satisfactory way of generating an initial set of input coefficients. However, in similar study, Lehtonen & Tykkylainen (2012) recognised the LQs-based model as a gamble and they concluded that there is no satisfactory method for general use at the regional level. Also, Jahn (2015) developed a Location Quotient IO framework to estimate intra- and interregional IO tables in German economy of 2010.

Integrated Input-Output Framework and Energy Models -To study linkages, Velazquez (2006) developed a specific IO model of sectoral water consumption by combining the extended

[1] Reinterpretation of the Ghosh Model as 'a Leontief Price-Model) means that changes in sectoral output occur because of shifts in the equilibrium price, which are caused by price changes of primary inputs. The latter quality dimension is rather difficult to statistically quantify.

Leontief IO model with the model of energy use developed by Proops (1988). However, it is unclear to what extent such models can be adapted to other economies, regions, and different types of infrastructure. Minh Do (2011) represented various energy technologies by combining the Leontief static IO framework with a detailed energy model to achieve a greater linkages details both for the energy and economic sectors; and to overcome the drawback of general equilibrium models which poorly represent energy technologies which are constantly evolving.

Integrated Input-Output Framework and the Life-Cycle Assessment (LCA) Techniques - Integrated IO model and LCA; or just LCA as a matrix to represent process models of lifecycle stages analogous to an IO model also used in linkages analysis. For example, Kahrl & Roland-Holst (2008) used IO model to identify linkages between water and energy sector, while applied LCA for energy intensive water projects to assist policy makers to choose less energy intensive modes of water provisioning. Also, Zamagni et al. (2008) applied LCA for scenario analysis.

Integrated input-output framework and econometric models - Peavy (2007) estimates regional employment impacts of a large automotive plant in Canton, Mississippi (USA) using an integrated model composed of an IO model and a purpose build model called *Relative Employment Density Model* (*REDM*). This study concludes that IO model typically overstates the employment impact significantly because it is not capable of taking into account 'displaced jobs'- i.e. an employee fills a new position and the vacated job remains vacant or eliminated entirely - in the region. REDM, as an alternative model, provides lower and more accurate employment estimates because it can account for displaced jobs. The study recommends that policy makers need to factor the empirical results of the two models in their economic planning.

Integrated Input-Output Framework and Data Envelop Analysis (DEA) - Wattana (2010) used integrated input-output framework and DEA to study the efficiency of electricity sector in Thailand. The DEA component is discussed in details later on in this section.

4) Non-IO Methods

Siddiqi & Anadon (2011) used a Non-IO method using simple spreadsheets inputting published data from various sources and in different formats to assess water and energy (oil and gas) linkages in the MENA region. This method, although developed a broad comparison of various scenarios, appears very elementary lacking the ability to capture the linkages adequately. For example, it measured direct linkages but not indirect and total effects. As such, it underestimated consumption. Bard (2014) used an algebra-based approach to IO analysis assuming unavailability of computers to handle the heavy computation. Bard referred to the Leontief work that since its discovery in 1928 was almost remained untouched until the invention of computers.

Dennen et al. (2007) used *numerical analysis* of water and electricity data; *scenario analysis*; and *a web-based tool* instead of IO m to analyse water and electricity linkages. They concluded that thorough LCA of electricity generation by different types of fuel including water (hydro), it was required to better understand the quantity of water required for generating electricity.

Adams & Shachmurove (2008), Gan & Zhidong (2008), Lee & Chang (2008), or Stern (2007) used econometric models to measure energy linkages in Asian economies. Econometric models require extensive assumptions and data manipulation to model long-term scenarios. The weakness of these models, similar to LCA, is that they are designed to capture a specific link, therefore, not suitable for capturing multiple linkages or multiple dimensions of a link. Generally, econometric models are used in engineering and scientific areas with limited or no required assumptions, because majority of data element can be measured accurately. Application of econometric models to economic policy analysis may not be useful because of their significant focus on technological-scientific dimensions.

5) Life-Cycle Assessment (LCA) Model

Hendrickson et al. (1998) applied LCA Model to analyse pollution impacts of all 519 sectors of U.S. They examined linkages of energy and resources consumption as well as environmental discharges associated with each environmental damage-preventive measure or design alternative.

The key weaknesses of the LCA models are as follows: they suffer from truncation errors because of placing boundaries around the processes that form part of the LCA; they do not lend themselves to study linkages of multiple dimensions flexibly and adequately (e.g. technological, political, environmental, and social linkages) because of the complexities to map all involved processes. As such, the LCA methodology is mainly suitable for study of one dimension of a specific link (e.g. technology).

6) Data Envelop Analysis (DEA)

Amores & Rueda-Cantuche (2009) used DEA for measuring sectoral linkages for 27 European Union economies as a flexible and efficient approach for measuring linkages and key sectors in an economy. DEA Method uses a “key value” (DEA Score) for identification of key sectors holding Backward (BL) and Forward (FL) potential increases of multiple dimensions such as production, income, employment, CO_2 emission, etc. These researchers believed that their proposed method removes criticisms surrounding traditional methods of calculating key sectors by explicitly measuring BL and FL for multiple dimensions. They argued that in the absence of their proposed technique, it is difficult to say whether a sector is playing an important role for all dimensions, for a few, or for most of the dimensions. DEA, which can measure variables in different units (e.g. in monetary terms for output or income; and physical terms for employees), uses specific set of weights depending on which policy dimension is studied. However, selection of these weights attracted disagreements among experts believing to influence the outcomes. Discussion of weight in terms of DEA is outside the scope of this research study, which can be referred to in (Zhu 2003; Amores & Rueda-Cantuche 2009). In the context of this research, the discussion of merits, or otherwise of, weights is made in Chapter 5.

7) "Shortcut" Models

Bromley (1972), Burford & Katz (1981), Drake (1976), Harrigan (1982), Katz & Burford (1981), Lieu (1983), Mattas et al. (1984), Pagoulatos et al. (1986), Phibbs & Holsman (1980) used "*Shortcut*" *Models* for analysing linkages and multipliers at regional levels. They justify the use of these models on the grounds of great expense in data collection, including managing and processing economic survey data; application of complex mathematical estimation techniques required to build a fully-fledged input-output model; extremely time consuming processes causing an extensive delay for officially releasing IO tables; and unavailability of input-output tables for specific regions. For example, Bromley (1972) and Pagoulatos et al. (1986) suggested alternative approaches to IO method for measuring the linkages without building a complete IO model, namely, internal indices of purchases and sales which require a special set of data, and matrix triangulation. Each of these "Shortcut" approaches identifies those sectors, which when exogenously stimulated, will generate the greatest indirect effects on the economy. In addition, Bromley suggests that internal indices of purchases are reasonable output multipliers. His findings is analogous to the j^{th} column sector's total backward linkages being equivalent of its output multipliers in an IO model. In addition, Bromley suggests that a combination of information from internal indices of purchases and sales would unravel information about the internal structure of inter-industry transactions similar to that provided by a matrix triangulation approach.

Sandoval (1967) used computational "Shortcut" to calculate Type I and Type II multiplier effects. For example, Type II Income and Employment Multipliers can be calculated as a constant multiple of Type I Income and Employment Multipliers. Mattas et al. (1984) also suggested "Shortcut" methods for estimating multipliers for small regions from state IO tables by applying the proportionality constants and specially developed mathematical formulations.

The strengths of the "Shortcut" Methods include their ability to measure linkages and multipliers by using minimal data; their usefulness for regions for which no input-output tables are available. Their main weakness is loss of some information. "Shortcut" Methods cannot provide detailed sectoral information when compared with a region for which an input-output table may be available. Thus, its strength in using minimal data leads to its weakness. For example, Lieu (1983) shows that for calculating output multipliers, the "shortcut" method can only show the impact of a unitary change in final demand of a sector on aggregate regional output. However, calculations by the IO method would identify the impact of a unitary change in final demand of a sector on the sector itself as well as on other sectors of an economy.

8) IO Models based on Bayesian Framework

Temurshoev (2015) used IO Models based on Bayesian[2] Framework for representing uncertainty treatment in input-output analysis. Lugovoy et al. (2014) applied Bayesian Framework in conjunction with Monte Carlo Markov Chain method to update IO matrix (or more generally a Social Accounting Matrix, SAM) as well as for aggregation and disaggregation of an IO matrix. Chick (1997) used the Bayesian Framework for simulation of inputs and outputs in a stochastic system as well as in deterministic but unknown system. The latter is based on a computationally intensive computer algorithm which calculates a function of certain inputs and provides a deterministic output, while the former method is based on the parameters of the input distributions which are unknown, or outputs need to be calculated based on random variabilities in the IO system. Stochastic IO system are normally attributed to the probability distribution of the outputs, which according to Glynn (1986) depends on the prior distribution of the input parameters.

The review suggests that *IO practitioners have not adopted Bayesian Framework for linkages and related analysis* because it is viewed as a non-standard approach to IO analysis. Hence, its robustness is questionable. Further, it is computationally complex as compared with simpler and more transparent alternatives for example, the traditional RAS method.

9) Commercially Developed Input-Output Models

These models are sophisticated econometric modeling systems for linkages and variety of IO analysis. The major models in this category include RIMS II (Regional Input-Output Modelling System) by the Bureau of Economic Analysis of the US Department of Commerce; the IMPLAN system (IMpact analysis for PLANning) economic impact modeling system; the Preservation Economic Impact Model (PEIM) developed by the Rutgers University Center for Urban Policy Research and the National Park Service; and REMI (Regional Economic Models Inc).

Commercial models are based on one or combinations of static or dynamic IO frameworks, or CGE being either regional-specific or capable of being adapted to a national or a regional analysis.

The shortcomings of in-house developed models are in their purpose-specific nature, being either very data intensive or require specially collected and formatted data, and high licensing cost.

4.2 Shortcomings of the Existing Methods

Leontief IO model and mixed Leontief and Ghosh framework are the two most widely adopted methods for analysing inter sectoral linkages. These frameworks are believed to sacrifice

[2] The Bayesian Framework models all uncertainty in terms of probability distribution which includes unknown parameters. This is useful for updating IO coefficients when simulating input and output for various scenario analysis. The most common method for IO updating is the RAS method (Stone 1961). However, there are other methods such as GRAS (Gunluk-Senesen & Bates 1988), KRAS (Lenzen et al. 2009), TRAS (Gilchrist & St Louis 1999), NLS (Friedlander 1961), WLS (Byron 1978), CEM (Golan et al. 1994) as alternative models to estimate unknown coefficients based on known sums of rows and columns and a known IO Matrix from a previous year.

economic reality because of their underlying assumptions. In Ghosh model, for example, output depends on value added. That is, a unitary change in a given sector's value added will increase output in the economy with no need for additional primary factors in rest of the sectors. This means that, there is more output in the economy but value added has remained unchanged in other sectors. In marked contrast, in Leontief model, output depends on final demand. For example, one unit increase in final demand for output of a given sector will increase output in the whole economy to satisfy the increase in demand. However, this increase in output is not taken into account for subsequent change in final demand in spite of availability of more output in the economy. Literature review reveals that such observations suggest that the attributes of Ghosh and Leontief models do not exhibit the realistic features of any production and final-use processes, for example see Manresa & Sancho (2012), Reyes & Mendoza (2013), Miller & Blair (2009) and de Mesnard (2007).

Major shortcomings of Leontief framework are perceived to be related to the constancy of input coefficients (constant return to scale and constant production technology); not specifying how technical coefficients would change in relation to change in technology or change in each sector's capital requirements; not describing why input and output follow a linear pattern in economy; and taking into account final demand as independent variable. The fallacy of fixed coefficient of production as clarified by Rose & Miernyk (1989) is therefore no longer an issue. Also, to overcome some of the other abovementioned shortcomings, methods such as RAS (Rows and Sums) - which was originally suggested by Stone (1961) - are developed to assist with updating IO coefficients or changing coefficients particularly for scenario analysis; or closed input-output models are developed to endogenise final demand variables such as households for analysing income multipliers. In turn, in Ghosh model, major shortcomings are related to unsuitability for long-term analysis; difficulty with economic interpretation in terms of quantities; elastic treatment of final demand; and assuming that local economy or investment perfectly react to any change in supply. To overcome the Ghosh shortcomings, only complementary aspects of the Ghosh model is used in conjunction with the Leontief model. For example, Jones (1976), Bulmer-Thomas (1982) and Oosterhaven (1988) adopted the Ghosh model to estimate forward linkages from the perspective of the allocation of outputs and the supply side of the IO model. Forward linkages were earlier calculated based on the Leontief coefficient matrices from the demand perspectives. See for example, Chenery & Watanabe (1958), Hazari (1970) and Laumas (1976a).

From analytical perspective, one of the key shortcomings of the Leontief method is in its underlying IO direct accounting framework, which does not easily enable tracking of all inputs into final demand sales as opposed to inputs for production. The existing direct accounting framework through Leontief transformation method sums the value of inputs to an inter-industry sector plus all of the input-supplier's inputs, and any subsequent cascading effects to arrive at final cumulative estimate of direct economic activities because of a unitary change in final demand for products of that sector. Therefore, for each production sector, all production activities both inside and outside that sector is fully accounted for through total requirements coefficients of the Leontief inverse matrix. However, the existing direct accounting framework lacks similar transformative process for final demand accounting. Because it does not readily enable tracking of all direct and indirect inputs to final demand sales. For example, the electricity sector in addition to selling some of its generated electricity to sectors of final demand, also sells some to manufacturing sectors. The latter sectors add value to the electricity's inputs by producing their own products for sales to final demand without crediting the electricity sector's inputs to final demand. Therefore, in this case the electricity's inputs to final demand has remained unaccounted. The reason for accounting inputs to final demand is that, satisfying final demand is not confined just to products from one sector, rather final demand sales is represented by supply from a cluster of contributing sectors including a main provider sector in the economy.

Therefore, there is a need for tracking linkages to final demand as production sectors are producing for final demand. This analysis is very important from the policy perspective too. Because, first, it reveals the extent by which jobs in other sectors are linked to the production sectors that are producing for the final demand; second, in conjunction with the standard accounting method, it provides comparative estimates of each sector's value added, and its income component; and third, it allows to understand the level of dependency of an economy on its key production sectors for supporting final demand. To overcome this shortcoming, Swenson (2014) has suggested a final demand accounting framework, which also referred to as final demand transformation approach, to cumulatively analyse inputs flowing into final demand from each of the contributing sectors similar to the Leontief transformation as discussed above. This research has adopted the final demand accounting framework as part of the linkages analysis in Australian context. Its formulation is given later in this chapter, while results are discussed in Chapter 8.

Despite above observations, these models have strong characteristics such as transparency and operational simplicity because of their linearity, proven capabilities for linkages analysis at detailed or aggregate levels, enabling analysis of complex structure of the economy, showing cascading effects of change in final demand, and informing policy and planning decisions. Also, some of the shortcomings are resolved by applicable solutions.

The key shortcomings of other methods like Leontief dynamic method is its complexity to construct the model and to analyse; and its extremely data intensive nature specifically requiring vast array of investment (capital) coefficients and price matrices at time t which were not available in case of this research.

CGE model is mainly static with limited dynamic capability. Normally it uses fixed technological coefficients while it can handle non-linear functions too. The major shortcoming of CGE are its complexity requiring highly advanced mathematical and optimisation skills; requiring strong theoretical assumptions; time consuming to set-up and operate; being extremely data intensive prohibiting its adoption; assumes perfect data input to the model; relatively expensive to develop the model; being difficult to distinguish direct and indirect linkages effects; being an optimisation model the results are highly fine-tuned. Therefore, unlike the dynamic IO model it does not provide the state of the economy "as is". Also, some strength of CGE are in its responsiveness to price effect; permitting input substitution; being a general equilibrium model for both prices and quantities; handling the intermediate demand by Leontief function while primary factor demands are determined by CGE or Cobb-Douglas function (cost minimization). For example, see Kelly et al. (2015), Denniss (2012), Duchin & Steenge (2007), Wing (2004), King (2012), West (1995).

4.3 Analytical Framework for this Research

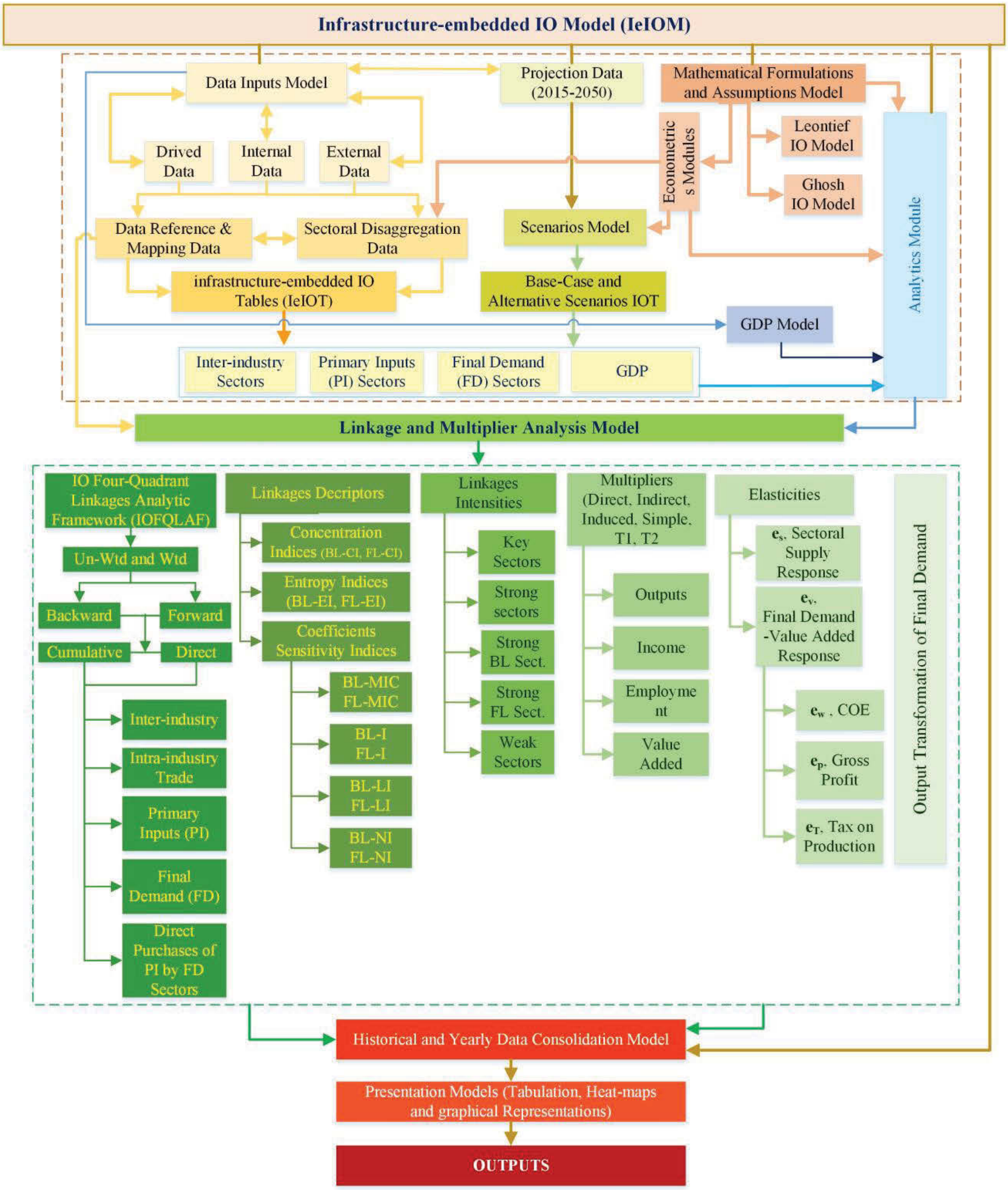
Figure 4.1 provides an overview of the key elements of the Infrastructure-embedded Input-Output Model (IeIOM) - developed in this research for estimating infrastructure linkages and multipliers. A description of its main components is provided below.

The Model's Underlying IO Engine – IeIOM is an integrated model that operates on static IO methodology, and is supported by econometric modules. While the model primarily uses demand-driven component of the Leontief framework, it also selectively uses strengths of supply-driven Ghosh framework. The reason for adoption the aforementioned frameworks is to prevent distortion estimating forward linkages from the same coefficients that are used to estimate backward linkages. For example, see Steinback (2004), Lahr & Dietzenbacher (2001) and Miller & Blair (2009). Therefore, IeIOM measures backward linkages based on Leontief and forward linkages based on Ghosh formulations. Additionally, this model enable measurement of multipliers, elasticities, coefficients sensitivity-classes, the number of sectors that each sector buys from and the number of sectors that a sector selling to, and the degree of sectoral integration and specialisation in the economy. Also, the model identifies the sectors with the highest contribution to a sector's backwards and forward linkages, and through final demand accounting framework provides an economic impact summary for different sectors to the extent that those sectors contributed to final demand versus intermediate consumption.

The use of static IO model is justified on the grounds of its reproducibility, applicability, ease of use and debugging, and more importantly its relevance in the Australian context where industry-based capital and investment matrices, which are needed to build underlying structure of the model in a dynamic input-output framework, are not available (see, Valadkhani 2003).

Although IeIOM is based on static underlying framework, the model is capable of providing analytical results of the 25 input-output tables, over a 42 year period where the coefficients mostly involve year-to-year changes, as opposed to intra-year changes; Further, the 'misconception' of fixed technological coefficient of production, as clarified by Rose & Miernyk (1989), is therefore no longer an issue. The reason is that, the model can reveal the evolving pattern of backward and

Figure 4.1: Infrastructure-embedded IO Model (IeIOM), a schematic representation

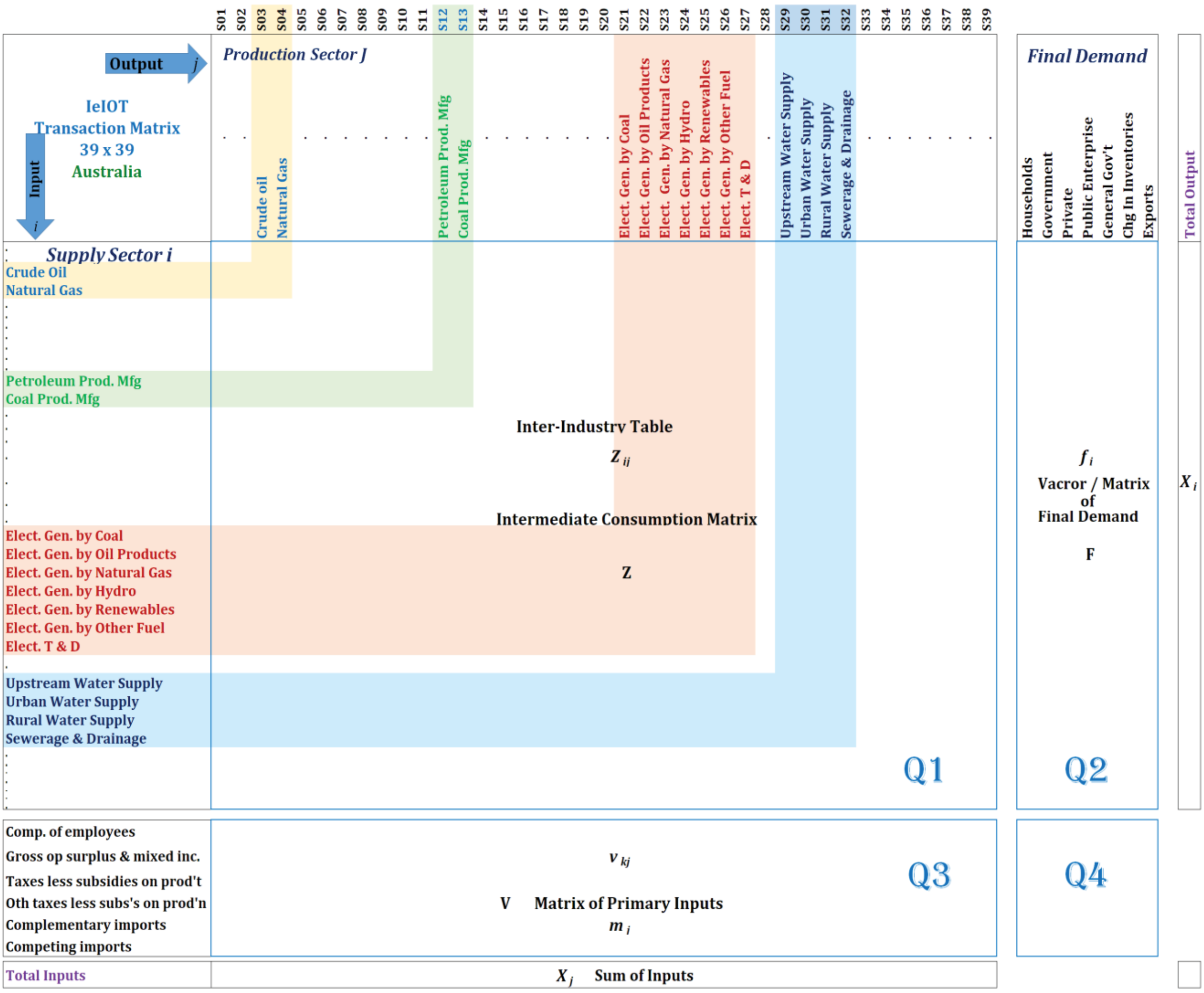


Source: Developed by the author of this research.

forward linkages as well as dynamic changes in each sector's input and output, changes in total economy's output, as well as changes in each primary factor of production proportionate to the final demand at each point in time. As a result, the information on both sector-specific observable and interpretable technological changes and the changing pattern of the Australian economy over the period of study, including its key sectors, are clearly captured. Moreover, this model is flexible and is able to embed infrastructure sectors needed by this research as further discussed below.

Infrastructure-embedded Input-Output Tables (IeIOT) is a 39 x 39 table based on their parent tables released by ABS. Each IeIOT is embedded with new, and more detailed, upstream and downstream infrastructure sectors in order to build a better knowledge of sectoral linkages over the period 1975 to 2015 in the Australian Economy (Table 4.2, and more detailed Tables IV.3 and IV.4 in Appendix IV). For example, *Electricity Supply Sector* is disaggregated into upstream electricity generation by fuel types, and the electricity transmission and distribution sector; or *Oil and Gas Extraction Sector* is represented by Crude Oil (incl. condensate) and Gas (incl. Nat Gas, LPG and CSG) Sectors. The *Petroleum and Coal Products Manufacturing Sector* is disaggregated into Petroleum Products Manufacturing and Coal Products Manufacturing Sectors. Also, the Upstream Water Supply Sector is embedded in the IeIOT and the *Water Supply, Sewerage and Drainage Sector* is disaggregated into downstream Urban Water Supply, Rural Water Supply, and Water Services (Sewerage & Drainage) Sectors. The electricity, oil, gas, coal, water and other product flows accounting identity conforms to ANZSIC sectoral system of classification and the energy balance condition as discussed in Miller & Blair (2009).

Table 4.2: IeIOT and its fifteen disaggregated sectors

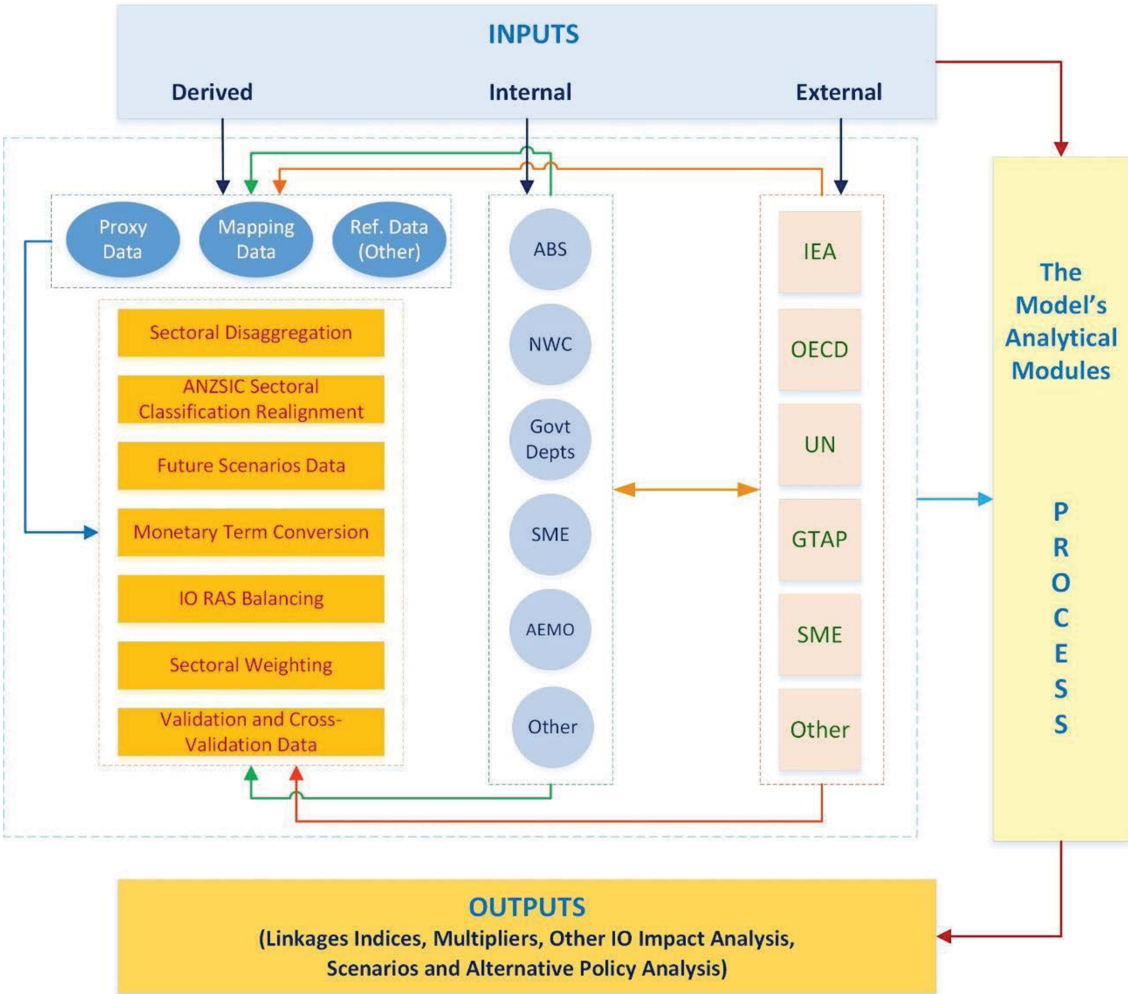


X_i= Total output of sector i Z_{ij}= supply of sector i for sector j f_i= final demand of products of sector i v_{kj}= elements of value added m_j=Imports

This disaggregation is in recognition of their historical profile and the influence of technology particularly the influence of high voltage transformers on development of the Electricity Transmission and Distribution Sector. Also, the disaggregation of the water sector is in recognition of its historical profile. That is the rural has a focus on irrigation for agriculture while the urbanisation influences the development of urban water supply and sewerage and drainage services. Likewise, the oil and gas sectors, and petroleum and coal products manufacturing sectors are disaggregated by reference to their historical profile of developing important linkages with the inter-industry and final demand sectors as well as their influencing in developing the Australian economy as a whole.

Data Inputs Model and Databases - Figure 4.2 represents the data inputs model and databases which are dynamically accessed by the IeIOM and its supporting models.

Figure 4.2: The IeIOM dynamic data inputs model and databases



Source: Developed by this author for the model created in this research.

The IeIOM is dynamically connected to its extensive and complex core and reference databases populated from diverse domestic and external data sources including the ABS Input-Output Tables, Product Details Tables, ANZSIC sectoral codification and concordance data as its core data inputs as well as the supplementary IO data from the OECD and UN databases; the ABS inter-industry employment data for Australia; IEA energy balances data for Australia, and the supplementary GTAP electricity generation data; the water data from the ABS, and the revenue and water operating expenses data from the National Water Commission (NWC); policy, forecasting, and future scenarios data from the Commonwealth and State governments departments, parliamentary sources, the Bureau of Resources and Energy Economics (BREE); and other supporting data collected from subject matter experts (SME) locally and internationally.

Additionally, the data inputs model contains derived data elements based on the originally supplied data to assist with linkages and multipliers analysis.

To ensure that data integrity and consistency is maintained throughout analytical processes, the data inputs model is embedded with on access data validation, cross-validation and error generation modules. Also, the databases are updatable with the latest data when become available.

IeIOT and Treatment of Imports - IeIOT represents only domestic intermediate sales and purchases. Therefore, imports are excluded from elements of inter-industry transaction matrix. Instead complementary import and competing imports are treated exogenous to the inter-industry quadrant of IeIOT and shown by two separate rows of primary inputs in the value added third quadrants (Australian value added excludes competing imports).

Common Classification Structure for each IeIOT over the Period of the Study - The ABS parent tables are governed by the Australian and New Zealand Standard Industrial Classification (ANZSIC) 1993 (ABS 1975 to 2006 IO Tables) and ANZSIC 2006 (ABS post-2006 IO Tables).

To achieve uniformity of Table-format as well as to conduct comparative sectoral analysis, all parent tables were realigned to the Input-Output Product Group (IOPG) and to the Input-Output Industry Group (IOIG) of the ANZSIC 1993.

IeIOT, Real Term Monetary Units and the Choice of a Deflator System - The IeIOT parent input-output tables are in current monetary term because of scarcity of data in physical units of measurement. In this research, the IeIOT are in monetary real (constant) term (2014-15 prices). The reasons for deflating the tables are being customary to work with economic data in constant dollars term for stability and comparability; and it is more likely to hold the stability of technical coefficients under constant-dollar term as stated by Leontief (1951) than in current-dollar term; accuracy of forecasting and projections are achieved more under constant-dollar term. Bezdek & Wendling (1976) demonstrate that while results vary considerably among industries, generally constant-dollar forecasts are more accurate in the long-run. However, they found that in short-run the results are mixed (also, see Dietzenbacher & Temurshoev 2012).

For constant term conversion, this research has used the annually reported Australian GDP-deflators in preference to CPI because the CPI only considers goods and services consumed by average private households, whereas GDP-deflator is a broad-based indicator representing all goods and services.

IeIOM supporting Econometric Modules (Sub-models) - to facilitate linkage analysis, several econometric modules were developed in this research. These include:

Sectoral Disaggregation Model which draws on proxy and reference data to breakdown the aggregate sectors in the standard Australian IO tables into the sectors of interest; To estimate missing proxy data, the model uses regression models to estimate missing values when encountered. Also, this model maps sectors, classified under different ANZSIC systems, into a pre-defined ANZSIC codification. This facilitates development of the IeIOT for subsequent analysis. This model, based on relevance, uses operating expenses, operating revenue, energy balances data for Australia, GTAP electricity generation fuel mix data and employment data to disaggregate the highly aggregated sectors in standard IO Tables over the period 1975 to 2015.

Mathematical Formulations and Assumptions Model develops the underlying input-output relationships and computation frameworks for IeIOM and each of its modules.

Scenario Analysis Model obtains the IO future data over the period 2015 to 2050 from the databases of the data inputs model. Also, this model develops the base-case scenario tables (BCSIOT) and alternative scenarios tables (ASIOT) for subsequent analysis. The Scenario Analysis Model assists with developing and investigating the impacts of the advanced production technology, long-term government policies, and to examine how other economic situations would impact the economy over the period 2015 to 2050. The results of the scenarios together with qualitative and quantitative knowledge of the sectoral linkages would assist with economic planning, infrastructure investment options and government policy decisions.

Linkages and Multipliers Analytics Model uses the IeIOT, BCSIOT and ASIOT for linkage and multiplier analysis. This Model, carries out analysis of linkages for six major categories (see Figures 4.1). An overview of measured entities by this model is shown in Tables 4.3 to 4.5.

Consolidation Model brings all the computed linkage results into a common dataset;

Presentation Model exports data in Consolidation Model to statistical analysis software or to spreadsheets for tabulation, developing heat-maps and graphs to facilitate interpretation of results;

Outputs Model enable printing or exporting results to report writing software.

4.3.1 Gaps Addressed by the IeIOM

The *notable shortcomings* identified through literature review on this topic revealed that majority of the studies did not extend their analysis beyond the first quadrant of the standard IOT, and generally did not complement their linkage analysis by application of major linkage descriptors (see section 1.5 in Chapter 1). As a result, several linkages remained undetected. Also, most of

Table 4.3 Linkage dimension estimated by IeIOM

	Un-Weighted				Weighted					
	Direct		Total		Direct		Total (RSOW)		Total (TSOW)	
Linkages dimensions	**BL**	**FL**	**BL**	**FL**	**BL**	**FL**	**BL**	**FL**	**BL**	**FL**
Inter-Industry BL	•		•		•		•		•	
Primary Inputs PI-BL	•		•		•		•		•	
Overall Sectoral BL (i.e. Inter-Industry + Primary Inputs BL)	•		•		•		•		•	
Compensation of employees (COE-BL)	•		•		•		•		•	
Gross operating surplus and mixed incomes (GOP-BL)	•		•		•		•		•	
Taxes less subsidies on products (TLS-BL)	•		•		•		•		•	
Other taxes less subsidies on production (OTS-BL)	•		•		•		•		•	
Complementary Imports (CYM-BL)	•		•		•		•		•	
Competing Imports (CGM-BL)	•		•		•		•		•	
Total Value Added BL (TVA-BL)	•		•		•		•		•	
Inter-Industry FL		•		•		•		•		•
Final Demand FL (FD-FL)		•		•		•		•		•
Overall Sectoral FL (i.e. Inter-Industry + Primary Inputs FL)		•		•		•		•		•
Households (HH-FL)		•		•		•		•		•
Government (GT-FL)		•		•		•		•		•
Private (PV-FL)		•		•		•		•		•
Public Enterprise (PE-FL)		•		•		•		•		•
General Government (GG-FL)		•		•		•		•		•
Change in Inventories (CV-FL)		•		•		•		•		•
Exports (XP-FL)		•		•		•		•		•
Total Direct Use of PI by Final Demand Sectors (DPI-BL)	•		•		•		•		•	
Direct Use of PI by Households (HH-BL)	•		•		•		•		•	
Direct Use of PI by Government (GT-BL)	•		•		•		•		•	
Direct Use of PI by Private (PT-BL)	•		•		•		•		•	
Direct Use of PI by Public Enterprises (PE-BL)	•		•		•		•		•	
Direct Use of PI by General Government (GG-BL)	•		•		•		•		•	
Direct Use of PI by Inventories (IV-BL)	•		•		•		•		•	
Direct Use of PI by Exports (XP-BL)	•		•		•		•		•	
Most Important Backward Coefficients (MIC-BL)	•									
Important Backward Coefficients (IC-BL)	•									
Less Important Backward Coefficients (LI-BL)	•									
Not Important Backward Coefficients (NI-BL)	•									
Most Important Forward Coefficients (MIC-FL)		•								
Important Forward Coefficients (IC-FL)		•								
Less Important Forward Coefficients (LI-FL)		•								
Not Important Forward Coefficients (NI-FL)		•								
Concentration Backward Linkages (CI-BL	•									
Concentration Forward Linkages (CI-FL)		•								
Entropy Backward Linkages (EI-BL)							•		•	
Entropy Forward Linkages (EI-FL)								•		•
Total Linkages Dimensions	154									

Table 4.4: Multiplier types and effects estimated by IeIOM

Multipliers	Type I	Type II	Direct	Indirect	Induced
Output	•	•	•	•	•
Employment	•	•	•	•	•
Income	•	•	•	•	•
Value Added	•	•	•	•	•

Table 4.5: Elasticities estimated by IeIOM

Elasticity Type (in context of this thesis)	Elasticity Components
e_v = Elasticity of Final Demand-Value Added Response	e_W = Compensation of Employees Elasticity
	e_P = Gross Proft & Mixed Incomes Elasticity
	e_T = Taxes on Production Elasticity
e_s = Elasticity of Sectoral Supply Response	

the studies identified "key" sectors just by taking into account the above average backward and forward linkages without analysing the variability among the coefficients that comprise backward and forward linkages. Moreover, some of the contemporary studies of the linkages, for example Cuello (1999), were solely based on the application of Leontief model for measuring both backward and forward linkages. Another shortcoming was in the formulation of traditional system of weights (TSOW) for measuring weighted linkages, which is fully discussed in Chapter 5.

To address the above issues, the IeIOM has made several provisions. For example, *i*) included major linkages descriptors in the model; *ii*) developed an Input-Output Four-Quadrant Linkages Analytical Framework (IOFQLAF) to extend the existing linkages analysis beyond the inter-industry quadrant; *iii*) developed a Comparable Coefficient of Variation (C-COV) to overcome the shortcomings of the traditional COV which does not provide an economy-wide platform for comparing each sector's linkage variability against other sectors; *iv*) incorporated a system of weights (RSOW) to overcome the issue with weighted linkages estimation as well as determining the relative weight of each sector in the economy; *v*) incorporated the sensitivity classification of backward and forward coefficients as the foundation of linkages analysis in the linkage analysis model. This analysis identifies four coefficient classes including the Most Important Coefficients (MIC) as discussed (Chapter 5); *vi*) additionally IeIOM computes linkage intensities because it is important to know how deeply an economic sector is involved in an economy and to what extent its output contributes to economic growth (Mukhopadhyay & Chakraborty 2004, Marsh 2008); to show sector-dependent technological progress; and to evaluate the effect of sectoral policies and reforms on the Australian economy.

4.3.2 Incorporation of Un-weighted and Weighed Methodologies

In addition to unweighted estimation of linkages, the IeIOM has adopted a system of weights some of the major reasons are as follows. Sectoral weighting assists with: overcoming the issue of equal weighting assumed by both Leontief and Ghosh models. This means that all sectors of the economy should respond equally to a unitary change in final demand (Lattimore et al. 2009); determining the importance of each sector in the Australian economy; identifying the relative size of each sector, and its associated contribution, in the economy; and analysing policy implication in comparison to unweighted linkages measures. The proposed weighted formulation utilises the input-output coefficients of both Leontief model (for backward linkages measurement) and Ghosh model (for computing forward linkages). In this research, weights are in accordance with the: *i*) relative share of each sector in the economy's total final demand; *ii*) relative share of each sector in the economy's total value added; and *iii*) relative share of each sector in economy's total output generation. Weighted coefficient models were used commonly by researchers. For example, Kula (2008), Cuello et al (1992), Hazari (1970), Diamond (1974), and Laumas (1976b). However, selection of these weights attracted disagreements among a few practitioners such as Zhu (2003); or Amores & Rueda-Cantuche, (2009) on the grounds that might affect outcomes. Chapter 5 discusses systems of weights in details and provides proposed formulations.

4.3.3 Balancing of IeIOT and Testing the Model

The row and column totals of IeIOT and the scenario tables (BCSIOT and ASIOT) were balanced using the Stone & Brown (1962) RAS technique because row and column sums of disaggregated and the overall IO table are known (see miller & Blair 2009; Lahr & De Mesnard 2004; Holy & Safr 2017). To maintain the authenticity of data, care was taken to minimize changes to the officially reported IO values. For example, in this research slight adjustment of imports exogenous to the inter-industry quadrant assisted with balancing.

The plausibility of results is used for validating the developed IO model by this research. Throughout the developmental processes, the model's logic was progressively tested to perform to expectation. To maintain data reliability, model is loaded with data from officially recognised sources (see Figure 4.2 and associated discussion). Also, data input was validated using data validation and cross-validation techniques. Additionally, the plausibility of generated results were checked and confirmed by Subject Matter Experts (SME) and IO experts.

4.3.4 Mathematical Formulation of the IeIOM

Because IeIOM operates on both Leontief model and partly on Ghosh frameworks, the mathematical formulation as apply to IeIOM is discussed in this section. Leontief component of the Model aims to explain the sectoral outputs (production of each sector) in accordance to final consumption by sectors of final demand. As such, the model focuses on the rows of the IO table not the columns. Leontief framework assumes that sectors of an economy need to produce just enough to satisfy the final demand. Accordingly, the IeIOM is an equilibrium model whose data can be expressed in terms of: a set of identities; a set of underlying assumptions as major ones were discussed in section 4.2; and equilibrium conditions, for example, see Miller & Blair (2009) and Schaffer (1999). The structure and components of the IO tables used by the model are defined by Table 4.2, and Table IV.1 and Table IV.2 in Appendix IV to assist with mathematical formulation of the aforementioned identities. In this section, the IeIOM formulation for the inter-industry quadrant of the IO table is defined. For comprehensive analysis of the linkages, this research extends the Leontief formulation to other three quadrants of the IO table and discusses as part of the linkages analytic module in section 4.3.6. The linkages analytic module, also includes several major linkage descriptors whose mathematical formulation is discussed in section 4.3.7 to 4.3.9 too. To better clarify the IeIOM mathematical notations applicable to the IeIOM underlying Leontief and Ghosh framework, this research has adapted notations styles presented by Praktiknjo (2016).

Below set of identities apply to the interindustry quadrant 1 and the primary factors quadrant 2:

$$X_i = \sum_{j=1}^{n} Z_{ij} + f_i \qquad X_i \geq 0, \ \ f_i \geq 0 \qquad \text{(Eq. 4.1)}$$

$$X_j = \sum_{i=1}^{n} Z_{ij} + V_j + M_j \qquad X_j \geq 0, \ \ V_j \geq 0, \text{and } M_j \geq 0 \qquad \text{(Eq. 4.2)}$$

V_j is shown by the following relationship where I_{ij} represent the Imports:

$$V_j = X_j - \sum_{i=1}^{n} z_{ij} - \sum_{i-1}^{n} I_{ij}$$

Equations below define $a_{L,ij}$ as the Leontief *input coefficients* based on the inter-industry quadrant one matrix $\boldsymbol{Z}$ with column total inputs X_j. Also, $p_{L,kj}$ is the primary factor input coefficients of the matrix $\boldsymbol{V}$ within the same j column:

$$a_{L,ij} = \frac{z_{ij}}{X_j} \qquad 0 < a_{L,ij} \leq 1 \text{ and } a_{L,ij} \in A_L \qquad \text{(Eq. 4.3)}$$

$$p_{L,kj} = \frac{v_{kj}}{X_j} \qquad 0 < p_{L,kj} \leq 1 \text{ and } p_{L,kj} \in A_L \qquad \text{(Eq. 4.4)}$$

Substituting Eq. 4.3 in Eq. 4.1 and Eq. 4.2 yields the so called Leontief production function (Eq. 4.5):

$$X_i = \sum_{j=1}^{n} a_{L,ij} \cdot X_j + f_i \qquad \text{(Eq. 4.5)}$$

$$X_j = \sum_{i=1}^{n} a_{L,ji} \cdot X_i + V_l + M_j \qquad \text{(Eq. 4.6)}$$

Let $\overrightarrow{x_i}$ and $\overrightarrow{f_i}$ be the vectors with elementsX_i and the total final demand f_i respectively. Similarly, $\overrightarrow{v_l}$ and $\overrightarrow{m_j}$ contain the value added (v_{kj}) and imports (I_{ij}) elements respectively. Let A_L be the Leontief direct coefficient matrix with elements$a_{L,ij}$. Using A_L, the Eq. 4.5 and Eq. 4.6 can be presented in matrix notation shown by Eq. 4.7 and Eq. 4.8 accordingly:

$$\overrightarrow{x_i} = A_L \cdot \overrightarrow{x_i} + \overrightarrow{f_i} \qquad \text{(Eq. 4.7)}$$

And $$\overrightarrow{x_j} = A_L \cdot \overrightarrow{x_j} + \overrightarrow{v_l} + \overrightarrow{m_j} \qquad \text{(Eq. 4.8)}$$

Also, by mathematical conversion, the output can be formulated in terms of final demand (Eq. 4.9):

$$\overrightarrow{x_i} = (I - A_L)^{-1} \cdot + \overrightarrow{f_i} \qquad \text{(Eq. 4.9)}$$

$(I - A_L)^{-1}$ is the Leontief Inverse function with elements $l_{L,ij}$. The Leontief Inverse (the *total Requirements* matrix in IeIOM) expresses total output as a linear combination of final demand. The columns of the Leontief inverse matrix show by how much the final demand in the particular sectors j leads to demand in the upstream sectors i. Because of this characteristic, the Leontief model is usually known as the demand driven model, capable of explaining the sectoral backward linkages. Total requirements is the summation of direct and indirect inputs, where indirect inputs are intermediate inputs required to produce intermediate inputs towards the final product. Assuming that the direct input coefficients $a_{L,ij}$ are constant, then the $l_{L,ij}$ elements of the Leontief Inverse matrix remain constant too. The element $l_{L,ij}$ can be defined with respect to a reference sector and interpreted accordingly. For example, if the reference sector is sector $\boldsymbol{i}$, then $l_{L,ij}$ is defined as either: the output in sector $\boldsymbol{i}$ per unit of final demand for the product of sector $\boldsymbol{j}$; or in case of linkages marginal analysis as the increase in output of sector $\boldsymbol{i}$ per unit increase in final demand for product of sector $\boldsymbol{j}$. Because the definition focuses on sector $\boldsymbol{i}$ as a supplier sector, then the magnitude of $l_{L,ij}$ is regarded as the forward linkage of i^{th} sector for the j^{th} sector.

However, if $l_{L,ij}$ definition is focused on the j^{th} sector, as the production sector, it would be defined as the increase in output of sector $\boldsymbol{j}$ as a result of one unit increase in final demand of the j^{th} sector. However, the $a_{L,ij}$ (Eq. 4.3) is defined as the amount of inputs required from sector *i* to produce one unit of output in sector j. $a_{L,ij}$ is dependent on each sector's production technology following the behavioural assumption which previously discussed in this section. Knowing the values of $a_{L,ij}$ and $l_{L,ij}$ assist policy and planning decisions because of being underlying elements of linkages analysis. In Eq. 4.4, $p_{L,kj}$ as the coefficient of the primary input matrix (V_l Matrix) shows the amount of primary input v_{kj} required to produce one unit of output by sector *j*.

IeIOM treats import as follows. If import was directly used for production (i.e. complementary imports - in Australian IOT, it is normally reported as nil) it was included as m_j in the input calculations for sector j. However, if import was indirectly used towards production, according to ABS, first it was allocated to the sector responsible for supply input to sector *j* and then counted towards the production of sector *j*.

As described earlier, IeIOM is an equilibrium model where the column and row totals for each of the sectors in the economy is the same. As such the following equation applies:

$$X_i = X_j \qquad \text{(Eq. 4.10)}$$

Based on the above discussions, the IO Table which is used by IeIOM is transformed into an analytic model which by using the mathematical relationships presented in Eq.4.1 to Eq. 4.10 its general model can be expressed by the following relationship:

$$X = (I - A)^{-1}\, F \qquad \text{(Eq. 4.11)}$$

where *X* is a *n* x 1 vector of sector outputs representing the total output of all sectors in the Australian economy; ***F*** is a *n* x 1 vector of final demand representing the total final demand from all sectors of the economy; ***A*** is a *n* x *n* matrix of direct coefficients; and ***I*** is an identity matrix to the same size of ***A*** matrix whose diagonal values are one.

In this research changes in ***F*** plays an important role in policy decisions as demonstrated by the scenario analysis over the period 2015 to 2050 results of which are discussed in Chapter 9.

With respect to *Ghosh model*, instead of assuming that intermediate inputs are proportional to column totals (X_j), it is assumed that intermediate inputs are equal to row totals (X_i). In contrast to Leontief, Ghosh model focuses on the columns instead of the rows of an input-output table. Using this approach, the sectoral inputs (i.e. demand of each sector) are described by the primary inputs used. Because gross value added has the largest proportion of the primary inputs, in literature usually gross value added and primary inputs are used interchangeably. Therefore the following set of identities apply to the Ghosh model:

$$X_j = \sum_{i=1}^{n} Z_{ij} + V_j \qquad X_i \geq 0,\ \ f_i \geq 0 \qquad \text{(Eq. 4.12)}$$

Where X_j is the total input of sector j, Z_{ij} the production of sector i to sector j, and V_j the primary inputs of sector j. The schematic representation of IO Table shown by Tables 4.2, and Table IV.1 in Appendix IV applies to the following mathematical formulations:

$$b_{G,ij} = \frac{z_{ij}}{X_i} \qquad 0 < b_{G,ij} \leq 1 \text{ and } b_{G,ij} \in B_G \qquad \text{(Eq. 4.13)}$$

where $b_{G,ij}$ is the row-based Ghosh input coefficients, which also is known as allocation coefficients (Park 2016, Praktiknjo 2016). These coefficients are derived using the inter-industry matrix Z with the row total inputs X_i.

Therefore, Eq. 4.12 can be reformulated by Eq. 4.13 as following:

$$X_j = \sum_{i=1}^{n} b_{G,ij} \cdot X_i + V_j \qquad \text{(Eq. 4.14)}$$

Let $\vec{x_j}$ and $\vec{v_j}$ the vectors which contain the total inputs X_j and the total primary inputs V_j . Let B_G the Ghosh direct coefficient matrix with standardised elements $b_{G,ij}$. Using B_G, the Eq. 4.12 and Eq. 4.14 can be presented in matrix notation shown by Eq. 4.15 and Eq. 4.16 accordingly:

$$\vec{x_j}^T = \vec{x_j}^T \cdot B_G \cdot \vec{v_j}^T \qquad \text{(Eq. 4.15)}$$

And $$\vec{x_j}^T = \vec{v_j}^T \cdot (I - B_G)^{-1} \qquad \text{(Eq. 4.16)}$$

Where $(I - B_G)^{-1}$ is the Ghosh Inverse with elements g_{ij}. Assuming that direct Ghosh allocation coefficients $b_{G,ij}$ are constant, then g_{ij} are also constant. In Ghosh model, it is in equilibrium when the sectoral total inputs is the same as only the total primary inputs used. The rows of the Ghosh inverse matrix represent by how much one unit of primary input in the sector i induce supply from this sector i to its downstream sectors j. As such, the Ghosh model is regarded as supply-driven model being suitable for estimation of forward linkages.

Therefore, the IeIOM general form of the Ghosh model can be represented by the equation:

$$V = (I - B)^{-1} X \qquad \text{(Eq. 4.17)}$$

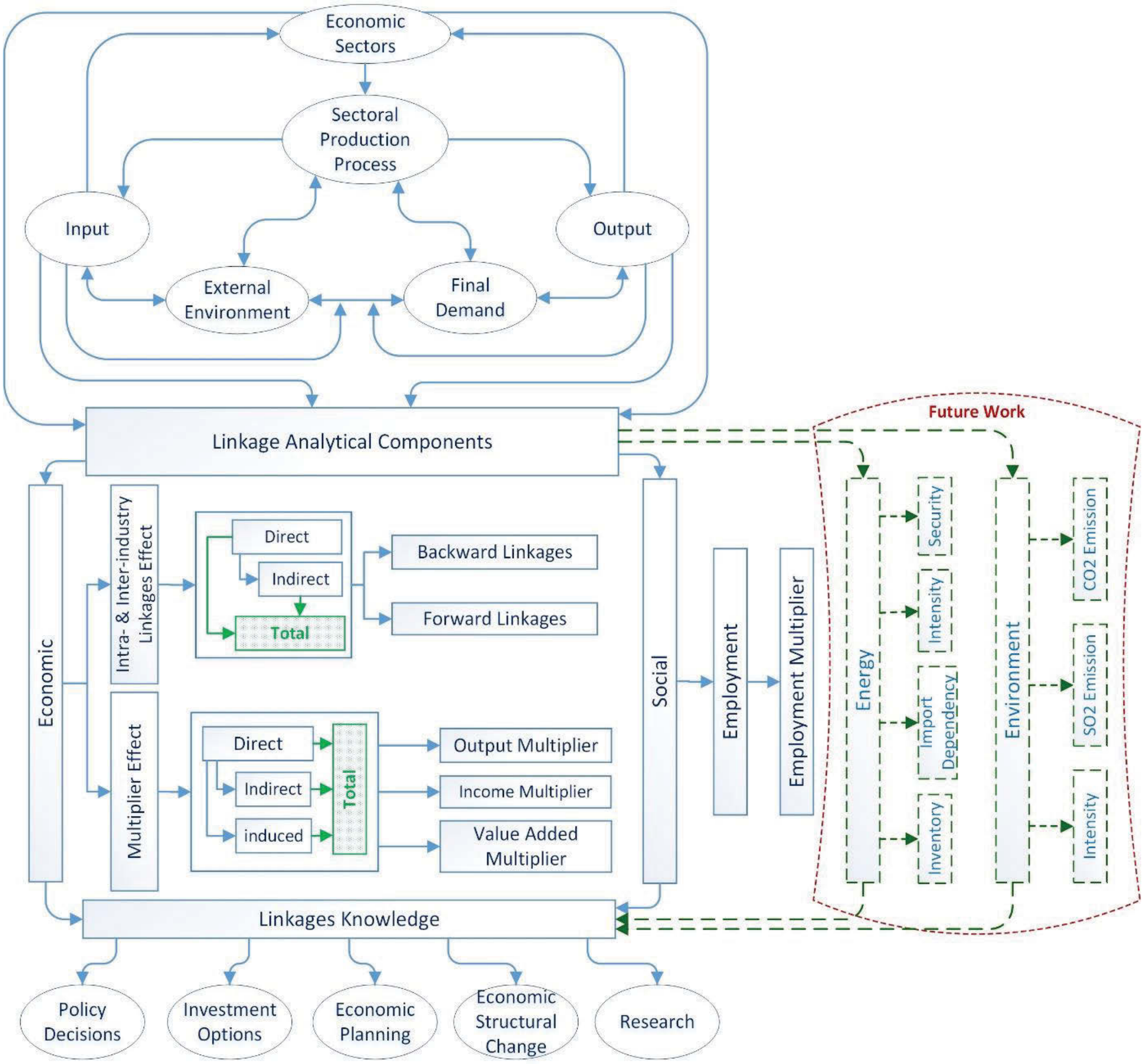
Showing supply-driven flow intermediate flows as opposed to the Leontief demand-driven flow.

4.3.5 The Linkages Analytic Module

Formulation and Structure - In the context of this research, the economic and social linkage profiles of the Australian economy is identified and synthesized in terms of variety of different multipliers, linkage descriptors, elasticities, interdependence coefficients, and final demand transformation of economic activity. The schematic linkage analysis is presented in Figure 4.3.

Linkages describe the economic relationships between the buyer and seller sectors along the supply chain. In this section a general definition of linkages is provided while for further clarity on types of linkages and related definitions are provided in Tables IV.5 and IV.6 in Appendix IV.

Figure 4.3: Infrastructure linkages: Schematic Overview



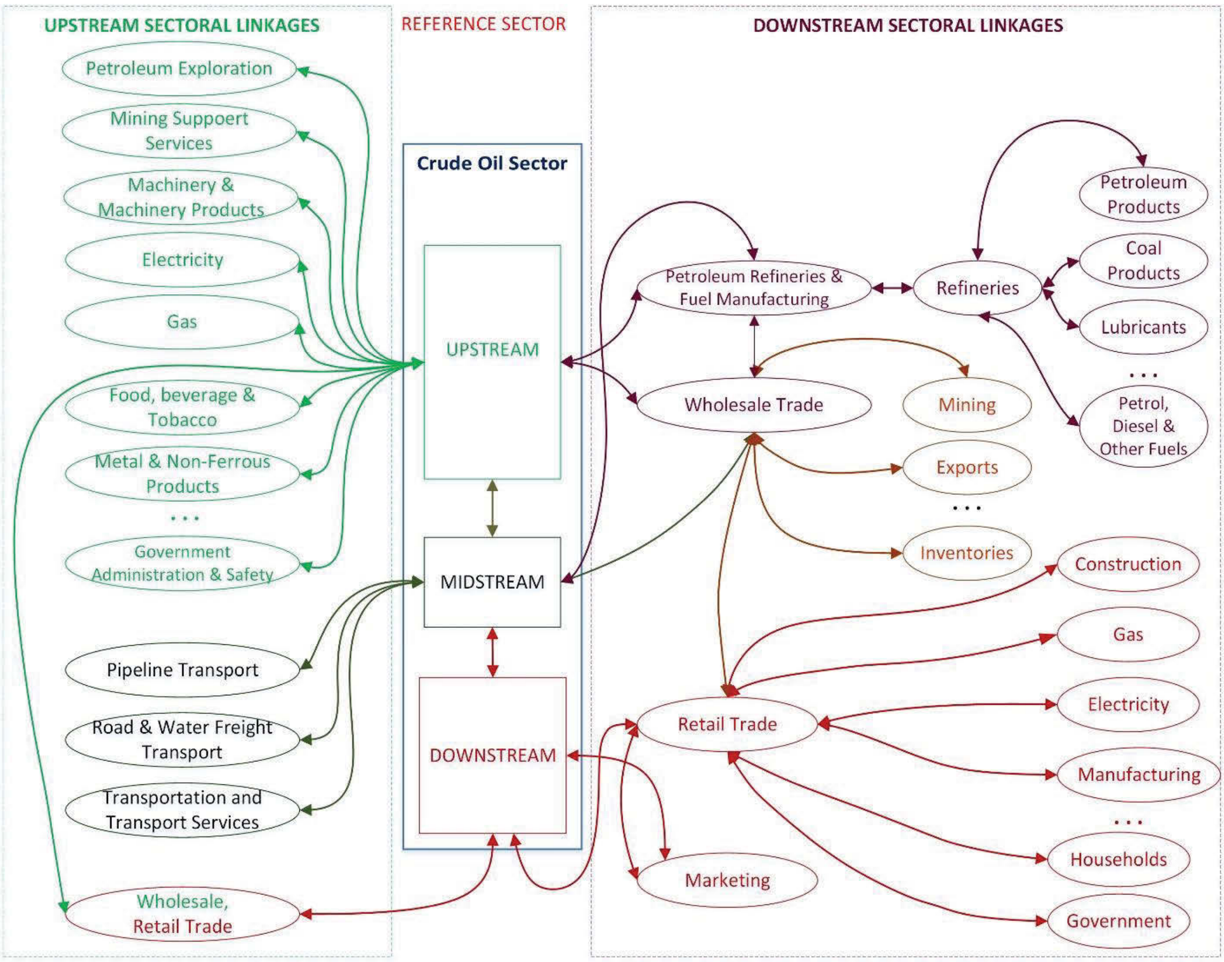
Source: Developed by the author of this research.

Linkages Definition in context of this research - Literature review does not prevail a comprehensive definition of infrastructure linkages. For example, Pederson et al. (2006) defines infrastructure linkages as "relationships or influences that an element in one infrastructure imparts upon another infrastructure". Or, He & Zhu (2016) define linkages as "the contacts and flows of information and/or materials between two or more industrial sectors or firms". In absence of a comprehensive definition, this research defines linkages as: *upstream supply, midstream transport and downstream links (connections) within an infrastructure as well as between two infrastructure sectors through which the state of one infrastructure influences not only a closely correlated state of the other, but also products of one infrastructure would enable production in another infrastructure*. This definition, then, applies to a system of interconnected infrastructure sectors in an economy which seamlessly influencing each other. These purposeful connections are both within a sector (intra-sectoral linkages) and externally between two sectors (inter-sectoral linkages). The reason for focusing on two sectors (pair) is that the web of linkages is made up of many pairs of connections. Also, the term 'state' refers to the functionality, availability, accessibility, adequacy and sustainability of services as well as dependency of one sector on the other sectors, and vice versa. More importantly, this 'state' defines stable demand and supply relationships (products flow) among sectors.

Therefore, if the sector's acceptable 'state' is not defined, and in practice not achieved and maintained, then linkages may not remain stable over time; or if the 'state' of a sector changes significantly then the economy-wide impacts on all sectors would be significant too.

With respect to the product flow if the sector's production technology is resource intensive it requires high inputs to enable production, then the sector's linkages with upstream suppliers are strong stimulating production in other sectors to supply the needed intermediate inputs. For example, Figure 4.4 shows the Crude Oil Sector, its supplier sectors, and major sectors such as petroleum products manufacturing, coal products manufacturing, transport and storage, electricity sector and wholesale trade which are dependent on it as the Sector itself is dependent on them. Likewise, the interpretation of dependability applies to other sectors of an economy. For simplicity, this diagram excludes web of linkages which is generated among other sectors.

Figure 4.4: Linkages of Crude Oil as a reference sector with other sectors



Source: Developed by the author of this research

Because of these linkages it is possible to estimate how sectors respond to change which are as a result of socio-economic policy changes/alternatives, and infrastructure investment options.

Types of Linkages - based on historical influence of linkages in evolution of infrastructure as discussed in Chapter 3, linkages are divided into three types: Backward Linkages (BL); Forward Linkages (FL), and Complementary Linkages (CL).

The focus of this research is in on the major types, BL and FL, while CL was discussed in historical profile chapter 3. Tables IV.5 and IV.6 in Appendix IV provide definitions of BL and FL as cited in the literature which in essence are very closely related and similar. In context of this research, the following definitions apply:

Backward Linkages - The level of demand for additional inputs used by producers to supply additional goods or services (Hirschman 1958; Breisinger et al. 2010; IFC 2015).

Forward Linkage - A measure of total effects on outputs as a result of a unitary changes in value added (Dietzenbacher, 1997) assuming use of factor inputs constant (Amores & Rueda 2009).

Complementary Linkages - are a combinations of BL and FL playing a significant role in geographical location of some sectors as discussed in the historical chapter 3. For example, in case of Fabricated Metal Product Manufacturing in Australia, it may locate between an Iron and Steel Manufacturing (Backward Linkages) and between a Machinery and Machinery Products Manufacturing (Forward Linages) for accessibility and reduction in supply delivery costs.

4.3.6 Measurements of Linkages

There are several recognised methods for measuring linkages, namely Classical Direct; Classical Total; Complete Hypothetical Extraction Method (HEM); and Incomplete HEM (Temurshoev & Oosterhaven 2014; Temurshoev 2010). Classical Direct and Classical Total linkage methods are also known as Classical Multiplier Methods (Hirschman 1958; Rasmussen 1956; Jones 1976; Yotopoulos & Nugent 1976; Drejer 1999; Amores & Rueda-Cantuche 2009).

Additionally, there are some mathematics-inspired methods for measuring linkages. Examples are: Entropy Method by Skolka (1965), Theil (1967), Shannon & Weaver (1975); Integrated Hypothetical Extraction and Classical Multiplier Method by Guerra (2014); Fuzzy Clustering Approach by Diaz et al. (2006), or Fuzzy Logic Approach by Morillas et al. (2011). These methods however not widely used. The Classical and HEM are the most commonly used methods for measuring linkages, which are discussed below. Additionally, this research suggests an extended linkage measurements method which is covered in this section too.

a) Classical Methods

Chenery & Watanabe Method (1958) - this method is based on the Leontief Model ($\boldsymbol{X} = \boldsymbol{AX} +$

F). It uses direct input and output coefficients to measure direct backward and forward linkages. In this method, the column sum of the Leontief direct input coefficient matrix provides a measure of a sector's direct backward linkages; and the row sum of the output coefficients shows the magnitude of the sector's direct forward linkages. The main weakness of this method is that it only evaluates the direct linkages which are sector-specific (i.e. it measures only the first round sectoral relationships between production and supply, thus neglecting indirect effects of intermediary purchases). For direct estimation of linkages, this research uses modified Chenery & Watanabe method (using Ghosh model) to calculate the direct forward linkages (Rueda-Cantuche & ten Raa, 2013), while direct backward linkages are calculated using Leontief direct input coefficients. The formulation of the modified method is shown below:

$$BL_{.j}^{d^{C-W}} = \sum_{i=1}^{n} \frac{x_{ij}}{X_j} = \sum_{i=1}^{n} a_{ij} = \acute{e}\boldsymbol{A} \qquad \forall i \text{ and } j = 1,2,3,\ldots,n \qquad \text{(Eq. 4.18)}$$

$$0 < a_{ij} \leq 1 \text{ and } a_{ij} \in \mathbf{A}$$

$$FL_{i.}^{d^{C-W}} = \sum_{j=1}^{n} \frac{x_{ij}}{X_i} = \sum_{j=1}^{n} b_{ij} = \boldsymbol{B}e \qquad \forall j \text{ and } i = 1,2,3,\ldots,n \qquad \text{(Eq. 4.19)}$$

$$0 < b_{ij} \leq 1 \text{ and } b_{ij} \in \mathbf{B}$$

where:

d	*direct* linkages
C-W	Chenery- Watanabe linkages measurements method
BL	Backward Linkages descriptor
FL	Forward Linkages descriptor
X_j	*Total Output* of j^{th} sector
x_{ij}	Represents the link between suppling sector *i* and using sector *j*.
a_{ij}	Technical coefficients.
X_i	total supply/sales of row sector *i* to each column sector j
b_{ij}	Ghosh direct coefficients
e	Column summation vector with all of its elements equal to one
e'	Row summation vector with all of its elements equal to one
A	Leontief A Matrix
B	Ghosh B Matrix

The above linkage measurements are un-weighted, implying that all sectors in an economy have equal importance. To correct the Chenery and Watanabe method, direct input coefficients which are used in calculation of BL are weighted by the share of each sector in the total final demand. In Leontief model, final demand is an exogenous variable which can be used as a suitable weight to compare the relative strength of each sector's final demand in the total final demand in the economy. Also, the output coefficients which are used to calculate FL are weighted by each sector's share of total value added. Value added is an exogenous variable in Ghosh supply-driven model which can be used to measure the share of each sector's value added in the total value added. The weighted formulas which are used in this research are shown below:

$$BL_{.j}^{dw^{C-W}} = \sum_{i=1}^{n} \alpha_j a_{ij} \qquad \forall i \text{ and } j = 1,2,3,\ldots,n \qquad \text{(Eq. 4.20)}$$

$$0 < a_{ij} \leq 1 \text{ and } a_{ij} \in \mathbf{A}$$

$$FL_{i.}^{dw^{C-W}} = \sum_{j=1}^{n} v_i b_{ij} \qquad \forall j \text{ and } i = 1,2,3,\dots,n \qquad 0 < b_{ij} \leq 1 \text{ and } b_{ij} \in \mathbf{B} \qquad \text{(Eq. 4.21)}$$

$$\alpha_j = (\alpha_i)^T = \frac{y_i}{\sum_{i=1}^{n} y_i} \qquad \forall i \text{ and } j = 1,2,3,\dots,n \qquad \text{(Eq. 4.22)}$$

$$v_i = (v_j)^T = \frac{v_j}{\sum_{j=1}^{n} v_i} \qquad \forall j \text{ and } i = 1,2,3,\dots,n \qquad \text{(Eq. 4.23)}$$

Where

$\boldsymbol{\alpha_j}$	relative share of each sector's final demand in total final demand in an economy (i.e. importance of a sector in terms of final demand)
v_i	relative share of each sector's value added in total value added in economy (i.e. importance of each sector in terms of value added)
dw	*direct* linkages *weighted*
T	Transpose values

In this research, weighted and un-weighted Chenery & Watanabe direct linkages calculated and their normalised values are used as the basic indicators for linkages analysis purposes.

Rasmussen Method (1956) - this method is an improvement over the Chenery & Watanabe Method because it measures both direct and indirect (i.e. total) linkage effects of each sector in an economy. Rasmussen Method uses the column sum and row sum of the Leontief inverse matrix, $(I-A)^{-1}$, to calculate total linkages effects (i.e. $\mathbf{L} = \mathbf{I} + \mathbf{A} + \mathbf{A}^2 + \mathbf{A}^3 + \dots + \mathbf{A}^n$, where the most important impact is direct impact (of originally affected sector) measured by **A** matrix while subsequent effects (shown by $\mathbf{A}^2, \mathbf{A}^3, \dots, \mathbf{A}^n$) are indirect effects. Therefore, by this Method, the total output that a country or a region would have to achieve in order to provide a unit change in final demand of a sector can be estimated. The formulation of Rasmussen method given below:

$$BL_{.j}^{t^R} = \sum_{i=1}^{m} l_{ij} \qquad \text{(Eq. 4.24)}$$

$$FL_{i.}^{t^R} = \sum_{j=1}^{m} l_{ij} \qquad \text{(Eq. 4.25)}$$

Where: l_{ij} is elements of $(I - A)^{-1}$, m = number of sectors, t = total linkage, R = Rasmussen

To correctly identify and rank sectoral linkages, it is important to transform linkage measures into linkage indices (i.e. to normalise) by relating them to the overall linkage average defined by:

$$O_{avg} = \frac{1}{m^2}\sum_{j=1}^{m}\sum_{i=1}^{m} l_{ij} = \frac{1}{m^2}\sum_{j=1}^{m} BL_{.j}^{t^R} = \frac{1}{m^2}\sum_{i=1}^{m} FL_{i.}^{t^R} \qquad \text{(Eq. 4.26)}$$

Therefore, Rasmussen suggested "*index of power of dispersion*, $\boldsymbol{U_{.j}}$" and the "*index of sensitivity of dispersion*, $\boldsymbol{U_{i.}}$" based on Leontief inverse coefficients. The formulations are as following:

$$U_{.j} = \frac{1}{m} BL_{.j}^{t^R} \Big/ \frac{1}{m^2}\sum_{j=1}^{m} BL_{.j}^{t^R} = BL_{.j}^{t^R} \Big/ \frac{1}{m}\sum_{j=1}^{m} BL_{.j}^{t^R} \quad (j = 1, 2 \dots m) \qquad \text{(Eq. 4.27)}$$

$$U_{i.} = \frac{1}{m} FL_{i.}^{t^R} \Big/ \frac{1}{m^2}\sum_{i=1}^{m} FL_{i.}^{t^R} = FL_{i.}^{t^R} \Big/ \frac{1}{m}\sum_{i=1}^{m} FL_{i.}^{t^R} \quad (i = 1, 2 \dots m) \qquad \text{(Eq. 4.28)}$$

$\boldsymbol{U_{.j}}$ expresses the extent of expansion caused in the system of sectors by an expansion in a given production sector. Or in other words, the relative extent to which an increase in final demand for products of a given production sector is dispersed through the system of sectors. $\boldsymbol{U_{i.}}$ Expresses the extent to which the system of sectors draws upon a given supply sector (row), or alternatively the extent to which a given supply sector is affected by an expansion in the system of industries.

These indices also known as **Hirschman-Rasmussen Linkages** because Hirschman (1958) suggested the same approach to Rasmussen based on Leontief inverse when for the first time he explored "Total Backward Linkage" and "Total Forward Linkage" (Drejer 2002).

Key Sector Analysis - Additionally, Rasmussen introduced the concept of the "Key Sectors" when both $U_{.j}$ and $U_{i.}$ of a given sector are above average (greater or equal to one). Rasmussen recognised that a sector could have relatively high values of $U_{.j}$ and $U_{i.}$ and yet be related only to a small proportion of the other sectors in the economy. For this reason he supplemented these two measures with a standard deviation coefficients for each $V_{.j}$ and $V_{i.}$ respectively. Therefore, to make a distinction between sectors whose linkages are spread over many sectors in the economy and the sectors whose linkages are concentrated in a few sectors further assessment is needed because both indices are based on averages whose value could be affected by extreme values within their associated inverse matrices. For example, a sector may show a strong backward linkage by heavily drawing on one or a few sectors and with little dependency on other sectors. Therefore, in order to identify "key sectors" correctly Rasmussen suggested the measure of linkage variability using the coefficient of variation (COV):

$$V_{.j} = \frac{\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(l_{ij}-\frac{1}{n}BL_{.j}^{t^R}\right)^2}}{\frac{1}{n}BL_{.j}^{t^R}} = \frac{\sqrt{Var_j(l_{ij})}}{\frac{1}{n}BL_{.j}^{t^R}} \quad j = 1,2,3,\cdots,n \qquad \text{(Eq. 4.29)}$$

$$V_{i.} = \frac{\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(l_{ij}-\frac{1}{n}FL_{i.}^{t^R}\right)^2}}{\frac{1}{n}FL_{i.}^{t^R}} = \frac{\sqrt{Var_j(l_{ij})}}{\frac{1}{n}FL_{i.}^{t^R}} \quad j = 1,2,3,\cdots,n \qquad \text{(Eq. 4.30)}$$

Therefore, "Key Sectors" are identified when both indices are above average and COV is relatively small. However, there are issues with COV that does not provide a relative indicator of variability compared against other sectors. This issue is discussed in Chapter 5.

The concept of "Key Sector" and their methodology are further discussed in Chapter 7 where this research presents a proposed method of identifying the linkages of each sector in the economy.

Modified Rasmussen Method – During 1970's IO practitioners such as Beyers (1976), Jones (1976) and in subsequent years Antras et al. (2012), and Miller & Temurshoev (2013), Temurshoev & Oosterhaven (2014), Dietzenbacher et al. (2005), Dietzenbacher (1992), Clements (1990), and Cella (1984) improved the Rasmussen's Method in applied and theoretical form to assist with sectoral policy analysis and finding answers to various input-output questions. For example, utilisation of Ghoshian inverse coefficients as a preference to Leontief coefficients for calculation of Forward Linkages for which the following formula applies:

$$FL_{i.}^{G} = \sum_{j=1}^{m} g_{ij} \qquad \text{(Eq. 4.31)}$$

$$U_{i.} = FL^{G}_{i.} / \frac{1}{m}\sum_{i=1}^{m} FL^{G}_{i.} \quad (i = 1, 2 \ldots m) \qquad \text{(Eq. 4.32)}$$

Likewise, formulation of COV for forward linkages changed to reflect Ghoshian approach:

$$V_{i.} = \frac{\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(l_{ij} - \frac{1}{n}\sum_{j=1}^{m} g_{ij}\right)^2}}{\frac{1}{n}\sum_{j=1}^{m} g_{ij}} = \frac{\sqrt{Var_j(g_{ij})}}{\frac{1}{n}\sum_{j=1}^{m} g_{ij}} \quad j = 1,2,3,\cdots,n \qquad \text{(Eq. 4.33)}$$

Where G = $(I - B)^{-1}$ Ghosh Inverse with g_{ij} elements, and $U_{i.}$ = Forward Linkage

b) Hypothetical Extraction Method (HEM) - This method originally proposed by Paelinck et al. (1965) and implemented by Strassert (1968). Later its reformulated versions implemented by Schultz (1977), Meller & Marfán (1981), Cella (1984), Milana (1985), Clements (1990), Heimler (1991), Valadkhani (2003); Kay et al. (2007); Lopes (2011), and Kelly et al. (2015). The basic idea behind HEM is that in order to understand the economic role of a sector, its impact is simulated by way of fully eliminating its physical and transactional economic connections to the remaining sectors from the economy. Therefore, if the sector of interest ceases to interact with the rest of sectors, then, the opportunity cost in terms of lost gross output can be determined (see Miller & Lahr 2001). According to Amores & Rueda-Cantuche (2009) HEM does not distinguish between FL and BL and works only in terms of one dimension at a time (e.g. either income, or production, or employment) often obtaining contradictory conclusions depending on each dimension studied. Sonis et al. (1995) suggested the concept of *pure linkage* where the feedback and internal effects of a backward or a forward linkage is completely eliminated from the total backward and forward linkages in order to better understand the impact of the sector which is extracted from the system of sectors on the economy.

HEM is not a suitable method for analysis of linkages because it sacrifices economic reality by fully removing a sector from the economy. The complex system of linkages is inhibitive of extracting a sector in a justified manner. Valadkhani (2003) partially removed a sector from the economy to assess the jobs lost as a result of the collapse of Ansett, an Australian airline. Nevertheless, either methods of removing a sector hypothetically leads to loss of information.

Developed IO Four-Quadrant Linkages Analysis Framework - The Classical and HEM methods are traditionally confined to the inter-industry sector. As a result, several other linkages have remained undetected. To overcome this issue, this research extends analysis of linkages beyond the first quadrant of the IO tables, and proposes an IO Four-Quadrant Linkages Analysis Framework (IOFQLAF). The structure and notations of this framework is shown by Table 4.6 *where*: **A** is the (*m* x *m*) inter-industry (first quadrant) matrix of IO technical coefficients; **B** is the (*n* x *n*) direct IO coefficient matrix for Final Demand quadrant; **C** is the direct IO coefficient matrix for Primary Factors of Production quadrant; **D** is the direct IO coefficient matrix for the Direct Final Use of Production Factors quadrant; $\boldsymbol{X_j}$ Horizontal Vector of Total Production with elements x_j^d; **F** is the (n x n) Total Final Demand (Transaction) Matrix with elements f_{ik}; $\boldsymbol{f}$ is the (n x 1) Vertical Vector of Total Final Demand with elements $f^s_{ik} = \sum_k f_{ik}$; $\boldsymbol{X_i}$ Vertical Vector of Total Demand for Products and Services (Revenue) with elements x^s_i; **H** is the Direct Final Use of Production Factors (Transaction) Matrix with elements h_{lk}; $\boldsymbol{h}$ is the Vertical Vector of Direct Final Use of Primary Production Factors with elements $h^s_{lk} = \sum_j h_{lk}$ (superscript s refers to the supply of primary factors along each row); $\boldsymbol{y}$ Vertical Vector of Demand for Primary Production Factors with elements $y^s_{lm} = \sum_j v_{lj} + \sum_k h_{lk}$ where $m = j + k$ and $\{j = 1, 2, \cdots, n$ and $k = 1, 2, \cdots, n\}$; and $\boldsymbol{g}$ Horizontal Vector of Total Final Demand Categories with elements g_k where k=1, 2, . . . , n).

Table 4.6: IO structure of Four-Quadrant Linkages Analytic Framework

	(1) Ind.	(2) Non -Ind.	**(3) (1)+(2)**	(4) Con	(5) Gvt	(6) Inv	(7) Exp	(8) Sto	**(9) (4) to (8)**	**(10) Total**
(1) Industry	Intermediate Demands [Z] A			Final Demand Matrix [F]		B			$f_1 = f^s_{ik}$	$x_i = x^s_i$ $\boldsymbol{X_i}$
(2) Non-Industry	z_{ij}					f_{ik}			$\boldsymbol{f}$	
(3) *Sum (1) + (2)* *Total Intermed. Use*										
(4) Wages (Labour)									$h_1 = h^s_{ik}$	$y_1 = y^s_{lm}$
(5) Net Indir. Taxes	Factors of Production Matrix [V]			Direct Final Use of Production Factors Matrix [H]						
(6) Gross Profit		v_{lj}				h_{lk}				$\boldsymbol{y}$
(7a) Complementary Imports	C					D			$\boldsymbol{h}$	
(7b) Competing Imports										
(8) Sum (4) to (7a) *Australian Production*										
(9) *Sum (8) + (7b)* *Total Uses*										
(10) Total	x^d_j $[X_j]$ Total Production			g_k		$\boldsymbol{g}$	Final Demand Categories			

Calculation of Direct Coefficient Matrix for each Quadrant - Derivation of Leontief and Ghosh technical coefficients for quadrants A was given by Eq. 4.3 and Eq. 4.13 in Section 4.3.4, mathematical formulation of IeIOM, respectively. The same approaches apply to quadrants B, C and D. For example see Eq. 4.4 for quadrant B in Section 4.3.4.

Deriving the Cumulative Coefficient Matrices for A, B, C and D Quadrants - derivation of Leontief and Ghosh cumulative (total) coefficients for quadrant A was covered in Section 4.3.4. Cumulative coefficients for quadrants B, C, and D is discussed below.

The following equation applies to quadrant three with direct IO coefficient matrix **C:**

$$\boldsymbol{y} = \boldsymbol{C} \cdot \boldsymbol{X_i} + \boldsymbol{h} \qquad \text{(Eq. 4.34)}$$

Likewise, for quadrant two with direct IO coefficient matrix **B**:

$$\boldsymbol{f} = \boldsymbol{B} \cdot \boldsymbol{g} \qquad \text{(Eq. 4.35)}$$

And for quadrant four with IO coefficient matrix **D**:

$$\boldsymbol{h} = \boldsymbol{D} \cdot \boldsymbol{g} \qquad \text{(Eq. 4.36)}$$

Using the Leontief formula and substituting the above relationships yield the following:

$$X_i = (\boldsymbol{I} - \boldsymbol{A})^{-1}\boldsymbol{f} \qquad \text{(Eq. 4.37)}$$

$$X_i = (\boldsymbol{I} - \boldsymbol{A})^{-1}\boldsymbol{B} \cdot \boldsymbol{g} \qquad \text{(Eq. 4.38)}$$

Substituting Eq. 37 in Eq. 34:

$$\boldsymbol{y} = \boldsymbol{C}\,(\boldsymbol{I} - \boldsymbol{A})^{-1}\boldsymbol{f} + \boldsymbol{h} \qquad \text{(Eq. 4.39)}$$

And then by substituting Eq. 4.36, and Eq. 4.37 in Eq.4.39 it would result:

$$\boldsymbol{y} = \boldsymbol{C}\,(\boldsymbol{I} - \boldsymbol{A})^{-1}\boldsymbol{B}.\boldsymbol{g} + \boldsymbol{D}.\boldsymbol{g}$$

$$\boldsymbol{y} = [\boldsymbol{C}\,(\boldsymbol{I} - \boldsymbol{A})^{-1}\boldsymbol{B} + \boldsymbol{D}]\boldsymbol{g} \qquad \text{(Eq. 4.40)}$$

Table 4.7 summarises the cumulative coefficient matrices for each of the IO quadrants. The presented formulas are suitable for measuring backward linkages. For forward linkages, the Ghosh matrices apply (Eq. 4.13 and Eq. 4.17 and similarly for other quadrants).

Table 4.7: Cumulative coefficients formulation for each IO quadrant

Intermediate Demands $(\boldsymbol{I} - \boldsymbol{A})^{-1}$	**Final Demand** $(\boldsymbol{I} - \boldsymbol{A})^{-1}\boldsymbol{B}$
Factors of Production $\boldsymbol{C}\,(\boldsymbol{I} - \boldsymbol{A})^{-1}$	**Direct Final Use of Production Factors** $\boldsymbol{C}\,(\boldsymbol{I} - \boldsymbol{A})^{-1}\boldsymbol{B} + \boldsymbol{D}$

c) **Other descriptive measures of linkages -** The following descriptors that are embedded in the linkages analysis model of IeIOM complement the developed extension (discussed in the above) by providing more detailed knowledge of linkages.

Coefficients Sensitivity Classification: The Most Important Coefficients (MIC) - utilising both direct and cumulative coefficients, this descriptor classifies IO coefficients into four sensitivity classes (Table 4.8). In particular, the sensitivity of the MIC class indicates by how many percentages an input coefficient may change so that the output of any sector does not change by more than one percent. The smaller the sensitivity indices, the more sensitive the coefficients will be. This sensitivity analysis, also identifies the number of sensitive coefficients in columns and rows of IO tables, their impacts on technological changes, the pattern of change and the stability of coefficients over a period of time (see Reyes 1996; Fernandez & Santos 2009; Forssell 1984, 1988). The number of MIC in each sector shows as to where direct policy and investment decision more effectively. The formulation is given below while results are discussed in Chapter 6.

$$w_{ij}(p) = a_{ij}\left(l_{ji} + l_{ii}\frac{X_j}{X_i}\right) \quad \text{(Eq. 4.41)}$$

$$r_{ij} = \frac{p}{w_{ij}} \quad \text{(Eq. 4.42)}$$

where a_{ij} is technical coefficient, l_{ji} and l_{ii} are the elements of Leontief inverse matrix, X_j and X_i are the total sectoral production and supply, and p is defined as the minimum percentage to be classify a coefficient as MIC (in case of this research set to one percent), r_{ij} is an index for coefficients sensitivity classification. Coefficients of Ghosh matrices apply to forward linkages.

Table 4.8: Coefficients sensitivity classes and sensitivity limits

The Most Important Coefficients (MIC)	r_{ij}<0.1
Important (I)	0.1 <=r_{ij} < 0.5
Less Important (LI)	0.5 <=r_{ij} <1.0
Not Imortant (NI)	r_{ij} >= 1.0

Backward and Forward Concentration Indices – This analysis which is based on Leontief total requirements matrix informs the number of sectors that each sectors buy goods and services products from (backward linkages) and the sectors to which it sells its products (forward linkages). The larger indices indicate that sectors have established higher number of inter-sectoral linkages and vice versa. Also, this index indicate if the country's sectors buy many inputs from many industries, buy many inputs from some sectors, or some inputs from many industries (Soofi 1992; Claus & Li 2003; Lenzen 2003).

$$CI^L_{.j}(l_{ij}) = \left[n\left(1 - \sum_{i=1}^{n}(C_{.j,ij})^2\right)\right]^{1/2} \quad \text{(Eq. 4.43)}$$

$$CI^G_{i.}(b_{ij}) = \left[n\left(1 - \sum_{j=1}^{n}(C_{i.,ij})^2\right)\right]^{1/2} \quad \text{(Eq. 4.44)}$$

where $C_{.j,ij} = \frac{l_{ij}}{\sum_{i=1}^{n} l_{ij}}$, $C_{i.,ij} = \frac{b_{ij}}{\sum_{j=1}^{n} b_{ij}}$, l_{ij} and b_{ij} elements of Leontief and Ghosh inverse matrices, n = number of sectors, $CI^L_{.j}$ = Backward Concentration Indices; $CI^G_{i.}$=Forward Indices.

Entropy Indices of Sectoral linkages - these indices inform the level of sectoral integration and specialisation in the economy. They are descriptive of both inter-industry sectors and the economy as a whole because of including final demand into calculations. The higher entropy indices show that a sector is more integrated into the economy and as such is a specialised sector which other sectors depend on it, and vice versa (Claus & Li 2003; Lenzen 2003, Soofi 1992, Theil 1971)

$$EI^L_{j.} = \sum_{j=1}^{n} d_{.j,ij}\log\left(\frac{1}{d_{.j,ij}}\right) \quad \text{(Eq. 4.45)}$$

$$EI^G_{i.} = \sum_{i=1}^{n} d_{i.,ij}\log\left(\frac{1}{d_{i.,ij}}\right) \quad \text{(Eq. 4.46)}$$

where $d_{.j,ij} = \frac{l_{ij}^w}{\sum_{i=1}^n l_{ij}^w}$, $d_{i.,ij} = \frac{b_{ij}^w}{\sum_{j=1}^n b_{ij}^w}$ for all i and j , l_{ij}^w and b_{ij}^w weighted elements of Leontief and Ghosh inverse matrices, n = no. of sectors, $EI_{.j}^L$ and $EI_{i.}^G$= Backward and Forward Entropy Indices;

Value Added Indices - value added analysis informs contribution of each sector to the Australian economy's Gross Value Added (GVA). This research performs the analysis both in real term (2014-15 prices) and in indexed term (1975=100) to investigate the pattern over the period 1975-2015. Results are discussed in Chapter 6.

4.3.7 Elasticity Analysis

In the context of this research the following types of elasticities are define:

Elasticity of Sectoral Supply Response - This elasticity measures how responsive (flexible) a supply sector has been to the changes in demand for the input it supplies to other sectors during two consecutive periods (t and $t-1$) of full estimation of the IO tables (Cuello et al. 1992). Sectors with above average elasticity indices (i.e. greater than or equal to one) are considered responding to demand for their inputs successfully. This elasticity also indicates that as a result of 1% increase in supply of a given sector's products to the intermediate sectors by what percentages the inputs from the intermediate sectors into this supply sector would increase over the period t and $t-1$. The elasticity formulation is given below, and the results are discussed in chapter 8.

$$e_{i(t,t-1)}^s = \left(\frac{Z_{i(t)} - Z_{i(t-1)}}{Z_{i(t-1)}}\right) \Big/ \left(\frac{Z_{j(t)} - Z_{j(t-1)}}{Z_{j(t-1)}}\right) \qquad \text{(Eq. 4.47)}$$

where $e_{i(t,t-1)}^s$ = Elesticity of Sectoral Supply Response, $Z_{i(t)}$ = inter-industry total supply in year t , $Z_{j(t)}$ = inter-industry total input in year t, and similarly defined for the period $t-1$.

Elasticity of Final Demand - Value Added Response (*FD-VA*) - this research has developed this elasticity indicator as a measure of flexibility of a sector to provide primary inputs (change in value added) to support its additional production (inputs to other sectors) as a result of a change in final demand over the period t and $t-1$. This elasticity also determines that as a result of one percent increase in final demand by what percentages the primary factor inputs of a supply sector would increase over the period t and $t-1$. Formulations are:

$$e_{i(t,\,t-1)}^v = \left(\frac{v_{j(t)} - v_{j(t-1)}}{v_{j(t-1)}}\right) \Big/ \left(\frac{f_{i(t)} - f_{i(t-1)}}{f_{i(t-1)}}\right) \qquad \text{(Eq. 4.48)}$$

where $e_{i(t,t-1)}^v$ = Elesticity of Value Added-Final Demand Response, $v_{j(t)}$ = sectoral total value added in year t , $f_{i(t)}$ = sectoral final demand in year t, and similarly defined for the period $t-1$.

To better understand the elasticity results, the elasticity of value added components labour (w), capital (C), and taxes (T) are determined by the following formulation:

$$e^{w}_{i(t,t-1)} = \left(\frac{w_{j(t)} - w_{j(t-1)}}{w_{j(t-1)}}\right) \Big/ \left(\frac{f_{i(t)} - f_{i(t-1)}}{f_{i(t-1)}}\right) \quad \text{(Eq. 4.49)}$$

$$e^{C}_{i(t,t-1)} = \left(\frac{C_{j(t)} - C_{j(t-1)}}{C_{j(t-1)}}\right) \Big/ \left(\frac{f_{i(t)} - f_{i(t-1)}}{f_{i(t-1)}}\right) \quad \text{(Eq. 4.50)}$$

$$e^{T}_{i(t,t-1)} = \left(\frac{T_{j(t)} - T_{j(t-1)}}{T_{j(t-1)}}\right) \Big/ \left(\frac{f_{i(t)} - f_{i(t-1)}}{f_{i(t-1)}}\right) \quad \text{(Eq. 4.51)}$$

Justification of Adopting Elasticity Methodology - The elasticity methodology in the context of this research helps to understand effectiveness of the sectoral linkages in terms of provision of inputs (inter-industry supply and factors of production) to other sectors.

4.3.8 Final Demand Transformation of Economic Activity

The final demand transformation approach (or final demand accounting) tracks all direct and indirect linkages to final demand as production sectors are producing for final demand. This method is similar to Leontief transformation method which keeps track of a sector's inputs plus supplier-sectors' inputs and other cascading effects until total inputs for a sector's production are determined. The standard IO tables cannot readily enable final demand tracking process. The formulation given below transforms the existing IO Tables into a suitable format by reallocating all economic activity into the sectors that are producing for final demand.

$$\boldsymbol{\acute{L}_t} = \boldsymbol{L}\,(\boldsymbol{I}.\boldsymbol{\acute{F}}) \quad \text{(Eq. 4.52)}$$

where $\boldsymbol{\acute{L}_t}$ = Leontief inverse matrix, $(\boldsymbol{I} - \boldsymbol{\acute{A}})^{-1}$, of production by Final demand transformation, $\boldsymbol{\acute{A}}$ = direct IO coefficient matrix obtained from $\boldsymbol{\acute{Z}}$, where $\boldsymbol{\acute{Z}}$ is a new transaction matrix based on the standard transaction matrix $\boldsymbol{Z}$ endogenised by households consumptions and value added primary factors. Development of $\boldsymbol{\acute{Z}}$ assists with estimation of household income, and evaluation of value added and jobs creation comparing the standard and final demand transformed methods. Also, $\boldsymbol{\acute{F}}$ is an adjusted vector of final demand by excluding households' share of final demand which is endogenised to prevent double counting.

Because of the unavailability of households' income data at sectoral level, the Final Demand Transformation Model, assumes that the total domestic households' income is comprised of about 40 to 50% of the total value added. Additionally, for the households' income an extra 10% of the total value added is declared as income from non-market sources such as government's social welfare and subsidies, or foreign-sources earnings so that the total value added (which is the equivalent of GDP) is reflective of such income consistent with the reality. Based on these assumptions, the Model algorithm estimates the right percentages for matrix balancing purposes.

The value of this exercise is that the totals for all production columns are the same as the overall sectoral supply in the standard direct accounting IO table as well as the overall sectoral final demand. Also the overall sectoral value added in both type of analysis are the same (see Swenson

2014). The column totals inform how much production (sectoral activity) in the Australian economy flows into final demand by the contribution of each sector in satisfying a sector's final demand sales. This analysis together with the standard linkages analysis provide more insights for policy and investment decisions. Results are discussed in Chapter 8.

4.3.9 Analysis of Multipliers

This section describes multipliers concepts, type of multipliers, multiplier-effect categories, and method of analysing each.

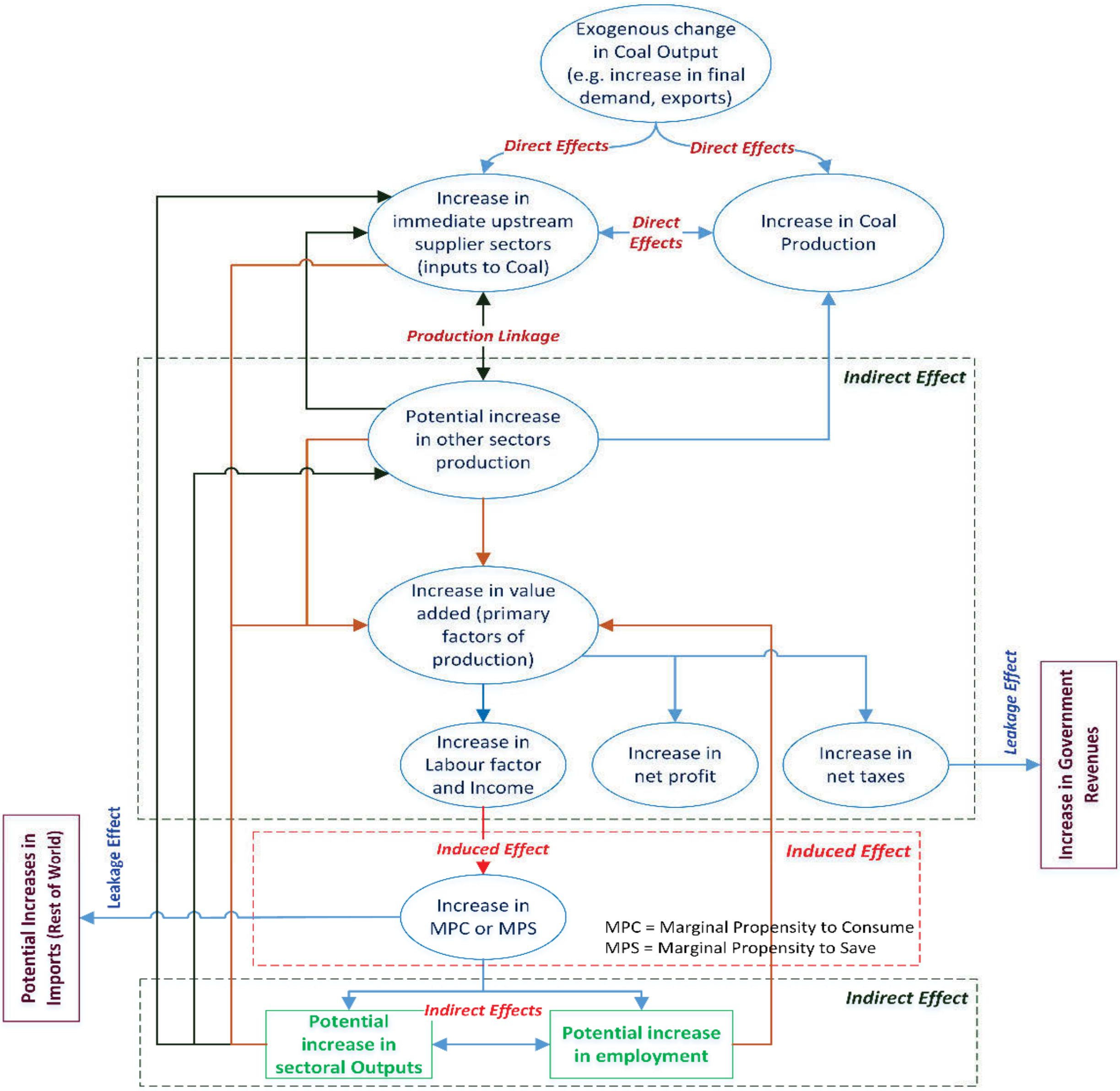
Concepts and differences of multipliers and linkages

Aurousseau (1921) developed simple multipliers to identify a baseline for economic activities, which progressed further by Kahn (1931) and then by Keynes (1936) who developed income and employment multipliers at a highly aggregated level. According to Keynes, multiplier "*establishes a precise relationship, given the propensity to consume, between aggregate employment and income and the rate of investment. It tells us that, when there is an increment of investment, income will increase by an amount which is K times the increment of investment*" i.e. $\Delta y = k\Delta I$. This is a macroeconomic approach while investors, policy makers, and economic planners need to know the details at sectoral micro-level rather than overall impacts. For example, government may decide to stimulate economic activities through investments in roads and transport infrastructure. There would be an immediate impact on the construction sector but how will the effects of boosted construction activity distribute through the economy? Or, if import restrictions on certain products are relaxed, how this change affect specific industries? Or, if government spending on certain sector is reduced, how in an economically linked system of sectors the impact on other sectors individually can be measured while it is possible to estimate the impact on sectors that are directly affected? Multiplier formulations were improved to measure the impacts of one sector on other sectors in the whole economy. For example see Kelly et al. (2015), Swenson (2014), Correa (2006), UN (1999), Pleeter (1980), and Miernyk (1965, 1976).

In the context of this research, multiplier is defined as the system of economic transactions that track a change in final demand with direct, indirect, induced and total effects (details, Figure 4.5).

Multipliers track change in the economy through "flow-on" effects and capture the size of each effect progressively. The "flow-on" effects start with a large size direct change in demanding pattern of the affected sector, which then creates a smaller secondary "flow-on" effect affecting suppliers of the originally affected sectors, and then as tertiary effects to suppliers of the suppliers' sectors and so on until the effects diminish or become stable (see Dillard 1948; Garnick 1970; Drake 1976; IFC 2015). For example, assuming that demand for electricity increases, then additional economic activities would follow in the economy. To satisfy the demand, the electricity infrastructure requires more coal, gas, water, machinery and parts, oil and petroleum products as

Figure 4.5: Multipliers as the system of interlinked transactions in the economy



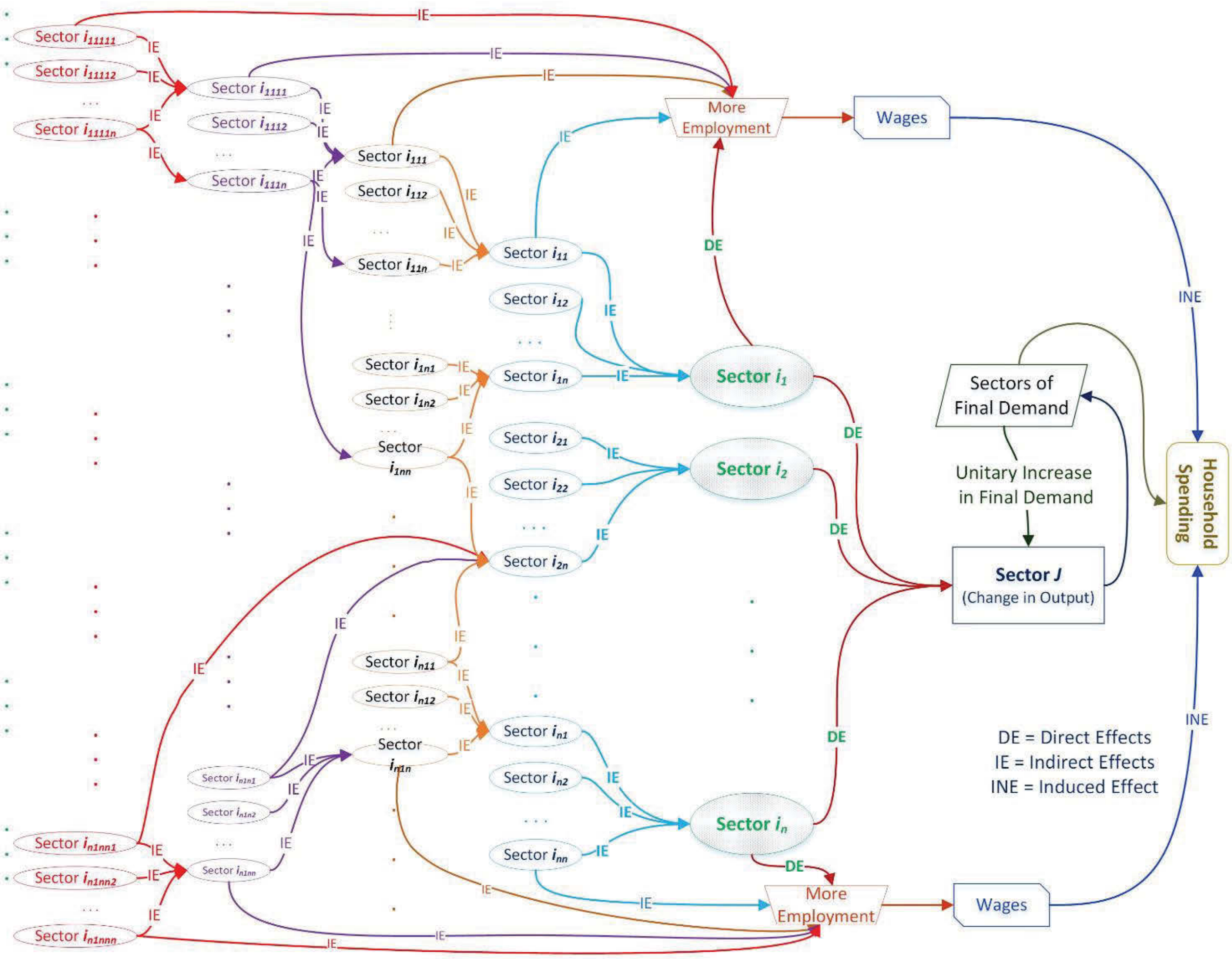
Source: Developed by the author of this research

major items. The coal, gas, water, and oil sectors in turn need to buy machinery, parts, fuel, water, and materials to enable them to produce more. Also, some expenditure may be required to finance the required imports which in this case money would leak out of the local economy. Nevertheless, the intermediate demand for imported materials will continue but eventually reduce to a negligible amount as the need for imported goods is decreased over time. Figure 4.6 shows these effects.

Difference between multipliers and Linkages - Because both multipliers and cumulative linkages are estimated based on IO tables; and because by development of open and closed input-output models it is possible to measure linkages and multipliers direct, indirect, induced and total effects at sectoral and macroeconomic levels, indeed there is less differences between the two indicators.

There is a general recognition that IO multipliers and linkages are the same as shown in Tables IV.5 and IV.6 in Appendix IV. The perceived differences arise because of their historical roots.

Figure 4.6: Multipliers effects in the economy, a schematic representation



Source: Conceptualised by the author of this research

Multipliers introduced much earlier than IO approach by Aurousseau (1921) for sole purpose of economic impacts analysis while the focus of IO framework, which started to gain recognition in 1941 by analysis of US IO data, has been on sectoral linkages analysis. Also, it has been recognised that multipliers are easier to work with while in essence they are using the same IO data. Another perceived difference is because of the contemporary approach to measurement of linkages which has not extended beyond the first quadrant of IO tables to explore the full potentiality, while major multipliers such as employment, income and value added directly access data from the second quadrant. Also, literature almost commonly refers to employment multipliers as physical employment multipliers (measured in Full Time Equivalent, FTE), a preference to monetary equivalents which by default is the case with IO tables being in monetary terms (see Miller & Blair 2009). Yet, IO tables can measure cumulative employment linkages (multipliers) in physical terms when external employment (FTE) data are linked to IO tables as is the case with the traditional employment multipliers. Also, customary to the field of public policy, government objectives which are linked to socio-economic indicators are preferred to be measured by the number of jobs created for the citizens rather than in monetary term. Therefore, from this perspective, historically linkages are considered economic-output-based while multipliers are socio-economic-policy-based. As such combination of the two measures provide complementary information. Multipliers and linkages should be treated with caution because of restrictive assumptions underlying IO framework (static character, linear production function, no impact of scale economies, no substitution, infinitely elastic supply). Literature shows that multipliers ignore capacity constraints. Also, ignore the role of supply by focusing on change in final demand and its impact on total economy only (i.e. multipliers focus on the demand-side of the economy only). For example see (Sila & Juvancic, 2005; Garnick, 1970; Drake, 1976). These are reasons for complementary nature of linkages and multipliers in contemporary practices. Therefore, on the provision that the required data is available this research recommends the use of Computable General Equilibrium (CGE) models which incorporate supply constraints (see Section 4.1) for more accurate estimation of multipliers.

Multiplier Types and Measurement Formulation

This research measures output, income, employment and value added multipliers and estimates Type I and Type II total effects in the whole economy as a result of change in final demand. These totals assist derivation of direct, indirect and induced multiplier effects as shown below:

Type I = Direct Effects + Indirect Effects

Type II = Direct Effects + Indirect Effects + Induced Effects

Type I multipliers are obtained from the Leontief open input-output model, while Type II multipliers are obtained from the Leontief closed input-output model where households and value added are treated as endogenised entities to assist computation of induced effects.

Direct effects measure the response of a particular sector to a change in the same sector's final demand, while indirect *effects* measure the response by all sectors of the economy from a change occurred in final demand of a particular sector. *Induced effects* measure the response by all sectors of the economy because of an increase (decrease) in expenditures of new household income and inter-institutional transfers generated (lost) from the direct and indirect effects of the change in final demand for a particular sector. According to Miller & Blair (2009) "*it is generally conceded that Type I multipliers probably underestimate economic impacts (since household activity is absent) and Type II multipliers probably give an overestimate (because of the rigid assumptions about labour incomes and attendant consumer spending)*." Therefore, this research adopted estimation of both Types of multipliers for the Australian economy to provide guidelines for sectoral policy formulation. Table 4.9 presents formulations. Results are discussed in Chapter 8.

Table 4.9: Formulation of multiplier effects by multiplier type

	Type I	**Type II**	**Direct**	**Indirect**	**Induced**
Output	$O_j^I = \sum_{i=1}^n l_{ij}$	$O_j^{II} = \sum_{i=1}^n \acute{l}_{ij}$	1* or $\sum_{i=1}^n a_{ij}$	Type I – Direct	Type II – Type I
Income	$I_j^I = \sum_{i=1}^n e_i \cdot l_{ij}$	$I_j^{II} = \sum_{i=1}^n a_{e,i} \cdot \acute{l}_{ij}$	e_j	Type I – Direct	Type II – Type I
Employment	$E_j^I = \sum_{i=1}^n a_{e,i} \cdot l_{ij}$	$E_j^{II} = \sum_{i=1}^n a_{e,i} \cdot \acute{l}_{ij}$	a_j	Type I – Direct	Type II – Type I
Value Added	$V_j^I = \sum_{i=1}^n a_{v,i} \cdot l_{ij}$	$V_j^{II} = \sum_{i=1}^n a_{v,i} \cdot \acute{l}_{ij}$	v_j	Type I – Direct	Type II – Type I

*in case of considering value added components the direct output is equal to one. In case of considering the inter-industry quadrant then the direct output is $\sum_{i=1}^n a_{ij}$ where a_{ij} is direct coefficients of the **A** matrix.

$\acute{l}_{ij}$ are elements of the truncated household endogenised Leontief inverse matrix in closed input-output model.

$e_i = \frac{e_j}{X_j}$ is the income coefficient where e_j is **A** matrix direct income (compensation of employees) coefficients for each production sector, and X_j total output of that production sector.

$a_{v,i} = \frac{v_j}{X_j}$ where v_j is the direct value added coefficient from the **A** matrix, and X_j the total output of that production sector.

$a_{e,i} = \frac{a_j}{X_j} \times 1000$ is employment-output ratio where a_j is the direct employment (compensation of employee) from the **A** matrix, and X_j the total output of that production sector.

4.4 Key Features of the Methods

- The existing linkages analysis models (Section 4.1 and 4.2) offer a narrow viewpoint of the linkages, confined to inter-industry quadrant only, and limited mainly to measuring one aspect of the linkages, for example, technology, input-output, environment, or investments as reflected in the scope of their application. As such they are not developed as models for comprehensively capturing multiple dimensions of infrastructure linkages concurrently. Therefore, a more comprehensive methodological framework is needed to capture the multiple infrastructure linkages, to estimate their magnitudes, to examine cross-relationships of such dimensions, and to analyse the linkage impacts on the whole economy.

- The linkage-analysis methods are generally static in nature covering short periods of time, normally one year or a few years, which does not enable analysis of the changing patterns of linkages. Also, the analysed linkages are distorted, because forward linkages are estimated from the same coefficients which were used to calculate backward linkages. This limits the usefulness of these models for a longer-term analysis. Even models that have been developed for the purpose of scenario analysis would require extensive modification.
- Some of the models like dynamic IO, CGE, DEA, and Bayesian models are complex and useful for analysing specific dimensions of linkages like technology. For example, a CGE model, when extended, becomes extremely large and mathematically complex, thus requiring a different level of expertise for common use. Also, CGE results are ultra-fine-tuned because of the model's flexibility, which may compromise reality; also it is difficult to distinguish direct and indirect linkage effects.
- On the other hand, some of the IO models are inherently restrictive. For example, LCA method places boundaries around processes which limits its flexibility for estimating multiple linkages as well as subjecting measurements to truncation error; or in case of econometric models, which normally are used in scientific and engineering areas with no or limited assumptions and using accurate data, may not independently lend themselves to the analysis of the effects of linkages on economic policy, because of their significant focus on technological-scientific dimensions and the need for a large volume of data.
- However, integrated methods which use standard IO framework, mainly the static model, in conjunction with one or more techniques such as Location Quotient (LQ), LCA, econometrics, and DEA perform better because of their complementary features. But, these models are not comprehensively developed, thus limiting their use for capturing multiple aspects of the linkages as discussed above.
- IeIOM, which is developed in this research (Section 4.3), is an integrated model operating on static IO methodology, and is supported by econometric sub-models. The use of static IO model is justified on the grounds of reproducibility, applicability, ease of use and debugging - more importantly in the absence of industry-based capital and investment matrices required to build the underlying structure of the model in a dynamic IO framework. This model has satisfactorily produced (in this research) useful results of twenty-five input-output tables, over a forty-two year period; and the 'misconception' of fixed coefficient of production, as clarified by Rose & Miernyk (1989), is therefore no longer an issue.
- One of the main features of IeIOM is its ability to overcome the shortcoming of the existing models by capturing multiple linkage dimensions including: IO backward and forward linkages; linkage elasticities, the most important linkages through coefficients sensitivity analysis; the number of sectors that an infrastructure receives inputs from and the number of sectors that it provides inputs to; and the degree of sectoral integration and specialisation in

the economy. Additionally, IeIOM identifies the highest contributors to backwards and forward linkages, and through final demand accounting framework provides an economic impact summary for various sectors to the extent that those sectors contributed to final demand versus intermediate consumption. Moreover, IeIOM captures income, employment, value added and outputs multipliers and their direct, indirect and induced effects; and through a GDP model identifies investment linkages, and the linkages of infrastructure with economic growth.

- A useful feature of the underlying IO engine of the IeIOM is related to its operation on both Leontief framework and selectively using the strengths of Ghosh framework. This combination assists to measure linkages more accurately by preventing distortion estimating forward linkages from the same coefficients that are used to estimate backward linkages.
- Also, IeIOM enables development of IeIOT (the model's IO tables) and to embed them into new, and more detailed upstream and downstream infrastructure sectors, in order to better investigate the nature of infrastructure linkages in the Australian economy.
- IeIOM is built on mathematical foundation using reformulated linkage estimation methodology so that unweighted and weighted measurements are made more accurately. The insights gained will assist with developing robust infrastructure policies and informed investment and economic planning decisions.
- One of the main feature of the methodology used in this research is the implementation of Input-Output Four-Quadrant Linkages Analysis Framework (IOFQLAF) to extend the measurement of the linkages beyond traditional practice is just confined to the first quadrant of the input-output tables (Section 4.3.6).
- The IeIOM framework represent a distinct advancement over existing methods, in that it effectively incorporates various dimensions of the linkages and explores the implication of the linkages at an economy-wide level. This approach, to the best knowledge of this author, represents the first comprehensive study into the nature of infrastructure linkages for Australia.

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5 SYSTEM OF WEIGHTS: ALTERNATIVE CONCEPTIONS

This chapter develops an alternative system of weights for enhancing the policy usefulness of analysed linkages. This chapter is organised as follows. Section 5.1 provides an overview of the system of weights. Section 5.2 reviews the current (traditional) system of weights, their shortcomings, and how to overcome them. Section 5.3 develops a proposed system of weights. Section 5.4 compares and contrasts the results of the proposed and traditional system of weights, and Section 5.5 provide a summary and the key features of the methods.

5.1 Overview

Literature review reveals that analysis of sectoral linkages are usually performed under two major system of weights: *Equally-Weighted System of Weights* (*ESOW*), and the *Weighted System of Weights* (*WSOW*), for example see Cella (1984) , Diamond (1974), Gurgul & Lach (2015), Hazari (1970), Khayum (1995), Laumas (1976b), Rasmussen (1958), Shuja et al. (2008), and Temurshoev & Oosterhaven (2014).

Under the ESOW, all sectors of the economy are given equal importance because of the Leontief underlying IO assumption which assigns a weight vector equal to unity to all sectors (Cuello 1992; Drejer 2002; Leontief 1936, 1986a, 1986b; Loviscek 1982). Under Weighted System of Weights (WSOW) however each cumulative coefficients of the Leontief inverse matrix is directly multiplied by a chosen vector of sectoral weights in order to bring out the relative importance and strength of each sector in the economy. The shortcoming of the existing WSOW can be described from both theoretical and empirical perspectives. Theoretically, the development of the weighted inverse matrix does not conform to the underlying process by which the Leontief inverse matrix is derived; and subsequently the outcomes are affected from empirical point of view. This research suggests a possible method to overcome this weakness in section 5.3.

The WSOW plays a significant role in "key" sector analysis (section 5.3.4) because: the importance of each sector in the economy is reflected in linkage indices (section 5.2.3); the issues with extreme linkage indices are resolved through weighting approach (section 5.2.2). For example, Jones (1976), in case of Korean rice sector, demonstrates the effectiveness of weighting system to resolve such extremities; and more importantly, the statistical variation among comprising cumulative coefficients of backward and forward linkages are taken into account (section 5.3.3). The reason for the latter importance is that the linkage indices can be related to either *many high inverse coefficients with low coefficient of variation*, or to *a few high inverse* *coefficients yet showing low coefficient of variation*. This research, suggests improvements to coefficient of variation to identify "key" sectors more accurately (section 5.3).

The weighted "key" sector analysis would provide investors and policy-makers with insights that are lacking in equally weighted approach (Chapter 4, section 4.3.6) because, equally weighted system of weights (ESOW) ignores differential weighting of each sector by giving equal importance to all sectors. As such, adoption of ESOW for linkages analysis in policy context (e.g. "key" sector analysis) is not recommended (section 5.2.1).

Therefore, based on the above discussions the role of ESOW and WSOW in linkages analysis are different. The sectoral linkages which are estimated under the ESOW are regarded as *Technological Linkages,* while the WSOW-based linkages are regarded as *Policy Linkages* or *Structural Linkages* because they are specifically weighted to suit the principal objectives of policy-makers, investors, or economic planners (section 5.2).

Provision of complementary information on both un-weighted and weighted dimensions of linkages would provide policy-makers and investors with insights contributing to informed policy and investment decisions.

Because of the influence of WSOW on linkages analysis, the Ramussen's (1956) method of equally-weighted linkage indices, and his suggested method of weighting have been subsequently improved by researchers in terms of weighting and normalisation (section 5.2).

The next section describe the current system of weights (ESOW and WSOW) in more details.

5.2 Current System of Weights

This section discusses system of weights based on their role in linkages analysis and describes weaknesses, and possible approaches to overcome the weaknesses.

5.2.1 Equally-Weighted System of Weights (ESOW)

The Equally-Weighted System of Weights (ESOW) is the default system in Leontief input-output framework where equal weights are assigned to all sectors recognising them to be equally important in the economy. According to Laumas & Soper (1979), ESOW has "*weights analogous to the scheme implicit in an unweighted index number*" where components are not adjusted to reflect importance or certain characteristics. For example, under ESOW, the index of backward linkage based on an unweighted sum of the row elements implies that different sectors in the system of sectors have equal weights. Likewise, in case of the index of forward linkage which is based on the sum of the row elements. Khayum (1995) argues that unweighted linkage indices alone are inadequate measure of importance of each sector, particularly for identifying critical sectors in the economy, because they assume equal weights for all the sectors. Khayum emphasis that weighted linkage indices would resolve the equal weighting issue because they allow proper comparison of the backward and forward linkages in the system of sectors in the economy.

Measurement of backward and forward linkage indices under ESOW, and their usefulness, need to be examined through a context-based approach. For example, the Leontief framework, because of its technological focus, assumes that each sector has a specific and fixed production technology (Leontief 1936; ten Raa 1994). In this context, linkage indices assist with examining the pattern of change in production technology of a given sector, and to analyse the impacts of labour saving advanced technologies on other sectors. As such, the ESOW-based linkages are technological linkages because they are derived from technological coefficients and they are just confined to the intermediate sectors of the economy. Therefore, the magnitude of technology linkages may not be directly suitable for policy or investment decisions where the exogenous variables of final demand, value added and output are drivers of such decisions. For example, Rasmussen (1956) developed equally-weighted linkage indices based on which he formulated a method to identify "key" sectors in the economy (Chapter 4, section 4.3.6). He advocated that a "key" sector which has a strong technological linkage induces the growth in other sectors in the economy. However, the magnitude of technological linkage indices for identifying "key" sectors is inadequate, misleading and subject to bias because: first, these linkages under ESOW assuming equal weights for all sectors of the economy which means all sectors are equally important; second, the magnitude of the indices may be overestimated because of sectoral equal weighting; and third, importance of each sector in final demand (or other preferred variables specified by policy-makers) are not incorporated into the magnitude of the technical linkages before "key" sectors are identified and their inducement impacts on other sectors are analysed (for example see Chatterjee 1989; McGilvray 1977; Khayum 1995; Laumas 1976; Mattas & Shrestha 1991; Tamurshoev 2004).

Another weaknesses of the ESOW-based linkages stem from definition of backward and forward linkages. According to Rasmussen (1956) and Chatterjee (1989) sectoral linkage assume an identical increase in demand by one unit for all of the sectors in the economy, which is unlikely to occur due to differing degree of importance of each sector in the system of sectors.

Moreover, under ESOW, the impacts of extreme coefficient values which are incorporated into the calculation of linkage indices cannot be resolved as further discussed in section 5.2.

A possible approach to overcome these shortcomings is to incorporate information on sectoral dimensions such as the relative size of the sectors and their contribution in the economy (for example in terms of sectoral share in final demand, or share in value added) into the magnitude of the linkages.

The results of linkage indices under different system of weights as demonstrated by this research (chapter 8) are different. These results are consistent with similar finding by Laumas (1976), Khayum (1995), and Shuja et al. (2008).

5.2.2 Weighted System of Weights (WSOW)

This section discusses the role of WSOW, its usefulness and weaknesses. The usefulness is discussed in terms of reflecting the relative importance of each sector in the system of sectors; correcting extreme input-output coefficients which contribute to calculation of linkage indices and multipliers; identifying sectors with the high level of economic activities as indicators of investment; evaluating demand response to dispersive behaviour of change in unitary price of sectoral productions throughout the economy; and contributing to the development of robust policies by complementing the information obtained by analysis of technical linkages. Also, this section presents contrary views to the application of weighing systems for linkages analysis.

The role of WSOW is particularly important in policy, investment, and planning decisions as well as measuring change in economic structure of an economy. For these purposes, linkages which are measured under WSOW are known as *policy linkages* or *structural linkages*. The WSOW-based linkage indices incorporate exogenous variables of final demand and value as possible weights into the linkages calculation which are distinctively used for examining alternative policy decisions.

Rasmussen (1956) recognised the importance of weights and suggested sectoral share of final demand as a possible choice of weight. According to Rasmussen, different weights may be applied to backward and forward linkage indices while the choice of weight for backward or forward linkages could be different. Zamanian (1984) argues that Rasmussen linkage indices were properly weighted in the sense that the indices of sectoral linkages are measured by the ratio of the backward and forward linkages to the national backward and forward linkages. This explanation ignores the existence of the unitary vector of weights which ultimately does not allow the importance of the measured ratios (linkage indices) to be recognised in the economy.

Below is a brief discussion as to why weighted system of weights are useful for overcoming the shortcomings of the equally-weighted system of weights:

Identifying relative importance of each sector in the economy – assumption of equal weights defies reality. The reason is that, over time, in response to a unitary change in final demand of a given production sector, or because of shifts in the economic conditions (e.g., changes in economic policy, investment objectives, or terms of trade) the output of all sectors are affected to varying degrees. Different sectors should therefore be assigned different weights to bring out the relative strength of various sectors in the economy. Rasmussen (1956) recognised the importance of weighted linkage measurements. Subsequently Bharadwaj (1966), Clements & Rossi (1991), Cuello (1992), Drejer (2002), Hazari (1970), Laumas (1976), Lenzen (2003), Rao & Harmston (1979), Schultz (1977) adopted weighted linkage analysis and suggested improvements in terms of weights and normalisation.

Resolving issues with sectoral demand and extreme IO coefficient values - the unweighted linkages assume an identical increase in demand by one unit for all the sectors. This is unlikely to occur because sectors have different importance in the economy. For example, in Leontief model the un-weighted forward linkages are defined as the increase in output of the supply sector i corresponding to one unit increase in final demand for products of each production sector j (Miller & Blair 2009).

A literature review reveals several issues with the above definition: first, according to Rasmussen (1956) it gives *"equal rights"* to each sector to increase its production by one unit, and subsequently demands for equivalent inputs from its upstream supply sector; second, it does not take into account the importance of output producing sectors to the final demand because it is normally expected that more important sectors contribute more to the final demand; third, it does not take into account the size of the demanded inputs proportional to the size of the input recipient sector. For example, a few production sectors with disproportionally large inputs would skew the supply sector's forward linkage results when there is no mechanism to signal the sectoral size (for example, see Rasmussen 1956; Hazari 1970; Chatterjee 1989; Dietzenbacher 1997 & 2001; Drejer 1999; Guerra & Sancho 2010).

These issues can be corrected by applying weights where an increase in final demand is evenly distributed on the system of sectors. For example, weights can be based on each sector's relative share of total final demand (see section 5.2.3 methods of assigning weights, also section 5.3 proposed reformulated system of weights). Therefore, by applying weights to the IO coefficients, the normalised magnitudes of the weighted linkages would be different to their unweighted version. Both methods measure the impacts of a unitary change in final demand on input and output requirements through sectoral interdependence across the economy.

By the weighted method, sectors respond to a unitary change in final demand according to their importance for the sector of final demand. This is different to unweighted method which assumes each sector has equal importance to the sector of final demand. For example in case of unweighted forward linkages, it is calculated based on the unweighted sum of row elements of the inverse matrix. That is, the increase in output of supply sector i corresponds to a one unit increase in final demand for the product of each production sector j. In case of an n-sector economy, sector i's output, as inputs to other sectors, should be responsive to n unit increase in final demand assuming that each sector in the economy has equal weight. However, an increase in final demand of n units can be equally distributed on the system of sectors according to their importance for the sector of final demand, which is equivalent to an increase of $\frac{ny_j}{\sum_{j=1}^{n} y_j}$ where y_j represents each sector's total final demand and the denominator is the economy's total final demand. In this case the above ratio can be expanded as:

$$n\left(\frac{y_1}{\sum_{j=1}^{n} y_j} + \frac{y_2}{\sum_{j=1}^{n} y_j} + \cdots + \frac{y_n}{\sum_{j=1}^{n} y_j}\right) = n\left(\frac{\sum_{j=1}^{n} y_j}{\sum_{j=1}^{n} y_j}\right) = n$$

Therefore, by applying the weights, there is no alteration in the magnitude of change in final demand, rather the change in demand of sector j is reflective of its importance to the sector of final demand. Furthermore, the weighted linkages are normalised to $\frac{\sum_{i=1}^{n} U_{i.}^{w}}{n} = 1$ and $\frac{\sum_{j=1}^{n} U_{.j}^{w}}{n} = 1$ (where $U_{i.}^{w}$ is the weighted forward linkage index, and $U_{.j}^{w}$ is the weighted backward linkage index, i and j from 1 to n).

Resolving the issue with identification of key sectors - Rasmussen (1956) and Hirschman (1958) as the pioneer architects of the *key sectors* suggested that economic development and structural change mostly happen in only a relatively small number of sectors with above average linkage effects. These sectors then accelerate and amplify initially small changes, thus creating ripple effects for the whole economy. Therefore these sectors play an important role in economic development. According to Hirschman, a sector's weighted backward and forward linkages reflect its level of involvement in an economy and hence it can be considered as a good indicator of investment. For this purpose Hirschman applied a system of weights based on the *vector of ratios of inputs demand to total input supply* at minimum level of sectoral capacity (see Section 5.2.3, alternative approaches for assigning weights).

Hirschman-Rasmussen formulation of linkage indices were subsequently modified mainly in regards to the approaches for weighting by Bharadwaj (1966), Clements & Rossi (1991), Cuello (1992), Hazari (1970), Laumas (1976), Lenzen (2003), Rao & Harmston (1979), Schultz (1977) - to better serve the purpose of policy-makers and planners. The reason for such improvement is that identification of key sectors are directly linked with the principal objective of the policy-makers, which accordingly a suitable vector of weight need to be deployed. For example, policy objective may require to identify key sectors capable of generating new employment, new income, or export generation and import minimisation capacities to name a few.

Sectoral importance and dispersive behaviour of change in unit price - conceptually the degree of importance of a sector in the economy and the change in unit price of its products are interrelated which might lead to product substitution. In terms of dispersion and absorption of change in unit price of sectoral products, depending on the importance of a sector in the economy, the impacts may be dispersed in the economy and reflected either in form of reduced economic activities and prices rises elsewhere in economy, or being absorbed much readily. For example, in case of crude oil sector, the change in unit price of crude oil historically reflected in reduced economic activities and price rises elsewhere in the economy. However, in case of electricity sector, for example recent changes in unit price of electricity, are dispersed and absorbed by other sectors much readily through linkages impacting the final users to certain degree. Therefore, there is a need for a suitable method of assigning weights to the sectors to identify their relative importance in the economy in order to be strategically responsive to change in unit prices.

5.2.3 Alternative Approaches for Assigning Weights

The literature shows various methods of assigning weights to sectors of economy. It is assumed that the more important sectors in the economy potentially respond faster to changes in final demand because of their access to more recent production technologies. For example, Lenzen (2003) refers to the real-world production responses to changes in final demand being different to those predicted from input-output tables. Therefore, the choice of an appropriate system of weights is important; according to Wood (2009) and Lenzen (2003) ensure that the linkages indices describe the effects of percentage changes in final demand rather than a dollar changes for more informed policy purposes. The linkages indices, both weighted and unweighted ($U_{.j}^{w}, U_{.j}, U_{i.}^{w}, U_{i.}$) are normalized by grand average sum of backward linkages, and grand average sum of forward linkages in the economy $\left(\frac{\sum U_{.j}^{w}}{n}, \frac{\sum U_{j.}}{n}, \frac{\sum U_{i.}^{w}}{n}, \frac{\sum U_{i.}}{n}\right)$ for comparability purposes. In other words, the sum of all backward linkages and the sum of all forward linkages are equal to n, and the average linkage is equal to one.

Common approaches for assigning weights are discussed below.

Vector of Sectoral Share of Total Final Demand - Rasmussen (1956) pioneered assigning weights for linkages analysis in recognition of importance of each sector in the economy where he suggested assigning weights based on the *sectoral share of total final demand* ($w_{i.} = \frac{f_j}{\sum_{i=1}^{n} f_j}$ where $f_j = (f_i)^T$ and f_i = sector i's total final demand), and applied it directly to each downstream production sector's total requirements coefficients. He pointed out that "*it is not necessary to apply the same system of weights for the two different set of indices* (*backward and forward linkages*)". His work perhaps dismiss the criticisms by a number of researchers like Bharadwaj (1966), Hazari (1970), McGilvray (1977) and Cuello (1992) that Rasmussen indices did not take into account the importance of each sector's final demand. The current weighted formulation of backward and forward linkages, and their reformulation which is suggested by this research, are covered in section 5.3. The unweighted formulation was covered in Chapter 4.

The assignment of weights based on the share of final demand is adopted by many researchers, for example, Temurshoev & Oosterhaven (2014), Wood (2009), Kula (2008), Claus & Li (2003), Lenzen (2003); Cochrane (1990), Laumas & Soper (1979), and Hazari (1970).

However, if the Rasmussen's weighted formulation of forward linkages is closely examined in reference to the Leontief's underlying equation $x = (\boldsymbol{I} - \boldsymbol{A})^{-1}\boldsymbol{y}$, one can derive that the weighted forward linkages is equal to $\frac{x_i}{y}$, which is the *sectoral share of output in total final* *demand.* For example, see Jones (1976). This outcome placed the usefulness of the Sectoral Share of Final Demand as a policy-useful system of weights under question. This research has identified that the above mentioned criticism is related to the flaws in theoretical formulation of the weighted system. Therefore, a reformulated approach is suggested to overcome this issue (see section 5.3).

Vector of sectoral share of input demand to total input supply - Hirschman (1958) assigned weights based on the *vector of ratios of input demand to total input supply* at minimum level of sectoral operating capacity to measure linkages. Hirschman justified the choice of the weights as a 'vector of probabilities' for the realisation of the induced investment because the weights represent each sector's level of involvement in an economy. Therefore, he suggested that the weighted linkages would suitably serve as indicator of investment.

Because the minimum level of operating capacity varies from sector to sector, and could be subjective too, McGilvray (1977) objected to Hirschman's weighting system which did not provide a common comparison platform. Also, McGilvray objected that even by weighting the linkage indices, yet there is no indication on how the investment opportunities are generated or how the induced investment may take place. This criticism applies to almost all economic measurements related to sectoral interconnectedness. For example, see Hewings et al. (1987) or Szyrmer (1985a, 1985b). Also, McGilvary's latter criticism appears unjustified because weighted indices, at the best, are "informers" of one dimension of a sector's relative involvement in an economy, while the answer to the "how" need to be complemented by an array of other economic and policy indicators to assist with development of economic strategies conducive to generation of investment opportunities. For example, major indicators could include: employment, income, and value added indicators; indices of variability of Leontief and Ghosh inverse coefficients contributing to the input demand and input supply; identification of the Most Important Coefficients (MIC) contributing to the weighted linkages measures; elasticities of sectoral supply response and elasticity of the final demand-value added response in relation to a unitary change in final demand; and the number of other sectors with which a sector is linked in the economy. These indicators, are discussed in Chapter 4.

Vector of sectoral share of value added - since the recognition of some elements of the Ghosh model by Miller & Blair (2009) and Lahr & Dietzenbacher (2001) for measuring forward linkages (Chapter 4) a new method of assigning weights based on the *sectoral share of total value added* was introduced. This method was adopted and implemented by many researchers, for example, Kelly et al. (2015); Temurshoev & Oosterhaven (2014); Dietzenbacher & Lahr (2001); Kula (2008), Lenzen (2003), Soofi (1992), and Schultz (1977).

Choice of sectoral share of value added is relevant to policy objectives that are linked to income, employment, export, and import performance of an economy. Moreover, when input-output coefficients are weighted by this approach, the coefficients reflect the social and technological impacts, which otherwise it would be just technology-based.

Vector of sectoral share of total output - this approach was used by Shultz (1977), Clements & Rossi (1991), Jones (1976), Rao & Harmston (1979), Cuello (1992). Also, Cuello (1992), in an attempt to improve identification of key sectors in Washington State's economy (USA), applied sectoral share of total outputs to Leontief inverse coefficients, which produced satisfactory results. However, the output-based weights assignment approach is not useful for policy analysis because outputs are driven by final demand unless the deliberate objective of the policy-maker is to increase production in the economy for socio-economic considerations as further discussed in section 5.2.4, selection of a system of weights. Lenzen (2003) discussed the disadvantage of output-weight approach on the ground that: "*linkages did not have intuitive meanings*"; the unweighted and weighted forward linkage indices results for an Australian case were not significantly different; and the linkages-weights correlation under the output and final demand methods of assigning weights were insignificant. The Lenzen's criticism is valid because this is the final demand that dictates how much output need to be produced in an economy.

To evaluate the output-based weight assignment method under the combined Leontief-Ghosh and Leontief only models, this research reformulated the Cuello's method from fully Leontief based to a combined Leontief-Ghosh model. The results of the new model revealed that the linkages of the key sectors of the Australian economy under unweighted and weighted approaches were close together and significant. Also, there were significant positive relationships between the weighted linkages and the assigned weights (sectoral share of total outputs, and share of total final demand).

This outcome is different to the Lenzen's (2003) results under Leontief model. According to Lenzen, by using Australian data, backward and forward linkages were not different for sectors under study concluding that industries with a large total output had also demonstrated above-average intermediate output. Furthermore, when a system of weights based on final demand was used, that linkages correlation was no longer significant. These findings led to rejecting the suitability of output-based system of weights. These results informs the impacts of the modelling approach and the method of assigning weights on linkages results. Therefore, by exploring different methods to answer a policy questions, policy-makers can make more informed decisions. Behaviour of backward and forward linkages under combined Leontief-Ghosh and Leontief models are further discussed in Appendix V.

Other approaches for assigning weights - besides the abovementioned approaches, there are other methods that assist with the policy question in hand. For example, Hazari (1970) suggested that if the objective is to maximize short-term rate of growth, one could develop *capital based weights assignment approach* to analyse matrices $\boldsymbol{C}\,(\boldsymbol{I}-\boldsymbol{A})^{-1}$ where $\boldsymbol{C}$ is the capital coefficient matrix, and $(\boldsymbol{I}-\boldsymbol{A})^{-1}$ is the Leontief inverse matrix. There are other policy-specific systems of weights. Sevaldson (1965), Zamanian (1984) applied *households consumptions* (also referred to as *consumer goods deliveries*), *investments*, *sector employment share*, *sector export share*, or *sector import share* as other possible approaches to assign weights to inverse coefficients.

5.2.4 Selection of a System of Weights

The choice of the system of weights is closely related to the reason for its development, which is mainly policy-dependent. For example, if the job creation is the main objective, then a system of weights based on a sector's employment share could be developed, or if the objective is to increase exports then a system of weights based on sector's export share would be a suitable choice.

Also, the choice of systems of weights depends on the economic status of a country. For example in a less developed countries, the government may decide to introduce rapid economic structural change. In this circumstance, a system of weights which facilitate change need to be developed and used for linkages analysis. In contrast, in developed countries such as Australia, the objective might be to progress the economy according to the predicted rate of growth, or as the economic situation demands. For example, a system of weights based on sectoral share of final demand is appropriate when it is driven by policy objectives such as increasing exports to stimulate production activities in other sectors, and to expand foreign trade. With reference to stable economies, mostly developed economies, it is important that change in final demand is carefully investigated in order not to disturb the national economy. For example, Rao & Harmston (1979) pointed out that a system of weights based on final demand (i.e. final demand-weighted linkage indices) causes volatile changes in the pattern of final demand (for example leading to larger than expected change in inter-industry demand) which would destabilize production linkages leading to short falls in resources intended for expansion.

As discussed earlier, the output-based system of weights intuitively appears not be useful for policy analysis because outputs are driven by final demand. Nevertheless, it could be argued that because total output includes both final demand and the inter-industry demand, yet it is useful.

Output-weights may intentionally be a policy objective of policy makers. For example: to deliberately increase total output in a region in order to create more employments in a region; or to expand exports. Or as another example, Rao & Hartmen (1979) recognised the usefulness of the output-weights for cases where accelerating economic growth in a region is desirable without causing significant change to the structure of production.

A review of the literature shows that researchers responded to the usefulness of the system of weights based on total outputs differently. For example, Jones (1976), Rao & Harmston (1979), Cuello (1992) preferred it over a system of weights based on the sectoral share of final demand, while opposite views were expressed by Lenzen (2003). Also, this research which applied output-weights to the Australian input-output data did not find significant differences in identifying key sectors in comparison to other major systems of weights (see Chapter 8).

Therefore, it is concluded that responsiveness of each economy is generally different to a system of weights; and that selecting a suitable system of weights is driven by the policy makers' direction and objectives, nature of the economic problem and circumstances under examination, the actual characteristics of the economy as captured by the IO data, and the quality of the data.

5.3 Proposed System of Weights

This section briefly reviews formulation of weights, methods of applying weights to the input-output tables, and formulations of weighted linkages. The un-weighted formulation of measuring linkages was discussed in Chapter 4.

This research has found three major theoretical flaws with current weighted formulations. To overcome these weaknesses, a reformulated approach for developing a weighted system of weights is proposed to enhance estimation of weighted linkages. These existing flaws are in the development of the weighted inverse matrix violating the underlying principals with which the Leontief inverse matrix is developed; the method of calculating sectoral weights ignoring the relativity measure; and the lack of an in-build sectoral comparability within the formulation of Coefficient of Variation which contributes to the identification of the key sectors in an economy.

This section discusses each of the above items in turn, and after discussing some of pre-requisite processes presents the proposed weighted linkages formulations. Also, common horizontal and vertical directions along which input-output coefficients are weighted and their impacts on weighted formulation processes are discussed. Additionally, the identification of key sectors in conjunction with reformulated system of weights are covered in section 5.4. For comparison purposes, typical outcomes of weighted and unweighted linkages measurements under the existing and proposed system of weights using Australian data are presented in section 5.4, while a comprehensive discussion of quantitative results is covered in Chapter 8.

5.3.1 Sectoral Weights: Existing and Proposed Formulation

Traditional formulation of sectoral weights - traditionally, a typical vector of sectoral weights with elements w_i (e.g. each sector's share of final demand) is formulated by obtaining the ratio of each sector's total final demand to the economy's total final demand. For example, see Wood (2009), Kula (2008), Li & Claus (2003), Lenzen (2003), Andreosso-O'Callaghan et al. (2004), Rao & Hrmston (1979) or Hazari (1970). This method is formulated as following:

$\boldsymbol{w} = (w_1, w_2, w_3, \cdots, w_n)$ where each element is expressed by:

$$w_i = \frac{f_i}{\sum_{i=1}^{n} f_i}, \quad \text{or} \qquad w_j = (w_i)^T = \frac{f_j}{\sum_{j=1}^{n} f_j} \qquad \text{(Eq. 5.1)}$$

The weakness of traditional method of developing weights - This method only focuses on each sector's weight as the *percentage* of economy's total final demand (Eq. 5.1) and misses on the important concept of measuring a sector's weight ***relative*** to other sectors of the economy.

Proposed method of developing weights - because the concept of *relativity* is more meaningful when sectors are weighted based on their importance (size) in the economy, this research has modified the denominator of Eq. 5.1 from the economy's total final demand to the average total final demand representing an average sector in the economy. The reformulation of the weight's element is shown below:

$$w_i = \frac{f_i}{\frac{1}{n}\sum_{i=1}^{n} f_i} = \frac{nf_i}{\sum_{i=1}^{n} f_i}, \quad \text{or} \quad w_j = (w_i)^T = \frac{nf_j}{\sum_{j=1}^{n} f_j} \qquad \text{(Eq. 5.2)}$$

By this approach, the sum of sectoral weights is equal to the number of sectors contributing to non-zero weight:

$\sum_{i=1}^{n} w_i = n$, or $\sum_{j=1}^{n} w_j = n$ where n is the number of sectors. (Eq. 5.3)

Or, the average of all sector's weight is equal to one.

$$avg_{i=1\ to\ n}\,(w_i) = avg_{j=1\ to\ n}\,(w_j) = 1 \qquad \text{(Eq. 5.4)}$$

The exogenous final demand variable f_i could be any other policy relevant variable as discussed in section 5.2.3, other approaches to assigning weights).

A typical results of traditional and the proposed method of calculating sectoral weights and their impacts on linkages indices are discussed in section 5.4, Table 5.5.

5.3.2 Weighting Coefficients: Existing and Proposed Formulation

This section discusses the existing method of weighting input-output coefficients, their applications to estimate weighted linkages, and their shortcomings. Also, the section explores alternative row and column directions along which IO coefficients of a matrix are normally weighted. The dimensional direction which is used by this research is discussed too. Also, this section, presents a reformulated system of weights.

Existing method of weighting IO coefficients - the literature shows that the existing method of applying weight to IO coefficients originated from the work of Rasmussen (1956) who directly multiplied sectoral weights to each element of the Leontief inverse, l_{ij} , to develop the weighted matrix. Accordingly, weighted total backward and forward linkages are estimated as follows.

a) *Weighted Total Backward Linkages* (direct plus indirect linkage effects):

$$BL_{.j}^{w} = \sum_{i=1}^{n} l_{ij}^{w} = \sum_{i=1}^{n} l_{ij}\, w_i \qquad \text{(Eq. 5.5)}$$

where $l_{ij}^{w} = l_{ij}w_i$ and $w_i \in \boldsymbol{w} = \begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix}$ (if the weights of supply sector i are applied)

Or, if the weights of production sector j are applied (see discussion on the dimensional-direction-of-weighting underneath):

$$BL_{.j}^{w} = \sum_{i=1}^{n} l_{ij}\, w_j \qquad \text{(Eq. 5.6)}$$

where $w_j \in \acute{\boldsymbol{w}} = (\boldsymbol{w})^T = (w_1, w_2, \cdots, w_n)$ and l_{ij} is the element of $(\boldsymbol{I} - \boldsymbol{A})^{-1}$.

$BL_{.j}^{w}$ (weighted total backward linkage) of the j^{th} production sector is a measure of total input requirements from all upstream sectors for a unit increase in the final demand of the j^{th} sector's output, given each sector's share in total final demand. As such, it is a measure of impact on the supplier industries of a unit increase in total final demand (Claus & Li 2003). If the Leontief inverse was not weighted, the backward linkage would be an estimate of the total (direct and indirect) increase in the output.

b) *Weighted Total Forward Linkages* (Leontief Model) - the below set of formulas apply:

$$FL_{i.}^{w} = \sum_{j=1}^{n} l_{ij}^{w} = \sum_{j=1}^{n} l_{ij}\, w_j \qquad \text{(Eq. 5.7)}$$

where $w_j \in \boldsymbol{w} = (w_1, w_2, \cdots, w_n)^{\boldsymbol{T}}$ sectoral share of final demand (i.e. the supply sector i distribute its outputs as inputs to each j column production sector based on the size (importance) of each production sector in final demand). l_{ij} is the element of $(\boldsymbol{I} - \boldsymbol{A})^{-1}$.

Eq. 5.6 depends on researchers' choice of weight and the dimensional direction of applying weights to elements of the Leontief inverse matrix as shown in Table 5.1 and Figure 5.1.

In Leontief context, the weighted forward linkages are defined as the total outputs that sector i should supply as inputs to its downstream production sectors (j) in order to produce an additional unit of final demand output, given each sector's share in total final demand (Claus & Li 2003).

c) *Weighted Total Forward Linkages* (Ghosh Model) - the below set of formulas apply:

$$FL_{i.}^{\delta} = \sum_{i=1}^{n} g_{ij}^{w} = \sum_{j=1}^{n} g_{ij}\, \delta_i \text{ , where } \delta_i \in \boldsymbol{\sigma}^{\boldsymbol{T}} = (\delta_1, \delta_2, \cdots, \delta_n)^{\boldsymbol{T}} \qquad \text{(Eq. 5.8)}$$

δ_i is the weight based on each sector's share of value added.

In Ghosh context the weighted forward linkages are defined as the total increases in output of the supply sector i (the row sector) as a result of one unit increase in its value added (Shuja et al. 2008, Bulmer-Thomas 1982).

d) *Weighted Backward Linkage Indices*

For comparison purposes, Rasmussen (1956) suggested to normalise backward linkages by relating them to the national economy's average backward linkages. The result of the normalisation process is known as weighted backward linkage indices as shown by the following equation (see Appendix V for a discussion on national economy's average linkages):

$$U_{.j}^{w} = \frac{BL_{.j}^{w}}{(1/n)\sum_{j=1}^{n} BL_{.j}^{w}} \qquad \text{(Eq. 5.9)}$$

$U_{.j}^{w}$ in *Leontief context* is defined as the measure of average stimulus to other industries according to each sector's share in total final demand, resulting from a unitary increase in the final demand of the sector number j's output. Or, it can be defined as an estimate of increased output of the j^{th} sector that is the result of an increase in the total final demand which is distributed to all sectors according to each sector's share in the total final demand (Claus & Li 2003). The system of weights in here is based on each sector's contribution to the total final demand. However, it can be based on another policy parameter.

e) *Weighted Forward Linkage Indices* (Leontief Model)

$$U_{i.}^{w} = \frac{FL_{i.}^{w}}{(1/n)\sum_{i=1}^{n} FL_{i.}^{w}} \qquad \text{(Eq. 5.10)}$$

$U_{i.}^{w}$ in *Leontief context* is defined as the estimate of the increased output that is to be supplied by a supply sector number i to all other sectors if an increase in the total final demand is distributed among the sectors according to each sector's share in the total final demand (Claus & Li 2003; and Shuja et al. 2008).

f) *Weighted Forward Linkage Indices* (Ghosh Model)

$$U_{i.}^{\delta} = \frac{FL_{i.}^{\delta}}{(1/n)\sum_{i=1}^{n} FL_{i.}^{\delta}} \qquad \text{(Eq. 5.11)}$$

$U_{i.}^{\delta}$ in *Ghosh context* is defined as an estimate of the total (direct and indirect) output increases in downstream j user-sectors implied by output changes in input supplying sector i as a result of unitary change in its value added, given each sector's share in total value added (Claus & Li 2003; Shuja et al. 2008).

Testing the accuracy of normalisation process - the following relationship hold:

$$\frac{\sum_{i=1}^{n} U_{.j}^{w}}{n} = 1 \text{ and } \frac{\sum_{i=1}^{n} U_{i.}^{\delta}}{n} = 1 \qquad \text{(Eq. 5.12)}$$

The traditional system of weights and associated method of weighting IO coefficients are adopted by researchers. For example, see Shuja' et al (2008), Claus & Li (2003), Lenzen (2003), and Cuello (1992). Tables 5.1 and 5.2 summarise choice of weights and formulations applied.

The Weaknesses of Existing Weighting Method

a) The Weakness of Weighted Forward Linkages

The weighted total forward linkage indices, $U_{i.}^{w}$, based on Leontief cumulative coefficients (Eq.

5.10) can be expressed as the ratio of output supplied by a supply sector i to the economy's total output as shown below:

Eq. 5.7 can be written as:

$$FL_{i.}^{w} = \frac{\sum_{j=1}^{n} l_{ij} y_j}{\sum_{i=1}^{n} y_j} \quad \text{(Eq. 5.13)}$$

Using the Leontief main equation $X = (I - A)^{-1}Y$, the numerator of Eq. 5.13 can be written as:

$$X_{i.} = \sum_{j=1}^{n} l_{ij}\, y_j \quad \text{(Eq. 5.14)}$$

By substituting Eq. 14 in Eq. 13:

$$FL_{i.}^{w} = \frac{X_{i.}}{Y} \quad \text{(Eq. 5.15)}$$

Which in turn by substituted in Eq. 5.10 would yield:

$$U_{i.}^{w} = \frac{\frac{X_{i.}}{Y}}{\frac{1}{n}\frac{1}{Y}\sum_{i=1}^{n} X_i} = n\frac{X_{i.}}{X} \quad \text{(Eq. 5.16)}$$

Therefore, equation 5.16 shows that by using Leontief model, it is possible to represent the weighted total forward linkage indices as the ratio of total output supplied by an upstream sector i to the economy's total output. However, as discussed in sections 5.2.3 (vector of sectoral share of total output) the output-based outcome does not make the $U_{i.}^{w}$ indices suitable for policy decisions (unless the policy maker deliberately chooses to increase output for specific purposes which discussed in section 5.2.4). Therefore, it is concluded that the choice of the Ghosh-Leontief model for calculating forward linkages is more appropriate than the Leontief model.

The Theoretical Weaknesses of the Existing Weighting Method - development of the Leontief weighted inverse matrix as described above violates the underlying principle based on which the input-output inverse matrix is developed. The reason is that, the Leontief inverse $(\boldsymbol{I} - \boldsymbol{A})^{-1}$ is derived from direct coefficient matrix ($\boldsymbol{A}$). To develop the Leontief weighted inverse matrix properly, this research proposes a reformulated weighting method. Because the construction of weighted IO tables by the existing and the proposed methods is dependent on the matrix dimensional direction along which coefficients are weighted, first this dependency is discussed below followed by the discussion of the new method.

Matrix dimensional-direction-of-weighting IO coefficients - literature does not adequately cover matrix direction along which coefficients are weighted for constructing the weighted matrix. For example, for measuring the same linkage (e.g. weighted forward linkages), researchers applied weights to the elements of the total requirements matrix either in the horizontal dimension of the matrix or in the vertical dimension as it was evidenced through formulation of weighted backward and forward linkages as summarised in Tables 5.1 and 5.2.

Table 5.1: Backward linkages: direction of applying weights

	Backward Weighted Linkage ($BL^{w}_{.j}$) [3]			
Author	System of Weights	Formulation Example[1]	Direction to apply weights (Matrix Construction)	Justification
Rasmussen (1956), Laumas (1976)	Share of final demand	$BL^{w}_{.j} = \sum_{i=1}^{n} l_{ij}\, w_i$ where[5] $w_i \in \boldsymbol{w} = (w_1, w_2, \cdots, w_n)^{\boldsymbol{T}}$	Horizontally. Multiplied each row (i supplier) sector's weight by all l_{ij} related to that row.	Upstream sectors' inputs to the downstream sector weighted based on each sector's importance in final demand[2].
Hazari (1970)	Share of total final demand	$BL^{w}_{.j} = \sum_{i=1}^{n} l_{ij}\, w_i$ where $w_i \in \boldsymbol{w} = (w_1, w_2, \cdots, w_n)^{\boldsymbol{T}}$ (*Intension of author is unclear. Also, he used* w_j *for* w_i)	Horizontally. Multiplied each row sector's weight to related row's l_{ij}	Author did not justify. Inputs from each upstream sector were weighted based on importance of each upstream sector in final demand.
Rao & Harmston (1979); Dietzenbacher & Van Der Linden (1997),	Share of total output	$BL^{\delta}_{.j} = \delta_j \sum_{i=1}^{n} l_{ij}$ where $\delta_j = \frac{x_j}{X}$ and $j = 1, 2, \cdots n$	Vertically. Each col. (production) sector's weight was equally multiplied by the l_{ij} elements in the related column	Author did not justify. Inputs from each upstream sector were equally weighted according to the importance of downstream sector (inputs user) in final demand.
Cuello (1992)	Share of total output	$BL^{\delta}_{.j} = \sum_{i=1}^{n} l_{ij}\, \delta_i$ where $\delta_i = \frac{x_i}{X}$ and $\delta_i \in \boldsymbol{w} = (\delta_1, \delta_2, \cdots, \delta_n)^{\boldsymbol{T}}$	Horizontally multiplied each row sector's weight by the related row's l_{ij}	Author did not justify. Inputs from each user sector were weighted based on the importance of each supply (row) sector in total output.
	Share of total final demand	$BL^{w}_{.j} = \sum_{i=1}^{n} l_{ij}\, w_i$ where $w_i \in \boldsymbol{w} = (w_1, w_2, \cdots, w_n)^{\boldsymbol{T}}$	Horizontally multiplied each row sector's weight by the related row's l_{ij}	Author did not justify. Inputs from each user sector were weighted based on the importance of each supply (row) sector in final demand.
Khayum (1995), Dietzenbacher & Van Der Linden (1997), Andreosso &Yue (2004), Kula (2008), Kelly (2015)	Share of final demand	$BL^{w}_{j.} = w_j \sum_{i=1}^{n} l_{ij}$ where $w_j \in \boldsymbol{w}^{\boldsymbol{T}} = (w_1, w_2, \cdots, w_n)$	Vertically. Each col. (user) sector's weight was equally applied to all l_{ij} in the related col.	Author did not justify[4]. Inputs from each user sector were weighted based on the importance of each supply sector in final demand.

[1] A formula example is given in this table. Rasmussen has defined various linkages formulation for which weights were applied similarly. b_{ij} is an element of the Leontief total coefficient matrix.

[2] Backward linkage (based on Leontief inverse Matrix) is defined as increase in output of upstream sectors i to cope with a unitary increase in final demand of j^{th} sector (see Chapter 4, Appendix IV, Table IV.5).

[3] Weighted Backward linkage is defined as the input requirements for a unit increase in the final demand of sector j's output given each sector's share in total final demand.

[4] This group of authors opted to use Leontief total matrix for measuring backward weighted linkages where the system of weights is based on the sector's share of total final demand; and use Ghosh total matrix for measuring forward weighted linkages. This research also adopted this method because of plausibility of measurements as discussed by these authors.

[5] $\boldsymbol{w} = (\boldsymbol{w_1}, \boldsymbol{w_2}, \cdots, \boldsymbol{w_n})^{\boldsymbol{T}}$ is the horizontal representation of the vertical vector of sectoral weights $\boldsymbol{w}$.

Table 5.2: Forward linkages: direction of applying weights

	Forward Weighted Linkages ($FL_{i.}^{w}$) [3]			
Author	System of Weights	Formulation Example[1]	Matrix Construction	System of Weights Justification
Rasmussen (1956)	Share of total final demand	$FL_{i.}^{w} = \sum_{j=1}^{n} l_{ij}\, w_j$ where[5] $w_j \in$ $\boldsymbol{w^T} =$ $(w_1, w_2, \cdots, w_n)$	Horizontally. Each row (supply) sector's l_{ij} multiplied by its related col. (user/production) sector's weight.	Distributed increases in final demand of m units over the system of sectors according to their importance for the sector of final demand[2]. Leontief Total Matrix
Hazari (1970)	Share of total final demand	$FL_{i.}^{w} = \sum_{j=1}^{n} l_{ij}\, w_i$ where $w_i \in \boldsymbol{w} =$ $(w_1, w_2, \cdots, w_n)^{\boldsymbol{T}}$ *(intension of author is unclear, as the author interchangeably used w_i for w_j)*	Horizontally. Equally multiplied each row's l_{ij} by the related row sector's weight (i.e. weights of each supply sector i).	Author did not justify. Downstream supplies were weighted equally according to the importance of each row (supply) sector in final demand. Leontief Total Matrix
Rao & Harmston (1979), Dietzenbacher & Linden (1997)	Share of total output	$FL_{i.}^{\delta} = \delta_i \sum_{j=1}^{n} l_{ij}$ where $\delta_i = \frac{x_i}{X}$ and $i = 1, 2, \cdots n$	Horizontally. Each row (supply) sector's weight was equally multiplied by the related row's l_{ij}	Author did not justify. Downstream supplies weighted based on the importance of the supply sector in total output. Leontief Total Matrix
Cuello (1992)	Share of total output	$FL_{i.}^{\delta} = \sum_{j=1}^{n} l_{ij}\, \delta_j$ where $\delta_j = \frac{x_i}{X}$ and $\delta_j \in \boldsymbol{\delta}^T =$ $(\delta_1, \delta_2, \cdots, \delta_n)$	Horizontally. Each row (supply) sector's l_{ij} multiplied by its related col. (production) sector's weight.	Author did not justify. Downstream supplies were weighted according to user sector's importance in total output. Leontief Total Matrix
	Share of total final demand	$FL_{i.}^{w} = \sum_{j=1}^{n} l_{ij}\, w_j$ where $w_j \in \boldsymbol{w} =$ $(w_1, w_2, \cdots, w_n)^{\boldsymbol{T}}$	Horizontally. Each row (supply) sector's l_{ij} multiplied by its related col. (user) sector's weight.	Author did not justify. Downstream supplies were weighted according to user sector's importance in final demand. Leontief Total Matrix
Khayum (1995), Kula (2008), Andresso-O'Callaghan & Yue (2004)	Share of value added (primary inputs)[4]	$FL_{i.}^{\beta} = \sum_{j=1}^{n} g_{ij}\, \beta_i$ where $\beta_i = \frac{v_i}{\sum_{j=1}^{n} v_i}$ and $\beta_i \in \boldsymbol{\beta^T} =$ $(\beta_1, \beta_2, \cdots, \beta_n)^{\boldsymbol{T}}$	Horizontally. Each row's g_{ij} was equally multiplied by the supply row's weight.	Didn't justify. used Ghosh total weighted matrix for measuring weighted forward linkages. Downstream supplies were weighted equally to the importance of each supply sector in Value Added.

[1] A formula example is given in this table. Rasmussen has defined various linkages formulation for which weights were applied similarly. b_{ij} is an element of the Leontief total coefficient matrix.

[2] Forward linkage (based on Leontief inverse Matrix) is defined as increase in output of sector i corresponding to a one unit increase in final demand of *all* sectors (i.e. a total m units. See Chapter 4, Appendix IV, Table IV.6). However, each sector which is affected by the change in its final demand not necessarily requires equal amount of output from sector i as inputs for its production increases (which is the default assumption). By weighting each sector according to its share in final demand its importance to the sector of final demand is estimated. Therefore, each sector according to its importance can access to the increased output of sector i as a result of increases in final demands. Or in other words, sector i can distribute its outputs as inputs to each of demanding sectors based on their importance in producing for final demand.

[3] Weighted Forward linkage is defined as the increase in sector i's output in order to produce an additional unit of final demand given each sector's share in total final demand.

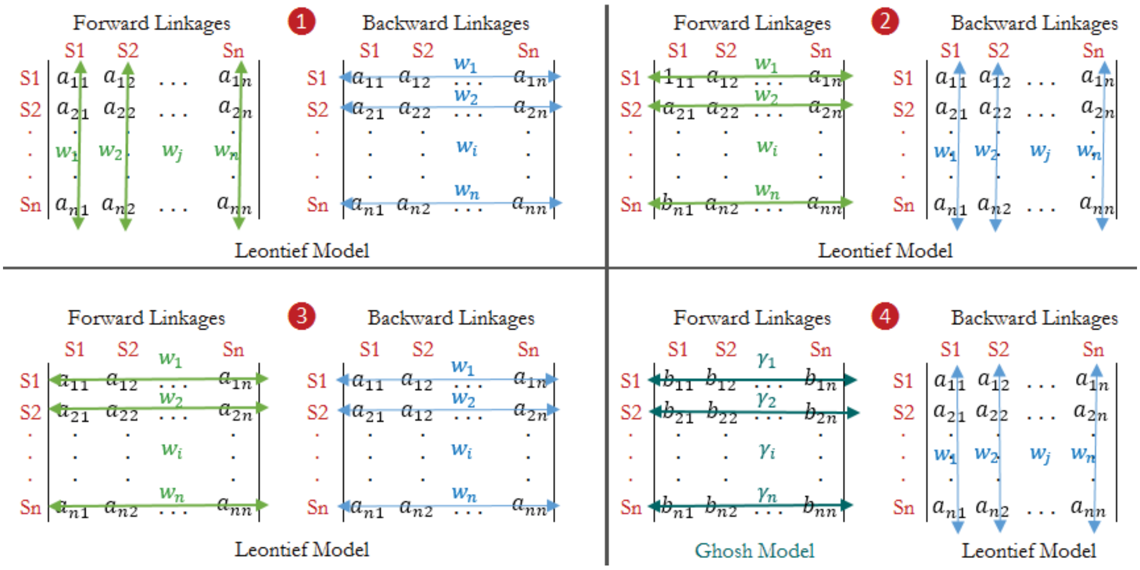
[4] Forward weighted linkage based on the share of total value added is defined as the increase in the output of supply sector i in response to a unitary increase in value added (based on the use of Ghosh total matrix).

[5] $\boldsymbol{w^T} = (w_1, w_2, \cdots, w_n)$ is transpose of vertical vector $\boldsymbol{w}$ (sectoral share of final demand) now as horizontal vector showing the relative weights of each production sector (column sector j) in total final demand.

The choice of directional weighting model would reflect the importance of each sector in weighted linkage indices differently. Therefore, based on these summaries, application of weight by matrix direction means that each IO coefficient associated with forward linkages (i.e. coefficients along each row of the matrix) can be weighted by the weight of the column sector that each represents, or alternatively, just by the weight of the row sector which they represent.

Likewise, in case of backward linkages, IO coefficients related to upstream sectors may be weighted by the input-recipient (downstream) sector's weight, or alternatively each coefficient inthe column can be weighted by the corresponding upstream sector's weight. Authors have mostly applied weights to the Leontief inverse matrix to analyse linkages. However, when plausibility of some aspects of the Ghosh model was recognised for measuring forward linkages (Miller and Lahr, 2000) authors such as Khayum (1995), Dietzenbacher & Van Der Linden (1997), Andresso-O'Callaghan & Yue (2004), Kula (2008), Kelly et al. (2015) used combination of Leontief and Ghosh models for measuring the linkages (see Appendix V, section V.1 and V.2). Therefore, weighted Ghosh inverse matrix was also constructed for analysing forward linkages. Figure 5.1 gives schematic dimensional directions through which backward IO coefficients are weighted for constructing the weighted matrices.

Figure 5.1: Alternative dimensional-direction-of-weighting IO coefficients



Source: This author, based on synthesizing the existing methods of weighting IO coefficients.

Justification of chosen directional weighting model - Authors either provided very little or no justification on the dimensional-direction-to-weight IO coefficients of the matrices. This research has applied the directional weighting model number four (Figure 5.1) because: first, the model used in this research is a combined Leontief-Ghosh model; and second the importance of each production sector in the final demand is reflected on backward linkages, and the importance of each supply sector in value added on forward linkages. The reason for identifying the importance of production sectors in final demand is based on the definition of weighted backward linkages, which is the input requirements for a unit increase in the final demand for sector j's (column sector) output given each production sector's share in total final demand. Therefore, the impacts on supplier sectors are measured because of a unitary increase in final demand. Additionally, if the product of a given production sector is important to the sectors of final demand, then naturally more demand is expected for its final uses, which in turn impacts upstream supplier sectors in terms of producing more outputs as inputs to satisfy the additional demand. In this case, the upstream inputs are distributed to each production sector based on its importance in the system of sectors. Therefore, the issue of extreme input values in cases where a few less important production sectors (small size sectors) heavily draw on their input-provider sectors is taken care of through the sectoral weighting process (section 5.2.2). Similarly, it is justified in case of forward linkages where the importance of each supply sector in value added is considered.

Proposed Reformulated System of Weights (RSOW)

a) Construction of Weighted Matrices - to be principally consistent with the development of input-output inverse matrices, the proposed method first develops the weighted direct coefficients matrices, $\boldsymbol{A}^{w}$ and $\boldsymbol{B}^{\delta}$, based on which the weighted $(\boldsymbol{I}-\boldsymbol{A}^{w})^{-1}$ and $\left(\boldsymbol{I}-\boldsymbol{B}^{\delta}\right)^{-1}$ matrices whose elements $\tilde{l}_{ij}^{w}$ and $\tilde{g}_{ij}^{\delta}$ are algebraically weighted are constructed.

By scalar weighting of the direct coefficients of the $\boldsymbol{A}^{w}$ and $\boldsymbol{B}^{\delta}$ the importance of each sector is reflected in corresponding IO coefficients. Normalising the elements of $\boldsymbol{A}^{w}$ and $\boldsymbol{B}^{\delta}$ by the corresponding column sum of the un-weighted inter-industry matrix would result the values of coefficients prior to being weighted. As such, the intended sectoral production recipe has remained unaffected while their importance in the economy is identified.

Let $\boldsymbol{A}=\begin{bmatrix} a_{11} & a_{12} & \cdots & a_{1n} \\ a_{21} & a_{22} & \cdots & a_{2n} \\ \vdots & & \ddots & \vdots \\ a_{n1} & a_{n2} & \cdots & a_{nn} \end{bmatrix}$ where $\boldsymbol{A}$ is a nxn un-weighted Leontief technological coefficients matrix with elements is a_{ij} (i and $j = 1, 2, 3, \cdots, n$).

Let $\boldsymbol{w}=\begin{bmatrix} w_1 \\ w_2 \\ \vdots \\ w_n \end{bmatrix}$ where $\boldsymbol{w}$ is the vector of weight based on each sector's share of total final demand, and w_i elements representing each i sector's (supply) weight.

Let $\boldsymbol{\acute{w}}=\begin{bmatrix} w_1 & 0 & \cdots & 0 \\ 0 & w_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & w_n \end{bmatrix}$ where $\boldsymbol{\acute{w}}$ is a $n \times n$ diagonal matrix satisfying the conditions

$$\begin{Bmatrix} i \neq j \rightarrow w_{ij} = 0 \\ i = j \rightarrow w_j = w_i \end{Bmatrix}$$

To construct $\boldsymbol{A}^{w}$ the following relationship applies:

$$\boldsymbol{A}^w = \boldsymbol{A}\acute{\boldsymbol{w}} = \begin{bmatrix} a_{11}w_1 & a_{12}w_2 & \cdots & a_{1n}w_n \\ a_{21}w_1 & a_{22}w_2 & \cdots & a_{2n}w_n \\ \vdots & \vdots & \ddots & \vdots \\ a_{n1}w_1 & a_{n2}w_2 & \cdots & a_{nn}w_n \end{bmatrix} \quad \text{(Eq. 5.17)}$$

based on $\boldsymbol{A}^w$ the weighted $(\boldsymbol{I} - \boldsymbol{A}^w)^{-1}$ with elements $\tilde{l}_{ij}^w$ is obtained.

The following formulation applies to the Ghosh model where the vector of system of weights, $\boldsymbol{\sigma}$, is based on sectoral share of total value added.

$$\boldsymbol{B}^\delta = \acute{\boldsymbol{\delta}}\boldsymbol{B} = \begin{bmatrix} b_{11}\delta_1 & b_{12}\delta_1 & \cdots & b_{1n}\delta_1 \\ b_{21}\delta_2 & b_{22}\delta_2 & \cdots & b_{2n}\delta_2 \\ \vdots & \vdots & \ddots & \vdots \\ b_{n1}\delta_n & b_{n2}\delta_n & \cdots & b_{nn}\delta_n \end{bmatrix} \quad \text{(Eq. 5.18)}$$

Where $\boldsymbol{B}$ is the Ghosh direct output coefficient matrix with b_{ij} elements,

the vector of weights, $\boldsymbol{\sigma} = (\delta_1, \delta_2, \delta_3, \cdots, \delta_n)^T = \begin{bmatrix} \delta_1 \\ \delta_2 \\ \vdots \\ \delta_n \end{bmatrix}$, and

$$\acute{\boldsymbol{\sigma}} = \begin{bmatrix} \delta_1 & 0 & \cdots & 0 \\ 0 & \delta_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & \delta_n \end{bmatrix} \text{ satisfying the conditions: } \begin{Bmatrix} i \neq j \to \delta_{ij} = 0 \\ i = j \to \delta_j = \delta_i \end{Bmatrix}$$

Based on $\boldsymbol{B}^\delta$, the Ghosh total coefficient matrix, $(\boldsymbol{I} - \boldsymbol{B}^\delta)^{-1}$ with elements $\tilde{g}_{ij}^\delta$ is obtained.

b) Weighted Total Backward and Forward Linkages

Reformulated Weighted Total Backward Linkages

The reformulated weighted total backward linkages, $\widehat{BL}_{.j}^w$, with cumulative coefficients $\tilde{l}_{ij}^w$ are estimated by the following formulation:

$$\widehat{BL}_{j.}^w = \sum_{i=1}^{n} \tilde{l}_{ij}^w = \acute{\imath}(\boldsymbol{I} - \boldsymbol{A}^w)^{-1} \quad \text{(Eq. 5.14)}$$

Where $\tilde{l}_{ij}^w$ is the total coefficients of the Leontief weighted total matrix, $(\boldsymbol{I} - \boldsymbol{A}^w)^{-1}$, and $\acute{\imath}$ is a $1 \times n$ summation vector with elements equal to unity.

Reformulated Weighted Total Forward Linkages (Ghosh Model)

$$\widehat{FL}_{i.}^\delta = \sum_{j=1}^{n} \tilde{g}_{ij}^w \text{ , where } \tilde{g}_{ij}^w \text{ is the element of } (\boldsymbol{I} - \boldsymbol{B}^w)^{-1} \quad \text{(Eq. 5.19)}$$

c) Weighted Total Backward and Forward Linkage Indices

Weighted Total Backward Linkage Indices (Leontief Model)

$$\acute{U}_{.j}^w = \frac{\widehat{BL}_{.j}^w}{(1/n)\sum_{j=1}^{n} \widehat{BL}_{.j}^w} \quad \text{(Eq. 5.20)}$$

Weighted Total Forward Linkage Indices (Ghosh Model)

$$\acute{U}_{i.}^{\delta} = \frac{\widehat{FL}_{i.}^{\delta}}{\left(1/n\right)\sum_{j=1}^{n}\widehat{FL}_{i.}^{\delta}} \qquad \text{(Eq. 5.21)}$$

5.3.3 Coefficient of Variation: Existing and Proposed Formulations

Because the linkage indices $U_{.j}$ and $U_{i.}$ are normalised averages, they are subject to extreme values. As such these indices may not fully describe the nature of linkages measurements as discussed in sections 5.2.2. Therefore, Rasmussen (1956) introduced a supplementary index called the Coefficient of Variation (COV), which its unweighted formulation was covered in Chapter 4, Eq. 4.29 and Eq. 4.30.

The purpose of coefficient of variation - as discussed by Rasmussen (1956), Hirschman (1958), Hazari (1970), Boucher (1976), Khayum (1995), and Kelly et al. (2015) – the purpose of COV is to measure the sectoral interdependence by assessing the relative dispersion of the economic inducement (stimuli) across sectors that are linked with other sectors through backward and forward linkage effects. For example, how evenly the effect of increased production in one sector could induce production increases in all of the linked upstream sectors, and likewise in case of supply sectors. Therefore, in this context, it need to be measured more accurately.

In this section, the weighted version of COV is discussed and a reformulated version is presented and its usage is justified.

The un-weighted C-COV is adapted from Kelly et al. (2015) who were investigating vulnerability and interdependency of UK infrastructure. This research has developed the Weighted C-COV which is used in this research and also complemented its unweighted version.

Existing Formulation of the Weighted Coefficient of Variation (COV)

Leontief Model

$$V_{.j}^{w} = \frac{\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(l_{ij}^{w}-\frac{1}{n}BL_{.j}^{w}\right)^{2}}}{\frac{1}{n}BL_{.j}^{w}} = \frac{\sqrt{Var_{j}\left(l_{ij}^{w}\right)}}{\frac{1}{n}BL_{.j}^{w}} \quad j = 1,2,3,\cdots,n \qquad \text{(Eq. 5.22)}$$

$$V_{i.}^{w} = \frac{\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(l_{ij}^{w}-\frac{1}{n}FL_{i.}^{w}\right)^{2}}}{\frac{1}{n}FL_{i.}^{w}} = \frac{\sqrt{Var_{i}\left(l_{ij}^{w}\right)}}{\frac{1}{n}FL_{i.}^{w}} \quad i = 1,2,3,\cdots,n \qquad \text{(Eq. 5.23)}$$

Where $V_{.j}^{w}$ is the backward linkages coefficient of variation index of the j^{th} sector, $V_{i.}^{w}$ is the forward linkages coefficient of variation index of the i^{th} sector, and l_{ij}^{w} is the weighted element of the Leontief inverse matrix.

Ghosh-Leontief Combined Model

$$V_{i.}^{\delta} = \frac{\sqrt{\frac{1}{n-1}\sum_{i=1}^{n}\left(g_{ij}^{\delta}-\frac{1}{n}FL_{i.}^{\delta}\right)^{2}}}{\frac{1}{n}FL_{i.}^{\delta}} = \frac{\sqrt{Var_{i}\left(g_{ij}^{\delta}\right)}}{\frac{1}{n}FL_{i.}^{\delta}} \quad i = 1,2,3,\cdots,n \qquad \text{(Eq. 5.24)}$$

where g_{ij}^{δ} is the element of the weighted Ghosh inverse.

Interpretation of Weighted COV Indices

$V_{.j}^{w}$, the backward linkage weighted COV index shows to what extent the production sector number j (j^{th} $sector$) draws evenly on the system of sectors for the inputs needed for its production. For example in case of relatively large values it may be concluded that thej^{th} sector draws one-sidedly on the system of sectors (i.e. the j^{th} sector buys inputs only from a few sectors). Also, it can be interpreted that the benefits of the stimuli, i.e. expansion of other sectors, provided by the backward linkages would be unevenly shared; or in case of low index values it means that the expenditure in sector j (i.e. purchases from upstream sectors as inputs to production) would stimulate other sectors evenly.

In *Leontief model*, the $V_{i.}^{w}$ forward linkage weighted COV index is interpreted as an index indicating to what extent the system of sectors draw evenly on supply sector i. For example, a sector with relatively large variation index could be selling outputs of large magnitude to only a few sectors. Therefore, it is concluded that downstream user sectors draw one-sidedly on products of the supply sector i, and vice versa for low variation indices.

In *Ghosh model*, the $V_{i.}^{\delta}$ forward linkage weighted COV index shows to what extend the output increases as a result of unitary increase in value added expands (disperses) in other sectors evenly given each sector's share in value added. For example, the large index means that the inducement because of forward linkages in sector i was not evenly utilised by the downstream users given each sector's share in final demand; and vice versa for low index values.

The Proposed Comparable Coefficient of Variation

This research adapts Kelly's (2015) alternative method of un-weighted COV, which in this research is called Comparable Coefficient of Variation (C-COV), and proposes the Weighted Comparable Coefficient of Variation (WC-COV). The complete set of un-weighted and weighted methods then would overcome the shortcomings of the existing COV as discussed earlier. Also, this set would assist with precise identification of key sectors (see 5.3.4) showing to where direct policy and investment decision more effectively.

a) Formulation of Unweighted C-COV

The C-COV provides *a relative measure of sectoral variability* based on which sectors could be compared against each other. The traditional COV index is dependent on two sector-specific variables of average and the standard deviation of cumulative coefficients, l_{ij}, which contribute to the calculation of each sector's linkage indices ($U_{.j}$ and $U_{i.}$). Therefore, it lacks a common platform against which sectors' linkage variations can be compared. As such, the use of COV as a complementary measure of sectoral interconnectedness is deemed inadequate. To overcome this issue, C-COV index is introduced as an improved version of COV where it is defined as the ratio of each sector's standard deviation to all sectors' standard deviation of linkages' comprising cumulative coefficients; and because the denominator remains unchanged throughout the sectoral variability assessment, it provides a stable platform of relative comparison of sectoral variation in the system of sectors. Also, by introduction of C-COV the evaluation of $U_{.j}$, $U_{i.}$ and the C-COV indices, and likewise their weighted version, are streamlined because linkages and associated variations are compared with the national economy's respective values where indices are either above one or below one (Table 5.3). This arrangement is particularly useful when evaluating these parameters for determining key sectors. But, under the existing COV, the requirement is to consider relatively low indices without being further defined.

The un-weighted C-COV formulation for assessing variability of cumulative coefficients related to sectoral backward linkages is as following:

$$\gamma_{.j} = \sqrt{\frac{(n+1)\sum_{i=1}^{n}\left(l_{ij} - \frac{1}{n}\sum_{i=1}^{n} l_{ij}\right)^2}{\sum_{i=1}^{n}\sum_{j=1}^{n}\left(l_{ij} - \frac{1}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n} l_{ij}\right)^2}} \quad i = 1, 2, 3, \cdots, n \qquad \text{(Eq. 5.25)}$$

Also, the unweighted C-COV index for estimating the variability of cumulative coefficients related to each sector's forward linkages under the Ghosh model is obtained by the following relationship:

$$\gamma_{i.} = \sqrt{\frac{(n+1)\sum_{j=1}^{n}\left(g_{ij} - \frac{1}{n}\sum_{j=1}^{n} g_{ij}\right)^2}{\sum_{j=1}^{n}\sum_{i=1}^{n}\left(g_{ij} - \frac{1}{n^2}\sum_{j=1}^{n}\sum_{i=1}^{n} g_{ij}\right)^2}} \quad j = 1, 2, 3, \cdots, n \qquad \text{(Eq. 5.26)}$$

Interpretation of C-COV Indices - When $\gamma_{.j} \geq 1$ it implies that sectoral variance is above average relative to other sectors in the system of sectors. Therefore, it is implied that the sector receives inputs from a few upstream sectors. Therefore the benefits of the stimuli (i.e. expansion of output in other sectors) provided by the backward linkages would be unevenly shared.

From policy perspective, a sector with high C-COV is exposed to a level of investment risk should it be a target for investment for economic development. The reason is that if one or two of the few upstream sectors fail to provide inputs to such a downstream sector, then the sector will not be able to survive using domestic production which could potentially exposes the sector to import markets against the country's import minimization policies.

Similarly, when $\gamma_{i.} \geq 1$, it implies that sectoral variance is above average, and sector i supplied its output as inputs to only to a few downstream sectors. Therefore, all of the downstream sectors could not evenly benefit from output increases as a result of a change in the supply sector i because of its forward linkages with its downstream sectors. Therefore increases in value added did not help economic sectors to expand their production. Table 5.3 summarises interpretation of C-COV indices.

b) Formulation of Weighted Comparable Coefficient of Variation

Derivation of the weighted comparable coefficient of variation (WC-COV) formulation depends on several factors. First, the dimensional-direction-of-weighting IO coefficients influences the development of the weighted matrices (section 5.3.2, and Figure 5.1); and second, adoption of the

Table 5.3: Interpretation of Comparable Coefficient of Variation (C-COV)

$\gamma_{j.}$		$\gamma_{i.}$	
≥ 1	≤ 1	≥ 1	≤ 1
• Variance above average; • Potential investment risk; • A few upstream suppliers; • Uneven spread of stimuli; • Fails as a key sector criteria • Policy warning.	• Even stimuli spread; • Valid criterion (Key Sector analysis) • Safer for Investments	• Variance above average; • Potential investment risk; • A few downstream users; • Uneven sectoral expansion; • Fails as a key sector criteria • Policy warning.	• Even stimuli spread; • Valid criterion (Key Sector analysis) • Safer Investments

Source: This author, based on the proposed C-COV methodology

system of weights influences the derivation of WC-COV formulation. That is, whether the traditional (existing) system of weights, or the proposed reformulated system of weights (RSOW) is adopted (section 5.3.2). This research presents the WC-COV formulations under the two aforementioned factors as described below and summarised in Table 5.4:

1) WC-COV: RSOW and Directional Weighting Model Number Four

The WC-COV formulation which is used in this research is derived based on the proposed reformulated system of weights (RSOW, section 5.3.2 part II) utilising the directional weighting model number four (Figure 5.1). This weighting model first, guides the dimensional direction of applying weights to IO coefficients based on the justification provided in section 5.3.2 in context of this research; second, for comparison purposes guides consistent weighting of cumulative IO coefficients under the traditional (existing) system of weights so that the traditional and reformulated indices results can be compared properly; and third, enables derivation of alternative WC-COV formulations by applying directional weighting models number one, two and three (Figure 5.1).

Availability of alternative WC-COV formulations informs a close relationship between the method of evaluating the importance of each sector in the economy - which is reflected on the directional weighting models - and the principal objective of the policy-makers.

Below equations are weighted version of Eq. 5.25.

$$\gamma_{.j}^{RSOW,w} = \sqrt{\frac{(n+1)\sum_{i=1}^{n}\left(\tilde{l}_{ij}^{w} - \frac{1}{n}\sum_{i=1}^{n}\tilde{l}_{ij}^{w}\right)^2}{\sum_{i=1}^{n}\sum_{j=1}^{n}\left(\tilde{l}_{ij}^{w} - \frac{1}{n^2}\sum_{i=1}^{n}\sum_{j=1}^{n}\tilde{l}_{ij}^{w}\right)^2}} \quad i = 1, 2, 3, \cdots, n \qquad \text{(Eq. 5.27)}$$

Where:

$\gamma_{.j}^{RSOW,w}$ Weighted C-COV indices of backward linkages under reformulated system of weights;

w_j is each j column sector's relative share of total final demand in the context of this research;

$\tilde{l}_{ij}^{w}$ is the weighted element of the Leontief inverse matrix, $(\boldsymbol{I}-\boldsymbol{A}^{w})^{-1}$, where $\boldsymbol{A}^{w}$is the Leontief weighted direct coefficients matrix. The matrix $(\boldsymbol{I}-\boldsymbol{A}^{w})^{-1}$ would automatically inherit the construction characteristics of $\boldsymbol{A}^{w}$. In this case the $\tilde{l}_{ij}^{w}$ elements are algebraically weighted through the reformulation process which subsequently is used in $\gamma_{.j}^{w}$ formula;

n is the number of sectors.

Likewise, the below formulation of $\gamma_{i.}^{RSOW,\delta}$ - the weighted C-COV index of forward linkages under the reformulated system of weights - is the weighted version of Eq. 5.26:

$$\gamma_{i.}^{RSOW,\delta}=\sqrt{\frac{(N+1)\sum_{j=1}^{n}\left(\tilde{g}_{ij}^{w}-\frac{1}{n}\sum_{j=1}^{n}\tilde{g}_{ij}^{w}\right)^{2}}{\sum_{j=1}^{n}\sum_{i=1}^{n}\left(\tilde{g}_{ij}^{w}-\frac{1}{n^{2}}\sum_{j=1}^{n}\sum_{i=1}^{n}\tilde{g}_{ij}^{w}\right)^{2}}}\quad j=1,2,3,\cdots,n \qquad \text{(Eq. 5.28)}$$

Where: δ is relative share of the i^{th} supply sector in total value added;

$\tilde{g}_{ij}^{w}$ is the inverse element of $\left(\boldsymbol{I}-\boldsymbol{B}^{\delta}\right)^{-1}$ weighted Ghosh inverse matrix, where $\boldsymbol{B}^{\delta}$is the Ghosh weighted direct coefficients matrix. The Ghosh weighted inverse matrix $\left(\boldsymbol{I}-\boldsymbol{B}^{\delta}\right)^{-1}$would automatically inherit the construction characteristics of $\boldsymbol{B}^{\delta}$. In this case the $\tilde{g}_{ij}^{w}$ elements are algebraically weighted through the reformulation process and subsequently used in $\gamma_{i.}^{\delta}$ formula;

n is the number of sectors.

2) WC-COV: Existing System of Weights and Directional Weighting Model Number Four

The proposed formulation of WC-COV index of backward linkages is an improved version of the exiting weighted COV (Eq. 5.22) under the directional weighting model no. four. Derivation details are given in Appendix V.

$$\text{C-COV}_{(w,X_{.j}\ ,Model\ 4)}=\gamma_{.j}^{w}=\sqrt{\frac{(n+1)w_{j}^{2}\left[\sum_{i=1}^{n}l_{ij}^{2}-\frac{1}{n}\left(\sum_{i=1}^{n}l_{ij}\right)^{2}\right]}{\left[\sum_{j=1}^{n}w_{j}^{2}\sum_{i=1}^{n}l_{ij}^{2}-\frac{1}{n^{2}}\left(\sum_{j=1}^{n}w_{j}\sum_{i=1}^{n}l_{ij}\right)^{2}\right]}} \qquad \text{(Eq. 5.27)}$$

Where: $\gamma_{.j}^{w}$ is the weighted C-COV index of backward linkages under traditional system of weights, and the directional weighting model no. four;

$w_j \in \boldsymbol{w^T}=(w_1,w_2,\cdots,w_n)$ representing production sector no. j's relative share in final demand in the context of this research;

l_{ij} is the unweighted cumulative coefficients of the Leontief inverse; n is the number of sectors.

Similarly, the below formulation of WC-COV index of forward linkages under *Leontief model* is derived as an improved version of Eq. 5.23:

$$\text{C-COV}_{(w, X_{i.}, Model\ 4)} = \gamma_{\text{i.}}^{w} = \sqrt{\frac{(n+1)\left[\sum_{j=1}^{n} w_j^2 l_{ij}^2 - \frac{1}{n}\left(\sum_{j=1}^{n} w_j l_{ij}\right)^2\right]}{\left[\sum_{i=1}^{n}\sum_{j=1}^{n} w_j^2 l_{ij}^2 - \frac{1}{n^2}\left(\sum_{i-1}^{n}\sum_{j=1}^{n} w_j l_{ij}\right)^2\right]}} \qquad \text{(Eq. 5.28)}$$

Eq. 5.28 assumes that both WC-COV indices of backward and forward linkages are derived under Leontief framework utilising the same sectoral and directional weighting model. In this situation, both backward and forward linkages, and related WC-COV indices, are estimated based on the importance of each sector in total final demand, and the weighting model no. four. These arrangements are useful particularly with respect to forward linkages eliminating the issue of extreme values of sectoral supply under Leontief model as discussed in section 5.2.2. The reason is that the weighed supply sector i distributes its outputs to its downstream production sectors (j column sectors) according to their importance (size) in final demand correcting the issue.

However, the WC-COV index of forward linkages can be derived more appropriately under the *Ghosh framework* where sectoral weighting is based on the share of each supply sector i (row sectors) in total value added. In this case the proposed formulation based on directional weighting model number four is given below. This formulation is an improved version of Eq. 5.24.

$$\text{C-COV}_{(\delta, X_{i.}, Model\ 4)} = \gamma_{\text{i.}}^{\delta} = \sqrt{\frac{(n+1)\delta_i^2\left[\sum_{j=1}^{n} g_{ij}^2 - \frac{1}{n}\left(\sum_{j=1}^{n} g_{ij}\right)^2\right]}{\left[\sum_{i=1}^{n}\delta_i^2\sum_{j=1}^{n} g_{ij}^2 - \frac{1}{n^2}\left(\sum_{i=1}^{n}\delta_i\sum_{j=1}^{n} g_{ij}\right)^2\right]}} \qquad \text{(Eq. 5.29)}$$

g_{ij} is the unweighted cumulative coefficients of the Ghosh inverse;

$\delta_i \in \boldsymbol{\sigma} = (\delta_1, \delta_2, \cdots, \delta)^T$ representing the relative share of supply sector no. i in total value added;

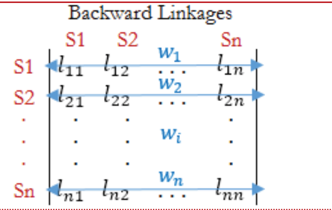
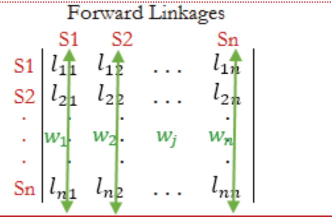
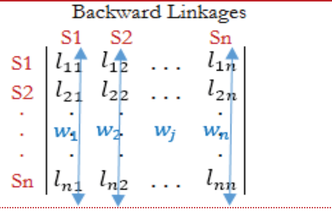
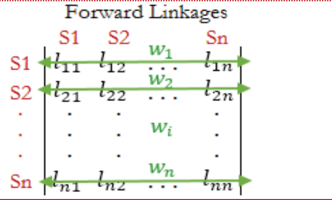
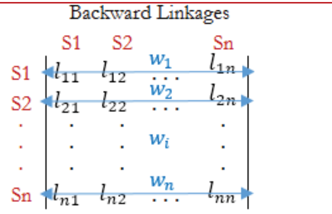
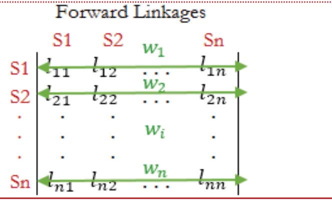
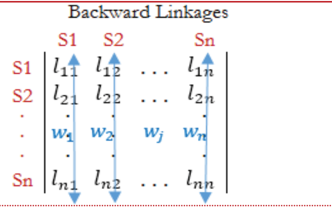
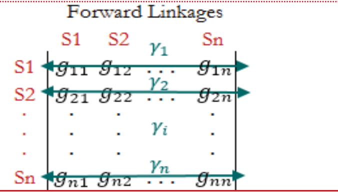
n is the number of sectors.

3) WC-COV: Existing System of Weights and Weighting Direction No. One, Two and Three

Table 5.4 shows WC-COV formulations under eight (four pairs) of directional weighting models including model one to three. The formulations are similar while each adjusted to reflect the direction along which of IO coefficients are weighted. Therefore, these formulations would equally apply to any chosen sectoral weight (e.g. share of total value added, total output, total exports) provided the directional weighting model associated with each formulation is maintained. Also, WC-COV index of forward linkages can be adjusted for l_{ij} or g_{ij} inverse coefficients to suit the choice of input-output framework. The formulations below is related to directional weighting model number one.

$$\gamma_{\text{.j}}^{w} = \sqrt{\frac{(n+1)\left[\sum_{i=1}^{n} w_i^2 l_{ij}^2 - \frac{1}{n}\left(\sum_{j=1}^{n} w_i l_{ij}\right)^2\right]}{\left[\sum_{j=1}^{n}\sum_{i=1}^{n} w_i^2 l_{ij}^2 - \frac{1}{n^2}\left(\sum_{j=1}^{n}\sum_{i=1}^{n} w_i l_{ij}\right)^2\right]}} \qquad \text{(Eq. 5.30)}$$

Table 5.4: WC-COV formulation summary by directional weighting models

Directional Weighting Method		WC-COV Formulation
① Leontief Model		$\gamma_{.j}^{w} = \sqrt{\dfrac{(n+1)\left[\sum_{i=1}^{n} w_i^2 l_{ij}^2 - \frac{1}{n}\left(\sum_{j=1}^{n} w_i l_{ij}\right)^2\right]}{\left[\sum_{j=1}^{n}\sum_{i=1}^{n} w_i^2 l_{ij}^2 - \frac{1}{n^2}\left(\sum_{j=1}^{n}\sum_{i=1}^{n} w_i l_{ij}\right)^2\right]}}$
		$\gamma_{i.}^{w} = \sqrt{\dfrac{(n+1)\left[\sum_{j=1}^{n} w_j^2 l_{ij}^2 - \frac{1}{n}\left(\sum_{j=1}^{n} w_j l_{ij}\right)^2\right]}{\left[\sum_{i=1}^{n}\sum_{j=1}^{n} w_j^2 l_{ij}^2 - \frac{1}{n^2}\left(\sum_{i-1}^{n}\sum_{j=1}^{n} w_j l_{ij}\right)^2\right]}}$
② Leontief		$\gamma_{.j}^{w} = \sqrt{\dfrac{(n+1)w_j^2\left[\sum_{i=1}^{n} l_{ij}^2 - \frac{1}{n}\left(\sum_{i=1}^{n} l_{ij}\right)^2\right]}{\left[\sum_{j=1}^{n} w_j^2 \sum_{i=1}^{n} l_{ij}^2 - \frac{1}{n^2}\left(\sum_{j=1}^{n} w_j \sum_{i=1}^{n} l_{ij}\right)^2\right]}}$
		$\gamma_{i.}^{w} = \sqrt{\dfrac{(n+1)w_i^2\left[\sum_{j=1}^{n} l_{ij}^2 - \frac{1}{n}\left(\sum_{j=1}^{n} l_{ij}\right)^2\right]}{\left[\sum_{i=1}^{n} w_i^2 \sum_{j=1}^{n} l_{ij}^2 - \frac{1}{n^2}\left(\sum_{i=1}^{n} w_i \sum_{j=1}^{n} l_{ij}\right)^2\right]}}$
③ Leontief Model		$\gamma_{.j}^{w} = \sqrt{\dfrac{(n+1)\left[\sum_{i=1}^{n} w_i^2 l_{ij}^2 - \frac{1}{n}\left(\sum_{j=1}^{n} w_i l_{ij}\right)^2\right]}{\left[\sum_{j=1}^{n}\sum_{i=1}^{n} w_i^2 l_{ij}^2 - \frac{1}{n^2}\left(\sum_{j=1}^{n}\sum_{i=1}^{n} w_i l_{ij}\right)^2\right]}}$
		$\gamma_{i.}^{w} = \sqrt{\dfrac{(n+1)w_i^2\left[\sum_{j=1}^{n} l_{ij}^2 - \frac{1}{n}\left(\sum_{j=1}^{n} l_{ij}\right)^2\right]}{\left[\sum_{i=1}^{n} w_i^2 \sum_{j=1}^{n} l_{ij}^2 - \frac{1}{n^2}\left(\sum_{i=1}^{n} w_i \sum_{j=1}^{n} l_{ij}\right)^2\right]}}$
④ Leontief Model		$\gamma_{.j}^{w} = \sqrt{\dfrac{(n+1)w_j^2\left[\sum_{i=1}^{n} l_{ij}^2 - \frac{1}{n}\left(\sum_{i=1}^{n} l_{ij}\right)^2\right]}{\left[\sum_{j=1}^{n} w_j^2 \sum_{i=1}^{n} l_{ij}^2 - \frac{1}{n^2}\left(\sum_{j=1}^{n} w_j \sum_{i=1}^{n} l_{ij}\right)^2\right]}}$
Ghosh		$\gamma_{i.}^{\delta} = \sqrt{\dfrac{(n+1)\delta_i^2\left[\sum_{j=1}^{n} g_{ij}^2 - \frac{1}{n}\left(\sum_{j=1}^{n} g_{ij}\right)^2\right]}{\left[\sum_{i=1}^{n} \delta_i^2 \sum_{j=1}^{n} g_{ij}^2 - \frac{1}{n^2}\left(\sum_{i=1}^{n} \delta_i \sum_{j=1}^{n} g_{ij}\right)^2\right]}}$

Source: Formulas were derived by this author based on the proposed WC-COV methodology.

Where $\gamma_{.j}^{w}$ is the weighted C-COV of backward linkages;

$w \in \boldsymbol{w} = (w_1, w_2, \cdots, w_n)^{\boldsymbol{T}}$ is relative share of each supply sector i in total final demand;

l_{ij} the cumulative coefficients of the Leontief inverse matrix;

Similarly, $\gamma_{i.}^{w}$ of forward linkages (Leontief model) for directional option one is as following:

$$\gamma_{i.}^{w} = \sqrt{\frac{(n+1)\left[\sum_{j=1}^{n} w_j^2 l_{ij}^2 - \frac{1}{n}\left(\sum_{j=1}^{n} w_j l_{ij}\right)^2\right]}{\left[\sum_{i=1}^{n}\sum_{j=1}^{n} w_j^2 l_{ij}^2 - \frac{1}{n^2}\left(\sum_{i-1}^{n}\sum_{j=1}^{n} w_j l_{ij}\right)^2\right]}} \qquad \text{(Eq. 5.31)}$$

$$\gamma_{i.}^{w} = \sqrt{\frac{(n+1)\left[\sum_{j=1}^{n} w_j^2 l_{ij}^2 - \frac{1}{n}\left(\sum_{j=1}^{n} w_j l_{ij}\right)^2\right]}{\left[\sum_{i=1}^{n}\sum_{j=1}^{n} w_j^2 l_{ij}^2 - \frac{1}{n^2}\left(\sum_{i-1}^{n}\sum_{j=1}^{n} w_j l_{ij}\right)^2\right]}} \qquad \text{(Eq. 5.31)}$$

Similarly, $\gamma_{i.}^{w}$ of forward linkages (Leontief model) for directional weighting Model number one is as following:

$$\gamma_{i.}^{w} = \sqrt{\frac{(n+1)\left[\sum_{j=1}^{n} w_j^2 l_{ij}^2 - \frac{1}{n}\left(\sum_{j=1}^{n} w_j l_{ij}\right)^2\right]}{\left[\sum_{i=1}^{n}\sum_{j=1}^{n} w_j^2 l_{ij}^2 - \frac{1}{n^2}\left(\sum_{i-1}^{n}\sum_{j=1}^{n} w_j l_{ij}\right)^2\right]}} \qquad \text{(Eq. 5.31)}$$

Where $w \in \boldsymbol{w}^{T} = (w_1, w_2, \cdots, w_3)$ is each sector's relative share in total final demand;

$X_{i.}$ is i vector of forward linkages with elements Leontief elements l_{ij} , $i = 1, 2, \ldots, n$;

Alternatively, Ghosh model can be used for derivation WC-COV. In this case $\gamma_{i.}^{\delta}$ is the same as Eq. 5.29. Also, see Table 5.4.

Typical results of applying weights using both traditional and the reformulated C-COV methods are shown in Table 5.7 in section 5.4, the results.

5.3.4 Weighted Key Sectors

The existing method of identifying *weighted* Key sectors - the sector need to satisfy three conditions: backward linkage index $\boldsymbol{U_{.j}} \geq \boldsymbol{1}$, forward linkage index $\boldsymbol{U_{i.}} \geq \boldsymbol{1}$, and COV indices of backward and forward linkages less than the relative average value.

The shortcoming of the existing method – there are two shortcomings with the existing method of identifying key sectors. First, the theoretical and empirical issues with the existing COV as discussed in section 5.3.3; second, the existing Leontief open model does consider households when identifying key sectors. For example, see Hewings (1982), Hewings et al (1984) and Cuello (1992). The latter shortcoming is an interesting area of further investigation.

The proposed method to overcome the first shortcoming – this research maintains the previous two conditions of $\boldsymbol{U_{.j}} \geq \boldsymbol{1}$, and $\boldsymbol{U_{i.}} \geq \boldsymbol{1}$ while suggests inclusion of WC-COV < 1 (and C-COV

<1 for unweighted version). The latter inclusion aligns evaluation of the three parameters with respect to above or below average value of one for ease of computation while incorporating further accuracy in identification of weighted key sectors.

The Table 5.8 (in section 5.4), shows weighted key sectors of the Australian economy in 2008-09 for the 19 sectors of interest for this research, using both existing and proposed un-weighted and weighted method of calculating the coefficient of variation.

5.4 Comparison of traditional and proposed methods

A typical results of traditional and the proposed method of calculating sectoral weights and their impacts on linkages indices are shown in Table 5.5.

Table 5.5 – Sectoral weight, existing and reformulated methods, 2008-09

	Weighted Total Linkage Indices (Normalised), 2008-09[5]					
	Un-weighted		Weighted[1]		Weighted[2]	
Sectors	BL	FL	BL[1]	FL[1]	BL[3]	FL[4]
Coal Mining	0.7874	0.5943	1.2252	1.0263	0.9995	0.9929
Crude Oil (incl. condensate)	0.6114	1.2657	1.0827	1.3397	0.9884	0.9991
Gas (incl. Nat Gas, LPG and CSG)	0.6431	0.8848	1.1200	1.0151	0.9892	0.9920
Exploration & Mining Support Services	1.0506	0.9445	0.9256	1.0024	0.9906	0.9916
Other Mining	0.8780	0.8498	1.2749	1.3726	1.0005	1.0018
Petroleum Products Manufacturing	0.8727	1.0997	1.2811	1.0003	0.9929	0.9904
Coal Products Manufacturing	1.0480	1.2492	1.0869	0.8377	0.9878	0.9882
Electricity Generation by Coal	1.3403	1.1086	1.2768	0.9077	0.9927	0.9900
Electricity Generation by Oil Products	1.2606	1.0748	1.0869	0.8374	0.9878	0.9882
Electricity Generation by Natural Gas	1.3576	1.0991	1.1311	0.8429	0.9889	0.9883
Electricity Generation by Hydro	0.9765	1.1461	1.0890	0.8590	0.9879	0.9887
Electricity Generation by Renewables	0.9691	1.0355	1.0902	0.8476	0.9880	0.9884
Electricity Generation by Other Fuel	1.2932	0.9791	1.0920	0.8361	0.9880	0.9881
Electricity Transmission and Distribution	0.7291	0.9791	1.1430	1.0677	0.9899	0.9941
Gas Supply	1.0753	1.2772	1.0801	0.8640	0.9880	0.9888
Water Supply UPSTREAM	0.6249	1.4574	1.0841	0.8360	0.9878	0.9881
Water Supply, Urban	1.7024	0.8533	1.2319	0.8318	0.9922	0.9891
Water Supply, Rural	1.5248	1.2077	1.0888	0.8397	0.9879	0.9882
Water Services (Sewerage & Drainage)	1.1372	0.8533	1.0344	0.8360	0.9896	0.9896

BL = Backward Linkages FL= Forward Linkages

[1] Sectoral weights, reformulated method (relative weights)
[2] Sectoral weights, traditional formulation (ratios)
[3] Weighted BL based on each sector's share of final demand
[4] Weighted FL based on each sector's share of value added
[5] Real Price Term (2013-14=100)

Source: This author's computation based on the model developed in this research.

Table 5.5, above, provides several useful insights. First, by using the traditional method of developing weights, it does not precisely differentiate between the indices values impacting on the identification of key sectors where indices greater than unity are part of the determining criteria (section 5.3.4). However, improved outcomes are achieved by applying reformulated system of weights, RSOW (Eq. 5.20 and Eq. 5.21), and by applying the suggested relative measure of sectoral weights (Eq. 5.2). Second, under the reformulated weighting method, the weighted backward and forward linkage indices, for example, for the Coal Mining are 1.2252 and 1.0263 against the unweighted indices of 0.7874 and 0.5943. The weighted backward index shows the input requirements for a unit increase in final demand of Coal according to the Coal Sector's importance in total final demand. Therefore, the weighted index measures the impacts on supply sectors of a unit increase in final demand. That is, increase in Coal production can induce economic activity in supply sectors, and the supplier of the supply sectors, and so on because the index value is above average. Therefore, the impact on supply sectors are high in terms of inducing economic activities in the economy. Third, when the unweighted value of the backward index is considered, it shows that total direct and indirect inputs which are required from supply sectors to satisfy a unit increase in final demand of Coal is 0.7874 units (below the average) because all sectors are assumed to be equal in the economy. Fourth, the unweighted indices do not qualify the Coal sector to be considered as a potential "key" sector because both backward and forward linkage indices are below average, while in case of the weighted indices, the Sector is qualified as a "key" sector pending assessment of the linkages variation indices. Fifth, when the results of the traditionally weighted linkage indices are evaluated (0.9995 and 0.9929) yet the Sector is not qualified for being considered as a "key" sector. Therefore, these five pieces of information, as the minimum, provide policy-makers with useful information about the role of the Coal sector in the economy when analysed under various method of analysis. Likewise, it would apply to any other sector which could be the focus of the policy. As a result, through a combination of these results more informed policy decisions can be made.

Table 5.6 however shows some improvements in outcomes of the key sector analysis under 'modified traditional system of weights' where the proposed method of assigning weights to each sector (Section 5.3.1 Eq. 5.2) was substituted for the traditional method (Section 5.3.1, Eq. 5.1). For example in the case of Coal (S02) Sector, the traditionally weighted backward and forward linkages were improved from (0.9995 and 0.9929) to (1.2156 and 1.008) which qualify the sector as a "key" sector.

The results of the two methods, as expected, are different. Under the reformulated weighting approach, some of the sectors of interest in this research like Crude Oil, Gas, Petroleum Products Manufacturing, Electricity Generation by Coal, Electricity Generation by Gas, and Electricity Transmission and Distribution are potentially eligible for being considered as key sectors (subject to assessment of coefficient of variation indices, while this is not the case under the traditional weighting approach. Similarly, under the proposed weighting approach the linkage magnitudes of some of the sectors increased, meaning that the sector has stronger linkages in comparison to those estimated from the traditional method. Similar outcomes are consistently observed using the Australian data over the period 1975 to 2015.

Table 5.6: Weighted linkage indices, modified existing and reformulated methods, 2008-09

Sector	Traditional Weighting		Reformulated Weighting	
	BL Indecies[1]	FL Indecies[1]	BL Indices[2]	FL Indices[2]
Coal Mining	1.2156	1.0085	1.2252	1.0263
Crude Oil (incl. condensate)	0.1256	0.8407	1.0827	1.3397
Gas (incl. Nat Gas, LPG and CSG)	0.2106	0.3679	1.1200	1.0151
Exploration and Mining Support Services	0.1969	0.2384	0.9256	1.0024
Other Mining	1.1390	1.2110	1.2749	1.3726
Petroleum Products Manufacturing	0.3342	0.1620	1.2811	1.0003
Coal Products Manufacturing	0.0039	0.0019	1.0869	0.8377
Electricity Generation by Coal	0.3593	0.1423	1.2768	0.9077
Electricity Generation by Oil Products	0.0065	0.0026	1.0869	0.8374
Electricity Generation by Natural Gas	0.0702	0.0136	1.1311	0.8429
Electricity Generation by Hydro	0.0155	0.0457	1.0890	0.8590
Electricity Generation by Renewables	0.0260	0.0227	1.0902	0.8476
Electricity Generation by Other Fuel	0.0148	0.0000	1.0920	0.8361
Electricity Transmission and Distribution	0.2763	0.4538	1.1430	1.0677
Gas Supply	0.0141	0.0466	1.0801	0.8640
Water Supply UPSTREAM	0.0000	0.0000	1.0841	0.8360
Water Supply, Urban	0.1949	0.0865	1.2319	0.8318
Water Supply, Rural	0.0076	0.0053	1.0888	0.8397
Water Services (Sewerage & Drainage)	0.1228	0.1227	1.0344	0.8360

[1] Traditional method: proposed sectoral weights (section 5.3.1, Eq. 5.2) were directly multiplied by l_{ij} elements of Leontief Total Requirements Coefficient Matrix

[2] Reformulated method of applying weights (see section 5.3.1)

Source: Results obtained from the model developed in Chapter 4.

Tables 5.7 and 5.8 compare of existing and proposed variation indices to identify sectors with below average variation indices (i.e COV < Avg Index, and C-COV < 1). The indices results together with linkage indices are used for identifying weighted key linkages (discussed in section 5.3.4).

The results of unweighted variation indices are almost similar. However, more consistent outcomes are produced by the C-COV formulation method. In comparison to weighted COV, the weighted C-COV indices identified more sectors with even input-pull and even output-push. These outcomes are further discussed below.

The weighted C-COV of backward and forward linkages show that all of the 19 sectors in Table 5.7 are evenly pulling inputs, or pushing outputs, in the system of sectors. But, the existing weighted COV indices identify only 4 sectors commonly identified by the weighted C-COV.

Unweighted C-COV and COV indices identify almost similar number of sectors (thirteen and twelve respectively) with even input demand from other sectors, or even output distribution to other sectors. Also, unweighted C-COV and COV commonly identified nine sectors which are

Table 5.7: Comparison of existing and proposed variation indices, 2008-09

		C-COV		COV		WC-COV		W-COV	
		BL	FL	BL	FL	BL	FL	BL	FL
Sect. No.	**Sector Name**	$\gamma_{.j}$	$\gamma_{i.}$	$V_{.j}$	$V_{i.}$	$\gamma_{.j}^{w}$	$\gamma_{i.}^{\delta}$	$V_{.j}^{w}$	$V_{i.}^{\delta}$
01	Coal Mining	●	●			●✓	●✓	●✓	●✓
02	Crude Oil (incl. condensate)	¤			¤	●✓	●✓	●✓	●✓
03	Gas (incl. Nat Gas, LPG and CSG)	●	●			●	●	¤	
04	Exploration and Mining Support Services	●✓	●✓	●✓	●✓	●	●	¤	
05	Other Mining	●	●	¤		●✓	●✓	●✓	●✓
06	Petroleum Products Manufacturing	●	●		¤	●	●	¤	
07	Coal Products Manufacturing	●✓	●✓	●✓	●✓	●	●	¤	
08	Electricity Generation by Coal			●	●	●	●	¤	
09	Electricity Generation by Oil Products	●✓	●✓	●✓	●✓	●	●	¤	
10	Electricity Generation by Natural Gas	●✓	●✓	●✓	●✓	●	●	¤	
11	Electricity Generation by Hydro	●✓	●✓	●✓	●✓	●	●	¤	
12	Electricity Generation by Renewables	●✓	●✓	●✓	●✓	●	●	¤	
13	Electricity Generation by Other Fuel	●✓	●✓	●✓	●✓	●	●	¤	
14	Electricity Transmission and Distribution	¤			¤	●✓	●✓	●✓	●✓
15	Gas Supply	●✓	●✓	●✓	●✓	●	●	¤	
16	Water Supply UPSTREAM				¤	●	●	¤	
17	Water Supply, Urban		¤	●	●	●	●	¤	
18	Water Supply, Rural			●	●	●	●	¤	
19	Water Services (Sewerage & Drainage)	●✓	●✓	●✓	●✓	●	●	¤	

● Both backward and forward variation indices were below average
¤ Either the backward variation index or the forward variation index was below average
●✓ Both C-COV and COV formulations produced similar results for the same sector
blank Variation index was above average, not reported.

Source: Analysis by the author of this research based on IO data released by ABS (2012).

fully characterised by evenly pulling inputs, or pushing outputs from/to other sectors. Overall, the unweighted results of both methods are compatible. Based on Table 5.3 (variation interpretation), the unweighted COV produced below average results for the *Electricity Generation by Coal* in 2008-09 (i.e. evenly drawing on the system of sectors as well as evenly distributing outputs as inputs to other sectors) while interestingly none were reported by the C-COV method. This shows that C-COV is more sensitive and reliable to situations where only a few sectors contribute to the high backward and forward linkage indices $U_{.j}$ and $U_{i.}$. This characteristic reduces the risk of incorrectly identify the key sectors in an economy. In case of the *Electricity Generation by Coal*, beside the high electricity usage for the Sector's own operation the Sector highly depends on upstream sectors Coal, Gas, Finance and Business Services, and Construction Sectors; and in case of distributing its outputs as inputs to downstream user sectors besides high own use and electricity losses the Sector provides high amount of its outputs to the Transmission and Distribution, Whole Sale and Retail Trades, Ferrous and Non-Ferrous Metals, Gas, and Transport

Table 5.8: Australian Key sectors, existing and proposed formulations, 2008-09

	Un-Weighted								Weighted							
Sectors	$U_{.j}$	$U_{i.}$	$\gamma_{.j}$	$\gamma_{i.}$	Key Sec	$V_{.j}$	$V_{i.}$	Key Sec	$\acute{U}^{w}_{.j}$	$\acute{U}^{\delta}_{i.}$	$\gamma^{w}_{.j}$	$\gamma^{\delta}_{i.}$	Key Sec	$V^{w}_{.j}$	$V^{\delta}_{i.}$	Key Sec
Coal Mining	0.787	0.594	●	●					1.225	1.026	●	●	○	●	●	○
Crude Oil (incl. condensate)	0.611	1.266	¤				¤		1.083	1.340	●	●	○	●	●	○
Gas (incl. Nat Gas, LPG and CSG)	0.643	0.885	●	●					1.120	1.015	●	●	○	¤		
Exploration and Mining Support Services	1.051	0.944	●	●		●	●		0.926	1.002	●	●		¤		
Other Mineral Mining	0.878	0.850	●	●		¤			1.275	1.373	●	●	○	●	●	○
Petroleum Products Manufacturing	0.873	1.100	●	●			¤		1.281	1.000	●	●	○	¤		
Coal Products Manufacturing	1.048	1.249				●	●	○	1.087	0.838	●	●		¤		
Electricity Generation by Coal	1.340	1.109	●	●	✓○	●	●	✓○	1.277	0.908	●	●		¤		
Electricity Generation by Oil Products	1.261	1.075	●	●	✓○	●	●	✓○	1.087	0.837	●	●		¤		
Electricity Generation by Natural Gas	1.358	1.099	●	●	✓○	●	●	✓○	1.131	0.843	●	●		¤		
Electricity Generation by Hydro	0.976	1.146	●	●	○	●	●		1.089	0.859	●	●		¤		
Electricity Generation by Renewables	0.969	1.035	●	●	○	●	●		1.090	0.848	●	●		¤		
Electricity Generation by Other Fuel	1.293	0.979	●	●	✓○	●	●	✓○	1.092	0.836	●	●		¤		
Electricity Transmission and Distribution	0.729	0.979	¤				¤		1.143	1.068	●	●	○	●	●	○
Gas Supply	1.075	1.277	●	●	✓○	●	●	✓○	1.080	0.864	●	●		¤		
Upstream Water Supply	0.625	1.457					¤		1.084	0.836	●	●		¤		
Urban Water Supply	1.702	0.853		¤	○✓	●	●	○✓	1.232	0.832	●	●	○	¤		
Rural Water Supply	1.525	1.208				●	●	○	1.089	0.840	●	●		¤		
Water Services (Sewerage & Drainage)	1.137	0.853	●	●	○✓	●	●	○✓	1.034	0.836	●	●	○	¤		

● Both backward and forward variation indices were below average

¤ Either the backward variation index or the forward variation index was below average

✓○ C-COV and COV indices plus linkages indices qualified identification of key sectors

○✓ Manual identification of key sectors noting below average variation index and one of the linkages indices being high

blank Variation index was above average, not reported.

Source: Analysis by this author based on IO data released by ABS (2012).

and Storage Sectors. Therefore, intuitively, it is expected that C-COV results be more reflective of the extreme values as discussed earlier.

While rejecting the above average C-COV and COV indices, it is important not to exclude marginally above average values through mathematically rigid filter of cut-off values. Marginal examination of variation indices are recommended particularly when both linkage indices, $U_{.j}$ and $U_{i.}$, are greater than unity. In this research the above average variation tolerance of +2 to +5% are considered provided both $U_{.j}$ and $U_{i.}$ are greater than unity. This would provide more detailed information on linkages for policy decisions. Furthermore, the average variations cut-off values may be dictated by the policy objectives. For example social parameters like employment; or the infrastructure age requiring renewal may demand to increase cut-off value so that investment can flow into certain sectors to benefit the society. Or in case of limited availability of fund to invest, the cut-off may be lowered to select stronger key sectors.

The reformulated measurements of weighted key sectors revealed eight key sectors out of the 19 sectors of interest in this research. In comparison, by using the existing method only four key sectors, which were in common with the former eight, were identified. The reason for identifying additional four key sector by the reformulated methods is attributed to more accurate indices results ($\acute{U}_{.j}^{w}$ and $\acute{U}_{i.}^{\delta}$ and weighted C-COV) as supported by Tables 5.5 and 5.6 in this chapter.

The un-weighted existing and reformulated methods commonly produced the same number of key sectors, 6 being in common. However, close examination of the *Coal Products Manufacturing* (*S13*) or Rural *Water Supply* (*S31*) as key sectors under un-weighted traditional method, reveals inaccuracies in COV variation indices which led the Sectors being identified as key sectors. For example, in case of S13, the main upstream sectors contributing to the Sector's production are Crude Oil, Petroleum Products Manufacturing, and Machinery and Transport sectors while the remaining upstream sectors either contribute relatively very little or no contribution at all.. Likewise is the case with the Sector's forward linkages, which only three upstream sectors contribute largely. Under such circumstances, COV produced below average variation indices, which in conjunction with above average backward and forward linkage indices led the Sector to be classified as a key sectors. However, under C-COV formulations such conclusion was rejected. Likewise is the case with the *Rural Water Supply* (*S31*).

The literature shows studies, which reported difficulties with identifying key sectors. For example, Cochrane (1990) pointed out that the traditionally calculated coefficients of variation are uniform across sectors affecting correct identification of key sectors, therefore concluded that COV are not reliable. Or Schultz (1979) although recommended use of a system of weights, like each sector's total output share, to improve outcomes, yet reported difficulties identifying key sectors properly. Therefore, the proposed C-COV overcomes this difficulty by producing reliable key sector results.

5.5 Summary and Key Features of the Methods

- Linkages can be estimated by Equally-Weighted System of Weights (ESOW) where all sectors have equal importance; or by Weighted System of Weights (WSOW) which brings out the relative importance of each sector in the economy, by incorporating the information about the size of the sectors and their contribution in the economy into the magnitude of the linkages. In this respect, WSOW overcomes the criticism that equally weighted linkage indices may be overestimated, and alone inadequate measures of the importance of each sector, particularly for identifying critical sectors in the economy.
- The role of ESOW and WSOW are different in the economy. The linkages estimated under ESOW are technological linkages while the WSOW-based linkages are regarded as policy linkages or structural linkages, because they are specifically weighted in accordance to policy objectives of policy-makers, investors, or economic planners.
- The development of weighted inverse matrix under the traditional (existing) WSOW does not conform to the underlying process by which the Leontief and Ghosh inverse matrices are derived impacting the linkages outcomes from the empirical point of view. To overcome these shortcomings, a possible reformulated method is suggested by this research.
- The proposed Reformulated System of Weights (RSOW) drives the weighted inverse matrix from the methodological first principle, a weighted direct coefficient matrix. Also, RSOW is complemented by a proposed Weighted Comparable Coefficient of Variance to compute the variation among weighted cumulative coefficients comprising backward and forward linkages.
- A key feature of WC-COV is its ability to give a relative indicator of variability compared with other sectors, thus overcoming the shortcomings of the traditional COV.
- One of the key features of RSOW is its important role in *key sector* analysis, because the importance of each sector in the economy is reflected in the linkage indices; the issue of extreme linkage indices is resolved through weighting; and the policy significance of identifying key sectors is more reflective of the impact flowing from the stimulation of a key sector on other sectors to facilitate economic growth.
- Weighted linkages and WC-COV enable identification of the key sectors of the economy by seamlessly comparing their magnitudes with the above average values, as opposed to COV which lacks such seamless integration ability. Comparison of the RSOW-based method of identifying key sectors with the traditional method reveals improved outcomes where the key sectors representing the *keyness* more accurately in the economy.
- The real-world production responses to changes in final demand is different to those obtained from input-output tables. Therefore, the choice of an appropriate system of weights; and the method of calculating a sector's weight are important considerations. However, the traditional method of assigning a weight to a sector, which is based on the ratio (percentage) of a sector's contribution to the economy, ignores the important concept of measuring a sector's weight

relative to other sectors of the economy. To correct this shortcoming, a reformulated method is proposed to compare the sectoral contribution with overall average economic activities representing an average sector in the economy. The proposed formulation has significantly improved the empirical outcomes in comparison to the traditional method.

- The choice of a system of weights is mainly policy-driven to facilitate achievement of the policy-makers' policy objectives; and also depends on the responsiveness of each economy to major system of weights. For example, a system of weights based on the relative share of a sector in final demand is appropriate when it is driven by policy objectives such increasing exports to stimulate production activities in other sectors. However, in stable economies the choice of such system need careful investigation so that the change in final demand does not lead to larger than expected change in inter-industry demand destabilising production linkages leading to shortfalls in resources intended for expansion; or the choice of a system of weights based on the relative sectoral share in total output may intuitively sound inappropriate for policy purposes because outputs are essentially driven by final demand. Nevertheless, evidence shows that some economies responded to output-based system of weights in preference to a final-demand-based system, while in other economies there are insignificant differences between alternative systems of weights. On the other hand, policy objectives that are linked to income, employment, exports, and imports performance of an economy are more appropriately handled through system of weights based on relative share of a sector in total value added.
- One of the challenges to appropriately developing weighted inverse matrices is selection of the matrix direction (vertically or horizontally) along which the input-output coefficients are weighted. This choice is driven by the definition of weighted backward and forward linkages determining the importance of upstream and downstream sectors to final demand and value added. The weighted coefficients, ultimately impact on the magnitude of linkage indices as well as the formulation of the Weighted Coefficient of Variance (WC-COV) used to measure variations among these coefficients. To demonstrate the aforementioned impact, four different WC-COV formulations based on the use of Leontief, Ghosh, or their integrated frameworks are provided to guide the estimation process.
- The outcomes obtained through the proposed and traditional system of weights although different, are yet complementary, providing useful insights into the nature of linkages under different formulations. Therefore, they provide opportunities to assess their impacts on policy objectives, through alternative policy scenarios.
- The weighted and equally-weighted estimation of linkages reveal technology and policy dimension of linkages which together with other linkage descriptors as discussed in Chapter 4 assist in exploring the multi-dimensional nature of the linkages for Australia (the main focus of this research).

6 RELATIVE IMPORTANCE OF IO COEFFICIENTS

This Chapter, (together with Chapters 7 and 8), develops different descriptors of sectoral linkages which will provide deeper insights into the nature of infrastructure linkages and ensure that policy and investments decisions are directly aligned with the strength of appropriate linkages.

This Chapter classifies input-output coefficients into four groups, namely, the Most Important Coefficients (MIC) for each production and supply sector, Important Coefficients (I), Less Important Coefficients (LI), and Not Important Coefficients (NI). Additionally, it discusses the sectoral interconnectedness by measuring backward and forward Concentration Indices, and Entropy Indices. The economy-wide sectoral linkages through sectoral contribution to GVA is also covered in this Chapter.

In addition to infrastructure of interest (IOI) introduced in Chapter 4, this Chapter also includes Exploration and Mining Support Services (S04), and Other Mineral Mining (S06) Sectors. In total 19 IOI are grouped into three sectoral categories: electricity generation, transmission and distribution sectors; primary energy resources, mining including coal, exploration and mining support services; and water. Also, linkages of major sectors of the Australian economy are discussed. Overall, details of linkages for 39 sectors considered in this research are provided over the period 1975 to 2015.

This chapter is organised as follows: section 6.1 provides details of the changes in relative contribution of each sector to the total gross value added (GVA) over the period 1975 to 2015 - to describe the linkages as well as to complement discussion in Chapter 2 (the importance of infrastructure in Australia). In section 6.2, the Most Import Coefficients (MIC) for each production and supply sector are discussed. Section 6.3 investigates two measures of inter-industry interconnectedness: number of backward and forward transactions as well as the level of sectoral integration and specialisation in the Australian economy. Section 6.4 presents the key findings of this Chapter.

6.1 Relative Contribution to GVA

This section examines the changes in relative contributions (expressed as percentages) of IOI and the rest of the sectors to the overall GVA.

Figure 6.1 shows that value added shares of IOI sectors in total GVA (in absolute terms) increase over the period of the study. The Gas (incl. Nat Gas, LPG and CSG) Sector (S04) exhibits the highest in total value added of all IOI sectors, while notably the value added of the Other Mineral Mining Sector (S06) starts to overtake from 2006-07. However, the Other Mineral Mining Sector's (S06) share in total GVA declines from its peak of over $AU70b in 2013-14, to about AU$52b in 2014-15 because of a sudden contraction of Chinese domestic construction industry which affected Australian iron ore exports.

The Coal Sector's (S02) value added reaches its peak in 2008-09 (~AU$48b) and then follows a sharp declining pattern, exhibiting its pre-2008 trends in 2014-15 (~AU$18b). This can be explained by the minerals boom which started in 2003 and continued to 2008-09 when GFC affected the global economy. The minerals boom which particularly for the Other Mineral Mining Sector (S06) continued to 2013-14 (relative to the Coal Sector which came to an end in 2008) provided record levels of mineral royalties, specially to the resource rich states of WA and QLD. Additionally, the Federal Government received high levels of minerals and company taxes. Also, Asia continued to experience strong post-GFC economic growth. According to RBA (2010), the boom resulted in flow of higher revenues to the Australia's economy because of its strong mineral sector. Similarly, other resource-IOI continued to make increasingly large contribution to GVA. Historically, the coal and iron ore are proxies for measuring the level of economic activities in the mining sector, for example, see Foster (2017).

Sectors in the next rank are the Electricity Supply T&D (S27), Coal (S02), Crude Oil (S03), Exploration and Mining Services (S05), Urban Water Supply (S30), Water Services (S32), and Rural Water Supply (S31) Sectors. However, these trends are not fully supported when IOI contribution percentages to GVA are indexed to 1975 (1975=100). For example, the contribution of majority of the sectors including the resource, and exploration and mining support services sectors decline (Figure 6.2). In this category, Exploration and Mining Support Services Sector (S05) provides the highest contribution, followed by Crude Oil (S03) and to a lesser extend Other Mineral Mining Sectors (S06). Regarding electricity generation by major fuel types, the sectors - S21 to S26 - follow a declining pattern until 2008 (Figure 6.3). From 2008 to 2013, their contribution gradually increase and then follows a new declining pattern.

Figure 6.1: Value added trends, for IOI: 1975-2015 (absolute terms)

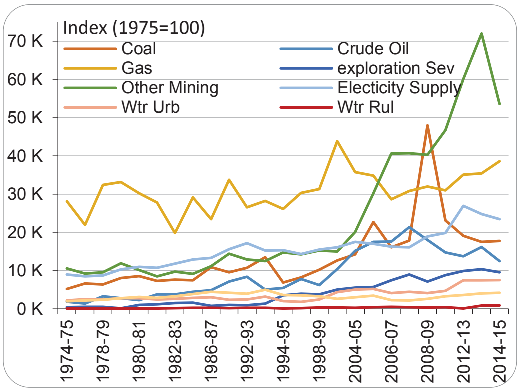
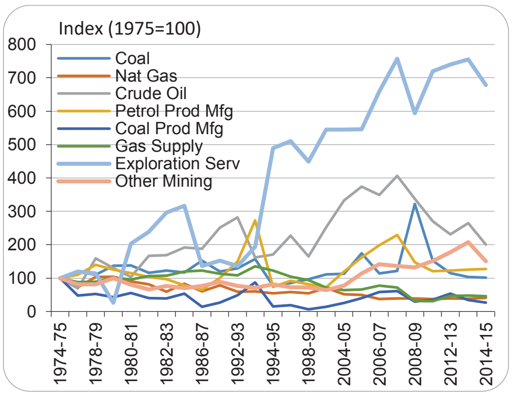


Figure 6.2: Changes in relative contribution to GVA (Resource-IOI), 1975-2015



Source: This author, based on the model developed in Chapter 4.

Figure 6.3: Changes in relative contribution to GVA (electricity), 1975-2015

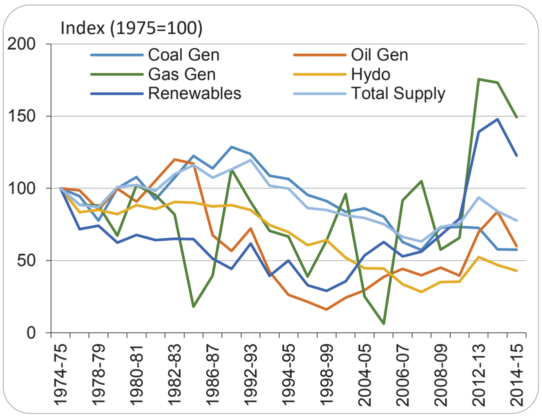


Figure 6.4: Changes in relative contribution to GVA (water), 1975-2015

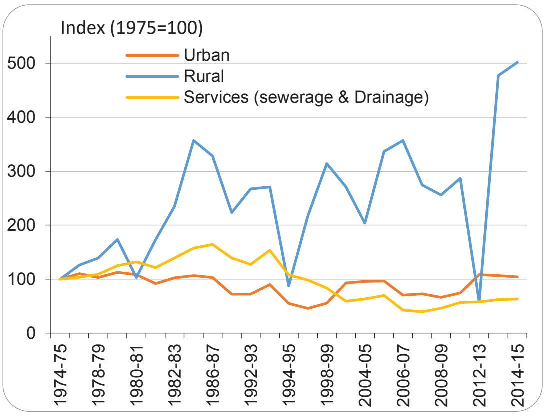


Figure 6.5: Changes in relative contribution to GVA (major sectors), 1975-2015

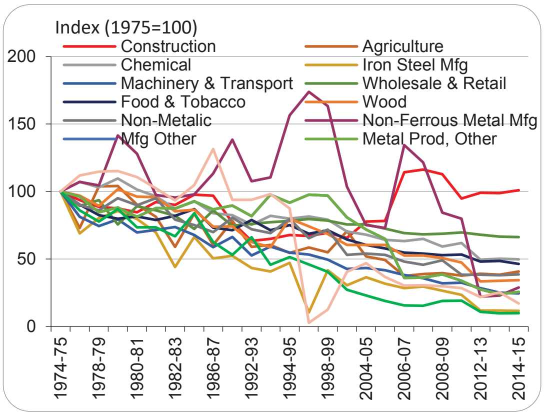
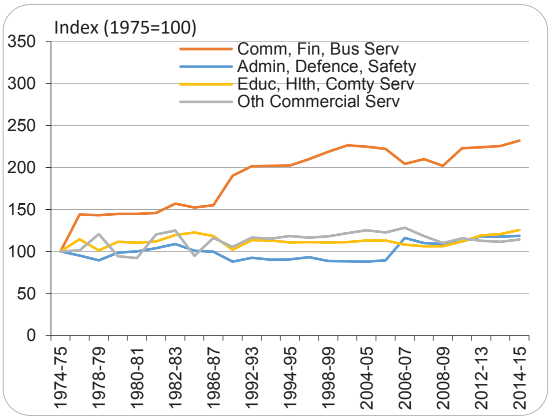


Figure 6.6: Changes in relative contribution to GVA (services sectors), 1975-2015



Source: This author, based on the model developed in Chapter 4.

Possible reason for the post-2008 increases could be Federal Government's extra spending to boost the Australian economy to prevent it from sliding into recession. Notably, the total value added of the Electricity Generation by Other Fuels (S26) compared to other generation types is very low because of its relatively very small sectoral size. Its contribution to GVA has however grown significantly since 2004-05 (Figure 6.8). This result suggest that the sector is potentially capable of contributing to GVA further if its activities are expanded through policies which are aimed at electricity generation by fuels other than primary energy sources.

Figure 6.7: Increasing pattern of competing imports, for IOI, 1975-2015

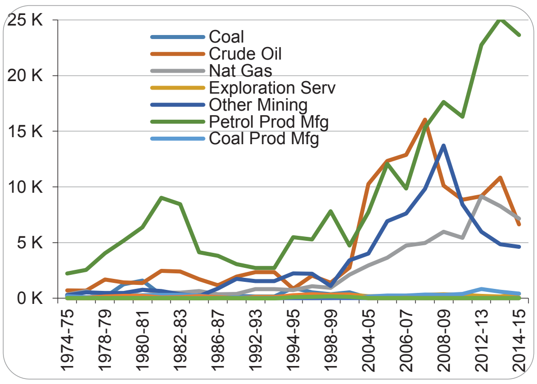
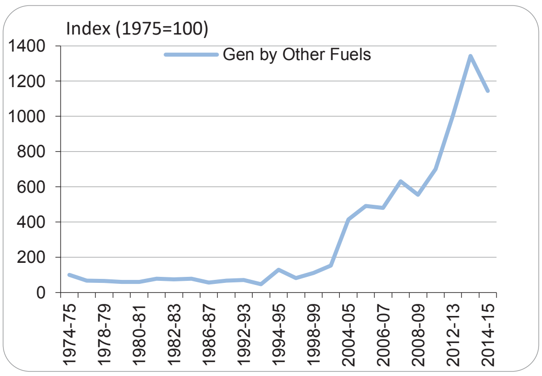


Figure 6.8: Changes in relative contribution to GVA (electricity generation by other fuels), 1975-2015



Source: This author, based on the model developed in Chapter 4.

Regarding water infrastructure, only the Water Services (Sewerage and Drainage) Sector (S32) exhibits an increasing contribution pattern while both Urban Water Supply (S30) and Rural Water Supply (S31) Sectors follow a declining pattern. The increasing pattern of the Water Services Sector (S32) could be attributed to the rapid growth in the Construction Sector (S33) and the emergence of new residential and industrial developments requiring water services. As a result the Sector not only earns fees and charges but also expands its infrastructure, renews old infrastructure which otherwise could incur high maintenance costs.

Figure 6.5 shows declining patterns of contribution to GVA by major sectors of the Australian economy with the exception of the Construction Sector (S33), and the Communication, Finance, Property and Business Services (S36) (Figure 6.6). The GVA share of Basic Non-Ferrous Metal Manufacturing Sector (S17) was on the rise up until 1996-97, but since then the sector's contributions have sharply continued to decline to the lowest relative contributions in 2012-13 irrespective of some increases over the period 2005 to 2008. Possible reasons could be due to: rapid increase in competing imports from AU$878m in 1975 to nearly AU$6b in 2015 reducing demand for domestic production; and the reduced mining activities as discussed earlier has also contributed to further decline in demand. Nevertheless, increase in construction and agricultural activities over the period has assisted the Sector to continue production at historically the lowest over the period 2013-2015 (Figure 6.6).

One of the main reasons for the declining patterns of contributions to GVA is related to the increasing pattern of Competing Imports as shown by Table VI.1 in Appendix VI for all sectors, and for IOI Sectors (Figure 6.7). Another reason, which to a higher extent relates to capital intensive resource infrastructure sectors, can be implementation of labour saving advanced large scale technologies. As discussed in Chapter 3, Australian sectors are at the forefront of implementing advanced technologies in resources and mining infrastructure which not only lowers production costs and improves productivity, but also enables these sectors to compete in the global economy. However, this expectation may not be materialised for some of the other major sectors of the economy. Therefore their declining contributions to GVA may not be associated with labour saving technologies. For example, Petroleum Products Manufacturing Sector (S12) uses almost outdated refining technology which cannot compete with the overseas petroleum refinery sectors which are using superior technologies producing less expensive products (e.g. the Asian markets) DITR (2007). Such situation encourages imports for higher profitability in spite of being seen as a leakage from the Australian economy.

Therefore, to reduce imports for promoting stronger domestic economy, policy may focus at developing the sectors to adopt advanced production technologies so that they could compete in the global economy. Also, initiating regulatory reforms with the view to attract new infrastructure investments would assists with production of domestically produced goods and services.

6.2 Most Important Coefficients (MIC) of Supply and Production Sectors

This section analyses the sensitivity of input-output technical coefficients (a_{ij}) as the fundamental elements of linkage analysis and indeed being primary sectoral linkages. These coefficients are classified into four distinct classes (as discussed in Chapter 4). This section discusses: each coefficients class; the relative importance of the Most Important Coefficients (MIC) in unitary increases in final demand for products of a given sector; the number and stability of MIC in each sector over the period 1975 to 2015; and their impact on policy decisions.

6.2.1 The Purpose of MICs and Sensitivity Analysis in General

Technical coefficients (a_{ij}) provide a sector-based production recipe including the inter-industry raw materials and the required primary factors in order to produce one unit of goods and services. The intermediate coefficients specify amounts of raw materials supplied by both the production sector itself and other sectors of the economy. Therefore, it is necessary to determine the important primary linkages (expressed by a_{ij}) of each sector with input provider and the demand sectors (output recipient sectors) in order to determine the influence of a sector on the production and demand of other sectors. The size of a_{ij} can impact production sectors differently depending on the level of production. For example, Fernandez & Santos (2015) or Forssell (1984) describe that a sector with large production level and small or medium size a_{ij} coefficients could be significantly impacted by the changes in its upstream input provider sectors. On the contrary, a sector with a small level of production and large a_{ij} coefficients might be impacted at a lesser degree because of its smaller production size. Through the sensitivity analysis, one could better understand the significance of the coefficients whether small or large in size. One of the classes is called Most Important Coefficients (MIC). The number (count) of MIC in each sector signifies its influence on production system in terms of backward or forward linkages (Forssell, 1988). Therefore, the purpose of coefficients sensitivity analysis is to determine to which extend a sector can generate significant changes in both production and demand of other sectors.

6.2.2 Interpretation of MICs

A coefficient is important if a variation lower than its magnitude creates a change larger than a pre-specified tolerance level in total production of any sector. The tolerance level is conventionally set at 0.5% or 1% of total production. Based on the computed Coefficient Sensitivity Index (r_{ij}), each coefficient's Class is determined:

Most Important Coefficients (MIC) : $r_{ij} < 0.1$
Important Coefficients (I) : $0.1 \leq r_{ij} < 0.5$
Less Important Coefficients (L) : $0.5 \leq r_{ij} < 1.0$
Not Important Coefficients (NI) : $r_{ij} \geq 1.0$

In case of MICs, any variation to a sector's a_{ij} lower than its magnitude would cause larger than a 1% change in total production of the sector. The tolerance level (1% in this research) can be specified at conventionally practiced level of either 0.5% or 1% depending on the policy or investment intentions. Therefore, a sector is highly linked to its upstream input-provider sectors (in case of Backward MIC), or to its downstream demand sectors (in case of Forward MICs).

Similarly, other classes are interpreted. Also, r_{ij} determines the degree of dependency on other sectors as well as the impact of those sectors on production of the reference sector. The lower the r_{ij} the more important the a_{ij} will be. r_{ij} is the tolerance limit of change in a_{ij} coefficient so that output in any related sector varies by 1% at the most, while final demand remains fixed (Jilek 1971; Schintke & Staglin 1988). Whenever a technical coefficient a_{ij} changes by more than r_{ij}, then output in a related sector will change by more than 1%. According to Reyes (1996) the evolution of Important Coefficient has effects on the output growth; and conventionally Important Coefficients are those whose r_{ij} value is not greater than 20% ($r \leq 0.2$).

6.2.3 Number of MICs and Impact on Sectoral Linkages

This section provides a summary of computed number of MICs for both IOI and other sectors of the Australian economy, and discusses their impacts on inter-sectoral linkages. The number of MICs are obtained based on the estimated values of Coefficient Sensitivity Index (r_{ij}) for this Class as discussed in previous section. As discussed in Chapter 4, this research implements the Sekulic (1968) and Jilek (1971) tolerance limit coefficient sensitivity analysis framework to classify sectoral coefficients in each input-output reference year. The result of this analysis, which in turn signifies the inter-sectoral linkages, describe the influencing power of a sector to generate significant changes in both production and demand of other sectors. In this context, MICs are associated with highly influential sectors. Table 6.1 presents estimates of number of MICs, in five-yearly intervals, over the period of study (for yearly estimates see Appendix VI, Table VI.2).

The ranked average total of all the sectors of the Australian economy are demonstrated in Table 6.1, with the infrastructure of interest (IOI) highlighted. This Table shows that 12 out of 19 IOI sectors had consistently the highest number of MICs over the study period. The total number of MICs for each of these sectors is largely dominated by the share of Forward MIC (FL-MIC, also referred to as ROW-MIC) numbers. The FL-MIC number is the count of the most significant demand-sectors for each IOI reference sector. Likewise, the BL-MIC (BL-MIC, also referred to as Column-MIC, Col-MIC) is the count of the most significant upstream input-provider sectors for each of the IOI reference-sector.

In 2014-15, Table 6.1 shows that among the IOI sectors, Electricity Transmission and Distribution Sector (S27) is the only sector with the highest number of BL-MIC (7) identifying the most significant backward linkages to its upstream input-provider sectors.

Table 6.1: Five-yearly sectoral pattern of the number of MICs, 1975-2015

		1974-75			1979-80			1986-87			1992-93			1998-99			2004-05			2008-09			2014-15			Avg (1975-2015)			
Sec Code	Sector Name	Col. (BL)	Row (FL)	Tot.	Col. (BL)	Row (FL)	Tot.	Col. (BL)	Row (FL)	Tot.	Col. (BL)	Row (FL)	Tot.	Col. (BL)	Row (FL)	Tot.	Col. (BL)	Row (FL)	Tot.	Col. (BL)	Row (FL)	Tot.	Col. (BL)	Row (FL)	Tot.	Col. (BL)	Row (FL)	Avg Tot	Rank (Tot)
S22	**Elec. Gen. Oil**	0	19	19	0	19	19	1	22	23	1	19	20	0	22	22	1	23	24	1	21	22	1	19	20	0	20	21	1
S23	**Elec. Gen. Nat. Gas**	2	22	24	2	21	23	3	17	20	2	16	18	1	18	19	2	15	17	2	17	19	2	16	18	2	17	19	2
S24	**Elec. Gen. Hydro**	1	18	19	1	19	20	1	16	17	1	15	16	1	18	19	1	17	18	1	18	19	2	15	17	1	17	18	3
S13	**Coal Prod. Mfg**	0	14	14	0	16	16	0	18	18	0	18	18	0	20	20	0	18	18	0	17	17	0	17	17	0	17	17	4
S25	**Elec. Gen. Renew.**	0	11	11	0	17	17	0	17	17	1	16	17	0	6	6	1	17	18	1	16	17	2	15	17	1	15	16	5
S31	**Rurl Water**	0	11	11	0	18	18	0	17	17	1	16	17	1	15	16	0	19	19	0	14	14	1	13	14	0	16	16	6
S28	**Gas Supply**	1	13	14	1	16	17	1	12	13	1	12	13	0	16	16	0	15	15	0	18	18	1	16	17	1	15	15	7
S27	**Elec. T&D**	5	7	12	5	7	12	8	6	14	8	7	15	5	6	11	7	6	13	7	8	15	7	6	13	6	7	13	8
S04	**Nat Gas**	0	16	16	0	21	21	1	17	18	2	8	10	1	12	13	1	8	9	2	7	9	1	5	6	1	11	12	9
S21	**Elec. Gen. Coal**	2	11	13	2	10	12	3	7	10	3	8	11	3	8	11	2	8	10	2	10	12	2	11	13	2	9	11	10
S30	**Urb Water**	1	10	11	1	9	10	1	8	9	1	12	13	1	8	9	1	10	11	1	10	11	1	9	10	1	9	10	11
S32	**Water, Sev.**	0	11	11	0	9	9	0	9	9	0	9	9	0	8	8	0	11	11	0	11	11	0	11	11	0	10	10	12
S09	Pulp & Paper Mfg	1	5	6	1	8	9	1	7	8	0	7	7	0	10	10	0	11	11	0	13	13	0	12	12	0	9	9	13
S11	Print & Pub.	1	6	7	1	7	8	1	5	6	1	7	8	2	8	10	1	6	7	1	7	8	1	8	9	1	7	8	14
S14	Chem. Prod.	2	5	7	2	7	9	1	8	9	2	5	7	1	4	5	2	4	6	3	4	7	2	5	7	2	6	8	15
S10	Wood Prod.	2	5	7	1	6	7	1	5	6	1	9	10	1	6	7	1	8	9	1	8	9	0	5	5	1	7	7	16
S12	**Petro. Prod. Mfg**	3	9	12	3	5	8	4	6	10	2	5	7	2	5	7	1	4	5	1	5	6	2	6	8	2	5	7	17
S15	Non-Metal & Min. Prod.	1	5	6	1	6	7	1	6	7	1	6	7	3	6	9	2	6	8	1	7	8	0	4	4	1	6	7	18
S16	Iron & Steel Mfg	3	4	7	2	5	7	1	5	6	2	5	7	1	7	8	2	6	8	1	6	7	0	6	6	2	6	7	19
S18	Other Metal Prod.	1	4	5	3	5	8	1	5	6	2	6	8	1	7	8	1	6	7	1	7	8	1	6	7	1	6	7	20
S33	Const.	4	0	4	6	0	6	6	0	6	4	0	4	8	2	10	5	2	7	9	2	11	7	2	9	6	1	7	21
S36	Comm, Fin. & Bus. Serv.	3	1	4	6	1	7	9	2	11	5	1	6	4	1	5	6	1	7	6	1	7	7	1	8	6	1	7	22
S17	Non-Ferrous Mfg	2	4	6	3	4	7	4	4	8	2	1	3	2	4	6	2	2	4	2	3	5	1	4	5	2	3	6	23
S20	Mfg Oth.	1	4	5	0	5	5	0	5	5	1	3	4	1	6	7	1	5	6	0	6	6	0	6	6	0	5	6	24
S34	Wsale&Retail	4	1	5	1	0	1	2	0	2	1	0	1	8	1	9	9	1	10	8	1	9	9	1	10	5	0	6	25
S08	Textile & Clothing	1	1	2	1	1	2	1	2	3	1	1	2	1	5	6	1	5	6	0	7	7	0	7	7	1	4	5	26
S19	Mach. & Transp Prod.	4	2	6	5	1	6	3	3	6	4	1	5	2	3	5	2	3	5	2	2	4	1	3	4	3	2	5	27
S01	Ag., Forest & Fish'g	2	1	3	1	1	2	2	1	3	2	1	3	2	3	5	2	3	5	2	3	5	2	4	6	2	2	4	28
S05	**Explor. Mining**	1	6	7	1	5	6	1	5	6	1	4	5	0	2	2	0	2	2	0	2	2	0	5	5	0	4	4	29
S07	Food & Bev	2	1	3	3	1	4	2	2	4	2	1	3	3	2	5	2	2	4	2	2	4	2	2	4	2	2	4	30
S35	Trsprt & Storage Serv.	1	2	3	1	1	2	1	2	3	1	1	2	2	3	5	1	2	3	1	3	4	2	4	6	1	3	4	31
S02	**Coal**	1	3	4	2	3	5	0	2	2	0	2	2	1	2	3	1	2	3	1	0	1	1	1	2	1	2	3	32
S03	**Crude Oil**	2	2	4	2	1	3	2	2	4	2	1	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	33
S06	**Oth. Mining**	1	3	4	0	2	2	1	2	3	1	2	3	1	2	3	1	1	2	1	1	2	1	2	3	1	2	3	34
S29	**Upstrm Water**	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	35
S37	Govt Admin.	1	1	2	0	0	0	0	0	0	5	1	6	0	1	1	0	1	1	0	1	1	2	1	3	1	1	2	36
S39	Oth. Comml Serv.	0	0	0	0	1	1	0	2	2	0	1	1	0	2	2	0	2	2	0	3	3	0	3	3	0	2	2	37
S26	**Elec. Gen Oth. Fuel**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	38
S38	Edu, Hlth & Cmty Serv.	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	39
Total		58	240	298	59	260	319	65	249	314	65	229	294	61	253	314	61	256	317	62	267	329	63	255	318	60	249	309	

Source: Results obtained from the model developed in Chapter 4.

The relatively high number of BL-MIC in S27 shows that it induces high level of economic activity in its immediate upstream sectors and in those sectors that are linked with them (i.e. immediate upstream sectors). The data shows that this sector has maintained an average of 6 BL-MICs showing less variation over the period 1975 to 2105. Therefore, the economic activities of the S27 would be significantly sensitive to changes in economic activity of each of these seven most important upstream sectors. In this respect S27 is regarded as a key sector in the economy too. By definition a variation lower than a_{ij} coefficient value of each of these MIC sectors would significantly impact operation of the S27 Sector which magnitudinally will be larger than one percent of its total economic activity. In 2014-15, the rest of the IOI sectors accounted for zero to two BL-MIC numbers. In comparison to S27, the smaller MIC numbers signify that the production in the remaining IOI will not be significantly affected by changes in the economic activity of their upstream sectors. Therefore, they are less dependent on majority of the sectors except one or two. Table 6.1 shows that Coal (S02), Crude Oil (S03), Other Mining (S06), and Upstream Water Supply (S29) have only one BL-MIC and only two FL-MIC. Nevertheless, their production are significantly important in the economy. For example in case of Coal (S02), it has only one BL-MIC - the Exploration and Mining Support Services (S05) - while the sector is self-sufficient in production. Therefore, from a policy point of view operation of these sectors cannot be downgraded on the basis of low number of MIC assuming that it would not impact the rest of the economic sectors. The resource-IOI are expected to fall in the low MIC category because of being capital intensive and their specialised operation requiring highly sophisticated technology.

In 2014-15, the number of BL-MIC for other sectors of economy were the highest (9) for Wholesale and Retail Trades (S34) followed by Construction (S33) and Communication, Finance, and Business Services (S36) each with 7. The Construction (S33) and Communication, Finance, and Business Services Sectors (S36) on average maintained their number of MICs over the study period. However, in case of the (S34) Sector the number of BL-MICs was significantly changed to an average number of 2 during 1975 to 1993, while the change over the period 1994 to 2015 was the highest, an average number of 8. The reasons for this significant change can be diversified product manufacturing, increased demand, and the 1990s major institutional and industrial reforms that changed the nature of the Wholesale and Retail Trade in Australia. Also, Johnston et al (2000) reported that adoption of productivity improvement and labour saving technologies enabled the Sector to expand its activities and to compete better in the Australian and global markets. The MIC numbers for other sectors was around average over time (Table 6.1).

With respect to the MIC-demand (FL-MIC) in 2014-15, the IOI sectors followed mostly the ranking hierarchy of their average total (Avg. Tot.) MIC numbers as shown by Table 6.1. The top seven IOI sectors in this category are: Electricity Generation by Oil Products (S22) Sector with 19 being in the first rank in the Australian economy; Coal Products Manufacturing (S13) with 17; Electricity Generation by Natural Gas (S23) and Gas Supply (S28) Sectors each with 16;

Electricity Generation by Hydro (S24) and Electricity Generation by Renewables (S25) Sectors each with 15; and Rural Water Supply (S31) with 13. Therefore, the total supply/sales of these sectors are highly dependent on their downstream sectors and vice versa. Any changes in economic activity of downstream sectors, or violation of tolerable level of change in associated coefficient magnitudes would significantly impact these IOI sectors. These IOI Sectors on average maintained their MIC numbers over the period of study.

6.2.4 Sectors Associated with MICs

In order to identify the sectors which are associated with each MIC and other coefficient classes, and also to track the changes over time, a complete set of heatmap tables associated with the Table 6.1 were developed to visualise and compare the composition of each sector's coefficient classes, and their stability, over the study period. While the discussion in this section is based on the full set of the developed heatmaps, a detailed discussion is focused on the 2008-09 and 2014-15 Heatmap Tables 6.2 to 6.5. The selection of these years helps to track the impact of the GFC on sectoral linkages over the period 2009 to 2015. The year 2014-15 is the latest year for which the official Australian IO Table was available at the time of writing this thesis. The analysis shows that the 2007-08 GFC and its post-2008 effects did not change the pattern of MICs over the period 2009-2015. This is because of Australia's strong economic position at local and global levels (RBA 2010) which assisted to avoid disruptions in the production of goods and services. Heatmap tables related to other years are provided in Appendix VI, Tables VI.3 to VI.8 for backward coefficients, and Tables VI.9 to VI.14 for forward coefficients.

As discussed in section 6.2.3 (Number of MICs and Impact on Sectoral Linkages), the Electricity Transmission and Distribution Sector (27) maintained its number of BL-MICs at an average 7 throughout the period of study as well as in 2014-15. The sectors associated with the MICs are those with the highest linkage influences on S27 which are: Gas Supply (S28), Electricity Transmission and Distribution (S27), and all electricity generation sectors except the Electricity Generation by Other Fuels (S26) which was classified as Important instead of MIC.

Also, the demand sectors linked with the Electricity Transmission and Distribution (27), as measured by the number of FL-MICs, almost remained unchanged over the period 2009 to 2015. These sectors are: Electricity Generation by Coal (S21), Electricity Generation by Gas (S23), Coal Products Manufacturing (S13), Basic Non-Ferrous Metals (S17), S27 itself for internal uses and transmission and distribution losses, Construction (S33), and majority of the services sector except Government Administration (S37) which was classified as Important instead of MIC.

The comparison of the two periods as shown by the Heatmap Tables reveals that while the number of MICs for both supply and demand sides remained almost the same, the pattern of distribution changed particularly in 2014-15 as discussed further in section 6.2.5.

Table 6.2: Backward MICs (COL-MIC), 2008-09

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	MIC	NI	NI	NI	NI	NI	MIC	LI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	LI
S02	NI	LI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI
S04	NI	NI	I	I	NI	I	LI	NI	NI	NI	NI	NI	NI	I	LI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	I	NI	NI	NI	NI	NI	LI	LI	LI	NI	NI	NI	NI
S05	NI	MIC	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S06	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI
S07	LI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	LI	I	LI
S08	NI	NI	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	LI	LI	I	I	I
S09	NI	NI	NI	NI	LI	LI	I	NI	I	NI	MIC	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	LI	I	I	NI	LI
S10	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	I	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	I	I	LI	I	NI
S11	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	I	NI	NI	LI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	LI	MIC	I	I	I
S12	I	I	NI	NI	LI	I	NI	NI	NI	NI	NI	I	NI	I	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	MIC	I	LI	NI	LI
S13	NI	NI	NI	MIC	NI	LI	NI	NI	NI	NI	NI	LI	NI	MIC	NI	I	I	I	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI
S14	I	NI	NI	NI	NI	LI	I	NI	NI	NI	I	NI	NI	MIC	LI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	LI	I	LI	I	I
S15	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	I	MIC	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	I	LI	LI	LI
S16	NI	LI	NI	NI	LI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	LI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	LI	NI	NI	NI
S17	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	MIC	I	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	LI	NI	LI	NI	NI	NI
S18	LI	I	NI	NI	LI	I	LI	NI	NI	NI	NI	NI	NI	LI	NI	LI	NI	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	MIC	I	I	I	I	I	LI
S19	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	LI	I	LI
S20	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	NI	LI	LI	I	I
S21	LI	I	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	LI	LI	LI	I	NI	I	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	I	I	LI	I	LI
S22	LI	NI	MIC	NI	NI	I	LI	NI	NI	NI	NI	I	NI	LI	LI	LI	I	NI	LI	NI	NI	MIC	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	I	I	LI	I	LI
S23	NI	NI	NI	I	NI	LI	LI	NI	NI	NI	NI	LI	NI	LI	NI	NI	I	NI	LI	NI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	I	LI	I	NI	LI	NI
S24	LI	NI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	I	LI	LI	I	NI	I	NI	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	I	I	LI	I	LI
S25	LI	NI	NI	NI	NI	I	LI	NI	NI	NI	NI	NI	NI	LI	LI	LI	I	NI	LI	NI	NI	NI	NI	NI	MIC	NI	MIC	NI	NI	NI	NI	NI	I	MIC	I	I	LI	I	LI
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	LI	LI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	I	LI	LI	I	NI	I	NI	MIC	LI	I	I	I	NI	MIC	NI	NI	NI	NI	NI	I	MIC	I	I	LI	I	LI
S28	NI	NI	I	MIC	NI	I	LI	NI	NI	NI	NI	NI	NI	MIC	I	NI	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	NI	NI	NI	NI	LI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	I	MIC	LI	I	I
S31	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	LI	I	LI	LI	I	NI	NI	LI
S32	I	NI	NI	NI	NI	LI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	MIC	LI	I	I
S33	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	I	MIC	I	LI	I
S34	LI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	LI	I	LI
S35	I	LI	NI	NI	NI	NI	I	NI	NI	NI	LI	NI	NI	LI	LI	LI	LI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	I	I	I	LI	LI
S36	LI	NI	NI	NI	LI	LI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	I	MIC	I	I	I
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	LI	I	I	NI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI
S39	LI	NI	NI	NI	NI	LI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	MIC	LI	I	I

Notes: MIC = Most Important Coefficient I = Important Coefficient LI = Less Important Coefficient NI = Not Important Coefficient

Source: Results obtained from the model developed in chapter 4.

Table 6.3: **Forward MICs (ROW-MIC), 2008-09**

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13
S01	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI
S02	NI	LI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI
S04	NI	LI	I	I	NI	MIC	I	NI	NI	NI	NI	NI	NI
S05	NI	MIC	LI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI
S06	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S07	LI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI
S08	I	LI	NI	NI	NI	LI	I	I	NI	NI	LI	NI	NI
S09	NI	MIC	NI	NI	I	MIC	MIC	NI	I	LI	MIC	NI	NI
S10	I	LI	NI	NI	NI	LI	LI	NI	NI	MIC	NI	NI	NI
S11	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	I	NI	NI
S12	I	I	NI	NI	NI	MIC	LI	NI	NI	NI	NI	I	NI
S13	MIC	MIC	I	MIC	I	MIC	NI	NI	LI	I	MIC	MIC	NI
S14	I	NI	NI	NI	NI	LI	I	NI	NI	NI	LI	NI	NI
S15	I	NI	NI	NI	NI	I	MIC	NI	NI	NI	NI	NI	NI
S16	NI	I	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI
S17	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S18	I	I	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI
S19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S20	LI	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI
S21	I	I	NI	NI	NI	MIC	I	NI	NI	NI	LI	NI	NI
S22	MIC	NI	MIC	NI	NI	MIC	MIC	NI	LI	I	MIC	MIC	NI
S23	MIC	NI	NI	MIC	I	MIC	MIC	NI	NI	LI	I	MIC	NI
S24	MIC	NI	NI	NI	NI	MIC	MIC	NI	NI	I	MIC	NI	NI
S25	MIC	NI	NI	NI	NI	MIC	MIC	NI	NI	I	I	I	NI
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	I	I	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI
S28	NI	I	MIC	MIC	NI	MIC	MIC	NI	NI	LI	MIC	MIC	NI
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	LI	NI	NI	NI	MIC	MIC	NI	NI	NI	LI	NI	NI
S31	MIC	I	NI	NI	NI	MIC	MIC	LI	NI	NI	I	I	NI
S32	MIC	LI	NI	NI	NI	MIC	MIC	NI	NI	NI	LI	NI	NI
S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S34	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S35	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI
S36	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S39	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI

	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26
S01	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S02	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S04	MIC	LI	NI	MIC	NI	I	NI	NI	NI	LI	NI	NI	NI
S05	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S06	NI	NI	LI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI
S07	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S08	I	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	NI
S09	MIC	I	I	I	I	MIC	NI	NI	NI	NI	NI	NI	NI
S10	I	NI	NI	NI	I	MIC	I	NI	NI	NI	NI	NI	NI
S11	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI
S12	I	NI	NI	LI	NI	I	NI	NI	NI	NI	NI	NI	NI
S13	MIC	MIC	MIC	MIC	MIC	MIC	NI	MIC	NI	I	LI	LI	NI
S14	MIC	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI
S15	I	MIC	NI	LI	I	MIC	NI	NI	NI	NI	NI	NI	NI
S16	NI	NI	MIC	I	MIC	MIC	LI	NI	NI	NI	NI	NI	NI
S17	NI	NI	NI	MIC	I	MIC	NI	NI	NI	NI	NI	NI	NI
S18	I	NI	LI	NI	I	MIC	NI	NI	NI	NI	NI	NI	NI
S19	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI
S20	LI	NI	NI	I	LI	MIC	NI	NI	NI	NI	NI	NI	NI
S21	I	NI	LI	MIC	NI	MIC	NI	MIC	NI	NI	NI	NI	NI
S22	MIC	MIC	MIC	MIC	MIC	MIC	LI	NI	MIC	NI	NI	NI	NI
S23	MIC	I	I	MIC	I	MIC	NI	NI	NI	MIC	NI	NI	NI
S24	MIC	MIC	MIC	MIC	I	MIC	NI	NI	NI	NI	MIC	NI	NI
S25	MIC	I	MIC	MIC	I	MIC	NI	NI	NI	NI	NI	MIC	NI
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	I	NI	LI	MIC	NI	I	NI	MIC	NI	NI	NI	NI	NI
S28	MIC	MIC	I	MIC	I	MIC	NI	NI	NI	MIC	NI	NI	NI
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S30	I	NI	LI	LI	NI	MIC	NI	NI	NI	NI	NI	NI	NI
S31	MIC	I	I	I	I	MIC	NI	I	NI	NI	NI	NI	NI
S32	I	NI	LI	LI	NI	MIC	NI	NI	NI	NI	NI	NI	NI
S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S34	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S35	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI
S36	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S39	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI

	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	NI	NI	NI	NI	NI	NI	I	MIC	NI	I	NI	I	I
S02	I	NI	NI	NI	NI	NI	LI	NI	NI	I	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI
S04	MIC	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	LI	I	NI
S05	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI
S06	NI	NI	NI	NI	NI	NI	I	LI	NI	I	NI	NI	NI
S07	NI	NI	NI	NI	NI	NI	I	MIC	NI	I	LI	I	LI
S08	NI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S09	NI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S10	LI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	I
S11	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	MIC	MIC	MIC
S12	NI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	I	I
S13	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	MIC	MIC	NI	NI
S14	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	I	I
S15	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	MIC	I
S16	NI	NI	NI	NI	NI	NI	MIC	MIC	LI	MIC	LI	NI	NI
S17	NI	NI	NI	NI	NI	NI	I	I	NI	MIC	NI	NI	NI
S18	NI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	I
S19	NI	NI	NI	NI	NI	NI	MIC	I	I	MIC	NI	I	NI
S20	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	MIC	MIC
S21	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	MIC	I
S22	MIC	NI	NI	I	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S23	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S24	MIC	NI	NI	I	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S25	MIC	NI	NI	LI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S26	NI	NI	NI	NI	NI	NI	MIC	NI	NI	MIC	I	I	LI
S27	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	MIC	I
S28	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	I
S29	NI	NI	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI
S30	LI	NI	NI	NI	NI	I	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S31	I	NI	NI	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S32	LI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S33	NI	NI	NI	NI	NI	NI	MIC	I	LI	MIC	NI	NI	NI
S34	NI	NI	NI	NI	NI	NI	I	I	LI	MIC	NI	LI	NI
S35	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	LI	I	NI
S36	NI	NI	NI	NI	NI	NI	I	I	NI	MIC	NI	LI	NI
S37	NI	NI	NI	NI	NI	NI	I	I	LI	MIC	I	LI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI
S39	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	LI	I	I

MIC = Most Important Coefficient I = Important Coefficient LI = Less Important Coefficient NI = Not Important Coefficient

Source: Results obtained from the model developed in chapter 4.

Table 6.4: Backward MIC (COL-MIC, 2014-15

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	I	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	NI	LI	NI	NI	LI
S02	NI	I	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI
S04	NI	NI	NI	NI	NI	I	LI	NI	NI	NI	NI	I	NI	I	NI	NI	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	I	NI	NI	NI	NI	NI	I	LI	LI	LI	NI	NI	NI
S05	NI	MIC	LI	LI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	LI	NI	LI	NI	NI	NI
S06	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	LI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	LI	NI	NI	NI
S07	LI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	I	LI
S08	NI	NI	NI	NI	NI	LI	LI	I	NI	NI	NI	NI	NI	LI	LI	NI	NI	LI	LI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	LI	LI	I	I	I
S09	NI	NI	NI	NI	NI	NI	I	NI	I	NI	MIC	NI	NI	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	LI	LI	I	NI	LI
S10	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	LI	NI	NI	NI	LI	NI
S11	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	I	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	I	MIC	I	I	I
S12	I	I	NI	NI	LI	I	NI	NI	NI	NI	NI	I	NI	I	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	MIC	I	LI	NI	NI
S13	NI	NI	NI	MIC	NI	I	NI	NI	NI	NI	NI	MIC	NI	I	LI	I	I	I	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI
S14	I	NI	NI	NI	NI	LI	LI	NI	NI	NI	LI	NI	NI	MIC	LI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	LI	I	NI	I	I
S15	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	LI	I	NI	NI	I	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	LI	NI	NI	NI
S16	NI	LI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	MIC	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	NI	NI	NI	NI
S17	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	LI	NI	LI	NI	NI	NI
S18	NI	I	NI	NI	NI	I	LI	NI	NI	NI	NI	NI	NI	LI	I	NI	NI	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	LI	I	LI	LI	LI
S19	NI	LI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	LI	I	LI
S20	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	NI	LI	NI	I	I
S21	I	I	NI	NI	NI	I	I	NI	NI	NI	LI	NI	NI	I	LI	LI	I	NI	LI	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	LI	NI	NI	I	MIC	I	MIC	MIC	I	I
S22	LI	NI	MIC	NI	NI	I	I	NI	NI	NI	LI	I	NI	LI	NI	NI	I	NI	NI	NI	NI	MIC	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	LI	MIC	I	I	I	LI	I
S23	NI	NI	NI	I	NI	I	LI	NI	NI	NI	NI	LI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	LI	I	I	NI	LI
S24	LI	NI	NI	NI	NI	I	I	NI	NI	NI	LI	NI	NI	LI	NI	NI	I	NI	LI	NI	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	LI	NI	NI	I	MIC	I	I	I	I	I
S25	LI	NI	NI	NI	NI	I	I	NI	NI	NI	LI	NI	NI	LI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	MIC	NI	MIC	NI	NI	NI	NI	NI	LI	MIC	I	I	I	LI	I
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	I	I	NI	LI	NI	I	I	NI	NI	LI	I	NI	NI	I	LI	LI	I	NI	LI	NI	MIC	I	I	MIC	MIC	NI	MIC	NI	NI	LI	NI	NI	I	MIC	I	MIC	MIC	I	I
S28	NI	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	I	NI	MIC	I	NI	I	NI	LI	NI	NI	NI	MIC	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	NI	I	LI	LI	NI	LI	NI
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	NI	MIC	I	I	I
S31	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	I	LI	NI	I	LI	LI	LI
S32	I	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	NI	MIC	I	I	I
S33	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	I	I	I	NI	NI
S34	LI	NI	NI	NI	NI	LI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	LI	I	LI
S35	LI	LI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	MIC	I	I	I	LI
S36	LI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	I	MIC	I	MIC	I	I	I
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	LI	I	I	NI	LI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI
S39	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	LI	MIC	LI	I	I

MIC = Most Important Coefficient I = Important Coefficient LI = Less Important Coefficient NI = Not Important Coefficient

Source: Results obtained from the model developed in chapter 4.

Table 6.5: Forward MIC (ROW-MIC), 2014-15

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	NI	MIC	NI	LI	LI
S02	NI	I	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	I	NI	MIC	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI
S04	NI	NI	NI	NI	NI	MIC	I	NI	NI	NI	NI	I	NI	MIC	NI	NI	I	NI	LI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	LI	I	NI
S05	LI	MIC	I	I	NI	MIC	I	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	I	NI
S06	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	MIC	NI	NI	NI
S07	LI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	MIC	NI	I	NI	I	LI
S08	I	LI	NI	NI	NI	I	I	I	NI	NI	NI	NI	NI	I	NI	NI	NI	LI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	MIC	MIC	MIC
S09	I	NI	NI	NI	LI	I	MIC	NI	I	LI	MIC	LI	NI	MIC	MIC	NI	NI	I	MIC	NI	LI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S10	LI	NI	NI	NI	NI	LI	LI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	LI	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	LI	MIC	LI
S11	I	NI	NI	NI	NI	LI	MIC	NI	NI	NI	I	NI	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S12	MIC	I	NI	NI	NI	MIC	LI	NI	NI	NI	NI	I	NI	I	NI	NI	LI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	I	LI
S13	NI	MIC	I	MIC	NI	MIC	MIC	NI	NI	LI	I	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	NI	MIC	NI	I	I	I	NI	MIC	NI	NI	NI	NI	LI	MIC	MIC	NI	NI	MIC	MIC	NI
S14	I	NI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	LI	MIC	I
S15	LI	NI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	I	I	NI	NI	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	LI	I	I
S16	NI	I	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	LI	MIC	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	LI	I	LI
S17	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	NI	LI	NI
S18	LI	I	NI	NI	NI	MIC	I	NI	NI	NI	NI	NI	NI	I	LI	NI	NI	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	MIC	I
S19	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	NI	I	NI
S20	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	MIC	MIC
S21	I	I	NI	NI	NI	MIC	MIC	NI	NI	NI	LI	NI	NI	I	NI	NI	I	NI	I	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S22	MIC	NI	MIC	NI	NI	MIC	MIC	I	NI	I	MIC	MIC	NI	MIC	MIC	I	MIC	I	MIC	I	NI	MIC	NI	NI	NI	NI	MIC	NI	NI	I	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S23	MIC	NI	NI	MIC	NI	MIC	MIC	NI	NI	NI	I	MIC	NI	I	LI	NI	MIC	LI	MIC	NI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S24	MIC	NI	NI	NI	NI	MIC	MIC	LI	NI	LI	I	NI	NI	MIC	I	I	MIC	I	MIC	LI	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	I	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S25	MIC	NI	NI	NI	NI	MIC	MIC	LI	NI	LI	I	NI	NI	MIC	I	LI	MIC	I	MIC	NI	NI	NI	NI	NI	MIC	NI	MIC	NI	NI	LI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI
S27	I	LI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	I	NI	NI	I	NI	I	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	MIC	I	I
S28	I	LI	LI	I	NI	MIC	MIC	NI	NI	NI	I	MIC	NI	MIC	MIC	I	MIC	I	MIC	NI	NI	NI	MIC	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	I
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	LI	NI	NI	NI	I	MIC	NI	NI	NI	LI	LI	NI	I	NI	NI	NI	NI	MIC	NI	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	LI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S31	MIC	I	NI	NI	NI	MIC	MIC	NI	NI	NI	I	I	NI	MIC	I	I	NI	LI	MIC	NI	I	NI	NI	NI	NI	NI	MIC	NI	NI	I	NI	I	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S32	MIC	LI	NI	NI	NI	I	MIC	NI	NI	NI	LI	LI	NI	MIC	NI	NI	NI	NI	MIC	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	MIC	LI	NI	NI
S34	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	LI	MIC	NI	LI	NI
S35	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	LI	I	NI
S36	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	NI	MIC	NI	LI	NI
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	LI	MIC	I	LI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI
S39	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	LI	I	I

(Author, 2017) MIC = Most Important Coefficient (Sector) I = Important Coefficient LI = Less Important Coefficient NI = Not Important Coefficient

Source: Results obtained from the model developed in chapter 4.

6.2.5 Stability of the MICs and Other Coefficient Classes

Table 6.6 shows the yearly pattern of change in each coefficient class over the period 1975-2015. The analysis reveals that out of a yearly total of 3042 coefficients in each IO Table over the period of study, 72.3% were not important. The percentages of yearly total MICs on average is 10.2%, and 11.1% (Important), 6.4% (Less Important). Figure 6.9 shows that the number of BL-MICs in each sector followed an overall increasing trends indicating that the sectors significantly induced increasing economic activities throughout the Australian economy over the period of the study. The four recessions in Australia over the period 1975 to 1991 (shown in Figures 6.9 and 6.10 by R1, R2, R3 and R4); the Asian Financial Crisis (Asian FC) which can be traced back to July 1997; and the later years GFC in 2007-08 caused disturbances to the stability of MICs and other Coefficient Classes. Figure 6.10 shows that the number of BL-MICs for majority of the sectors changes on average between zero to three except for Electricity Transmission and Distribution (S27) which followed an increasing pattern with an average of 6 BL-MICs over the period. The reasons for change in stability patterns are several recessions over the period 1975 to 1991.

Figure 6.9: Stability of Economy's MICs, 1975-2015

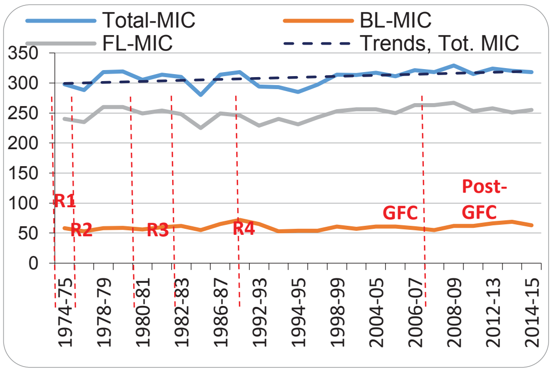
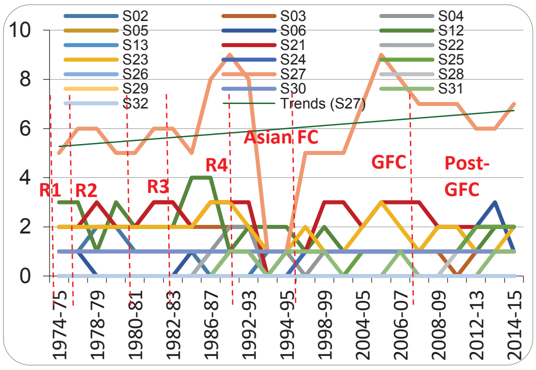


Figure 6.10: Stability of BL-MICs by IOI Sectors, 1975-2015



Source: This author, based on the model developed in chapter 4.

For forward linkages, the overall number of FL-MICs slightly increased over time (Figure 6.9) while in Gas (incl. Nat Gas, LPG and CSG) Sector (S04) the numbers followed a declining pattern from high 21 in 1978-79 to low 6 in 2014-15 (Figure 6.11). Likewise, the Electricity Generation by Gas (23) faced a declining pattern of its FL-MIC (Figure 6.12). A reason for this decline, as the data shows, can be related to the increasing level of the Gas exports over the period of study. Also, the latter is supported by the high contribution of the Sector to the total GVA as discussed earlier in section 6.1 (Linkages to the Economy as a Whole, Relative Contribution to GVA).

However, AEMO (2017) has attributed the demand shortage to decline in gas production. Therefore, this could be a reason for the declining pattern of the number of MIC in the Gas (incl. Nat Gas, LPG and CSG) Sector (S04) as shown in Figures 6.11 and 6.12. AEMO asserts that the production shortage has impacted gas-powered electricity generation which will be worsening from summer 2018-19 impacting NSW, VIC and SA gas-powered electricity generators.

Table 6.6: Stability of Important Coefficients, 1975 - 2015

Coefficient Type	1974-75 BL	1974-75 FL	1974-75 Total	1977-78 BL	1977-78 FL	1977-78 Total	1978-79 BL	1978-79 FL	1978-79 Total	1979-80 BL	1979-80 FL	1979-80 Total	1980-81 BL	1980-81 FL	1980-81 Total	1981-82 BL	1981-82 FL	1981-82 Total
MIC	58 (3.8)	240 (15.8)	298 (9.8)	53 (3.5)	235 (15.5)	288 (9.5)	58 (3.8)	260 (17.1)	318 (10.5)	59 (3.9)	260 (17.1)	319 (10.5)	56 (3.7)	249 (16.4)	305 (10)	60 (3.9)	254 (16.7)	314 (10.3)
Important	158 (10.4)	159 (10.5)	317 (10.4)	166 (10.9)	154 (10.1)	320 (10.5)	180 (11.8)	144 (9.5)	324 (10.7)	173 (11.4)	147 (9.7)	320 (10.5)	173 (11.4)	153 (10.1)	326 (10.7)	176 (11.6)	146 (9.6)	322 (10.6)
Less Important	106 (7)	62 (4.1)	168 (5.5)	105 (6.9)	81 (5.3)	186 (6.1)	110 (7.2)	74 (4.9)	184 (6)	127 (8.3)	71 (4.7)	198 (6.5)	120 (7.9)	70 (4.6)	190 (6.2)	129 (8.5)	83 (5.5)	212 (7)
Not Important	1199 (78.8)	1060 (69.7)	2259 (74.3)	1197 (78.7)	1051 (69.1)	2248 (73.9)	1173 (77.1)	1043 (68.6)	2216 (72.8)	1162 (76.4)	1043 (68.6)	2205 (72.5)	1172 (77.1)	1049 (69)	2221 (73)	1156 (76)	1038 (68.2)	2194 (72.1)
Yearly Total	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)

Coefficient Type	1982-83 BL	1982-83 FL	1982-83 Total	1983-84 BL	1983-84 FL	1983-84 Total	1986-87 BL	1986-87 FL	1986-87 Total	1989-90 BL	1989-90 FL	1989-90 Total	1992-93 BL	1992-93 FL	1992-93 Total	1993-94 BL	1993-94 FL	1993-94 Total
MIC	62 (4.1)	248 (16.3)	310 (10.2)	55 (3.6)	225 (14.8)	280 (9.2)	65 (4.3)	249 (16.4)	314 (10.3)	72 (4.7)	246 (16.2)	318 (10.5)	65 (4.3)	229 (15.1)	294 (9.7)	53 (3.5)	240 (15.8)	293 (9.6)
Important	182 (12)	154 (10.1)	336 (11)	180 (11.8)	159 (10.5)	339 (11.1)	183 (12)	162 (10.7)	345 (11.3)	177 (11.6)	170 (11.2)	347 (11.4)	174 (11.4)	178 (11.7)	352 (11.6)	186 (12.2)	165 (10.8)	351 (11.5)
Less Important	124 (8.2)	82 (5.4)	206 (6.8)	105 (6.9)	73 (4.8)	178 (5.9)	121 (8)	66 (4.3)	187 (6.1)	124 (8.2)	61 (4)	185 (6.1)	111 (7.3)	63 (4.1)	174 (5.7)	113 (7.4)	75 (4.9)	188 (6.2)
Not Important	1153 (75.8)	1037 (68.2)	2190 (72)	1181 (77.6)	1064 (70)	2245 (73.8)	1152 (75.7)	1044 (68.6)	2196 (72.2)	1148 (75.5)	1044 (68.6)	2192 (72.1)	1171 (77)	1051 (69.1)	2222 (73)	1169 (76.9)	1041 (68.4)	2210 (72.6)
Yearly Total	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)

Coefficient Type	1994-95 BL	1994-95 FL	1994-95 Total	1996-97 BL	1996-97 FL	1996-97 Total	1998-99 BL	1998-99 FL	1998-99 Total	2001-02 BL	2001-02 FL	2001-02 Total	2004-05 BL	2004-05 FL	2004-05 Total	2005-06 BL	2005-06 FL	2005-06 Total
MIC	54 (3.6)	231 (15.2)	285 (9.4)	54 (3.6)	243 (16)	297 (9.8)	61 (4)	253 (16.6)	314 (10.3)	57 (3.7)	256 (16.8)	313 (10.3)	61 (4)	256 (16.8)	317 (10.4)	61 (4)	250 (16.4)	311 (10.2)
Important	173 (11.4)	164 (10.8)	337 (11.1)	188 (12.4)	157 (10.3)	345 (11.3)	184 (12.1)	163 (10.7)	347 (11.4)	185 (12.2)	164 (10.8)	349 (11.5)	189 (12.4)	167 (11)	356 (11.7)	185 (12.2)	164 (10.8)	349 (11.5)
Less Important	130 (8.5)	66 (4.3)	196 (6.4)	129 (8.5)	74 (4.9)	203 (6.7)	123 (8.1)	77 (5.1)	200 (6.6)	131 (8.6)	84 (5.5)	215 (7.1)	132 (8.7)	71 (4.7)	203 (6.7)	132 (8.7)	72 (4.7)	204 (6.7)
Not Important	1164 (76.5)	1060 (69.7)	2224 (73.1)	1150 (75.6)	1047 (68.8)	2197 (72.2)	1153 (75.8)	1028 (67.6)	2181 (71.7)	1148 (75.5)	1017 (66.9)	2165 (71.2)	1139 (74.9)	1027 (67.5)	2166 (71.2)	1143 (75.1)	1035 (68)	2178 (71.6)
Yearly Total	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)

Coefficient Type	2006-07 BL	2006-07 FL	2006-07 Total	2007-08 BL	2007-08 FL	2007-08 Total	2008-09 BL	2008-09 FL	2008-09 Total	2009-10 BL	2009-10 FL	2009-10 Total	2012-13 BL	2012-13 FL	2012-13 Total	2013-14 BL	2013-14 FL	2013-14 Total
MIC	58 (3.8)	263 (17.3)	321 (10.6)	55 (3.6)	263 (17.3)	318 (10.5)	62 (4.1)	267 (17.6)	329 (10.8)	62 (4.1)	253 (16.6)	315 (10.4)	66 (4.3)	258 (17)	324 (10.7)	69 (4.5)	251 (16.5)	320 (10.5)
Important	196 (12.9)	158 (10.4)	354 (11.6)	186 (12.2)	148 (9.7)	334 (11)	182 (12)	149 (9.8)	331 (10.9)	197 (13)	158 (10.4)	355 (11.7)	194 (12.8)	151 (9.9)	345 (11.3)	187 (12.3)	158 (10.4)	345 (11.3)
Less Important	130 (8.5)	66 (4.3)	196 (6.4)	144 (9.5)	71 (4.7)	215 (7.1)	149 (9.8)	68 (4.5)	217 (7.1)	123 (8.1)	55 (3.6)	178 (5.9)	127 (8.3)	61 (4)	188 (6.2)	132 (8.7)	70 (4.6)	202 (6.6)
Not Important	1137 (74.8)	1034 (68)	2171 (71.4)	1136 (74.7)	1039 (68.3)	2175 (71.5)	1128 (74.2)	1037 (68.2)	2165 (71.2)	1139 (74.9)	1055 (69.4)	2194 (72.1)	1134 (74.6)	1051 (69.1)	2185 (71.8)	1133 (74.5)	1042 (68.5)	2175 (71.5)
Yearly Total	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)

Coefficient Type	2014-15 BL	2014-15 FL	2014-15 Total	Average BL	Average FL	Average Total	Trends BL	Overall BL Status	Trends FL	Overall FL Status	Trends Total	Tot Status
MIC	63 (4.1)	255 (16.8)	318 (10.5)	60 (3.9)	249 (16.4)	309 (10.2)		▲		△		△
Important	183 (12)	149 (9.8)	332 (10.9)	181 (11.9)	158 (10.4)	339 (11.1)		△		Inc-Dec-Stable		△
Less Important	136 (8.9)	72 (4.7)	208 (6.8)	125 (8.2)	71 (4.6)	195 (6.4)		▲		Dec-Inc-Stable		▲
Not Important	1139 (74.9)	1045 (68.7)	2184 (71.8)	1155 (75.9)	1043 (68.6)	2198 (72.3)		▽		▽		▽
Yearly Total	1521 (100)	1521 (100)	3042 (100)	1521 (100)	1521 (100)	3042 (100)		Inc-Dec-Stable		Inc-Dec-Stable		Inc-Dec-Stable

▲ Increase; ▼ Decrease; Inc-Dec-Stable
△ Slight Inc; ▽ Slight Dec; Dec-Inc-Stable

Note: Percentages are shown inside the brakets.

Source: Results obtained from the model developed in Chapter 4.

Figure 6.11: Natural GAS FL-MICs, 1975-2015

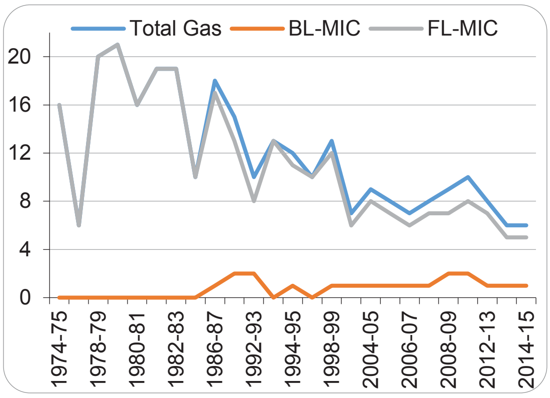
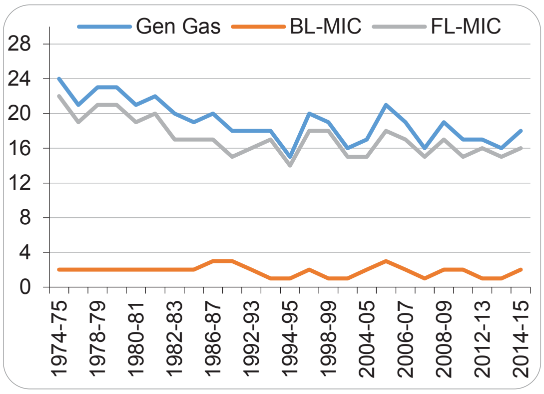


Figure 6.12: Elect. Gen. by Gas FL-MICs, 1975-2015



Source: This author, based on the model developed in Chapter 4.

Apart from BL-MIC, the overall number of yearly BL-Important Coefficients (BL-I) in the economy slightly increased over the period while the number of Backward Less Important Coefficients (BL-LI) increased more over the same period. These increases, together with the overall BL-MIC increases, implies that some of the Not Important Coefficients (NIs) had changed status to other Coefficients Classes. Also, analysis shows that BL-MIC, BL-I and BL-LI had changed Class status over the period of study because of the economic circumstances (as described earlier) as well the changes in demand over 1975-2005. Likewise, the same interpretation applies to the FL-MIC as shown in Table 6.6.

For brevity, Table 6.7 shows the changing pattern of forward coefficient classes over the period 1975-2015 for the Gas (incl. Nat Gas, LPG and CSG) Sector (S04). The results show that the pattern of changes for other resource-IOI mostly remained stable over time. Similar analysis was completed for backward coefficient classes for all sectors including IOI. Each row of the Table 6.7 shows the linkages of the S04 with the sectors shown in the "Sec" column year on year.

Section 6.3, discusses the Concentration and Entropy Indices, as other descriptors of the linkages.

6.3 Sector Interconnectedness: Concentration and Entropy Indices

The linkage descriptor of sectoral interconnectedness is based on the number of inter-industry transactions i.e. number of sectors a particular sector buys products from (backward linkages), and sells its products to (forward linkages).

Following Soofi (1992), two measures of sectoral interconnectedness are employed in this research: a measure of concentration (number of intermediate transactions); and entropy as a measure of variation as further discussed in the following two sections.

6.3.1 Backward and Forward Concentration Indices

Concentration indices estimate the number of inter-sectoral transactions in terms of purchases and sales from/to other sectors of the economy. The larger indices show that sectors have established higher number of inter-sectoral linkages and vice versa. Also, this index indicates if the sectors

Table 6.7: Forward Linkages Stability of the Natural Gas Sector (S04), 1975-2015

Sector	Sec. Code	1974-75	1978-79	1980-81	1982-83	1986-87	1992-93	1994-95	1998-99	2004-05	2006-07	2008-09	2012-13	2014-15
Ag., Forest & Fish'g	S01	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Coal	S02	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Crude Oil	S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Nat Gas	S04	NI	NI	NI	I	NI	NI	NI	NI	I	LI	I	LI	NI
Explor. Mining	S05	I	I	I	I	MIC	MIC	LI	I	I	I	NI	I	I
Oth. Mining	S06	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Food & Bev	S07	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Textile & Clothing	S08	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Pulp & Paper Mfg	S09	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Wood Prod.	S10	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Print & Pub.	S11	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Petro. Prod. Mfg	S12	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Coal Prod. Mfg	S13	I	I	MIC	MIC	MIC	MIC	MIC	MIC	MIC	MIC	MIC	MIC	MIC
Chem. Prod.	S14	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Non-Metal & Min. Prod.	S15	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Iron & Steel Mfg	S16	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Non-Ferrous Mfg	S17	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Oth. Metal Prod.	S18	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Mach. & Transp Prod.	S19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Mfg Oth.	S20	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Elec. Gen. Coal	S21	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Elec. Gen. Oil	S22	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Elec. Gen. Nat. Gas	S23	LI	NI	I	LI	I	MIC	I	I	I	MIC	MIC	MIC	MIC
Elec. Gen. Hydro	S24	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Elec. Gen. Renew.	S25	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Elec. Gen Oth. Fuel	S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Elec. T&D	S27	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Gas Supply	S28	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	I
Upstrm Water	S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Urb Water	S30	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Rurl Water	S31	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Water Serv.	S32	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Const.	S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Wsale & Retail	S34	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Trsprt & Storage Serv.	S35	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Comm, Fin. & Bus. Serv.	S36	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Govt Admin	S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Edu, Hlth & Cmty Serv.	S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Oth. Comml Serv.	S39	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI

MIC = Most Important Coefficient   I = Important Coefficient   LI = Less Important Coefficient   NI = Not Important Coefficient

Source: Results obtained from the model developed in Chapter 4.

buy many inputs from many sectors, buy many inputs from some sectors, or some inputs from many industries (Soofi 1992; Claus & Li 2003; Lenzen 2003). According to Claus & Li (2003) the number of sectoral transactions is an indicator of outsourcing (many purchases of intermediate products); and diversification (high number of sales to other sectors) in an economy. The latter, allows to examine an expansion of an existing sector into other products or markets. According to Khemani et al. (1993) diversification may be related or unrelated. Related diversification occurs when a sector expands into similar product lines. For example, a car manufacturer may engage in production of passenger vehicles and light trucks. Unrelated diversification takes place when the products are very different from each other, for example a food processing firm manufacturing leather footwear as well. According to Khemani et al. (1993) related diversification may be more profitable than unrelated diversification.

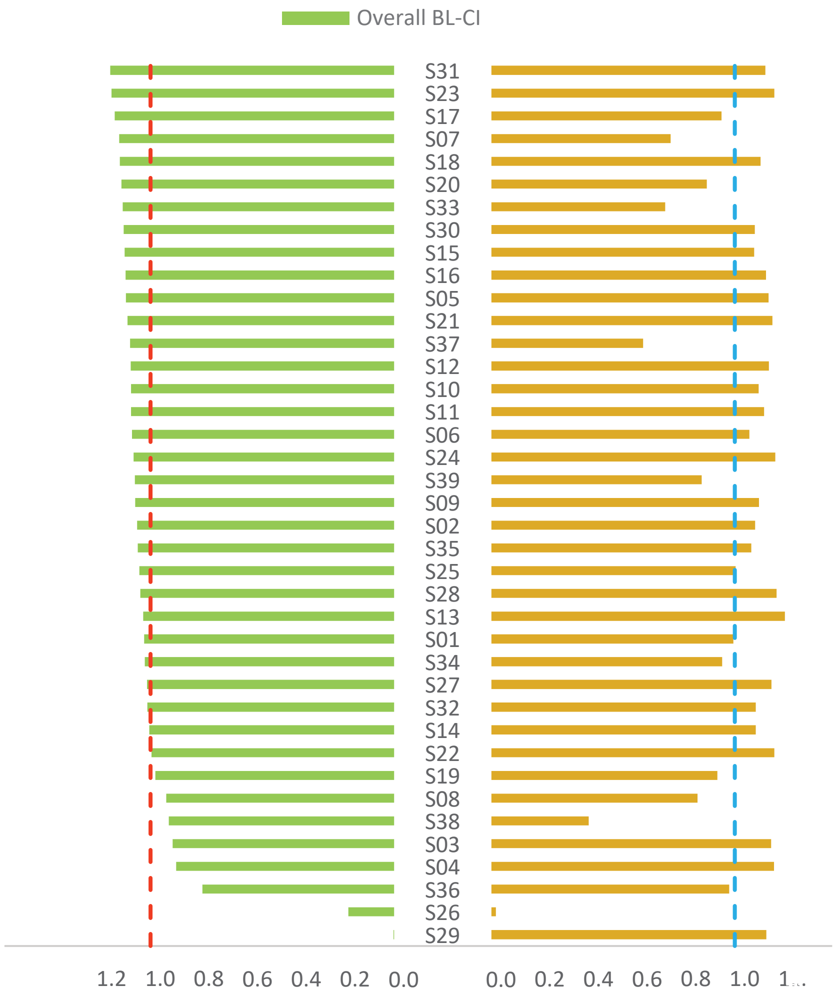
To examine sectoral interconnectedness, Figure 6.13 plots the average backward and forward concentration indices (BL-CI and FL-CI respectively) over the period 1975 to 2015. Detailed analysis of the indices are provided in Appendix VI, Tables VI.15 and VI.16.

Figure 6.13 shows that about 80% of the Australian sectors (31 out of 39) exhibit above average backward concentration indices. These sectors established strong linkages with their upstream sectors, and they are important in terms of the number of purchase transactions from other sectors. The top 10 sectors with the highest number of inter-industry purchase transactions are: Rural Water Supply (S31), Electricity Generation by Natural Gas (S23), Basic Non-Ferrous Metal Manufacturing (S17), Food, Beverage and Tobacco (S07), Other Metal Products (S18), Other Manufacturing (S20), Construction (S33), Urban Water Supply (S30), Non-Metallic and Mineral Products (S15), and Iron and Steel Manufacturing (S16).

The relatively higher number of backward transactions by these sectors indicates an increase in outsourcing in comparison to other sectors. Also, these sectors are strategically important in the economy because as a result of one unit increase in final demand for their products, they induce economic activities in the system of sectors in the economy.

For forward concentration indices, 27 out of 39 (~70%) sectors are identified with above average forward concentration indices (Figure 6.13). The top 10 sectors with the highest indices are: Coal Products Manufacturing (S13), Gas Supply (S28), Electricity Generation by Hydro (S24), Electricity Generation by Oil Products (S22), Electricity Generation by Natural Gas (S23), Gas (incl. Nat Gas, LPG and CSG) (S04), Electricity Generation by Coal (S21), Electricity Transmission and Distribution (S27), Crude Oil (incl. condensate) (S03), and Petroleum Products Manufacturing (S12). These sectors (being mainly energy sectors) are strategically important in the economy because increase in their outputs means that additional supplies are available for being used as inputs to production in other sectors (supply/Sales relationships).

Figure 6.13: Average Backward and Forward Concentration Indices, 1975-2015



Source: This author, based on the model developed in Chapter 4.

The relatively higher number of forward transactions is an indication of diversification. However, it is unlikely that the aforementioned electricity and resource-IOI have followed a diversification path rather it has been the high demand for their products which has driven their forward concentration indices high. Therefore, the above finding suggests that these sectors may consider "related diversification" by including renewable energy production among their traditional product lines as a viable investments option because of decline in costs of renewable energy technologies; also, production of low-emissions energy is the main objectives of the Commonwealth Government's Emissions Guarantee Objective as outlined in the National Energy Guarantee (NEG) Scheme (Turnbull, 2017) (see Chapter 10, Scenario Analysis).

The Electricity Generation by Natural Gas (S23) is the only sector in the top 10 list whose both backward and forward concentration indices are above average (in ranking position 2 and 4 respectively). Nevertheless, there are 25 sectors out of 39 (64%) sectors whose both backward and forward concentration indices are above average.

Historically, the backward and forward concentration indices for majority of the infrastructure of interest (IOI) in this research either slightly declined or remained stable except for the Electricity Generation by Renewables (S25) whose number of both backward and forward transactions are increased over the period of study (Figure 6.14); Coal Sector (S02) with slight increases in its backward transactions but sharp decline in its number of sales because of downturn in mining industry particularly over the period 2008-2015 as discussed earlier (Figure 6.15); the Electricity Transmission and Distribution Sector (S27) with increased number of purchases while its number of sales slightly reduced (Figure 6.16); and Water Services (Sewerage & Drainage) Sector (S32) which increased the number of its purchases from other sectors while its sales decreased over time. The increase in number of purchases could be related to infrastructure maintenances considering the age of the sector (Figure 6.17).

Figure 6.14: Concentration Indices (Elect. Gen. by renewables), 1975-2015

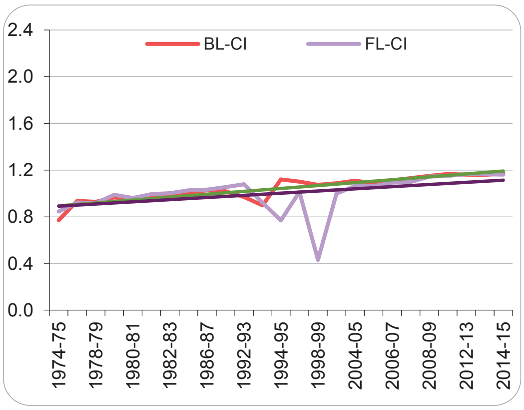


Figure 6.15: concentration indices (Coal), 1975-2015

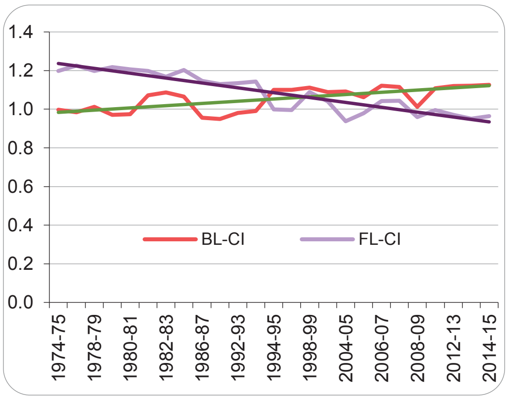


Figure 6.16: Concentration Indices (Elect. T&D), 1975-2015

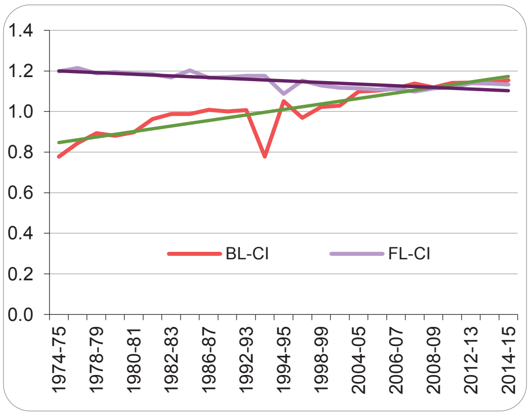
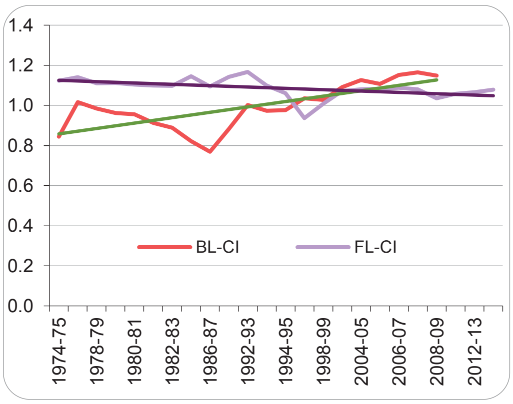


Figure 6.17: Concentration Indices (Water Services), 1975-2015



Source: This author, based on the model developed in chapter 4.

Overall, there are strong backward and forward transaction linkages in the Australian economy. The results also show that the sectors buy many products (as inputs) from many sectors with the exception of: Electricity Generation by Other Fuel (S26) with the lowest number of backward and forward transactions because of its very small size; Upstream Water Supply (S29) with the lowest backward transactions because of its reliance on water cycle systems; and the Communication, Finance and Business Services (S36) with relatively moderate backward concentration index

(0.787) and an average forward concentration index over the period of study showing relatively stronger linkages with its downstream sectors.

6.3.2 Backward and Forward Entropy Indices

The backward and forward entropy indices inform the level of sectoral integration and specialisation in the economy. Entropy indices are descriptive of both inter-industry sectors and the economy as a whole because of including the sectoral share of final demand into calculations. The higher entropy indices show that a sector is more integrated into the economy and as such is a specialised sector which other sectors depend on it, and vice versa (Claus & Li 2003; Lenzen 2003, Soofi 1992, Theil 1971). The formulation of entropy indices are discussed in Chapter 4.

Figure 6.18 shows average entropy indices of the Australian sectors weighted based on relative share in total final demand over the period 1975 to 2015. Relatively, about 49% of the sectors (19 out of 39) have above average backward entropy indices requiring more specialised inputs from their upstream supplier sectors towards their production; and about 44% of the sectors (17 out of 39) have above average forward entropy indices meaning that their additional specialised products are available as inputs for production in other sectors.

The top 10 sectors with the highest backward entropy indices (3.8 to 1.3) are: Wholesale and Retail Trades (S34), Communication, Finance, and Business Services (S36), Construction (S33), Food, Beverage and Tobacco (S07), Machinery, Transport and Machinery Products (S19), Basic Non-Ferrous Metal Manufacturing (S17), Transport and Storage Services (S35), Education, Health and Community Services (S38), Other Mineral Mining (S06), (S02) Coal Mining.

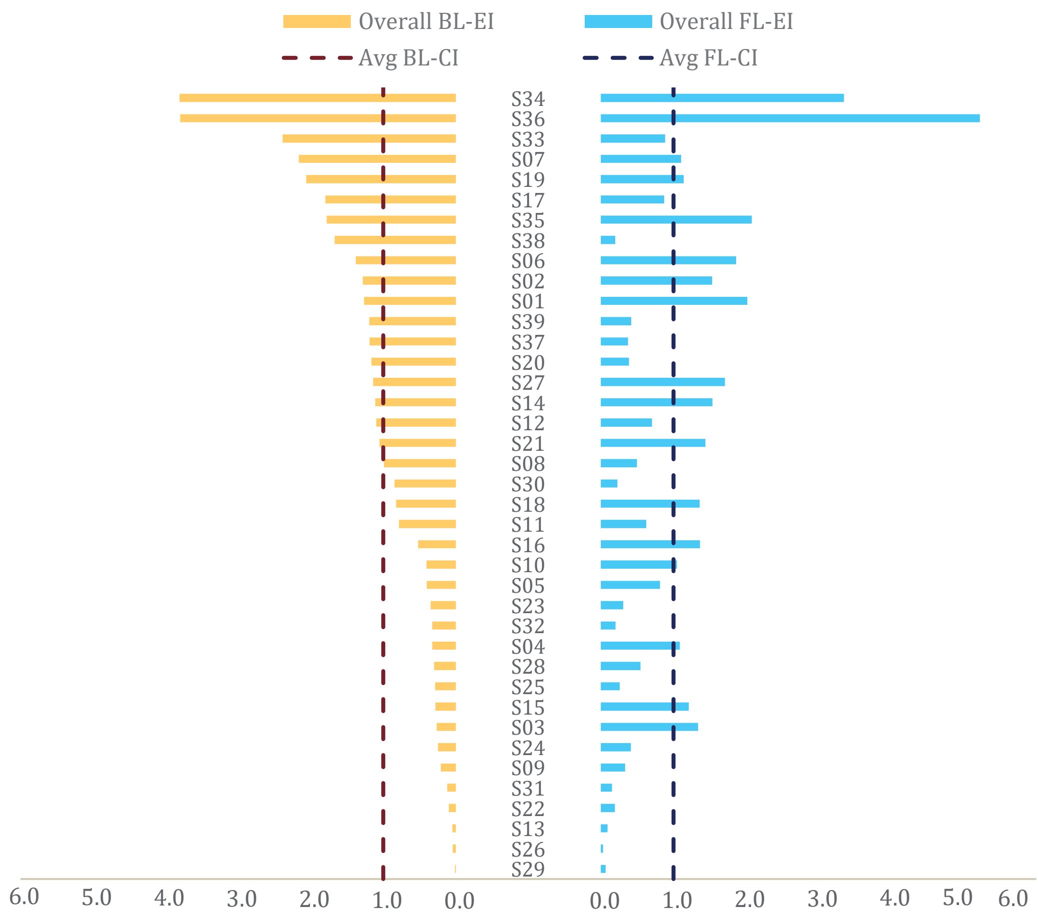
The less specialised sectors based of their low backward entropy indices (0.013 to 0.12) are: Upstream Water Supply (S29), Electricity Generation by Other Fuel (S26), Coal Products Manufacturing (S13), Electricity Generation by Oil Products (S22), Rural Water Supply (S31). These results are expected because of either the very small size of the sectors (S26, S13, S22), or in case of Upstream Water Supply its reliance on the rain and the water cycle systems.

The remaining sectors have moderate integration and specialisation in the economy.

With respect to forward entropy indices, the top ten sectors with the highest indices (5.2 to 1.4) are: Communication, Finance, and Business Services (S36), Wholesale and Retail Trade (S34), Transport and Storage Services (S35), Agriculture, Forestry and Fishing (S01), Other Mineral Mining (S06), Electricity Transmission and Distribution (S27), Chemical Products (S14), Coal Mining (S02), Electricity Generation by Coal (S21), and Iron and Steel Manufacturing (S16).

Because of the impacts of sectoral weighting in final demand, comparison of the top 10 sectors with the highest backward concentration and entropy indices reveals no sectors in common. It means that the sectors which once were important under Equal System of Weights are no longer

Figure 6.18: Average entropy indices, 1975-2015



Source: This author, based on the model developed in Chapter 4.

important under the Weighted System of Weights (see Chapter 5). However, when the forward linkages are compared three sectors are found in common: Electricity Transmission and Distribution (S27), Electricity Generation by Coal (S21), and Iron and Steel Manufacturing (S16). This comparison demonstrate the usefulness of various linkage descriptors for making policy and investments decisions. Because, in this case, the comparison of backward linkages alone did not prove useful. For example, the latter three sectors are strategic sectors because of their high number of sales transactions to other sectors (concentration), their highly integrated specialised supply (entropy), and as discussed in Chapter 7 because of their high forward linkage indices (how much they supply to other sectors). Moreover under both system of weights they proved important. Therefore, availability of these three indicators so far provides more information about the nature of the linkages than just by considering only one of them, normally the traditional equally weighted forward linkage indices. Table 6.8 shows the average entropy status of IOI and other sectors of the economy over the period of study.

With respect to infrastructure of interest, the backward entropy indices for Coal Mining (S02), Other Mining (S06), Electricity Transmission and Distribution (S27), and Urban Water Supply (S30) Sectors followed increasing trends over the period 1975 to 2015 indicating the need for more specialised inputs because of advancements in their production technologies. However, the

Table 6.8: All sectors average entropy indices status, 1975 to 2015

		Above Average Specialisation Status			Below Avg Status
Sector Name	Sec Code	BL-EI & FL-EI	BL-EI Only	FL-EI Only	
Agriculture, Forestry and Fishing	S01	●			
Coal Mining	S02	●			
Crude Oil (incl. condensate)	S03			●	
Gas (incl. Nat Gas, LPG and CSG)	S04			●	
Exploration and Mining Support Services	S05				●
Other Mining	S06	●			
Food, Beverage and Tobacco	S07	●			
Textile, clothing, footwear and leather	S08		●		
Pulp, Paper and Paperboard Manufacturing	S09				●
Wood Products	S10			●	
Printing, publishing other than music and Internet	S11				●
Petroleum Products Manufacturing	S12		●		
Coal Products Manufacturing	S13				●
Chemical Products	S14	●			
Non-Metallic and Mineral Products	S15			●	
Iron and Steel Manufacturing	S16			●	
Basic Non-Ferrous Metal Manufacturing	S17		●		
Metal Products, Other	S18			●	
Machinery, Transport and Machinery Products	S19	●			
Manufacturing, Other	S20		●		
Electricity Generation by Coal	S21	●			
Electricity Generation by Oil Products	S22				●
Electricity Generation by Natural Gas	S23				●
Electricity Generation by Hydro	S24				●
Electricity Generation by Renewables	S25				●
Electricity Generation by Other Fuel	S26				●
Electricity Transmission and Distribution	S27	●			
Gas Supply	S28				●
Water Supply UPSTREAM	S29				●
Water Supply, Urban	S30				●
Water Supply, Rural	S31				●
Water Services (Sewerage & Drainage)	S32				●
Construction	S33		●		
Wholesale and Retail Trade	S34	●			
Transport and Storage Services	S35	●			
Communication, Finance, Property and Business S	S36	●			
Government Administration, Defence, Public Orde	S37		●		
Education, Health and Community Services	S38		●		
Other Commercial Services including Waste Mana	S39		●		
Percentage of Total Sectors		**28.2%**	**20.5%**	**15.4%**	**36.0%**

Source: This author's analysis based on the outcomes of the model developed in Chapter 4.

forward entropy indices trends for Coal Mining (S02) and Other Mining (S06) Sectors declined (Figures 6.19 and 6.20) possibly because of advancements in production technologies of the input recipient sectors being less input intensive, or because of decline in coal mining particularly over the period 2013 to 2015 as discussed earlier. The forward trends in Electricity Transmission and Distribution (S27) and Urban Water Supply (S30) Sectors (Figures 6.21 and 6.22) insignificantly declined showing stable demand for specialised supply by these sectors. Table 6.9 summarises the trends, overall entropy indices status, and overall rank of the IOI sectors.

Overall, 11 out of 39 sectors (28%) of the Australian sectors have both above average backward and forward entropy indices indicating their high integration and specialisation in the economy. Therefore, for policy and investments decisions the knowledge of these sectors may prove useful. The full details of the sectoral entropy analysis are given in Appendix VI, Tables VI.17 and VI.18.

Figure 6.19: Entropy Indices (Coal), 1975-2015

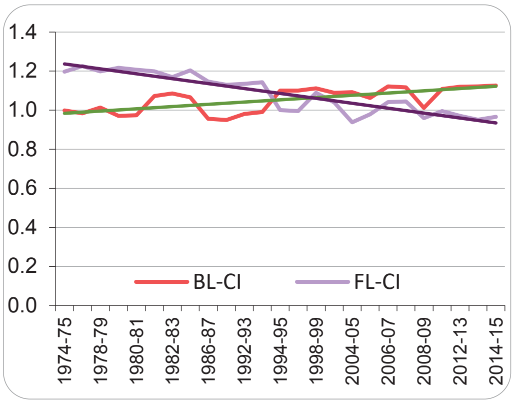


Figure 6.20: Entropy indices (Oth. Mining),1975-2015

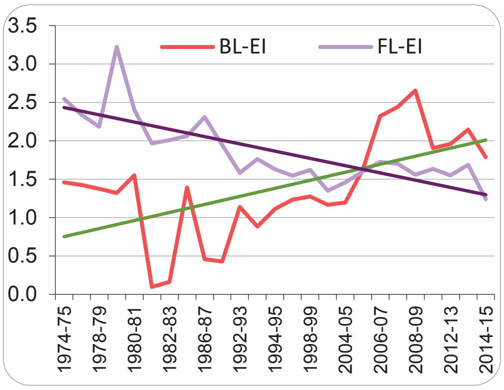


Figure 6.21: Entropy Indices (Elec. T&D), 1975-2015

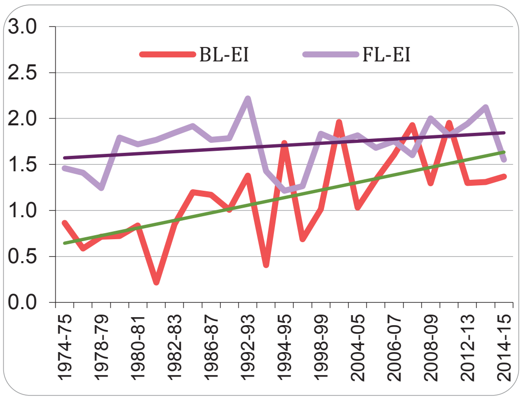
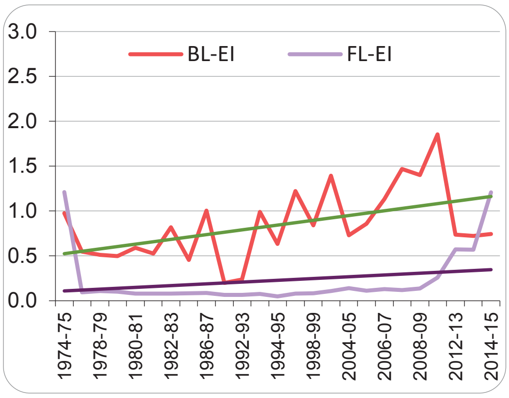


Figure 6.22:Entropy Indices(Urb Water),1975-2015



Source: This author's analysis based on the model developed in this research.

Table 6.9: IOI Sectors entropy indices trends, 1975 to 2015

		Trends Pattern		Overall EI Status		Overall Rank	
IO Sector	**Sec Code**	**BL-EI**	**FL-EI**	**BL-EI**	**FL-EI**	**BL-EI**	**FL-EI**
Coal Mining	S02	▲	▼	⤒	⤒	10	8
Crude Oil (incl. condensate)	S03	△	△	⤓	⤒	32	12
Gas (incl. Nat Gas, LPG and CSG)	S04	△	△	⤓	⤒	28	16
Exploration and Mining Support Services	S05	△	▲	⤓	⤓	25	20
Other Mining	S06	▲	▼	⤒	⤒	9	5
Petroleum Products Manufacturing	S12	△	▲	⤒	⤓	17	21
Coal Products Manufacturing	S13	⌅	⌅	⤓	⤓	37	37
Electricity Generation by Coal	S21	△	△	⤒	⤒	18	9
Electricity Generation by Oil Products	S22	⌅	⌅	⤓	⤓	36	35
Electricity Generation by Natural Gas	S23	△	△	⤓	⤓	26	30
Electricity Generation by Hydro	S24	▽	⌅	⤒	⤓	33	26
Electricity Generation by Renewables	S25	▽	▲	⤓	⤓	30	31
Electricity Generation by Other Fuel	S26	⌅	⌅	⤓	⤓	38	39
Electricity Transmission and Distribution	S27	▲	△	⤒	⤒	15	6
Gas Supply	S28	▽	⌅	⤓	⤓	29	23
Water Supply UPSTREAM	S29	⌅	⌅	⤓	⤓	39	38
Water Supply, Urban	S30	▲	△	⤓	⤓	20	32
Water Supply, Rural	S31	⌅	⌅	⤓	⤓	35	36
Water Services (Sewerage & Drainage)	S32	▼	⌅	⤓	⤓	27	33

▲ Increase ▼ Decrease △ Slight Inc ▽ Slight Dec ⌅ Stable ⤒ Above Avg ⤓ Below Avg

BL-EI = Backward Entropy Indices FL-EI = Foprward Entropy Indices

Source: This author's analysis based on the model developed in Chapter 4.

6.4 Summary of Key Findings

- The highest value added share of infrastructure of interest (IOI) in total GVA, both in absolute term and in indexed terms (1975=100) is attributed to Exploration and Mining Support

Services (S05), followed by Crude Oil (S03), and Other Mineral Mining (S06); however differently ranked in absolute terms. The information obtained under the indexed terms is more reliable for policy and investments decisions because each sectors' performance is compared with a common starting point, in this research 1975.

- The total value added of the Electricity Generation by Other Fuels (S26), compared to other generation types, is very low because of the Sector's relatively small size. Its contribution to GVA however has grown significantly since 2004-05. This suggests that this sector is potentially capable of contributing to GVA further if its activity is expanded through policies which encourage electricity generation by fuels other than primary energy sources.
- The contribution of Water Services (Sewerage & Drainage) (S32) to total GVA increases over the study period (indexed to 1975) because of rapid growth in the Construction Sector (S33), urbanisation, and industrial developments. These developments in turn lead to expansion of Water services infrastructure, and renewal of old infrastructure to avoid maintenance costs.
- Overall IOI contribution to GVA (indexed) declined because of observed high level of imports as well as adoption of advanced labour saving technologies over the study period.
- The level of imports by Petroleum Products Manufacturing (S12) is the highest, relative to other sectors over the study period. This is mainly related to outdated refining technology, thus reducing the competitiveness of domestic industry in comparison with advanced overseas petroleum refinery sectors (DITR 2007). This finding suggests the need for policies to increase the Sector's efficiency through less imports, thus enhancing its contribution to the local economy.
- 12 out of 19 IOI consistently demonstrated the highest number of the Most Important Coefficients (MIC), predominantly Forward MICs. In this group, Electricity Transmission and Distribution (S27) is the only sector with the highest number of Backward MICs (7), whose economic activities would be significantly sensitive to changes in economic activity of each of these seven most important upstream supply sectors. Any change in the coefficients of the linked sectors beyond the tolerance limit would strongly impacts the operation of S27. The high number of MICs also reflects the ability of S27 to induce economic activities in its immediate upstream supply sectors and in the economy as a whole.
- The sectors associated with the MIC have the highest linkage influences on Electricity Transmission and Distribution (S27) and include: Gas Supply (S28), Electricity Transmission and Distribution (S27) for own uses, and all electricity generation sectors except the Electricity Generation by Other Fuels (S26) which was classified as Important instead of MIC.
- The sectors associated with Forward MICs which are linked to Electricity Transmission and Distribution (S27) were stable over the period 2009 to 2015 and include: Electricity Generation by Coal (S21), Electricity Generation by Gas (S23), Coal Products Manufacturing (S13), Basic Non-Ferrous Metals (S17), the S27 itself for internal uses and transmission and

distribution losses, Construction (S33), and the majority of the services sector except Government Administration (S37) which was classified as Important instead of MIC.

- Sectors such as Coal (S02), Crude Oil (S03), Other Mineral Mining (S06) and Upstream Water Supply (S29) have only one Backward MIC and only 2 Forward MICs. Nevertheless, their operation is significantly important in the economy. This finding suggests that from a policy point of view, the operation of these sectors cannot be downgraded on the basis of low number of MICs assuming that it would not impact the rest of the economic sectors. The low number of MICs are expected for these resource-IOI because of their being capital intensive, and requiring specialised operation of highly advanced technologies.
- In 2014-15, the number of Backward MICs for other sectors of economy were the highest (9) for the Wholesale and Retail Trades (S34) followed by Construction (S33) and Communication, Finance, and Business Services (S36) each with 7. The S33 maintained its number consistently over the period of study because of high demand.
- The top sectors with the highest number of Forward MICs are Electricity Generation by Oil (S22) with 19 in the first rank; Coal Products Manufacturing (S13) with 17; Electricity Generation by Natural Gas (S23) and Gas Supply (S28) each with 16; and Electricity Generation by Hydro (S24) and Electricity Generation by Renewables (S25) Sectors each with 15 high dependency on their downstream sectors and vice versa, any change in IO coefficients of these sectors beyond the tolerance limit would significantly impact the sectors' operation.
- The 2007-08 GFC and its post-2008 effects did not change the stability pattern of MICs over the period 2009-2015. This is because of Australia's strong economic position at local and global levels which assisted to avoid disruptions in the production of goods and services.
- Out of the yearly total of 3042 coefficients in each IO Table over the study period, 72.3% were not important. The percentages of yearly total number of MICs on average is 10.2%, and 11.1% (Important), 6.4% (Less Important).
- The number of BL-MICs in each sector followed an overall increasing trend over the study period, indicating that the sectors induced significantly increasing economic activity throughout the economy while the overall number of forward MICs slightly declined over the period. The decline is attributed to increasing level of Gas exports supported by its high contribution to the total GVA, and also predicted Gas shortage by AEMO.
- The top 5 sectors with the highest number of inter-industry purchase transactions as identified by backward concentration indices are: Rural Water Supply (S31), Electricity Generation by Gas (S23), Basic Non-Ferrous Metal (S17), Food, Beverage and Tobacco (S07), Other Metal Products (S18) indicating an increase in outsourcing relative to other sectors. These sectors are strategically important because they generate economic activity throughout the economy.
- The top 5 sectors with the highest forward concentration indices are: Coal Products Manufacturing (S13), Gas Supply (S28), and Electricity Generation by Hydro (S24),

Electricity Generation by Oil Products (S22), and Electricity Generation by Natural Gas (S23). These sectors are strategically important, because their increased outputs means increased availability of production inputs for other sectors.

- The sectors with the highest forward concentration indices are fossil-fuel, and the fossil-fuel-powered electricity plants. Although the high number of forward transactions is an indicator of diversification, it is unlikely to occur in these sectors. Therefore, these sectors may consider "related diversification" (defined in section 6.3.1) by including renewable energy production among their traditional product lines as viable investments options because of declining costs of renewable energy technologies which are in alignment with the Commonwealth Government's Emissions Guarantee Objective outlined in the National Energy Guarantee (NEG) Scheme. This is a particularly an important consideration given that the "oil peak" may eventually come to an end, giving rise to the need for alternative energy products.
- Electricity Generation by Gas (S23) is the only sector among the top 5 sectors whose both backward and forward concentration linkages are above average. Overall, there are 25 sectors out of 39 sectors in this category which have developed strong linkages with economic growth.
- Water Services (Sewerage & Drainage) infrastructure (S32) increased the amount of purchases from other sectors over the study period, which could be related to infrastructure maintenance considering the age of the sector.
- The top 5 sectors with the highest backward entropy indices are: Wholesale and Retail Trades (S34); Communication, Finance, and Business Services (S36); Construction (S33); Food, Beverage and Tobacco (S07); and Machinery and Transport Products (S19) - demonstrating high level of integration in the economy for the specialised products and services they offer.
- The top 5 sectors with the highest forward entropy indices are: Communication, Finance, and Business Services (S36); Wholesale and Retail Trade (S34); Transport (S35); Agriculture, Forestry and Fishing (S01); and Other Mining (S06). These sectors supply specialised services to downstream sectors which are in high demand as inputs for production in other sectors.
- A comparison of a group of top 10 sectors with high backward concentration indices (governed by equal system of weights) with another group of top 10 with high backward entropy indices (weighted by relative share of each sector in total final demand) (see Chapters 4 and5 for details) reveals that the sectors in each group are different because of the influence of the system of weights. However, when forward linkages are compared, three common sectors were found, namely, Electricity Transmission and Distribution (S27), Electricity Generation by Coal (S21), and Iron and Steel (S16). These findings demonstrate the usefulness of different approaches to linkage analysis for policy formulation purposes, particularly for situations where more strategic decisions need to be made.

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7 IO FOUR-QUADRANT LINKAGE ANALYSIS FRAMEWORK

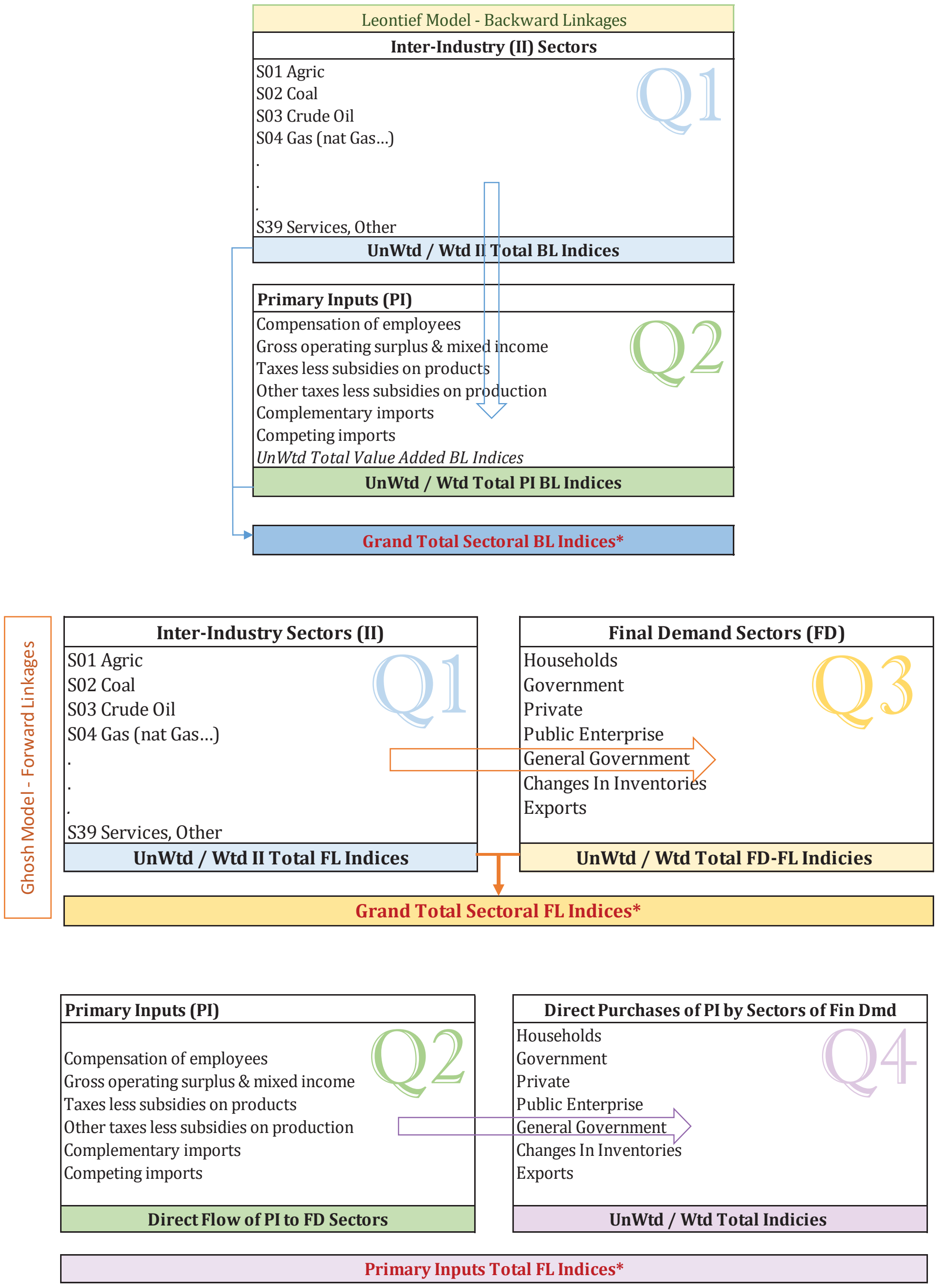
This Chapter focuses on empirical analysis of unweighted and weighted, direct and cumulative (total), backward and forward linkages - for IOI and other major sectors of the economy, over the period 1975-2015. This analysis will reveal the nature of linkages in terms of how much each sector purchases from, and supplies to, other sectors as a result of change in final demand and value added. This analysis will also provide insights which will be useful from a policy point of view, because it is important to know where to make policy and investments decisions which will create maximum linkage effects. The analysis is based on Input-Output Four-Quadrant Linkage Analysis Framework (Chapter 4).

This Chapter is organised as follows: Section 7.1 provides a brief introduction to the chapter. Section 7.2 discusses the inter-industry linkages (quadrant one of the IO Tables). The primary factors total linkages (quadrant two), and the final demand cumulative linkages (quadrant three) are discussed in sections 7.3 and 7.4 respectively. Section 7.5 describes linkages as a result of direct purchases of primary factors by each sector of final demand (quadrant four). Section 7.6 describes a proposed system of sectoral classification and discusses the results. Section 7.7 presents the key findings of the Chapter.

7.1 Introduction

In order to holistically analyse sectoral linkages, this research implements the Input-Output Four-Quadrant Linkage Analysis Framework (IOFQLAF), in contrast to the commonly practiced focus just on the inter-industry IO quadrant one. Also, the traditional method does not utilise the full potential of the IO tables for estimating individual sector's overall backward and forward linkages. Therefore, the estimation of sectoral linkages has remained incomplete. Formulation details of IOFQLAF were discussed in Chapter 4. The developed approach enables linkages analysis for: i) inter-industry production and supply sectors (IO quadrant one); ii) factors of production (IO Quadrant two); iii) sectors of final demand (IO Quadrant three); iv) direct purchases of primary factors by households and other sectors of the final demand (IO Quadrant four); and v) estimation of grand total backward and forward linkages as schematically represented by Figure 7.1. The vertically aggregated inter-industry and primary factors linkage indices show estimates of grand total backward linkages for the production sectors (i.e. j column sectors), while horizontally aggregated linkage indices for inter-industry and final demand sectors provide estimates of grand total forward linkages for each supply sector (i.e. i row sectors).

Figure 7.1: Linkage components by IO Four-Quadrant Framework



* Overall linkages indices is summation of Q1 and Q2 for BL and Q1 and Q3 for FL

Source: This author, conceptual linkages flow based on the IO Four-Quadrant Framework.

The grand total backward linkage indices estimate both inter-industry and value added input requirements of the j^{th}column sector whose production is changed by a unitary increase in its final demand. Likewise the overall forward linkages indices of the i^{th} row sector provides an estimate of total supply as a result of unitary changes in its value added. In other words, it describes the flow of outputs as inputs from the i^{th} supply sectors to its downstream sectors to induce further production by the recipient sectors as well as to the sectors of final demand for domestic final uses or for exports.

Additionally, by adapting both closed and open technology IO modelling frameworks, this chapter discusses the results of an in-depth quantitative analysis of unweighted (technology-based) and weighted (policy-based) sectoral linkages; empirically compares traditional and the developed IO Four-Quadrant Linkage Analysis Framework; and discuss the differences.

Moreover, this Chapter introduces a System of Sectoral Classification (SSC) approach as an improvement over the traditional key sector identification technique. The SSC evaluates the strength of both backward and forward linkage indices in conjunction with the proposed Comparable-Coefficient of Variation (C-COV) which was discussed in Chapter 4. A sector class is an indicator of the capacity of the sector to induce production and employment in other sectors particularly in the time of economic crisis. Also, beside other linkage indicators, which are discussed in this Chapter, the SSC outcomes can guide policy makers and investors to make more informed policy, planning and investment decisions.

This research has adopted the modified Chenery-Watanabe (CW) (1968) formulation method for estimating direct linkages, and the modified Rasmussen (1956) formulation method (also known as modified Hirschman-Rasmussen) for measuring cumulative (total) linkages (formulations given in Chapter 4). The selection of these two methods is justified by reliability and consistency of generated linkages results in comparison to known set of values as well as results obtained by other major methods. For this purpose, eight major methods were selected (Table 7.1) and linkage results evaluated. In terms of direct linkages, each of these methods produced the same results.

Also, the methods which are used in this research produced more consistent results in terms of cumulative linkages in comparison to other methods. For the latter evaluation, both unweighted and weighted direct and cumulative linkage results were compared in context of the key sector analysis. The reason for choosing this indicator is: first, its selection criteria are sensitive to linkage magnitudes (Chapter 4); and second, its outcomes are strategically important for policy and investment decisions. Therefore, the linkage estimation methods need to be selected appropriately so that reliable key sectors are reported. Table 7.1 shows the evaluation results. For example, each of the eight methods produce exactly the same key sector results for 12 sectors (identified with Max. No. = 8 out of 8). Also, the consistency of the results for the remaining sectors is evaluated at about 70% (i.e. $5 \leq Max\ No. < 8$). Production of the same or similar results demonstrates comparability of each method's underlying formulations. In case of evaluation of key sectors using direct linkage indices, the methods identify the same results for 22 out of 39 sectors, while the consistency of results for the remaining sectors is found at about 67%. Using cumulative linkages, the methods produced the same results as described for the "Max. No. Category". Table 7.1 shows outcomes produced by each method in 2008-09. To evaluate the reliability of the results over the study period, similar evaluation process was conducted for other years through the developed model. For example, see Table VII-1 in Appendix VII for 2014-15.

Table 7.1: Comparison of linkage methods, impacts on key sector analysis, 2008-09

2008-09		Original Chenery-Watanabe (CWo)	Modified Chenery-Watanabe (CWm)	Original Rasmussen Method (Ro)	Modified Rasmussen Method (Rm)	Original Hirschman-Rasmussen (H-R)	Original Hirschman-Rasmussen (H-R)	Original Cuello Method (Co)	Modified Cuello Method (Cm)	Evaluation of Common Results		
Sector	Sec Code	Direct Linkages	Direct Linkages	Total Linkages	Total Linkages	Direct Linkages	Total Linkages	Total Linkages	Total Linkages	Max No.	No. Direct out of 3	No. Total out of 5
Ag., Forest & Fish'g	S01	K	K	K	K	K	F	K	B	6	3	3
Coal	S02	W	W	W	W	W	W	W	W	8	3	5
Crude Oil	S03	F	F	F	K	F	W	W	W	4	3	1
Nat Gas	S04	W	W	W	W	W	W	W	W	8	3	5
Explor. Mining	S05	B	K	B	B	B	W	B	B	6	2	4
Oth. Mining	S06	K	K	K	K	K	K	K	W	6	3	4
Food & Bev	S07	K	B	K	K	K	K	K	B	5	2	4
Textile & Clothing	S08	W	W	W	W	W	W	W	W	8	3	5
Pulp & Paper Mfg	S09	W	F	W	F	W	W	W	K	5	2	3
Wood Prod.	S10	B	K	B	K	B	W	W	K	3, 3	2	2, 2
Print & Pub.	S11	W	F	W	W	W	W	W	K	6	2	4
Petro. Prod. Mfg	S12	B	K	W	W	W	F	W	W	5	0	4
Coal Prod. Mfg	S13	W	F	W	F	W	W	W	W	6	2	4
Chem. Prod.	S14	K	F	K	F	K	K	K	W	4	2	3
Non-Metal & Min. Prod.	S15	B	K	W	K	W	F	W	K	3, 3	0	2, 2
Iron & Steel Mfg	S16	B	K	B	K	B	F	W	K	3, 3	2	2
Non-Ferrous Mfg	S17	B	B	B	B	B	B	B	B	8	3	5
Other Metal Prod.	S18	B	K	W	K	W	F	W	K	3, 3	0	2, 2
Mach. & Transp Prod.	S19	K	B	K	B	K	K	K	K	5	2	4
Mfg Oth.	S20	W	W	W	W	W	W	W	W	8	3	5
Elec. Gen. Coal	S21	K	K	K	K	K	K	K	K	8	3	5
Elec. Gen. Oil	S22	B	K	B	K	B	B	B	K	5	2	3
Elec. Gen. Nat. Gas	S23	B	B	B	K	B	B	W	W	5	3	2, 2
Elec. Gen. Hydro	S24	B	K	B	K	B	B	B	K	5	2	3
Elec. Gen. Renew.	S25	B	K	B	K	B	B	B	K	5	2	3
Elec. Gen Oth. Fuel	S26	W	W	W	W	W	W	W	W	8	3	5
Elec. T&D	S27	K	K	K	K	K	K	K	K	8	3	5
Gas Supply	S28	B	K	B	K	B	W	B	B	5	2	3
Upstrm Water	S29	F	F	F	F	F	F	W	W	6	3	3
Urb Water	S30	B	B	B	W	B	B	W	W	5	3	3
Rurl Water	S31	B	K	B	F	B	B	W	W	4	2	2, 2
Water Sev.	S32	B	B	B	B	B	B	B	B	8	3	5
Const.	S33	K	K	K	K	K	K	K	K	8	3	5
Wsale&Retail	S34	K	K	K	K	K	K	K	K	8	3	5
Trsprt & Storage Serv.	S35	K	K	K	K	K	K	K	K	8	3	5
Comm, Fin. & Bus. Serv.	S36	K	K	K	B	K	K	K	K	6	3	4
Govt Admin	S37	B	B	B	W	B	W	K	B	4	3	2, 2
Edu, Hlth & Cmty Serv.	S38	B	B	B	B	B	B	K	K	5	3	3
Oth. Comml Serv.	S39	K	K	K	W	K	W	K	B	4	3	2, 2

B Strong BL **F** Strong FL **K** KEY Sector **W** Weak Linkages **Cw_o** Original Chenery-Watanabe **Cw_m** Modified Chenery-Watanabe
C_o Original Cuello **C_m** Modified Cuello **R_o** Original Rasmussen **R_m** Modified Rasmussen **H-R** Hirschman-Rasmussen **BL** Backward Linkage **FL** Forward Linkage

Source: Results from the model developed in Chapter 4.

7.2 Inter-Industry Sectoral Linkages

Direct Linkages (Weighted and Unweighted) - Table 7.2 presents overall unweighted and weighted direct linkages for IOI over the study period. The overall weighted direct backward linkages show an increasing pattern for majority of the IOI except for Petroleum Products Manufacturing (S12) (decreasing) and for Gas Supply (S28) (slightly decreasing). This means that S12's reliance on its upstream sectors to respond to a unit increase in its final demand is reducing over time. As shown earlier in Chapter 6, Figure 6.7, this is because of the Sector's performance for using imported petroleum products based on cost considerations. Also, results confirm previous findings which are discussed in Chapter 6, Section 6.1.

Table 7.2: Inter-industry overall direct linkage indices for IOI, 1975 to 2015

		Unweighted Direct Linkages						Weighted Direct Linkages					
		Trends		Avg Indices		Rank		Trends		Avg Indices		Rank	
Sector	Code	BL	FL	BL	FL	BL	FL	BL	FL	BL	FL	BL	FL
Coal	S02	▲	▼	0.8718	0.5472	29	32	▲	▼	0.5315	0.4257	15	19
Crude Oil	S03	▼	▼	0.4638	1.4291	38	7	△	▲	0.0491	0.6523	30	15
Nat Gas	S04	▽	▼	0.4640	1.1033	37	20	▲	△	0.0612	0.2321	26	24
Explor. Mining	S05	▼	▼	1.5228	1.3145	4	11	▲	▲	0.1272	0.2272	23	26
Oth. Mining	S06	△	▼	0.8845	0.9018	27	26	▲	△	0.6613	1.0688	13	8
Petro. Prod. Mfg	S12	▼	⌅	1.4359	1.1978	5	15	▼	⌅	0.5133	0.1696	16	28
Coal Prod. Mfg	S13	⌅	⌅	0.9961	1.5741	21	3	⌅	⌅	0.0020	0.0062	37	37
Elec. Gen. Coal	S21	▲	▽	1.1597	1.2425	12	13	△	▼	0.3109	0.8885	20	11
Elec. Gen. Oil	S22	▲	▲	0.7624	1.1123	32	19	⌅	⌅	0.0058	0.0285	36	35
Elec. Gen. Nat. Gas	S23	▼	▼	1.5686	1.1545	2	18	⌅	⌅	0.0607	0.0738	27	33
Elec. Gen. Hydro	S24	▲	△	0.9655	1.2165	23	14	⌅	⌅	0.0318	0.1201	34	30
Elec. Gen. Renew.	S25	▲	▲	0.8422	0.6278	30	31	△	△	0.0337	0.0485	33	34
Elec. Gen Oth. Fuel	S26	⌅	⌅	0.0152	0.0002	39	39	⌅	⌅	0.0000	0.0000	38	38
Elec. T&D	S27	▲	▽	0.8952	1.1898	26	16	▲	▼	0.3631	1.1574	18	6
Gas Supply	S28	▲	▲	1.0298	1.1803	18	17	▽	▽	0.0471	0.1319	31	29
Upstrm Water	S29	▽	⌅	0.4648	1.7876	36	1	⌅	⌅	0.0000	0.0000	39	39
Urb Water	S30	▲	▼	0.5819	0.9464	34	25	▲	▼	0.0544	0.2162	29	27
Rurl Water	S31	▼	▽	1.2717	1.3172	8	10	⌅	⌅	0.0065	0.0194	35	36
Water Sev.	S32	⌅	△	0.8036	0.9610	31	22	▲	▼	0.0755	0.2289	25	25

▲ Increase ▼ Decre △ Slight Increase ▽ Slight Decr ⌅ Increase-Decrease-Stable

Note: System of Weights: Weighted BL is based on each sector's relative share of total final demand; and weighted FL by each sector's relative share of total value added.

Source: This author's analysis based on the IO Four-Quadrant Linkages Analysis Framework.

In terms of overall weighted direct forward linkages, the importance of the following sectors to downstream production sectors increased over the period 1975-2015: Coal Mining (S02), Crude Oil (incl. condensate) (S03), Gas (incl. Nat Gas, LPG and CSG) (S04), Exploration and Mining Support Services (S05), and Other Mining (S06). However, the importance of Electricity Generation by Coal (S21), Electricity Transmission and Distribution (S27), Urban Water Supply (S30) and Water Services (Sewerage & Drainage) (S32), and to a lesser extent Gas Supply (S28) Sectors to their demand sectors and thus to final value added decreased over the period of study. Perhaps one of the reason for the latter decreases particularly for S21 and S27 Sectors could be due to increasing use of renewable sources in electricity generation in Australia. Also, difficulties with old coal-powered electricity generation plants and their shut down contributes to the supply decreases too. For example, Australia has seen extreme difficulties in its South Australian electricity plants which has placed national energy security on alert (Harmsen 2017). The electricity supply issues which are also predicted to worsen affecting the gas-powered electricity generators starting from 2018-19 (AEMO 2017a, 2017b) together with current issues with the coal-powered generators in South Australia has led the Federal Government to unveil AU$550m power plan in 2017 (Wills & Holderhead 2017) to fix the energy crisis.

The IOI unweighted pattern of increases in direct BL would be related to old production technologies while a decreasing pattern in indices size is related to labour saving technologies.

The weighted measurements of direct linkages reflect the influence of final demand (in case of backward linkages), and value added (in case of forward linkages) on domestic production identify the importance of production sectors to input-providers from policy point of view. For example, the overall unweighted inter-industry direct backward and forward linkage indices of the Coal Mining Sector (S02) were in the ranking positions 29 and 32 respectively. However, their weighted measurements placed the Sector in relatively higher linkage ranking positions (15 and 19 respectively). In contrast, the unweighted backward linkages of the high ranking position sectors: Electricity Generation by Natural Gas (S23, rank=2), Exploration and Mining Support Services (S05, rank=4), Petroleum Products Manufacturing (S12, rank=5), and Rural Water Supply (S31, Rank=8) moved significantly to the lower ranking positions 27, 23, 16, and 35 respectively when weighted. Similarly, the weighted direct forward linkages show sectoral supply as a direct measure of including economic activity in downstream sectors while their weighted indices estimate the flow of each sector's supply as inputs to other sectors based on the size and importance of the recipient sectors in value added. For example, the unweighted forward linkages of the Upstream Water Supply (S29, rank=1), Coal Products Manufacturing (S13, rank=3), Crude Oil including Condensate (S03, rank=7), and Rural Water Supply (S31, rank=10) moved to significantly lower ranking positions 39, 37, 15, and 36 respectively when weighted. Therefore, it is concluded that weighting estimate of direct linkages is not a replacement for the unweighted production recipe, rather it is estimating the importance of each elements of production recipe in final demand and in value added, thus their importance in a unit value of production.

In terms of other sectors of the economy, the top 10 sectors (ranked 1 to 10) with the highest weighted direct backward linkage indices are: Construction (S33), Wholesale and Retail Trades (S34), Communication, Finance, Property and Business Services (S36), Food, Beverage and Tobacco (S07), Government Administration, Defence, Public Order and Safety (S37), Machinery, Transport and Machinery Products (S19), Education, Health and Community Services (S38), Transport and Storage Services (S35), Other Commercial Services including Waste Management (S39), and Basic Non-Ferrous Metal Manufacturing (S17) respectively. These sectors' demand for inputs from their upstream sectors are the highest, therefore as a result of one unit increase in final demand for their products they induce high economic activity in other sectors.

The top 10 sectors with the highest overall weighted direct forward linkage indices are: Communication, Finance, Property and Business Services (S36), Wholesale and Retail Trades (S34), Transport and Storage Services (S35), Agriculture, Forestry and Fishing (S01), Construction (S33), Electricity Transmission and Distribution (S27), Machinery, Transport and Machinery Products (S19), Other Mining (S06), Chemical Products (S14), Printing, publishing other than music and Internet (S11). Some of the sectors in this group also are among top 10 sectors with the highest backward linkages. Therefore, potentially they could be regarded as a key which is discussed further in Section 7.6 in this chapter.

Further details of direct linkages for both IOI and other sectors of the economy are presented in Appendix VII in Tables VII-2 and VII-3. The weighted and unweighted formulations used in this research were discussed in Chapters 4 and 5.

Unweighted Cumulative (Total) Linkages - Table 7.3 presents the results of the overall unweighted cumulative (total) linkages for IOI sectors reflecting the impacts of both direct and indirect increases in outputs due to increase in final demand over the period 1975 to 2015.

The overall average un-weighted total BL related to 53% of IOI followed an increasing pattern over the study period. This implies that productivity of these sectors are low, perhaps because of the use of older production technology. This conclusion also applies to electricity generation by fuel types, particularly Electricity generation by Gas (S23) whose forward supply among all electricity generators has followed a decreasing pattern over the study period.

The average total unweighted BL for all primary resource sectors as well as Exploration and Mining Support Services (S05) followed a decreasing pattern over time showing an improvement in production technology. The latter conclusion is in alignment with the finding reported in the literature. For example, Wood (2009) refers to the work of Leontief who interpreted a decrease in the share of intermediate inputs for production of one unit output attributed to the adoption of more advanced production technology which increased the productivity of the sector.

The overall unweighted total backward linkage results for the Electricity Generation by Gas (S23) (1.3442) placed the Sector in the first ranking position indicating its tighter linkages with its upstream Gas (incl. Nat Gas, LPG and CSG) Sector (S04). However, the linkages between the S23 and S04 may be impacted by predicted low supply of Gas starting in 2018-19 (AEMO 2017a). The linkage intensity of the Electricity Transmission and Distribution (S27) to its upstream sectors (1.2364 in the 5th rank in Australia) - after Electricity Generation by Gas (S23) (1.3442 in the 1st rank), and Electricity Generation by Coal (S21) (1.3117 in the 2nd rank) - increased over the period1975 to 2015, enabling it to stably maintain its forward linkages with its downstream demand sectors. This is an expected result considering that its input providers are all electricity generators in the country whose production, as described earlier, are in trouble. Therefore, the productivity of Electricity Transmission and Distribution Sector (S27) is highly linked to the advanced technologies and improved production in its upstream generators while the Sector itself would also benefit from accessing more advanced transmission and distribution technologies.

The analysis shows that the supply patterns of the Electricity Generation by Renewables (S25) consistently increased over the study period confirming the same findings by MICs, entropy and concentration linkage descriptors as discussed in Chapter 6. Therefore, from policy perspective development of this Sector may reveal its further potential for higher electricity generation given

Table 7.3: IOI inter-industry un-weighted average total linkages, 1975-2015

		Trends		Overall Average Indices		Overall Indices Rank	
Sector	Code	BL	FL	BL	FL	BL	FL
Coal	S02	⊼	▼	0.9200	0.8811	28	28
Crude Oil	S03	▼	▼	0.7398	1.2810	36	7
Nat Gas	S04	▼	▼	0.7483	1.2618	35	9
Explor. Mining	S05	▼	▼	1.1939	1.2404	7	12
Petro. Prod. Mfg	S06	▽	▼	0.9276	0.8882	27	27
Petro. Prod. Mfg	S12	▼	▽	1.0403	1.0553	16	19
Coal Prod. Mfg	S13	▼	▼	0.8854	1.4122	31	2
Elec. Gen. Coal	S21	▲	⊼	1.3117	1.3874	2	3
Elec. Gen. Oil	S22	▲	▲	1.0977	1.2947	12	6
Elec. Gen. Nat. Gas	S23	▲	▼	1.3442	1.2807	1	8
Elec. Gen. Hydro	S24	▲	▲	1.2530	1.3844	4	4
Elec. Gen. Renew.	S25	▲	▲	1.1221	0.9262	10	21
Elec. Gen Oth. Fuel	S26	▽	⊼	0.5430	0.4512	39	39
Elec. T&D	S27	▲	⊼	1.2364	1.3432	5	5
Gas Supply	S28	△	▲	0.9497	1.1781	25	13
Upstrm Water	S29	▼	▽	0.6700	1.4644	38	1
Urb Water	S30	▲	▽	0.8305	0.8945	34	26
Rurl Water	S31	▼	⊼	1.1208	1.0978	11	16
Water Sev.	S32	▲	▼	0.8744	0.9011	32	24

▲ Increase ▼ Decrease △ Slight Inc ▽ Slight Dec ⊼ Inc-Dec-Stable

Source: This author's analysis based on the IO Four-Quadrant Linkage Analysis Framework.

the aforementioned issues with generation by other fuel types.

Figure 7.2 and Figure 7.3 illustrate total backward linkages trends over the period 1975-2015 for Coal (S02) and Crude Oil (S03). The graphs covering all IOI presented in Appendix VII Figures VII-1 to VII-20. These graphs are interpreted in conjunction with important timelines of the Australian economy, which for simplicity are not shown on each graph. The major timelines are: Australian Recessions in 1975, 1977, 1981-83, and 1990-91; the 1977 Asian Financial Crisis; the Second Oil Shock in 1979; Periods of economic slowdown in second half of 2000, first half of 2006, and 2008-2009; the Reform Period of 1975 to the late 1990s; 2004 National Water Initiative (NWI) and Energy Paper; 2007-08 Global Financial Crisis (GFC) (see Chapter 3 for details).

Table 7.4 shows unweighted average cumulative linkage indices and the ranking positions of other major sectors of the economy. The overall unweighted total backward and forward indices for 13 out of 39 (33%) sectors including IOI are above average. For the remaining sectors, five (12.8%) sectors have strong backward linkages, seven (17.9%) strong forward linkages, and 14 (35.9%) weak upstream and downstream linkages with other sectors of the economy.

Figure 7.2: Unweighted total linkage indices, Coal Mining, 1975-2015

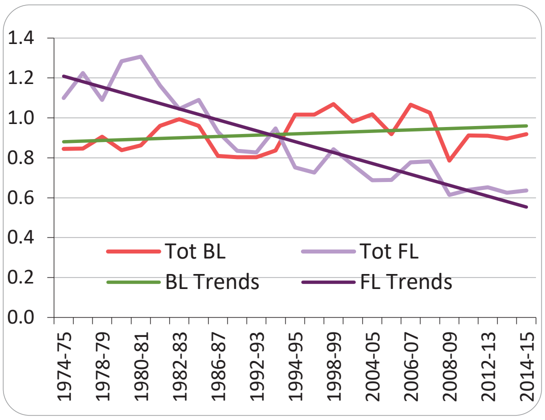
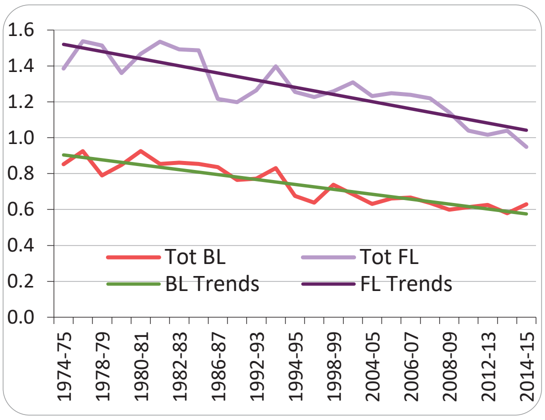


Figure 7.3: Unweighted total linkage indices, Crude Oil, 1975-2015



Source: This author's analysis based on the data from the model developed in Chapter 4.

Table 7.4: Overall-average unweighted total linkage, other sectors, 1975-2015

		Overall Indices		Overall Indices Rank	
Sector	Code	BL	FL	BL	FL
Ag., Forest & Fish'g	S01	0.9634	0.9033	23	22
Food & Bev	S07	1.2121	0.6626	6	34
Textile & Clothing	S08	0.9172	0.7250	29	32
Pulp & Paper Mfg	S09	0.9890	1.2529	20	11
Wood Prod.	S10	1.0602	1.1479	15	15
Print & Pub.	S11	0.9927	1.0414	19	20
Chem. Prod.	S14	1.0066	1.0656	18	17
Non-Metal & Min. Prod.	S15	1.0702	1.1729	14	14
Iron & Steel Mfg	S16	1.1512	1.2595	8	10
Non-Ferrous Mfg	S17	1.2775	0.7974	3	29
Other Metal Prod.	S18	1.0930	1.0578	13	18
Mach. & Transp Prod.	S19	0.9134	0.7521	30	30
Mfg Oth.	S20	1.0110	0.6480	17	36
Const.	S33	1.1352	0.6624	9	35
Wsale&Retail	S34	0.9281	0.7407	26	31
Trsprt & Storage Serv.	S35	0.9725	0.9012	21	23
Comm, Fin. & Bus. Serv.	S36	0.8360	0.8953	33	25
Govt Admin	S37	0.9576	0.5345	24	37
Edu, Hlth & Cmty Serv.	S38	0.7394	0.4798	37	38
Oth. Comml Serv.	S39	0.9652	0.6762	22	33

Source: Results from the model developed in Chapter 4.

The top 10 sectors of the economy (ranked 1 to 10) with the highest overall cumulative backward linkage indices are: Electricity Generation by Natural Gas (S23); Electricity Generation by Coal (S21), Basic Non-Ferrous Metal Manufacturing (S17), Electricity Generation by Hydro (S24), Electricity Transmission and Distribution (S27), Food, Beverage and Tobacco(S07), Exploration and Mining Support Services (S05), Iron and Steel Manufacturing (S16), Construction (S33), and

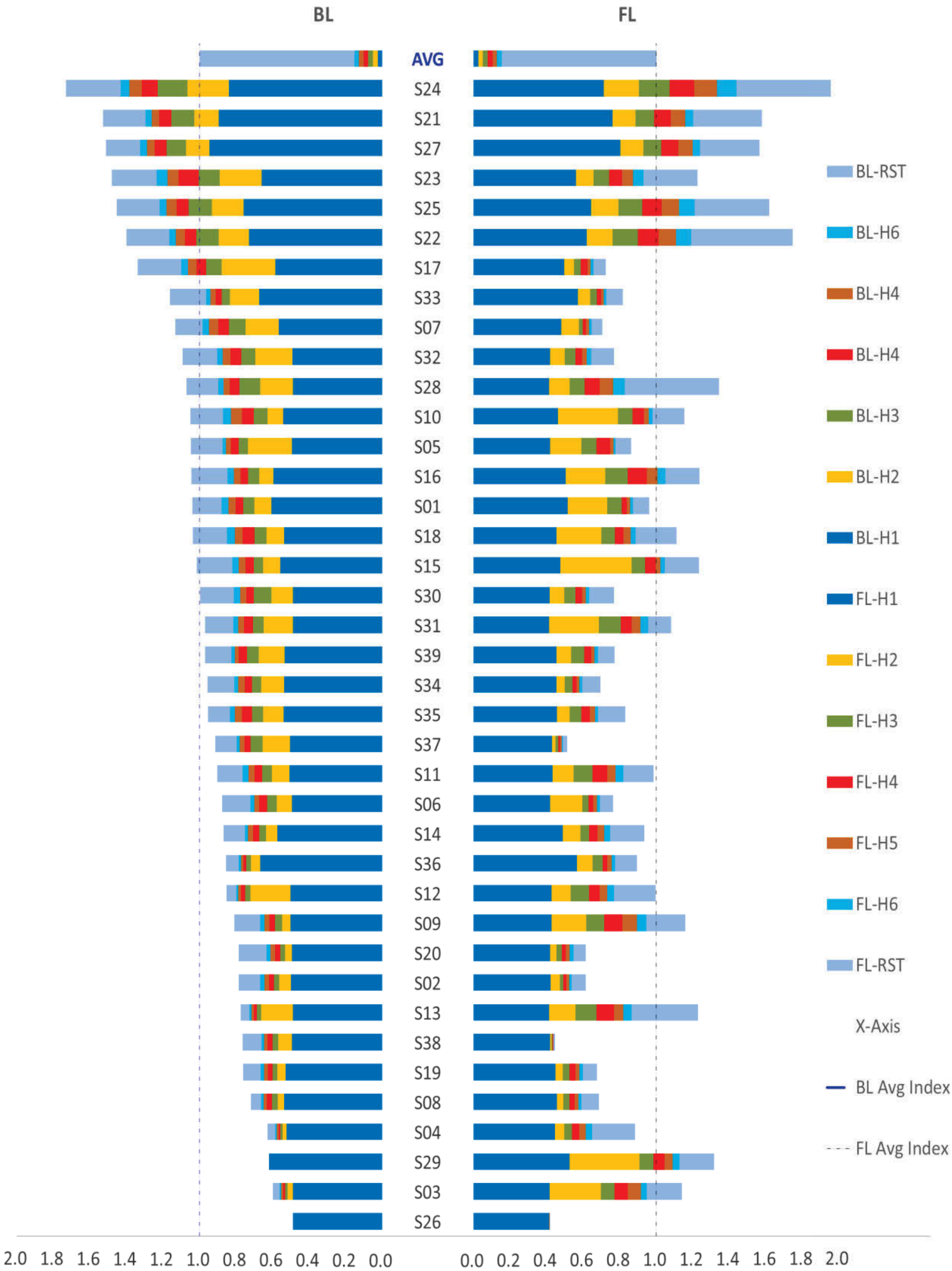
Electricity Generation by Renewables (S25) respectively. The backward linkage indices of these sectors are above average (1.3442 to 1.1221). They are strategic sectors capable of inducing high economic activity in other sectors as a result of change in final demand.

Regarding the overall cumulative forward linkages, the top 10 sectors (in ranking positions 1 to 10) with the highest indices are: Upstream Water Supply (S29), Coal Products Manufacturing (S13), Electricity Generation by Coal (S21), Electricity Generation by Hydro (S24), Electricity Transmission and Distribution (S27), Electricity Generation by Oil Products (S22), Crude Oil (incl. condensate) (S03), Electricity Generation by Natural Gas (S23), Gas (incl. Nat Gas, LPG and CSG) (S04), Iron and Steel Manufacturing (S16). These sectors have above average cumulative indices in the range of 1.4644 to 1.2595. Likewise, these sectors are strategic supply sectors making available their output as inputs to their downstream recipient sectors inducing production in these sectors. The common sectors in the two top 10 lists are potential key sectors whose details are discussed in section 7.6. Tables VII-4 and VII-5 in Appendix VII provide full details of unweighted total linkages over the period 1975 to 2015 for all sectors.

Contributors to Unweighted Linkage Indices - Contribution to sectoral linkages are divided into two categories: the *Intra-Industry Trade* linkages represented by "H1" showing contribution of the sector itself to purchases or supply transactions which is normally found along the principle diagonal of the inter-industry quadrant one of the IO Tables; and the *Inter-Industry Trade Linkages*, the contribution from other sectors of the economy because of the sectors' linkages with other sectors. The latter contributors are codified by: "H2" to "H6" representing the top five contributors to the magnitude of linkage indices; and "RST" representing aggregate contribution from rest of the sectors in the economy either supplying to, or purchasing from other sector. These notations are prefixed by BL (backward linkages) and FL (forward linkages) to distinguish the upstream and downstream linkages (e.g. BL-H2, FL-RST etc.). Figure 7.22 illustrates these top seven contributors to unweighted total linkages in 2008-09 (post-GFC). The sectors with above average total linkages are identified by the vertical average lines crossing the backward or forward wings of the graph. Table VII-10 in Appendix VII presents full details of the top contributors, and their linkage shares, for all sectors in 2008-09.

Based on a review of Figure 7.4 and Table VII-10, the following observations are drawn:
The top 10 sectors with the highest magnitude of intra-industry share in total backward linkage indices (BL-H1) are majority of the electricity sectors including: Electricity Transmission and Distribution (S27) with 0.9450 share in total index of 1.5123 (thereafter, 0.9450 in 1.5123); Electricity Generation by Coal (S21) 0.8963 in 1.5272; Electricity Generation by Hydro (S24) 0.8398 in 1.7320; Electricity Generation by Renewables (S25) 0.7582 in 1.4542; Electricity Generation by Oil Products (S22) 0.7304 in 1.4013; Electricity Generation by Natural Gas (S23) 0.6600 of 1.4795; and in other major sectors including: Construction (S33) 0.6730 in 1.1625; Communication, Finance, Property and Business Services (S36) 0.6693 in 0.8544; and

Figure 7.4: Unweighted total inter-industry linkages, 2008-09



Source: Results generated by the model developed in Chapter 4.

Agriculture, Forestry and Fishing (S01) 0.6069 in 1.0407. However, there are sectors whose nearly all of their inputs are provided through internal transactions such as Upstream Water

Supply (S29) 0.6210 in 0.6210; and Electricity Generation by Other Fuel (S26) 0.4890 in 0.4900. In case of electricity generation sectors majority of the intra-industry transactions are within the sector for own use, and energy loses during production, transmission, and distribution processes. For example, Electricity Generation by Other Fuel (S26) is the least efficient electricity generation sector because of significant energy loses. Regarding the Upstream Water Supply (S29) naturally it is expected that all of its input requirements are provided from the Water Cycle System within which it exists. However, in case of other sectors, the higher magnitudes of the intra-industry linkages implies the degree of sectoral self-sufficiency for production of goods and services reducing the inter-industry dependency for input requirements. The intra-industry share of backward transactions for 82% of the Australian sectors (32 out of 39 incl. 14 out of 19 IOI) is above 50%. The intra-industry share of 12 sectors (31%) is between 60 to 84%. The sectors whose intra-industry share of total linkage indices is below 50% are: Basic Non-Ferrous Metal Manufacturing (S17) 0.5858 share in total of 1.3391 BL index (44%); Water Services (Sewerage & Drainage) (S32) 0.4930 in 1.0929 (45%); Gas Supply (S28) 0.4895 in 1.0705 (46%); Exploration and Mining Support Services (S05) 0.4932 in 1.0480 (47%); and Urban Water Supply (S30) 0.4898 in 0.9957 (49%). These sectors have developed stronger linkages with other sectors of economy for their input requirements.

The aforementioned top 10 sectors also exhibit the highest magnitudes of intra-industry share in total forward linkage indices (FL-H1) (Table VII-10 in Appendix VII). This means that these sectors as a result of change in value added make most of their supply available for own use before distributing the rest to other sectors of the economy. This implies that these sectors for production and provisioning services heavily rely on themselves. 54% of the Australian sectors (21 out of 39 sectors including 26% of IOI, 5 out of 19) are in the latter category. The study shows that the backward and forward linkages of 46% of the Australian sectors (18 out of 39 including 5 IOI) are composed of above 50% share of intra-industry indices. Majority of these sectors are more independent sectors which may not generate high economic activity in other sectors. For example 14 of the 18 sectors are weak sectors having below average linkages. Nevertheless, they are strategic sectors because of their relatively specialised services. Therefore, from policy point of view these sectors may be considered in policies aimed at sectoral development. These sectors are summarised in Table 7.5.

The following sectors in the first rank have the highest magnitudinal share in other sectors' inter-industry backward linkages (BL-H2 in Table 7.6): Communication, Finance, Property and Business Services (S36) serving 25 out of 39 sectors (64%) of the economy; followed by Construction (S33), Electricity Generation by Coal (S21), Other Mineral Mining (S06), and Crude Oil (S02) serving a total of 10 out 39 Sectors. Communication, Finance, Property and Business Services (S36) also has the second ranking magnitudinal share in total linkages of 11 sectors.

Table 7.5: Percentage share of un-weighted inter-industry linkages, 2008-09

Sector Code	Sector Name	BL-H1	TOTAL-BL	BL-H1 share of Tot. BL (%)	FL-H1	TOTAL-FL	FL-H1 share of Tot. FL (%)
S26	Elec. Gen Oth. Fuel	0.4890	0.4899	100	0.4141	0.4148	100
S04	Nat Gas	0.5245	0.6279	84	0.4441	0.8823	50
S36	Comm, Fin. & Bus. Serv.	0.6693	0.8544	78	0.5668	0.8937	63
S08	Textile & Clothing	0.5377	0.7184	75	0.4554	0.6867	66
S19	Mach. & Transp Prod.	0.5303	0.7605	70	0.4491	0.6753	66
S14	Chem. Prod.	0.5758	0.8693	66	0.4876	0.9339	52
S38	Edu, Hlth & Cmty Serv.	0.4943	0.7644	65	0.4186	0.4461	94
S02	Coal	0.4987	0.7859	63	0.4223	0.6137	69
S20	Mfg Oth.	0.4938	0.7868	63	0.4182	0.6143	68
S27	Elec. T&D	0.9450	1.5123	62	0.8044	1.5633	51
S01	Ag., Forest & Fish'g	0.6069	1.0407	58	0.5140	0.9606	54
S33	Const.	0.6730	1.1625	58	0.5699	0.8166	70
S06	Oth. Mining	0.4957	0.8772	57	0.4198	0.7623	55
S35	Trsprt & Storage Serv.	0.5386	0.9543	56	0.4561	0.8295	55
S34	Wsale&Retail	0.5365	0.9564	56	0.4543	0.6933	66
S37	Govt Admin	0.5057	0.9140	55	0.4282	0.5113	84
S39	Oth. Comml Serv.	0.5347	0.9703	55	0.4528	0.7713	59
S07	Food & Bev	0.5672	1.1339	50	0.4804	0.7038	68
S30	Water, Urb	0.4898	0.9957	49	0.4147	0.7685	54
S32	Water, Sev.	0.4930	1.0929	45	0.4175	0.7684	54
S17	Non-Ferrous Mfg	0.5858	1.3391	44	0.4961	0.7239	69

BL-H1 = Intra-indusry BL FH-H1 = Intra-Industry FL IOI = Infrastructure of Interest
BL = Backward Linkage Indices FL = Forward Linkage Indices (shaded in yellow)

Source: Results obtained from the model developed in Chapter 4.

Table 7.6: Highest contributors to un-weighted total backward linkages, 2008-09

Sec. Code	Highest Order / Highest Contributor	First (BL-H2)	Second (BL-H3)	Third (BL-H4)	Fourth (BL-H5)	Fifth (BL-H6)
S36	Comm, Fin. & Bus. Serv.	• **(25)**	• **(11)**			
S35	Trsprt & Storage Serv.			• **(6)**	• **(8)**	• **(7)**
S34	Wsale & Retail		• **(6)**	• **(12)**	• **(9)**	• **(8)**
S33	Const.	• (3)	• **(12)**	• **(12)**	• (2)	• **(6)**
S28	Gas Supply				• (2)	
S21	Elec. Gen. Coal	• (3)			• (2)	
S19	Mach. & Transp Prod.				• (2)	• **(6)**
S14	Chem. Prod.				• (3)	
S12	Petro. Prod. Mfg					• (3)
S07	Food, Beverage and Tobacco				• (2)	
S06	Oth. Mining	• (2)				
S03	Crude Oil	• (2)				
S02	Coal				• (3)	
S01	Ag., Forest & Fish'g		• (3)			
Total Sectors		**35**	**32**	**30**	**33**	**30**

In brackets, no. of sectors with the highest linkage- share of the sector specified. IOI = Highlighted in blue
Highest contributors which appeared only once in a sector's linkages are not included.

Source: Results obtained from the model developed in Chapter 4.

The top 10 sectors whose first ranking contributor to their total backward linkages is S36(BL-H2) are: Exploration and Mining Support Services (S05) with 0.2422 in total inter-industry linkage Index of 0.5548 (or 44%); Water Services (Sewerage & Drainage) (S32) with 0.2014 in 0.59999 (or 34%); Gas Supply (S28) with 0.1766 in 0.5809 (or 31%); Construction (S33) with 0.1610 in 0.4895 (or 33%); Government Administration, Defence, Public Order and Safety (S37) with 0.1494 in 0.4083 (or 37%); Other Commercial Services including Waste Management (S39) with 0.1408 in 0.4356 (or 32%); Electricity Generation by Coal (S21) with 0.1316 in 0.6309 (or21%); Electricity Transmission and Distribution (S27) with 0.1292 in 0.5672 (or 23%); Wholesale and Retail Trade (S34) with 0.1256 in 0.4199 (or 30%); and Transport and Storage Services (S35) with 0.1142 in 0.4158 (or 27%). These results imply two points: first, production of a unit output by these sectors is highly dependent on inputs from Communication, Finance, Property and Business Services Sector (S36), and most of the production costs are related to products and services provided by this Sector; and second, from policy and investment perspectives, developing and investing in Communication, Finance, Property and Business Services Sector (S36) is useful because, majority of the sectors depend on its inputs. Also, by developing S36 it induces relatively high economic activity in other sectors which is also beneficial to the economy as a whole. Table 7.6 shows the sectors whose share in other sector's total linkages is relatively high, in the ranking positions one to five, codified by "BL-H2" to "BL-H6" in this research. The sectors shown in Table 7.6 are the highest contributors to backward linkages of 77 to 90% of the Australian sectors based on their ranking position.

Table 7.7 ranks the contributors according to the magnitude of their share in total forward linkages of 30 to 35 sectors of the Australian economy. The sectors with the highest share of total forward linkages (FL-H2) are: Communication, Finance, Property and Business Services (S36); Wholesale and Retail Trades (S34); Construction (S33); Electricity Generation by Coal (S21); and Chemical Production (S14). These sectors are the recipients of the majority of the sectoral supply available to them for more production.

Stability of Contribution Over Time - The pattern of contribution, which signifies the ties of economic sectors with their upstream providers and downstream supply recipients change over time (see Tables 7.8 to 7.10) in order to respond to changes in supply and demand as well as to the input requirements of more advanced production technologies. For example, adoption of more advanced technology or improving product diversification raises the requirements for advanced communication, finance, and business services inputs because of sectoral expansion.

Table 7.8 presents the changing patterns of the highest contributors to sectoral linkages for Electricity Generation by Natural Gas (S23), and the Gas (incl. Nat Gas, LPG and CSG) (S04) Sectors over the period 1975 to 2015. In particular, the backward and forward linkages of the Gas Sector (S04) followed declining patterns over the period 1975 to 2015 and also the forward linkages of S23 declined over the same period (Table 7.2, Table 7.3).

Table 7.7: Highest contributors to un-weighted total forward linkages, 2008-09

Sec. Code	Highest Order / Highest Contributor	First (FL-H2)	Second (FL-H3)	Third (FL-H4)	Fourth (FL-H5)	Fifth (FL-H6)
S39	Oth. Comml Serv.					• (6)
S38	Edu, Hlth & Cmty Serv.			• (2)	• (2)	
S37	Govt Admin				• (3)	• (4)
S36	Comm, Fin. & Bus. Serv.	• (8)	• (7)	• (5)	• (11)	• (6)
S35	Trsprt & Storage Serv.			• (2)	• (6)	• (4)
S34	Wsale & Retail	• (5)	• (11)	• (12)		• (6)
S33	Const.	• (10)	• (15)	• (10)	• (2)	
S21	Elec. Gen. Coal	• (5)				
S19	Mach. & Transp Prod.				• (2)	
S18	Oth. Metal Prod.			• (2)		
S17	Non-Ferrous Mfg				• (5)	• (4)
S16	Iron & Steel Mfg					• (2)
S14	Chem. Prod.	• (2)				
S07	Food, Beverage and Tobacco				• (3)	
S01	Ag., Forest & Fish'g					• (3)
Total Sectors		**30**	**33**	**33**	**34**	**35**

In brackets, highest contributor appeared in (x) no. of sectors' linkages. IOI = Highlighted in blue
Highest contributors which appeared only once in a sector's linkages are not included.

Source: Results obtained from the model developed in this research.

Table 7.8: Highest contributors to un-weighted linkages (selected sectors), 1975-2015

Sector	S04 Gas (incl. Nat Gas, LPG and CSG)														S23 Electricity Generation by Natural Gas													
Linkage Type	Backward Linkages							Forward Linkages							Backward Linkages							Forward Linkages						
Year / Order	H1	H2	H3	H4	H5	H6	RST	H1	H2	H3	H4	H5	H6	RST	H1	H2	H3	H4	H5	H6	RST	H1	H2	H3	H4	H5	H6	RST
1974-75	S04	S05	S35	S02	S19	S34	RST	S04	S27	S23	S34	S21	S19	RST	S23	S04	S28	S35	S05	S34	RST	S23	S27	S34	S19	S33	S07	RST
1977-78	S04	S05	S02	S35	S36	S34	RST	S04	S27	S23	S21	S34	S07	RST	S23	S04	S36	S34	S12	S35	RST	S23	S27	S34	S07	S21	S36	RST
1978-79	S04	S05	S36	S02	S35	S34	RST	S04	S27	S28	S23	S02	S33	RST	S23	S36	S04	S21	S35	S12	RST	S23	S27	S34	S21	S07	S33	RST
1979-80	S04	S05	S36	S35	S02	S19	RST	S04	S27	S23	S28	S21	S33	RST	S23	S04	S36	S28	S35	S05	RST	S23	S27	S34	S36	S07	S21	RST
1980-81	S04	S05	S36	S35	S02	S34	RST	S04	S27	S23	S21	S33	S36	RST	S23	S04	S28	S36	S35	S05	RST	S23	S27	S36	S34	S07	S33	RST
1981-82	S04	S05	S36	S35	S34	S19	RST	S04	S27	S28	S23	S12	S33	RST	S23	S28	S04	S36	S12	S35	RST	S23	S27	S36	S34	S21	S33	RST
1982-83	S04	S05	S36	S35	S19	S34	RST	S04	S27	S28	S23	S33	S21	RST	S23	S28	S04	S36	S21	S12	RST	S23	S27	S36	S34	S21	S33	RST
1983-84	S04	S05	S36	S35	S34	S02	RST	S04	S27	S23	S28	S21	S34	RST	S23	S04	S36	S28	S05	S21	RST	S23	S27	S34	S36	S21	S07	RST
1986-87	S04	S05	S36	S35	S34	S19	RST	S04	S27	S23	S28	S36	S33	RST	S23	S04	S28	S36	S35	S21	RST	S23	S27	S36	S34	S21	S37	RST
1989-90	S04	S05	S36	S35	S34	S19	RST	S04	S27	S23	S28	S37	S36	RST	S23	S04	S28	S36	S35	S05	RST	S23	S27	S37	S36	S34	S33	RST
1992-93	S04	S36	S05	S23	S34	S35	RST	S04	S28	S27	S17	S23	S07	RST	S23	S28	S04	S21	S36	S35	RST	S23	S27	S21	S37	S36	S38	RST
1993-94	S04	S36	S05	S19	S34	S35	RST	S04	S17	S27	S15	S23	S33	RST	S23	S04	S28	S36	S35	S19	RST	S23	S36	S37	S34	S17	S38	RST
1994-95	S04	S36	S05	S34	S35	S13	RST	S04	S15	S17	S33	S36	S34	RST	S23	S33	S36	S04	S28	S34	RST	S23	S36	S34	S27	S33	S35	RST
1996-97	S04	S36	S05	S34	S35	S14	RST	S04	S15	S36	S33	S17	S34	RST	S23	S36	S28	S04	S34	S33	RST	S23	S36	S34	S27	S33	S35	RST
1998-99	S04	S05	S36	S34	S33	S35	RST	S04	S33	S36	S15	S34	S27	RST	S23	S04	S36	S28	S33	S34	RST	S23	S36	S34	S27	S33	S35	RST
2001-02	S04	S36	S05	S34	S35	S19	RST	S04	S34	S36	S33	S15	S27	RST	S23	S36	S04	S28	S33	S34	RST	S23	S36	S34	S27	S33	S35	RST
2004-05	S04	S36	S05	S35	S19	S34	RST	S04	S27	S34	S23	S36	S33	RST	S23	S04	S36	S28	S33	S34	RST	S23	S34	S27	S36	S33	S35	RST
2005-06	S04	S36	S05	S35	S34	S19	RST	S04	S27	S34	S23	S33	S36	RST	S23	S04	S36	S28	S33	S34	RST	S23	S36	S34	S27	S33	S35	RST
2006-07	S04	S36	S33	S35	S34	S05	RST	S04	S33	S34	S35	S06	S36	RST	S23	S36	S28	S33	S04	S34	RST	S23	S27	S33	S34	S36	S04	RST
2007-08	S04	S36	S33	S34	S35	S05	RST	S04	S33	S34	S14	S36	S35	RST	S23	S36	S33	S04	S28	S34	RST	S23	S27	S33	S34	S36	S17	RST
2008-09	S04	S36	S33	S35	S28	S34	RST	S04	S27	S14	S33	S23	S17	RST	S23	S04	S21	S36	S28	S33	RST	S23	S27	S21	S34	S33	S36	RST
2009-10	S04	S36	S33	S35	S34	S28	RST	S04	S27	S33	S14	S17	S23	RST	S23	S04	S36	S21	S33	S28	RST	S23	S27	S21	S34	S36	S33	RST
2012-13	S04	S36	S33	S34	S35	S21	RST	S04	S33	S12	S27	S36	S34	RST	S23	S36	S21	S33	S04	S34	RST	S23	S27	S21	S34	S36	S33	RST
2013-14	S04	S36	S33	S34	S21	S35	RST	S04	S33	S27	S14	S36	S34	RST	S23	S36	S21	S33	S04	S19	RST	S23	S27	S21	S34	S36	S33	RST
2014-15	S04	S36	S33	S34	S21	S35	RST	S04	S33	S27	S14	S36	S34	RST	S23	S36	S21	S33	S04	S28	RST	S23	S27	S21	S34	S36	S33	RST

Source: Results obtained from the model developed in Chapter 4.

Table 7.8 shows that the highest contributor to backward linkages ("H2") of the Gas (incl. Nat Gas, LPG and CSG) Sector (S04) over the period 1974-75 to 1989-90 was Exploration and Mining Support Services Sector (S05), however for the remaining 14 years to 2014-15 it changed to Communication, Finance, Property and Business Services (S36). Perhaps, a reason could be due to the intensive exploration in the earlier period which led to identification of more oil and gas resources for being extracted in future year, which required access to high level of finance and business supports so that the extraction phase and subsequent processes could be started. Similar changing pattern is observed with respect to the second to fifth highest contributors ("H3 to "H6") details of which are presented in Table 7.9 and Table 7.10 for Gas (incl. Nat Gas, LPG and CSG) (S04) Sectors, and Electricity Generation by Natural Gas (S23 over the study period. Likewise, this research has analysed the above information for each IOI and other sectors of the economy where similar patterns are observed and same conclusions are reached.

Cumulative (Total) Weighted Linkage Indices - The weighted total linkages estimate sectoral interdependencies, reflecting policy objectives of the policy makers as discussed in Chapter 6.

Table 7.9: Changing patterns of highest contributors to Gas Sector linkages, 1975-2015

S04	Gas (incl. Nat Gas, LPG and CSG)												
	Backward Linkages						Forward Linkages						
H1	H2	H3	H4	H5	H6	RST	H1	H2	H3	H4	H5	H6	RST
S04 (25)	S05 (11)	S35 (1)	S02 (2)	S19 (3)	S34 (7)	RST (25)	S04 (25)	S27 (14)	S23 (7)	S34 (1)	S21 (3)	S19 (1)	RST (25)
	S36 (14)	S02 (1)	S35 (13)	S36 (1)	S19 (6)			S28 (1)	S28 (3)	S21 (2)	S34 (2)	S07 (2)	
		S36 (9)	S23 (1)	S35 (6)	S02 (1)			S17 (1)	S27 (4)	S23 (5)	S02 (1)	S33 (6)	
		S05 (7)	S19 (1)	S02 (2)	S35 (5)			S15 (2)	S17 (1)	S28 (4)	S33 (3)	S36 (4)	
		S33 (7)	S34 (8)	S34 (9)	S13 (1)			S33 (6)	S36 (3)	S17 (1)	S12 (1)	S21 (1)	
				S33 (1)	S14 (1)			S34 (1)	S34 (4)	S15 (2)	S36 (7)	S34 (6)	
				S28 (1)	S05 (2)				S14 (1)	S33 (4)	S37 (1)	S27 (2)	
				S21 (2)	S28 (1)				S33 (1)	S35 (1)	S23 (3)	S35 (1)	
					S21 (1)				S12 (1)	S14 (4)	S17 (2)	S17 (1)	
										S27 (1)	S15 (1)	S23 (1)	
											S06 (1)		

Note: The numbers in brackets represent the no. of years that highest contribution to linkages continued.

Source: Results generated by the model developed in Chapter 4.

Table 7.10: Changing patterns of highest contributors to Elect. Gen. by Gas linkages, 1975-2015

S23	Electricity Generation by Natural Gas												
	Backward Linkages						Forward Linkages						
H1	H2	H3	H4	H5	H6	RST	H1	H2	H3	H4	H5	H6	RST
S23 (25)	S04 (13)	S28 (7)	S35 (1)	S05 (2)	S34 (9)	RST (25)	S23 (25)	S27 (18)	S34 (10)	S19 (1)	S33 (8)	S07 (2)	RST (25)
	S36 (8)	S36 (8)	S34 (1)	S12 (2)	S35 (3)			S36 (6)	S36 (4)	S07 (1)	S21 (5)	S36 (2)	
	S28 (3)	S04 (5)	S21 (3)	S35 (6)	S12 (2)			S34 (1)	S37 (2)	S21 (1)	S07 (3)	S33 (9)	
	S33 (1)	S33 (1)	S28 (6)	S21 (1)	S05 (3)				S21 (6)	S36 (4)	S34 (1)	S21 (1)	
		S21 (4)	S36 (7)	S36 (1)	S21 (2)				S27 (1)	S34 (12)	S36 (7)	S37 (1)	
			S04 (3)	S28 (3)	S19 (2)				S33 (2)	S37 (1)	S17 (1)	S38 (2)	
			S33 (4)	S34 (1)	S33 (2)					S27 (5)		S35 (6)	
				S33 (5)	S28 (2)							S04 (1)	
				S04 (4)								S17 (1)	

Note: The numbers in brackets represent the no. of years that highest contribution to linkages continued.

Source: Results obtained from the model developed in Chapter 4.

Therefore, they are different to un-weighted measures which focus on linkages from a technological perspective (by utilising technical coefficients).

Table 7.11 shows the comparative outcomes of both Traditional System of Weights (TSOW) and the proposed Reformulated System of Weights (RSOW) methods (as described in Chapter 5) for IOI over the period of 1975 to 2015.

Table 7.11: Weighted overall-average BL and FL linkages, 1975-2015

		Reformulated SOW, Wtd Total Linkage Indices						Traditional SOW, Wtd Total Linkage Indices					
		Trends		Overall Avg Indices		Overall Rank		Trends		Overall Avg Indices		Overall Rank	
Sector	Code	BL	FL	BL	FL	BL	FL	BL	FL	BL	FL	BL	FL
Coal	S02	▲	▼	0.7889	0.9400	15	16	▲	▼	0.5602	0.6197	15	16
Crude Oil	S03	▲	▼	0.6421	1.0412	33	12	△	▲	0.0868	0.5396	25	18
Nat. Gas	S04	▲	▼	0.6503	0.8665	26	20	△	△	0.1076	0.2520	23	24
Explor. Mining	S05	▲	▼	0.6673	0.8667	24	19	▲	△	0.1055	0.1875	24	25
Oth. Mining	S06	▲	▼	0.8367	1.1973	14	5	▲	▲	0.7167	0.9776	12	11
Petro. Prod. Mfg	S12	▲	▼	0.7694	0.8440	16	24	▼	⌅	0.3800	0.1362	18	29
Coal Prod. Mfg	S13	▲	▼	0.6302	0.7682	37	36	⌅	⌅	0.0019	0.0050	38	37
Elec. Gen. Coal	S21	▲	▼	0.7467	1.0090	19	15	▲	▼	0.3668	0.8934	19	12
Elec. Gen. Oil	S22	▲	▼	0.6323	0.7749	35	34	⌅	⌅	0.0099	0.0314	35	35
Elec. Gen. Nat. Gas	S23	▲	▼	0.6494	0.7841	27	30	⌅	⌅	0.0594	0.0762	29	33
Elec. Gen. Hydro	S24	▲	▼	0.6413	0.7940	34	28	⌅	▼	0.0425	0.1228	33	30
Elec. Gen. Renew.	S25	▲	▼	0.6444	0.7820	31	32	▲	▲	0.0496	0.0658	30	34
Elec. Gen Oth. Fuel	S26	▲	▼	0.6301	0.7651	38	38	⌅	⌅	0.0033	0.0041	37	38
Elec. T&D	S27	▲	▽	0.7613	1.0795	18	11	▲	▼	0.5406	1.1884	16	8
Gas Supply	S28	△	▼	0.6454	0.8009	28	26	▼	▼	0.0447	0.1207	32	31
Upstrm Water	S29	△	▼	0.6289	0.7663	39	37	⌅	⌅	0.0000	0.0000	39	39
Urb Water	S30	▲	▼	0.6695	0.7853	23	29	▽	▽	0.0783	0.1823	28	27
Rurl Water	S31	▲	▼	0.6315	0.7727	36	35	⌅	⌅	0.0059	0.0148	36	36
Water Serv.	S32	▲	▲	0.6452	0.7775	30	33	▲	▼	0.0866	0.1868	26	26

▲ Increase ▼ Decrease △ Slight Inc. ▽ Slight Dec ⌅ Inc-Dec-Stable

Source: This author's analysis based on the model developed in Chapter 4.

Table 7.11 provides useful information: first, by using the traditional method of developing weights, the linkage indices are estimated very low make it difficult to clearly identify key sectors, backward-oriented, and forward-oriented sectors where indices greater than unity (above average) are part of the identification criteria. For example under the traditional method, Electricity Generation by Coal (S21), Crude Oil (incl. Condensate) (S03), and Other Mineral Mining (S06) are classified as weak sectors because both of their backward and forward linkage indices are below average. However, in Reformulated SOW, these sectors are classified as forward-oriented sectors which intuitively also make more sense. Both methods, however classify the Electricity Transmission and Distribution Sector (S27) as forward-oriented sector. Generally, under the traditional method, 18 out of 19 sectors (95%) are classified as weak sectors compared to 15 out of 19 sectors (79%) in Reformulated SOW; second, some of the indices by Traditional SOW appears not aligned with the expectation. For example, the Upstream Water Supply Sector (S29) has nil weighting in Traditional SOW implying that the Sector does not have any importance in the economy, which such result in relative sectoral term is not acceptable; third, because weighted indices, similar to unweighted measures, estimate the impacts on supply sectors of a unit increase in final demand, it appears that very small indices generated by the Traditional method may underestimate the aforementioned impacts. For example, in case of Gas (incl. Nat Gas, LPG and CSG) (S04), the backward linkage index estimated by the Traditional method is 0.1076 which is significantly smaller than 0.6503 estimate by the Reformulated weighting method. Likewise, for the forward linkage indices; fourth, from policy perspective, access to weighted results generated by the abovementioned two methods as well as the unweighted indices estimates are useful to examine the policy objectives under different scenarios with the view to make more informed policy and investment decisions.

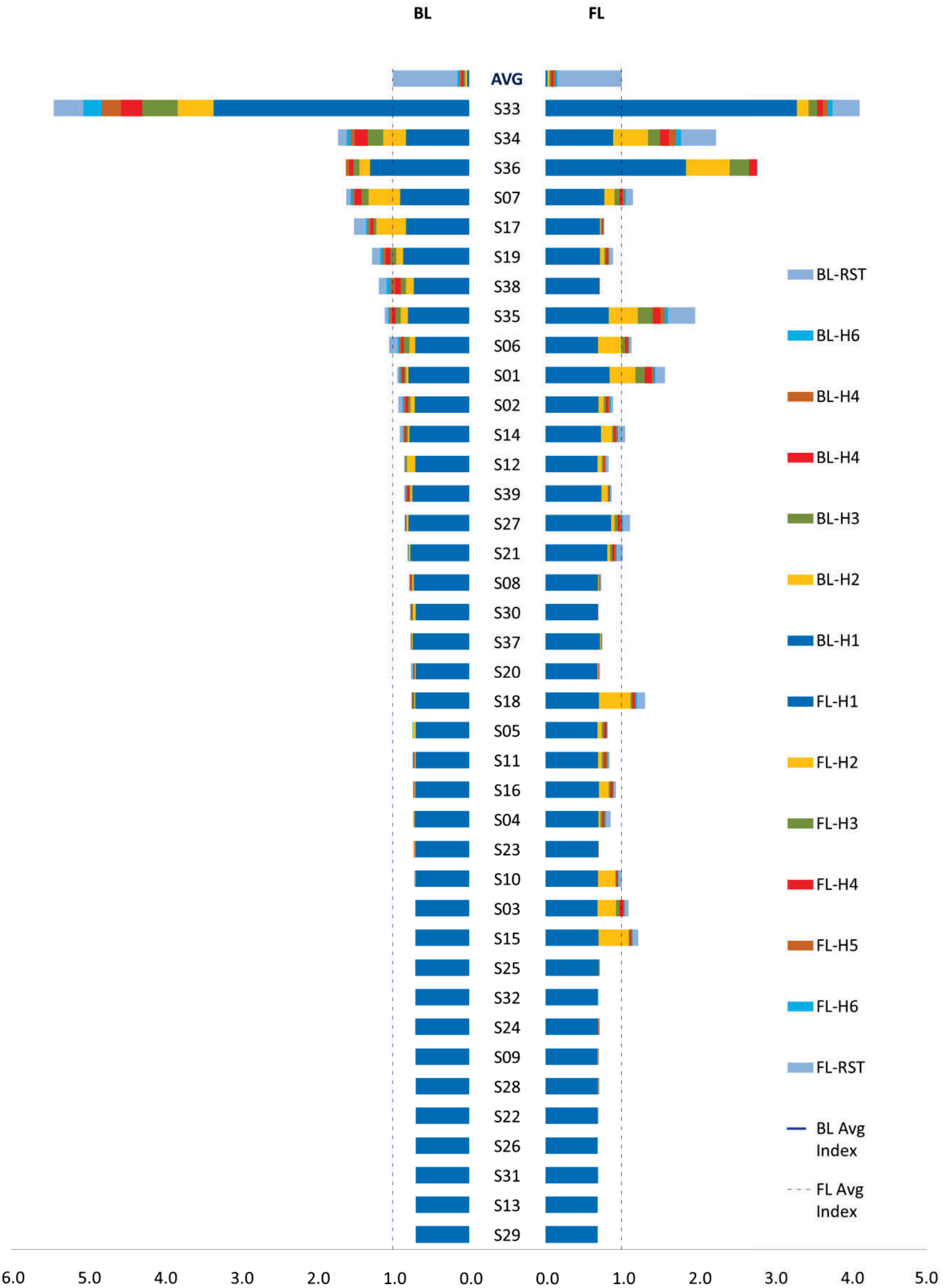
Figures 7.5 and 7.6 show weighted total linkages in 2008-09 using Reformulated SOW and Traditional SOW methods. While each weighting method estimates the magnitudes of total linkages differently, it is found that they identify the most important sectors of the economy similarly with minor ranking differences. For example, Construction (S33), Wholesale and Retail Trades (S34), Communication, Finance, Property and Business Services (S36), Food, Beverage and Tobacco (S07), Education, Health and Community Services (S37), and Government Administration, Defence, Public Order and Safety (S38) are identified as the most important sectors in the economy by both method. The reason that both weighting methods identify the most important sectors similarly is due to relatively high share of these sectors in final demand and in value added in comparison to other sectors. Also, these sectors are important in terms of primary input requirements for creating employment in the country, contributing to household income and government taxes, and also creating higher returns of capital as measured by gross profit and mixed income. The details of the latter linkages are measured by cumulative value added coefficients (Quadrant 3 of the IO Tables), which will be discussed later in this chapter.

The Reformulated SOW method identifies Exploration and Mining Support Services (S06) in the ranking position 8, while the Traditional SOW method places it in the ranking position 12. The Coal Sector (S02) was recognised by both weighting method at the same level of importance (ranked 11). Also, Electricity Transmission and Distribution Sectors (S27) ranked 13 and 15 respectively. Examining the weighted total linkages of IOI (Figure 7.7 and Figure 7.8) reveals that the Reformulated SOW better represents the importance of these sectors in the economy than the Traditional SOW method where about 53% of IOI have nil importance in the economy. The latter representation is believed to be far from reality because naturally each sector and its products are important in the economy to supports economic activity. For example, the intra-industry trade linkages are an evidence of such importance which the Traditional SOW method has represented their share in sectoral linkages as nil, which defies the reality.

Figure 7.9 to Figure 7.12 show the changing pattern of linkages by Reformulated and Traditional SOW methods for Coal (S02) and Crude Oil (incl. Condensate) (S03) over the period of 1975 to 2015. Graphs for all IOI are presented in Appendix VII, Figure VII-21 to VII-56. The overall trends for majority of the sectors follow similar directions however in comparison to Traditional method, the Reformulated SOW displays trends more clearly because of improved underlying formulation for estimating linkages (see Chapter 5).

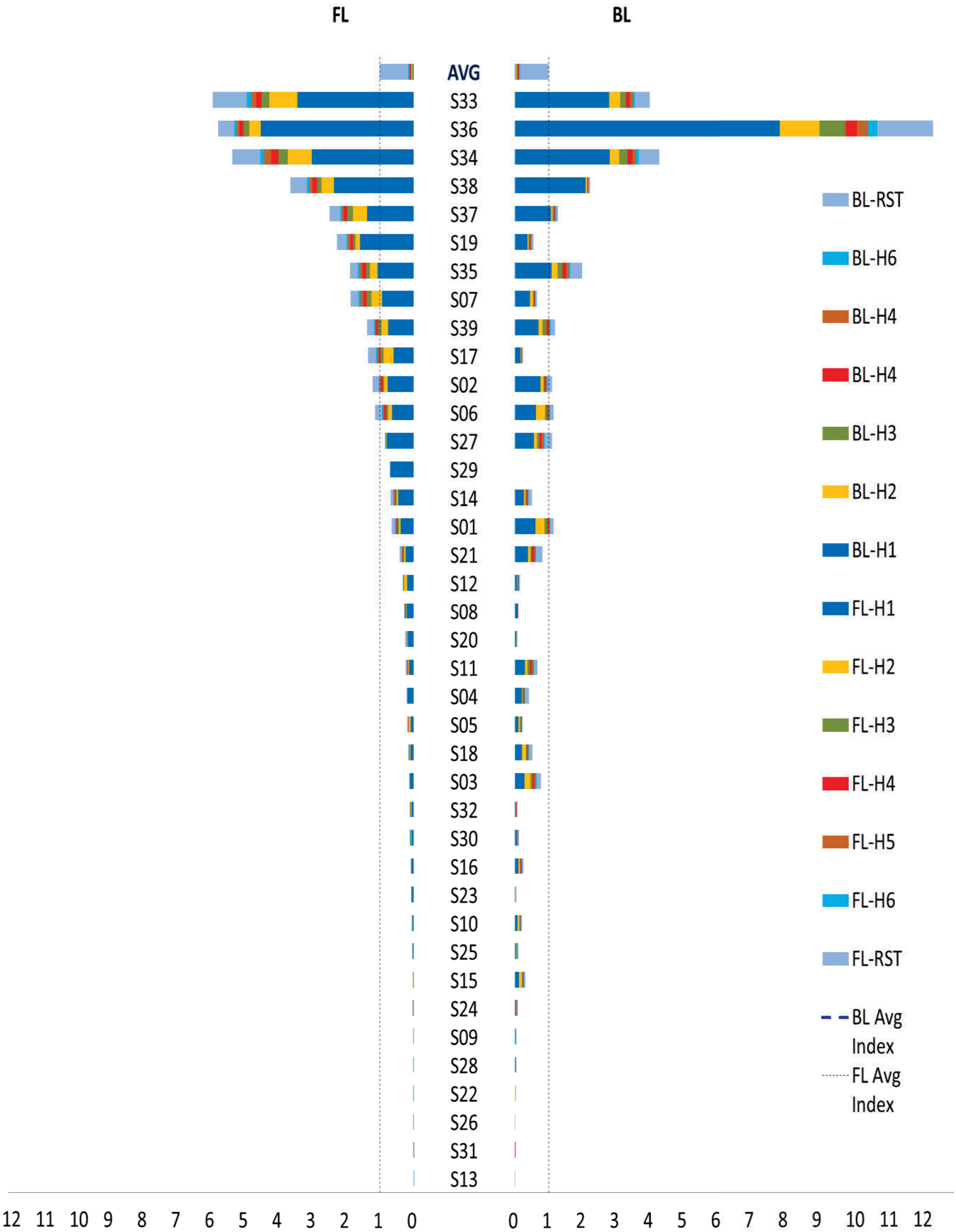
Appendix VII, Tables VII-6 to VII-9 provide full details of weighted linkages by both methods.

Figure 7.5: Weighted total linkages for all sectors (RSOW method), 2008-09



Source: Results generated by the model developed in this research.

Figure 7.6: Weighted total linkages for all sectors (TSOW method), 2008-09



Source: Results generated by the model developed in Chapter 4.

Figure 7.7: IOI Weighted total linkages (Traditional SOW method), 2008-09

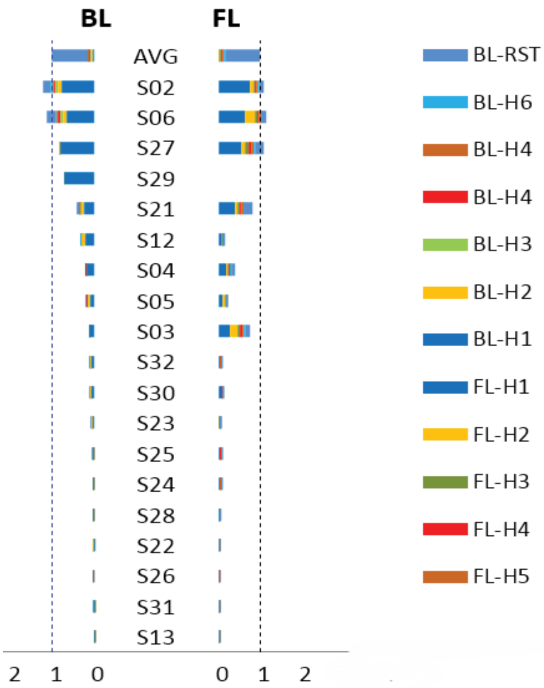
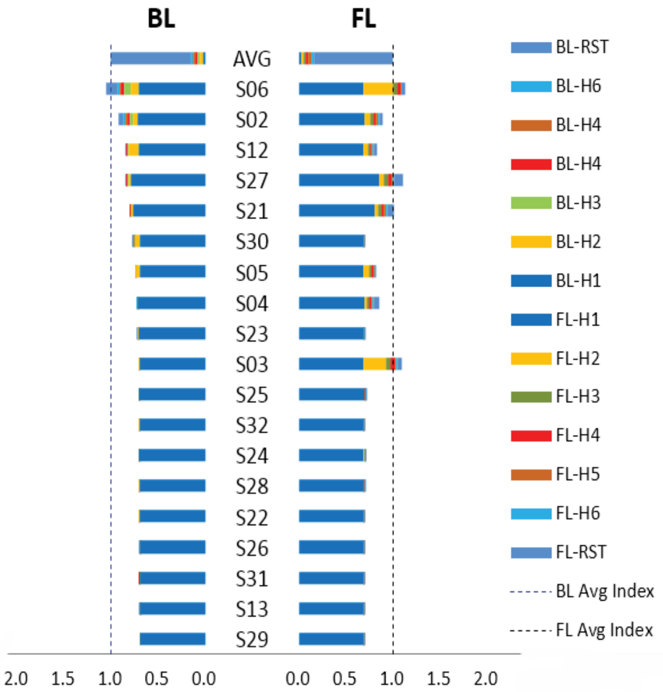


Figure 7.8: IOI weighted total linkages (Reformulated SOW method), 2008-09



Source: This author's analysis based on the model developed in this research.

Figure 7.9: Weighted total linkages (RSOW), Coal Mining, 1975-2015

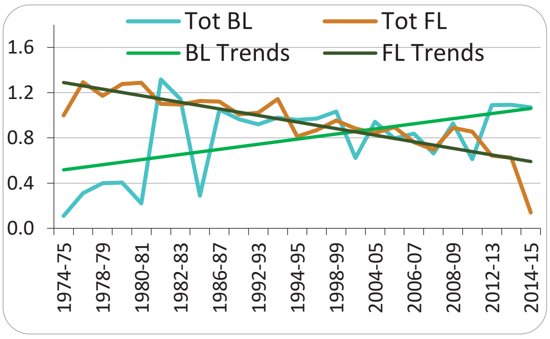


Figure 7.10: Weighted total linkages (TSOW), Coal Mining, 1975-2015

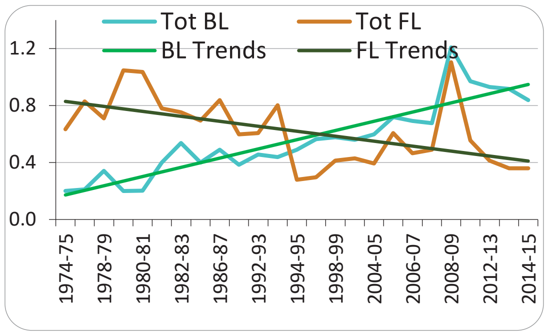


Figure 7.11: Weighted total linkages (RSOW), Crude Oil, 1975-2015

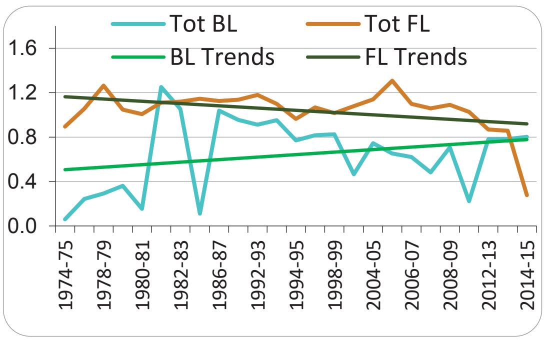
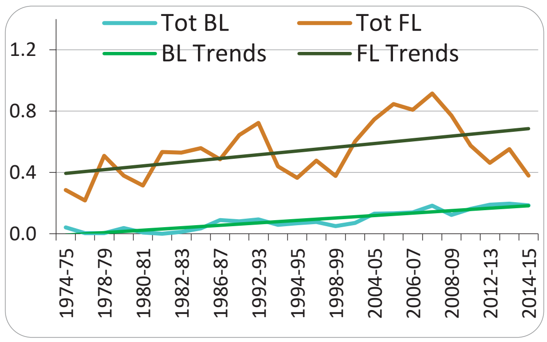


Figure 7.12: Weighted total linkages (TSOW), Crude Oil, 1975-2015



Source: This author's analysis based on the model developed in Chapter 4.

Contributors to Weighted Linkage Indices - Table 7.12 to Table 7.15 show the top 10 contributors with the highest contributions (BL-H2 and FL-H2) to weighted backward and forward linkage indices of recipient sectors. Weighting of the sectors influences the magnitude of linkage indices as well as identification of the highest contributors to indices. For example, in 2008-09 for Reformulated SOW method, Other Metal Products Sector (S18) has the highest share (BL-H2 = 0.4765 index points) in Construction Sector's (S33) inter-industry backward linkage index of 2.0986 (BL index of 5.4426 minus intra-industry trade index of 3.3440, see Table 7.12).

The Second top contributor is Agriculture, Forestry and Fishing (S01) with the share of 0.4138 (67%) in Food, Beverage and Tobacco (S07) Sector's inter-industry linkage index of 0.7106.

In terms of IOI, Crude Oil (incl. Condensate) (S03) is the highest contributor to weighted backward linkages of Petroleum Products Manufacturing (S12) by 0.1109 index points in the sixth ranking position; Construction (S33) with 0.0785 share in Other Mineral Mining (S06) linkage index in the ninth raking position, and Exploration and Mining Support Services (S05) with 0.0555 share in Coal Sector (S02) linkage index in tenth ranking positions (Table 7.12). Also, the highest contributor to backward linkages of Transport and Storage Services (S35) is Petroleum Products Manufacturing (S12) in the seventh ranking position.

In case of the highest contributors to backward linkages in 2008-09, it is found that both Reformulated and Traditional SOW methods identify the recipient sectors almost the same, however, different contributors. For example, Traditional SOW method identifies Communication, Finance, and Business Services (S36) as the top contributor for 7 out of 10 recipient production sectors (Table 7.12 and Table 7.13). These findings are similar to the top contributors in case of unweighted backward linkages as discussed earlier. However given the purpose of weighting which is to differentiate the importance of input recipients to upstream sectors, naturally it is expected that the weighting results differ from unweighted results. In comparison, the Reformulated SOW results (Table 7.12) are more sensible because it appears that the highest contributions are more aligned to the importance of the recipient sectors. For example, Agriculture, Forestry and Fishing (S01) is the highest contributor to Food, Beverage and Tobacco (S07); or Petroleum Products Manufacturing (S12) is the highest contributor to Transport and Storage Service rather than S36 which is identified by the Traditional SOW method.

For forward linkages estimated by Reformulated method, Communication, Finance, Property and Business Services (S33) in the first ranking position provides the highest supply to Other Commercial Services Sector (S39) followed by Wholesale and Retail Trades (S34), Other Metal Products (S18), Non-Metallic and Mineral Products (S18), Transport and Storage Services (S35), and Wood Products (S10) which in ranking positions second to fifth, and tenth respectively provide the highest supply to the Construction (S33) Sector (Table 7.15). With respect to IOI, Other Mineral Mining (S06) in the seventh ranking position supplies the highest inputs to Basic

Table 7.12: Top 10 highest contributors to weighted BL (RSOW method), 2008-09

Production Sector		Contributors							Magnitude of contribution							
Sec. Code	Sector	BL-H1	BL-H2	BL-H3	BL-H4	BL-H5	BL-H6	BL-RST	BL-H1	BL-H2	BL-H3	BL-H4	BL-H5	BL-H6	BL-RST	TOTAL-BL
S33	Const.	S33	S18	S15	S10	S16	S14	RST	3.3440	0.4765	0.4649	0.2711	0.2566	0.2428	0.3867	5.4426
S07	Food & Bev	S07	S01	S35	S34	S14	S11	RST	0.9005	0.4138	0.0957	0.0845	0.0345	0.0220	0.0601	1.6111
S17	Non-Ferrous Mfg	S17	S06	S05	S35	S12	S21	RST	0.8247	0.3893	0.0417	0.0363	0.0282	0.0260	0.1602	1.5063
S34	Wsale & Retail	S34	S07	S01	S35	S11	S19	RST	0.8237	0.3046	0.1979	0.1692	0.0569	0.0478	0.1150	1.7152
S36	Comm, Fin. & Bus. Serv.	S36	S38	S39	S37	S35	S34	RST	1.2960	0.1397	0.0842	0.0523	0.0418	0.0006	0.0022	1.6167
S12	Petro. Prod. Mfg	S12	S03	S33	S14	S35	S34	RST	0.7052	0.1109	0.0137	0.0042	0.0038	0.0036	0.0119	0.8532
S35	Trsprt & Storage Serv.	S35	S12	S34	S19	S07	S01	RST	0.8027	0.0919	0.0745	0.0446	0.0298	0.0200	0.0429	1.1066
S19	Mach. & Transp Prod.	S19	S17	S16	S34	S06	S35	RST	0.8653	0.0907	0.0753	0.0592	0.0427	0.0297	0.1113	1.2743
S06	Oth. Mining	S06	S33	S05	S12	S18	S02	RST	0.7055	0.0785	0.0750	0.0326	0.0227	0.0209	0.1144	1.0495
S02	Coal	S02	S05	S35	S12	S19	S34	RST	0.7135	0.0555	0.0337	0.0280	0.0230	0.0164	0.0569	0.9270

Table 7.13: Top 10 highest contributors to weighted BL (TSOW method), 2008-09

Production Sector		Contributors							Magnitude of contribution							
Sec. Code	Sector	BL-H1	BL-H2	BL-H3	BL-H4	BL-H5	BL-H6	BL-RST	BL-H1	BL-H2	BL-H3	BL-H4	BL-H5	BL-H6	BL-RST	TOTAL-BL
S33	Const.	S33	S36	S34	S35	S18	S15	RST	3.4455	0.8241	0.2356	0.1567	0.1490	0.1252	1.0155	5.9514
S34	Wsale & Retail	S34	S36	S33	S35	S07	S01	RST	3.0149	0.7056	0.2821	0.2143	0.2077	0.1233	0.8267	5.3745
S37	Govt Admin	S37	S36	S33	S34	S35	S19	RST	1.3791	0.4076	0.1800	0.0904	0.0688	0.0440	0.3229	2.4927
S38	Edu, Hlth & Cmty Serv.	S38	S36	S34	S33	S19	S35	RST	2.3607	0.3644	0.1431	0.1307	0.0909	0.0647	0.4964	3.6510
S36	Comm, Fin. & Bus. Serv.	S36	S33	S34	S39	S35	S19	RST	4.5329	0.3397	0.1742	0.0995	0.0872	0.0799	0.4731	5.7866
S07	Food & Bev	S07	S01	S36	S34	S35	S33	RST	0.9367	0.3010	0.1468	0.0974	0.0826	0.0585	0.2494	1.8724
S17	Non-Ferrous Mfg	S17	S06	S36	S33	S21	S34	RST	0.5888	0.2942	0.0877	0.0510	0.0478	0.0367	0.2398	1.3459
S35	Trsprt & Storage Serv.	S35	S36	S33	S34	S12	S19	RST	1.0580	0.2242	0.1176	0.1088	0.0765	0.0547	0.2347	1.8748
S39	Oth. Comml Serv.	S39	S36	S33	S34	S35	S11	RST	0.7547	0.1987	0.0896	0.0661	0.0291	0.0291	0.2023	1.3697
S19	Mach. & Transp Prod.	S19	S36	S16	S34	S17	S33	RST	1.5865	0.1341	0.0755	0.0728	0.0673	0.0537	0.2853	2.2752

Table 7.14: Top 10 highest contributors to weighted FL (RSOW method), 2008-09

Supplier Sector		Contributors							Magnitude of contribution							
Sec. Code	Sector	FL-H1	FL-H2	FL-H3	FL-H4	FL-H5	FL-H6	FL-RST	FL-H1	FL-H2	FL-H3	FL-H4	FL-H5	FL-H6	FL-RST	TOTAL-FL
S36	Comm, Fin. & Bus. Serv.	S36	S39	S38	S37	S35	S34	RST	1.8414	0.5732	0.2513	0.1075	0.0001	0.0001	0.0021	2.7757
S34	Wsale & Retail	S34	S33	S35	S07	S01	S38	RST	0.8844	0.4623	0.1568	0.1153	0.0870	0.0706	0.4599	2.2363
S18	Oth. Metal Prod.	S18	S33	S35	S06	S19	S37	RST	0.7027	0.4130	0.0248	0.0229	0.0175	0.0155	0.1096	1.3058
S15	Non-Metal & Min. Prod.	S15	S33	S35	S06	S34	S17	RST	0.6979	0.3898	0.0187	0.0142	0.0129	0.0090	0.0736	1.2160
S35	Trsprt & Storage Serv.	S35	S33	S34	S07	S01	S14	RST	0.8294	0.3836	0.1923	0.0990	0.0563	0.0416	0.3614	1.9635
S01	Ag., Forest & Fish'g	S01	S07	S34	S33	S35	S39	RST	0.8422	0.3387	0.1167	0.0920	0.0253	0.0235	0.1314	1.5698
S06	Oth. Mining	S06	S17	S33	S16	S15	S19	RST	0.6877	0.3070	0.0490	0.0336	0.0115	0.0095	0.0324	1.1307
S03	Crude Oil	S03	S12	S34	S33	S35	S07	RST	0.6801	0.2458	0.0478	0.0428	0.0166	0.0079	0.0497	1.0906
S10	Wood Prod.	S10	S33	S35	S34	S06	S37	RST	0.6904	0.2297	0.0130	0.0096	0.0081	0.0050	0.0434	0.9993
S33	Const.	S33	S35	S06	S17	S37	S34	RST	3.3015	0.1527	0.1142	0.0657	0.0650	0.0643	0.3570	4.1203

Table 7.15: Top 10 highest contributors to weighted FL (TSOW method), 2008-09

Supplier Sector		Contributors							Magnitude of contribution							
Sector	Sector	FL-H1	FL-H2	FL-H3	FL-H4	FL-H5	FL-H6	FL-RST	FL-H1	FL-H2	FL-H3	FL-H4	FL-H5	FL-H6	FL-RST	TOTAL-FL
S36	Comm, Fin. & Bus. Serv.	S36	S33	S34	S37	S35	S38	RST	7.8630	1.1661	0.7757	0.3343	0.3293	0.2715	1.6579	12.3977
S33	Const.	S33	S36	S34	S35	S37	S39	RST	2.7916	0.3375	0.1776	0.0989	0.0845	0.0661	0.4437	3.9999
S34	Wsale & Retail	S34	S33	S36	S35	S07	S38	RST	2.8051	0.2822	0.2559	0.1353	0.1003	0.0902	0.6117	4.2806
S06	Oth. Mining	S06	S17	S33	S19	S16	S18	RST	0.6342	0.2655	0.0505	0.0365	0.0344	0.0247	0.1056	1.1515
S01	Ag., Forest & Fish'g	S01	S07	S34	S33	S36	S38	RST	0.6162	0.2595	0.0961	0.0342	0.0228	0.0185	0.1045	1.1517
S03	Crude Oil	S03	S12	S34	S33	S35	S36	RST	0.2805	0.1893	0.0522	0.0486	0.0486	0.0219	0.1298	0.7709
S35	Trsprt & Storage Serv.	S35	S34	S33	S36	S07	S37	RST	1.0954	0.1661	0.1563	0.1066	0.0708	0.0398	0.3572	1.9923
S39	Oth. Comml Serv.	S39	S36	S33	S34	S38	S35	RST	0.7024	0.1248	0.1108	0.0593	0.0301	0.0262	0.1431	1.1966
S18	Oth. Metal Prod.	S18	S33	S36	S34	S19	S37	RST	0.2125	0.1139	0.0351	0.0218	0.0181	0.0136	0.1039	0.5190
S15	Non-Metal & Min. Prod.	S15	S33	S36	S34	S19	S07	RST	0.1200	0.0991	0.0189	0.0139	0.0067	0.0064	0.0473	0.3124

Source: Results generated by the model developed in Chapter 4.

Non-Ferrous Metal Manufacturing (S17), and the Crude Oil (incl. Condensates) (S03) supplies the highest inputs to the Petroleum Products Manufacturing (S12) (Table 7.14).

In comparison, the Traditional SOW method identifies the 6 out of 10 downstream recipients of the highest supply (sales) exactly the same as those identified by Reformulated method, however in different ranking positions. Also, it lists the same IOI among top 10 supplier sectors (Table 7.15). Overall, both weighting methods perform almost similarly for identifying top contributor sectors at supply and production sides.

Appendix VII, Tables VII-11 and VII-12 provide full details of top contributors to linkages by Reformulated and Traditional SOW methods in 2008-09. These contributors changed over time to suit economic activity of each sector based on similar reasons which discussed in case of un-weighted linkages. Table 7.16 and Table 7.17 show the summarised historical pattern of the highest contributors to linkages for two typical IOI, namely, Gas (incl. Nat Gas, LPG and CSG) (S04), and Electricity Generation by Gas (S23). For example, for Gas (incl. Nat Gas, LPG and CSG) Sector (S04), the major top contributors over the period 1975 to 2015 are: Exploration and Mining Support Services (S05) for twelve years; Communication, Finance, Property and Business Services (S36) for five years; and Construction (S33) for four years. Or, for Electricity Generation by Gas (S23), the major contributor over the study period are: Gas (incl. Nat Gas, LPG and CSG) (S04) for 12 years; Construction(S33) for five years; Gas Supply(S28) for four years; Communication, Finance, Property and Business Services (S36) for three years.

Impacts of Linkages Estimation Methods on Policy and Investment Decisions - Various methods which are used for measuring linkages yield different backward and forward linkage indices, which subsequently influence estimation of important indicators such as "key" sectors and the highest contributors to linkages, which in turn influences policy and investment decisions.

The usefulness of applying different linkages methods is two folds: first, it provides awareness, and knowledge, that "linkages" can be estimated by more than one traditional method (usually un-weighted, Leontief-based); and second, the results of each method have context-based meaning, interpretation, and significance which provide complementary answers to various policy scenarios. Therefore, more insightful policy decisions can be made. In addition to different linkages estimation method, the time period over which the linkages are estimated would influence the outcomes. For example, Table 7.18 shows the count of above average linkages by different linkages measurement methods in two different time periods: first, by estimating overall inter-industry backward and forward linkage indices over the period 1975 to 2015; and second, by estimating the linkages in a specific input-output reference year (2008-09 in this example). Therefore, by examining results in Table 7.18, one could note the possibility of identifying between six to thirteen Key Sectors (see Chapter 5 for formulations, and section 7.6 in this chapter for discussion of results).

Table 7.16: Pattern of change, top contributors to Natural Gas linkages (RSOW), 1975-2015

Sector	S04 Gas (incl. Nat Gas, LPG and CSG)														S23 Electricity Generation by Natural Gas													
Linkage Type	Backward Linkages							Forward Linkages							Backward Linkages							Forward Linkages						
Year / Order	H1	H2	H3	H4	H5	H6	RST	H1	H2	H3	H4	H5	H6	RST	H1	H2	H3	H4	H5	H6	RST	H1	H2	H3	H4	H5	H6	RST
1974-75	S04	S34	S19	S36	S35	S11	RST	S04	S23	S28	S21	S02	S16	RST	S23	S34	S04	S19	S36	S35	RST	S23	S21	S28	S16	S17	S30	RST
1977-78	S04	S36	S34	S19	S35	S05	RST	S04	S23	S28	S21	S02	S24	RST	S23	S04	S36	S34	S19	S35	RST	S23	S21	S04	S30	S28	S24	RST
1978-79	S04	S36	S05	S19	S34	S02	RST	S04	S28	S02	S23	S17	S15	RST	S23	S36	S34	S19	S04	S35	RST	S23	S04	S30	S39	S38	S37	RST
1979-80	S04	S36	S05	S19	S35	S02	RST	S04	S23	S28	S02	S17	S12	RST	S23	S36	S04	S28	S19	S35	RST	S23	S16	S17	S12	S04	S30	RST
1980-81	S04	S36	S34	S19	S35	S05	RST	S04	S23	S28	S21	S02	S17	RST	S23	S04	S36	S28	S34	S19	RST	S23	S21	S16	S17	S04	S30	RST
1981-82	S04	S05	S13	S39	S38	S37	RST	S04	S28	S03	S23	S02	S12	RST	S23	S28	S04	S39	S38	S37	RST	S23	S21	S16	S17	S28	S04	RST
1982-83	S04	S05	S13	S02	S23	S39	RST	S04	S28	S23	S02	S17	S21	RST	S23	S28	S04	S39	S38	S37	RST	S23	S21	S17	S16	S04	S30	RST
1983-84	S04	S36	S34	S19	S35	S11	RST	S04	S23	S28	S21	S02	S17	RST	S23	S36	S04	S34	S19	S35	RST	S23	S21	S17	S04	S16	S39	RST
1986-87	S04	S05	S13	S23	S39	S38	RST	S04	S28	S23	S21	S16	S15	RST	S23	S04	S28	S39	S38	S37	RST	S23	S21	S17	S04	S16	S30	RST
1989-90	S04	S39	S38	S37	S36	S35	RST	S04	S28	S23	S21	S17	S02	RST	S23	S04	S28	S39	S38	S37	RST	S23	S17	S37	S21	S04	S30	RST
1992-93	S04	S05	S23	S13	S02	S39	RST	S04	S28	S17	S07	S23	S15	RST	S23	S28	S04	S21	S02	S12	RST	S23	S21	S37	S17	S06	S04	RST
1993-94	S04	S05	S23	S13	S02	S39	RST	S04	S17	S23	S15	S07	S14	RST	S23	S04	S28	S39	S38	S37	RST	S23	S17	S04	S06	S37	S30	RST
1994-95	S04	S05	S34	S13	S19	S35	RST	S04	S15	S17	S07	S23	S14	RST	S23	S33	S28	S04	S15	S34	RST	S23	S17	S07	S14	S38	S06	RST
1996-97	S04	S05	S35	S34	S19	S23	RST	S04	S15	S17	S07	S23	S14	RST	S23	S28	S04	S33	S34	S35	RST	S23	S17	S38	S14	S06	S04	RST
1998-99	S04	S05	S33	S19	S34	S35	RST	S04	S15	S23	S07	S17	S16	RST	S23	S04	S28	S33	S19	S15	RST	S23	S34	S38	S07	S14	S17	RST
2001-02	S04	S33	S05	S19	S35	S34	RST	S04	S15	S34	S07	S23	S17	RST	S23	S33	S04	S28	S15	S19	RST	S23	S34	S17	S07	S38	S14	RST
2004-05	S04	S05	S35	S19	S34	S13	RST	S04	S23	S34	S15	S07	S17	RST	S23	S04	S28	S35	S34	S19	RST	S23	S34	S38	S07	S35	S14	RST
2005-06	S04	S05	S35	S34	S19	S13	RST	S04	S23	S15	S34	S07	S17	RST	S23	S04	S36	S28	S34	S35	RST	S23	S34	S38	S35	S04	S07	RST
2006-07	S04	S33	S35	S05	S19	S34	RST	S04	S33	S35	S34	S06	S17	RST	S23	S33	S28	S04	S15	S19	RST	S23	S33	S04	S34	S07	S38	RST
2007-08	S04	S33	S35	S05	S18	S13	RST	S04	S33	S34	S14	S35	S06	RST	S23	S33	S04	S18	S15	S28	RST	S23	S33	S17	S34	S38	S07	RST
2008-09	S04	S28	S35	S05	S34	S13	RST	S04	S14	S33	S23	S17	S06	RST	S23	S04	S28	S21	S19	S02	RST	S23	S33	S34	S17	S21	S35	RST
2009-10	S04	S33	S15	S18	S10	S14	RST	S04	S33	S14	S17	S06	S23	RST	S23	S33	S15	S18	S04	S10	RST	S23	S34	S21	S17	S07	S38	RST
2012-13	S04	S23	S35	S05	S13	S02	RST	S04	S33	S12	S06	S14	S17	RST	S23	S04	S28	S21	S19	S25	RST	S23	S33	S34	S21	S37	S06	RST
2013-14	S04	S05	S34	S23	S35	S19	RST	S04	S33	S14	S06	S17	S12	RST	S23	S04	S28	S21	S19	S25	RST	S23	S33	S34	S04	S06	S21	RST
2014-15	S04	S05	S23	S02	S13	S19	RST	S33	S04	S06	S37	S35	S17	RST	S23	S04	S28	S21	S19	S25	RST	S23	S33	S06	S37	S35	S17	RST

Table 7.17: Changing pattern of top contributor to weighted linkages, 1975-2015

S04	Gas (incl. Nat Gas, LPG and CSG)												
Backward Linkages							Forward Linkages						
H1	H2	H3	H4	H5	H6	RST	H1	H2	H3	H4	H5	H6	RST
S04 (25)	S34 (1) S36 (5) S05 (12) S39 (1) S33 (4) S28 (1) S23 (1)	S19 (1) S34 (5) S05 (3) S13 (3) S38 (1) S23 (3) S35 (7) S33 (1) S15 (1)	S36 (1) S19 (8) S39 (1) S02 (2) S23 (2) S37 (1) S13 (3) S34 (2) S05 (4) S18 (1)	S35 (7) S34 (4) S38 (1) S23 (1) S39 (1) S36 (1) S02 (2) S19 (4) S18 (1) S10 (1) S13 (2)	S11 (2) S05 (2) S02 (3) S37 (1) S39 (3) S38 (1) S35 (3) S23 (1) S34 (2) S13 (4) S14 (1) S19 (2)	RST (25)	S04 (24) S33 (1)	S23 (7) S28 (6) S17 (1) S15 (4) S33 (5) S14 (1) S04 (1)	S28 (5) S02 (1) S03 (1) S23 (5) S17 (3) S34 (3) S15 (1) S35 (1) S33 (1) S14 (2) S12 (1) S06 (1)	S21 (6) S23 (3) S02 (2) S07 (5) S15 (2) S34 (2) S14 (1) S17 (1) S06 (2) S37 (1)	S02 (5) S17 (7) S16 (1) S23 (4) S07 (3) S06 (2) S35 (2) S14 (1)	S16 (2) S24 (1) S15 (3) S12 (3) S17 (8) S21 (1) S02 (1) S14 (3) S06 (2) S23 (1)	RST (25)

S23	Electricity Generation by Natural Gas												
Backward Linkages							Forward Linkages						
H1	H2	H3	H4	H5	H6	RST	H1	H2	H3	H4	H5	H6	RST
S23 (25)	S34 (1) S04 (12) S36 (3) S28 (4) S33 (5)	S04 (9) S36 (3) S34 (1) S28 (11) S15 (1)	S19 (2) S34 (2) S28 (4) S39 (5) S21 (5) S04 (2) S33 (2) S35 (1) S18 (2)	S36 (1) S19 (8) S04 (2) S34 (4) S38 (5) S02 (1) S15 (4)	S35 (7) S19 (4) S37 (5) S12 (1) S34 (1) S15 (1) S28 (1) S02 (1) S10 (1) S25 (3)	RST (25)	S23 (25)	S21 (8) S04 (1) S16 (1) S17 (4) S34 (5) S33 (6)	S28 (1) S04 (3) S30 (1) S17 (6) S16 (2) S37 (2) S07 (1) S38 (4) S34 (3) S21 (1) S06 (1)	S16 (2) S30 (1) S39 (1) S12 (1) S17 (5) S04 (3) S21 (2) S06 (1) S14 (2) S07 (3) S35 (1) S34 (2) S37 (1)	S17 (1) S28 (2) S38 (4) S04 (5) S16 (2) S06 (3) S37 (2) S14 (1) S35 (2) S07 (2) S21 (1)	S30 (7) S24 (1) S37 (1) S04 (3) S39 (1) S06 (2) S17 (2) S14 (2) S07 (2) S38 (2) S35 (1) S21 (1)	RST (25)

Source: Results obtained from the model developed in Chapter 4.

Also, Table 8.19 shows the influence of linkage indices estimated by four different methods on identifying the major contributors (col. H1 to H6, and RST) to backward and forward linkage indices for Gas (incl. Nat Gas, LPG and CSG) (S04) Sector. By reviewing Table 7.19 it is found that all methods have commonly identified Communication, Finance, Property and Business

Services (S36), and Exploration and Mining Support Services (S05) as the top contributors to Gas Sector backward linkages (shown in col. "H2"). For example, the un-weighted measurement method (both not normalised, and normalised approaches) produce exactly the same results.

Table 7.18: Impacts of linkages analysis methods and time on indices results

	Time Dimension					
	Overall Average Linkages, 1975-2015			Total Linkage, 2008-09		
	Linkages Measurement Method					
Linkage Indices ≥ 1	**RSOW**	**TSOW**	**UnWtd**	**RSOW**	**TSOW**	**UnWtd**
BL Only (Backward-Oriented Sectors)	4	1	5	3	3	6
FL Only (Forward-Oriented Sectors)	9	2	7	7	2	6
Both FL and BL (Potential Key Sectors)	6	8	13	6	9	11
None (Weak Sectors)	20	28	14	23	25	16
Total Sectors	**39**	**39**	**39**	**39**	**39**	**39**

Source: Results obtained from the model developed in Chapter 4.

However, when sectoral importance through weighting approach are considered, it is found that the knowledge of top contributors to sectoral linkages are expanded in comparison to un-weighted approach. Also, the level of granularity produced by the reformulated method assisted to better analyse the results. Therefore, depending on the main policy objective of the policy makers, it is helpful to incorporate the results of alternative methods into the decision-making process. This research recommends that decision-making process need to be extended beyond the traditional methods rather to be inclusive of an array of linkages dimensions (see Chapters 4 and 5) whose results are presented in Chapters 6 to 8 pending on availability and reliability of underlying data.

7.3 Primary Factors Total Linkages (PF)

The total Primary Factors (PF) Linkage Indices represent the non-industrial input requirements in order to produce one unit of goods and services for final uses. Figure 7.1, Q2, shows PF in Australian context. The non-industry linkages are backward type (PF-BL), because they enable production by upstream inputs. For example, the un-weighted PF-BL index of 0.765 for Coal Sector (S02) in 2014-15 specifies the non-industrial input requirements in addition to the inter-industrial inputs requirements of 0.9125 in order to produce an additional unit of output (see Appendix VII, Tables VII-13 and VII-14 for full details).

The summation of inter-industrial backward linkages and the primary factors backward linkages represent the grand total backward linkages for each production sector, *j* column sectors (Figure 7.1). For example, in case of Coal Sector (S02) the grand total backward linkages is (0.9126 + 0.7650 = 1.6775). A large volume of literature reviewed by this author failed to provide, with no exception, the grand total backward linkages which is computable from each IO Table. Some authors attempted multipliers approach to estimate a few primary factor multipliers usually income or employment multipliers which still leave the grand total backward linkage indices

Table 7.19: Impacts of linkage analysis methods on identification of top contributors, 2008-09

	S04	Gas (incl. Nat Gas, LPG and CSG)												
	Backward Linkages							Forward Linkages						
Method	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**RST**	**H1**	**H2**	**H3**	**H4**	**H5**	**H6**	**RST**
Unweighted Total Linkages Simple (*Not Normalised*)	S04 (25)	S05 (11) S36 (14)	S35 (1) S02 (1) S36 (9) S05 (7) S33 (7)	S02 (2) S35 (13) S23 (1) S19 (1) S34 (8)	S19 (3) S36 (1) S35 (6) S02 (2) S34 (9) S33 (1) S28 (1) S21 (2)	S34 (7) S19 (6) S02 (1) S35 (5) S13 (1) S14 (1) S05 (2) S28 (1) S21 (1)	RST (25)	S04 (25)	S23 (7) S28 (4) S17 (1) S15 (2) S33 (7) S34 (3) S14 (1)	S34 (3) S21 (2) S23 (5) S28 (4) S17 (2) S15 (1) S36 (3) S33 (1) S14 (3) S12 (1)	S21 (3) S34 (1) S02 (1) S33 (6) S12 (1) S36 (5) S37 (1) S23 (3) S15 (1) S35 (1) S14 (1) S17 (1)	S19 (1) S07 (2) S33 (6) S36 (5) S21 (1) S34 (5) S17 (2) S15 (1) S06 (1) S23 (1)	S33 (1) S36 (4) S21 (3) S07 (4) S28 (1) S03 (1) S17 (1) S34 (4) S15 (2) S35 (1) S14 (1) S06 (2)	RST (25)
Unweighted Total Linkages Indices (Normalised)	S04 (25)	S05 (11) S36 (14)	S35 (1) S02 (1) S36 (9) S05 (7) S33 (7)	S02 (2) S35 (13) S23 (1) S19 (1) S34 (8)	S19 (3) S36 (1) S35 (6) S02 (2) S34 (9) S33 (1) S28 (1) S21 (2)	S34 (7) S19 (6) S02 (1) S35 (5) S13 (1) S14 (1) S05 (2) S28 (1) S21 (1)	RST (25)	S04 (25)	S27 (14) S28 (1) S17 (1) S15 (2) S33 (6) S34 (1)	S23 (7) S28 (3) S27 (4) S17 (1) S36 (3) S34 (4) S14 (1) S33 (1) S12 (1)	S34 (1) S21 (2) S23 (5) S28 (4) S17 (1) S15 (2) S33 (4) S35 (1) S14 (4) S27 (1)	S21 (3) S34 (2) S02 (1) S33 (3) S12 (1) S36 (7) S37 (1) S23 (3) S17 (2) S15 (1) S06 (1)	S19 (1) S07 (2) S33 (6) S36 (4) S21 (1) S34 (6) S27 (2) S35 (1) S17 (1) S23 (1)	RST (25)
Weighted Total Linkages Indices (Normalised) Reformulated System of Weights	S04 (25)	S34 (1) S36 (5) S05 (12) S39 (1) S33 (4) S28 (1) S23 (1)	S19 (1) S34 (5) S05 (3) S13 (3) S38 (1) S23 (3) S35 (7) S33 (1) S15 (1)	S36 (1) S19 (8) S39 (1) S02 (2) S23 (2) S37 (1) S13 (3) S34 (2) S05 (4) S18 (1)	S35 (7) S34 (4) S38 (1) S23 (1) S39 (1) S36 (1) S02 (2) S19 (4) S18 (1) S10 (1) S13 (2)	S11 (2) S05 (2) S02 (3) S37 (1) S39 (3) S38 (1) S35 (3) S23 (1) S34 (2) S13 (4) S14 (1) S19 (2)	RST (25)	S04 (24) S33 (1)	S23 (7) S28 (6) S17 (1) S15 (4) S33 (5) S14 (1) S04 (1)	S28 (5) S02 (1) S03 (1) S23 (5) S17 (3) S34 (3) S15 (1) S35 (1) S33 (1) S14 (2) S12 (1) S06 (1)	S21 (6) S23 (3) S02 (2) S07 (5) S15 (2) S34 (2) S14 (1) S17 (1) S06 (2) S37 (1)	S02 (5) S17 (7) S16 (1) S23 (4) S07 (3) S06 (2) S35 (2) S14 (1)	S16 (2) S24 (1) S15 (3) S12 (3) S17 (8) S21 (1) S02 (1) S14 (3) S06 (2) S23 (1)	RST (25)
Weighted Total Linkages Indices (Normalised) *Traditional System of Weights*	S04 (24) S39 (1)	S05 (10) S38 (1) S36 (14)	S35 (1) S02 (1) S36 (8) S37 (1) S05 (7) S33 (7)	S02 (2) S35 (12) S36 (1) S23 (1) S19 (1) S34 (8)	S19 (3) S36 (1) S35 (7) S02 (2) S34 (8) S33 (1) S28 (1) S21 (2)	S34 (8) S19 (5) S02 (1) S35 (5) S13 (1) S14 (1) S05 (2) S28 (1) S21 (1)	RST (25)	S04 (25)	S23 (7) S28 (4) S17 (1) S15 (2) S33 (7) S34 (3) S14 (1)	S34 (3) S21 (2) S23 (5) S28 (4) S17 (2) S15 (1) S36 (3) S33 (1) S14 (3) S12 (1)	S21 (3) S34 (1) S02 (1) S33 (6) S12 (1) S36 (5) S37 (1) S23 (3) S15 (1) S35 (1) S14 (1) S17 (1)	S19 (1) S07 (2) S33 (6) S36 (5) S21 (1) S34 (5) S17 (2) S15 (1) S06 (1) S23 (1)	S33 (1) S36 (4) S21 (3) S07 (4) S28 (1) S03 (1) S17 (1) S34 (4) S15 (2) S35 (1) S14 (1) S06 (2)	RST (25)

The no. in brackets: (years that a contributor continued with highest contribution to linkages)
Source: Results obtained from the model developed in this research.

un-estimated. This research has addressed this shortcoming by developing the IO Four-Quadrant Linkage Analysis Framework (IOFQLF) (see Chapter 4 for details). The full linkage results of the primary factors are presented in Appendix VII, Tables VII-13 and VII-14. For brevity, the discussion in this section is focused on a complete set of un-weighted primary factors total backward linkages for the Gas (incl. Nat Gas, LPG and CSG) (S04) Sector over the period 1975 to 2015 (Table 7.20 and Figure 7.13), while a summary discussion is provided for all IOI later in this section by reviewing the results presented in Table 7.22.

Analysis shows that the linkages of IOI, and other sectors of the economy have evolved through prominent economic events influenced by domestic and international forces. The most important

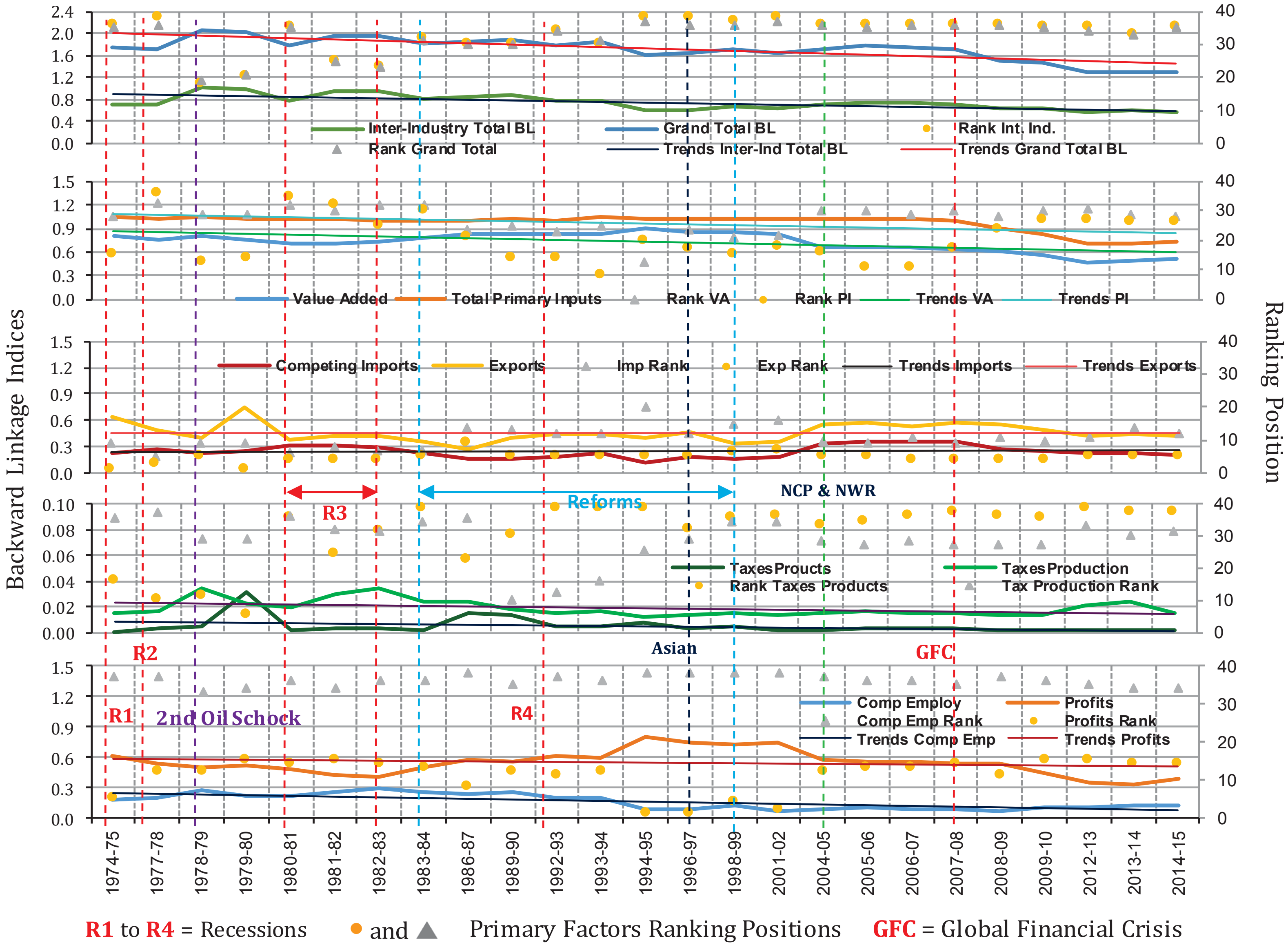
Table 7.20: Gas (S02) Sector's complete set of backward linkages, 1975-2015

(S04) Gas (incl. Nat Gas, LPG and CSG)													
Primary Factors / Year	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95
Compensation of employees	0.1810	0.1984	0.2739	0.2180	0.2151	0.2510	0.2842	0.2538	0.2307	0.2537	0.2034	0.2026	0.0797
Gross operating surplus & mixed income	0.6178	0.5298	0.5005	0.5132	0.4799	0.4246	0.4045	0.5014	0.5730	0.5608	0.6038	0.6000	0.8042
Taxes less subsidies on products	0.0006	0.0033	0.0042	0.0309	0.0014	0.0026	0.0032	0.0020	0.0156	0.0128	0.0040	0.0041	0.0075
Other taxes less subsidies on production	0.0147	0.0161	0.0340	0.0229	0.0186	0.0292	0.0338	0.0234	0.0243	0.0178	0.0152	0.0157	0.0126
Complementary imports	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Competing imports	0.2229	0.2782	0.2223	0.2470	0.3050	0.3067	0.2831	0.2241	0.1648	0.1678	0.1708	0.2174	0.1233
UnWtd Total Value Added BL Indices	***0.8136***	***0.7443***	***0.8085***	***0.7541***	***0.7136***	***0.7049***	***0.7224***	***0.7786***	***0.8280***	***0.8323***	***0.8225***	***0.8184***	***0.8965***
UnWtd Total Factor Inputs BL Indices	**1.0371**	**1.0258**	**1.0350**	**1.0319**	**1.0200**	**1.0142**	**1.0088**	**1.0047**	**1.0083**	**1.0129**	**0.9972**	**1.0399**	**1.0273**
UnWtd Inter-industry Total BL Indices	0.7191	0.7011	1.0396	0.9869	0.7798	0.9406	0.9583	0.8185	0.8415	0.8791	0.7870	0.7969	0.5987
UnWtd Grand Total BL Indices*	**1.7562**	**1.7269**	**2.0746**	**2.0188**	**1.7999**	**1.9548**	**1.9671**	**1.8232**	**1.8499**	**1.8920**	**1.7843**	**1.8368**	**1.6260**

	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overal Avg
Compensation of employees	0.0830	0.1154	0.0748	0.0777	0.0991	0.0935	0.0917	0.0726	0.1031	0.1015	0.1191	0.1214	0.1599
Gross operating surplus & mixed income	0.7491	0.7262	0.7444	0.5757	0.5540	0.5583	0.5352	0.5351	0.4514	0.3543	0.3376	0.3856	0.5448
Taxes less subsidies on products	0.0025	0.0038	0.0008	0.0015	0.0027	0.0027	0.0025	0.0010	0.0017	0.0016	0.0020	0.0014	0.0047
Other taxes less subsidies on production	0.0133	0.0147	0.0134	0.0146	0.0157	0.0154	0.0146	0.0134	0.0140	0.0202	0.0231	0.0143	0.0186
Complementary imports	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Competing imports	0.1798	0.1620	0.1875	0.3426	0.3457	0.3457	0.3563	0.2715	0.2539	0.2288	0.2189	0.2095	0.2414
UnWtd Total Value Added BL Indices	***0.8454***	***0.8563***	***0.8326***	***0.6680***	***0.6687***	***0.6673***	***0.6415***	***0.6210***	***0.5685***	***0.4760***	***0.4798***	***0.5212***	***0.7234***
UnWtd Total Factor Inputs BL Indices	**1.0277**	**1.0221**	**1.0210**	**1.0121**	**1.0171**	**1.0157**	**1.0003**	**0.8935**	**0.8242**	**0.7064**	**0.7007**	**0.7321**	**0.9694**
UnWtd Inter-industry Total BL Indices	0.6121	0.6849	0.6321	0.6993	0.7504	0.7285	0.7007	0.6279	0.6582	0.5805	0.6098	0.5753	0.7483
UnWtd Grand Total BL Indices*	**1.6398**	**1.7070**	**1.6531**	**1.7114**	**1.7675**	**1.7442**	**1.7009**	**1.5214**	**1.4824**	**1.2870**	**1.3105**	**1.3075**	**1.7177**

Source: Results obtained from the model developed in Chapter 4.

Figure 7.13: Un-weighted total and grand total backward linkages, Gas (S04) Sector, 1975-2015



Source: This author's analysis based on the model developed in this research.

events (shown by Figure 7.63), include: four recession periods in 1975, 1977, 1981 to 1983, 1990-91 which are represented by R1 to R4 respectively; the second oil shock in 1979, Asian Crisis in 1997, a period of reforms over the period 1983 to 1999, National Completion Policy Agenda (NCP) in 2004 and National Water Reforms in 2004, and Global Financial Crisis (GFC) in 2007-08. Also, in addition to the recession periods, the Australian economy experienced several periods of economic slowdowns in the post-2000 periods mainly in: second half of the 2000, 2006, 2009, to a lesser extent in 2008-09, and the post-GFC period in comparison to the rest of the world.

In case of Gas (incl. Nat Gas, LPG and CSG) (04), the Sector's employment linkages as measured by the Compensation of Employees (Table 7.20 and Figure 7.13) were the highest over the period 1975 to 1994 with an average index of 0.2305. The employment followed saw-tooth effects over the recession period, and then reached to its lowest magnitude (0.2026) in 1993-94. However, in 1994-95 the Sector's labour inputs to production significantly dropped to a low index of 0.0797 (about 65% decline with reference to aforementioned average). This declining patter continued over the period 1994-5 to 2014-15 with an average BL index of 0.0948 (an overall decrease of59% comparing the averages of the former and latter periods). The major reason for the observed downward pattern in labour backward linkages - apart from the impacts of the abovementioned economic events - is due to adoption of more advance labour-saving technologies given the un-weighted nature of linkages which reveals change in production technology over time. By cross referencing this finding with the results of the highest contributor to backward linkages of the Gas Sector in 1994-95, it is found that the Sector from 1992-93 to 2014-15 is dependent on financial and business inputs from the Communication, Finance, Property and Business Services (S36) (Table 7.8, col. "H2") needed to upgrade to more advanced production technology. On average, labour inputs to production over the period of 1975 to 2015 is 0.1599 index points out of the average grand total backward linkage index of 1.7177, 9.3% of overall total inter-industry and total primary factors input requirements to respond to a unitary increase in final demand.

Similar pattern of change, as discussed in the above, is observed for each of the seven items of the primary factors associated with the Gas Sector (S04) as well as with total primary factors, and total inter-industry backward linkages, and grand total backward linkage indices of the Gas Sector (Figure 7.1 and Figure 7.13, and Table 7.20). The pattern of change for one of the primary factor items could describe possible reasons for change in another item. For example, the Gross Profit and Mixed Incomes is a measure of return to capital as a result of producing a unit of output. Figure 7.13 shows direct relationships between decreasing labour indices and increasing pattern of return to capital indices (or Gross Profit Indices). For example the high decline of labour indices in 1994-95 corresponds to the highest profit index (0.8042) in that year. Although since then the profits had gradually declined, nevertheless the 2014-15 profits remained almost as high as the 1975 level. Table 7.20 shows that on average the profits remained stable (an average 0.5448 index points over the study period).

Further, the Gas Sector's contribution to net taxes (Tax Less Subsidies on Products plus Other Taxes Less Subsidies on Production) is the highest in 1979-80 (0.0538) when Australia's Gas export due of the 1979 second oil shock is the record high (0.7542), and the Sector's Gross Profit is also relatively high (0.5132). The net taxes means that for one unit of gas production the Sector contributes a maximum of 0.0538 (3.1%) unit of gas output to government revenues.

Also, the Gas Sector had relatively high imports (cumulative total index of 0.2470) in 1979-80 following the 1979 Second Oil Shock. Overall, the Gas sector demonstrated positive balance of trade over the period 1975-2015 with an overall-average imports of 0.2414 against an overall-average exports of 0.4597 (Table 7.20 and Table 7.21). Overall, the Sector's total value added and the total primary factors followed a decreasing pattern over the period of study.

Table 7.21: Gas (S02) Sector's complete set of overall forward linkages, 1975-2015

	(S04) Gas (incl. Nat Gas, LPG and CSG) - Total Forward Linkage Indices												
Primary Factors / Year	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95
Households	1.1064	1.0090	0.7258	0.8561	0.8738	0.5399	0.6529	0.8828	0.8804	1.0497	0.4148	0.3889	0.4388
Government	0.1508	0.1675	0.1380	0.1452	0.1555	0.0865	0.1075	0.1617	0.2113	0.3048	0.0834	0.1010	0.0653
Private	0.1661	0.1285	0.1449	0.1912	0.1854	0.1186	0.1271	0.1223	0.1897	0.2295	0.0679	0.1226	0.1086
Public Enterprise	0.0384	0.0242	0.0307	0.0490	0.0480	0.0245	0.0330	0.0478	0.0437	0.0496	0.0133	0.0406	0.0252
General Government	0.0432	0.0264	0.0308	0.0320	0.0282	0.0177	0.0222	0.0232	0.0504	0.0357	0.0130	0.0260	0.0279
Changes In Inventories	0.0223	0.0020	0.0141	0.0207	0.0060	0.0109	0.0016	0.0390	0.0045	0.0167	0.0237	0.0034	0.0092
Exports	***0.6319***	***0.4872***	***0.3994***	***0.7542***	***0.3819***	***0.4120***	***0.4172***	***0.3488***	***0.2603***	***0.3996***	***0.4521***	***0.4475***	***0.3944***
UnWtd Total FD-FL Indicies	**2.1592**	**1.8448**	**1.4836**	**2.0483**	**1.6789**	**1.2100**	**1.3616**	**1.6256**	**1.6403**	**2.0856**	**1.0682**	**1.1299**	**1.0694**
UnWtd Inter-ind. Total FL Index	2.0071	1.8441	1.5565	1.8032	1.6922	1.3582	1.4279	1.6870	1.8441	2.2528	1.0806	1.1630	1.1310
UnWtd Grand Total FL Index**	**4.1663**	**3.6889**	**3.0402**	**3.8515**	**3.3711**	**2.5682**	**2.7895**	**3.3126**	**3.4844**	**4.3384**	**2.1488**	**2.2929**	**2.2004**

	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overal Avg
Households	0.4392	0.5093	0.3244	0.3687	0.3203	0.2546	0.1917	0.2854	0.2959	0.2081	0.1867	0.1931	0.5399
Government	0.0594	0.0770	0.0445	0.0613	0.0571	0.0305	0.0353	0.0372	0.0372	0.0316	0.0261	0.0265	0.0976
Private	0.0913	0.1271	0.0794	0.1140	0.1230	0.0957	0.1272	0.1222	0.1344	0.1768	0.1852	0.2059	0.1414
Public Enterprise	0.0116	0.0177	0.0091	0.0262	0.0267	0.0093	0.0162	0.0217	0.0268	0.0125	0.0110	0.0114	0.0274
General Government	0.0159	0.0181	0.0134	0.0135	0.0141	0.0177	0.0225	0.0196	0.0249	0.0330	0.0353	0.0398	0.0262
Changes In Inventories	0.0047	0.0092	0.1941	0.0041	0.0022	0.0141	0.0148	0.0014	0.0022	0.0020	0.0015	0.0018	0.0176
Exports	***0.4697***	***0.3293***	***0.3543***	***0.5529***	***0.5781***	***0.5376***	***0.5701***	***0.5419***	***0.4756***	***0.4267***	***0.4404***	***0.4281***	***0.4592***
UnWtd Total FD-FL Index	**1.0918**	**1.0877**	**1.0191**	**1.1407**	**1.1216**	**0.9597**	**0.9778**	**1.0294**	**0.9969**	**0.8906**	**0.8863**	**0.9067**	**1.3093**
UnWtd Inter-ind. Total FL Index	1.1106	1.1611	0.8709	1.0593	1.0166	0.7473	0.7959	0.8823	0.9109	0.7587	0.6921	0.6906	1.2681
UnWtd Grand Total FL Indices**	**2.2024**	**2.2488**	**1.8900**	**2.2000**	**2.1382**	**1.7070**	**1.7737**	**1.9118**	**1.9079**	**1.6494**	**1.5784**	**1.5973**	**2.5773**

** Un-weighted Grand Total = Inter-Industry PLUS Final Demand Total Forward Linkage Indices
Source: Results obtained from the IO Four-Quadrant Linkage Analysis Framework

The Gas Sector's inter-industry cumulative backward linkages decreased slightly, while the Grand Total backward linkages over the study period declined at a slightly higher rate.

A summarised overall average linkage results covering all IOI over the period 1975 to 2015 is presented by Table 7.22 and highlights are discussed below. Discussion of each individual sector similar to the Gas Sector is beyond the scope of this Chapter. The primary factors overall-average cumulative backward linkages, and final demand overall-average cumulative forward linkages over the study period as well as sectoral ranking of all sectors of the economy are presented in Appendix VII, Tables VII-14 and VII-15 respectively. Also, Table VII-16 presents unweighted total forward linkages for the total final demand category.

Among IOI, the sectors with the highest total labour requirements for production are Exploration and Mining Support Services (S05) followed by Electricity Generation by Hydro (S24), and

Table 7.22: Primary factors overall-average total backward indices for IOI, 1975-2015

Sector	Sec Code	Compensation of employees	Gross operating surplus & mixed income	Taxes less subsidies on products	Other taxes less subsidies on production	Complementary Imports	Competing Imports	UnWtd Total Value Added BL Indices	UnWtd Total Factor Inputs BL Indices	UnWtd Inter-industry Total BL Indices	UnWtd Grand Total BL Indices
Coal	S02	0.3045 (30)	0.5666 (10)	0.0034 (38)	0.021 (30)	0 (15)	0.0866 (24)	**0.892 (14)**	**0.982 (14)**	**0.9198 (28)**	**1.9018 (27)**
Crude Oil	S03	0.1841 (35)	0.493 (17)	0.0045 (37)	0.0153 (36)	0 (9)	0.2621 (8)	**0.6925 (31)**	**0.9591 (31)**	**0.7398 (36)**	**1.6989 (36)**
Nat Gas	S04	0.1599 (37)	0.5448 (13)	0.0047 (36)	0.0186 (35)	0 (11)	0.2414 (9)	**0.7234 (30)**	**0.9694 (20)**	**0.7483 (35)**	**1.7177 (35)**
Explor. Mining	S05	0.4893 (4)	0.3467 (23)	0.0212 (3)	0.0407 (10)	0 (2)	0.0711 (30)	**0.8767 (17)**	**0.969 (22)**	**1.1939 (7)**	**2.1629 (10)**
Oth. Mining	S06	0.2925 (32)	0.5376 (14)	0.0109 (22)	0.0243 (27)	0 (26)	0.1182 (19)	**0.8543 (20)**	**0.9835 (13)**	**0.9276 (27)**	**1.9111 (25)**
Petro. Prod. Mfg	S12	0.1762 (36)	0.3382 (25)	0.0195 (4)	0.0153 (37)	0 (13)	0.4117 (4)	**0.5297 (35)**	**0.9609 (30)**	**1.0403 (16)**	**2.0013 (16)**
Coal Prod. Mfg	S13	0.1469 (38)	0.2803 (30)	0.0254 (1)	0.0135 (38)	0 (7)	0.4919 (1)	**0.4406 (38)**	**0.9579 (34)**	**0.8854 (31)**	**1.8433 (32)**
Elec. Gen. Coal	S21	0.4686 (8)	0.7582 (2)	0.0137 (15)	0.0685 (5)	0 (20)	0.0835 (25)	**1.2953 (2)**	**1.3926 (2)**	**1.3117 (2)**	**2.7042 (1)**
Elec. Gen. Oil	S22	0.4453 (9)	0.7078 (3)	0.0142 (12)	0.0688 (4)	0 (22)	0.068 (31)	**1.222 (3)**	**1.3041 (3)**	**1.0977 (12)**	**2.4018 (5)**
Elec. Gen. Nat. Gas	S23	0.3717 (19)	0.6745 (5)	0.0112 (19)	0.0537 (6)	0 (10)	0.1293 (18)	**1.0999 (5)**	**1.2404 (5)**	**1.3442 (1)**	**2.5846 (3)**
Elec. Gen. Hydro	S24	0.4846 (5)	0.7802 (1)	0.0149 (9)	0.0737 (2)	0 (21)	0.0809 (26)	**1.3385 (1)**	**1.4343 (1)**	**1.253 (4)**	**2.6873 (2)**
Elec. Gen. Renew.	S25	0.4413 (10)	0.6969 (4)	0.0141 (13)	0.07 (3)	0 (24)	0.0717 (29)	**1.2082 (4)**	**1.294 (4)**	**1.1221 (10)**	**2.416 (4)**
Elec. Gen Oth. Fuel	S26	0.3153 (26)	0.5737 (9)	0.0091 (31)	0.039 (11)	0 (1)	0.0084 (38)	**0.9279 (9)**	**0.9454 (38)**	**0.543 (39)**	**1.4885 (38)**
Elec. T&D	S27	0.3674 (20)	0.6141 (7)	0.0112 (18)	0.0742 (1)	0 (29)	0.0787 (27)	**1.0557 (6)**	**1.1456 (6)**	**1.2364 (5)**	**2.3821 (6)**
Gas Supply	S28	0.3046 (29)	0.5487 (12)	0.0073 (34)	0.0346 (13)	0 (3)	0.0637 (33)	**0.8879 (15)**	**0.959 (32)**	**0.9497 (25)**	**1.9087 (26)**
Upstrm Water	S29	0 (39)	0 (39)	0 (39)	0 (39)	0 (8)	0 (39)	**0 (39)**	**0 (39)**	**0.67 (38)**	**0.67 (39)**
Urb Water	S30	0.2597 (33)	0.6718 (6)	0.0097 (27)	0.0209 (31)	0 (4)	0.0472 (35)	**0.9525 (7)**	**1.0094 (9)**	**0.8305 (34)**	**1.8398 (33)**
Rurl Water	S31	0.3166 (25)	0.61 (8)	0.011 (20)	0.0236 (28)	0 (6)	0.0923 (23)	**0.9502 (8)**	**1.0535 (7)**	**1.1208 (11)**	**2.1743 (9)**
Water Serv.	S32	0.4687 (7)	0.4088 (18)	0.0145 (11)	0.0253 (25)	0 (16)	0.0568 (34)	**0.9028 (12)**	**0.9741 (17)**	**0.8744 (32)**	**1.8485 (31)**

Source: Results obtained from the IO Four-Quadrant Analysis Framework.

Water Services (Sewerage & Drainage) (S32) in ranking positions 4, 5 and 7 in the Australian economy. This finding implies that the production technology in these sectors is labour intensive requiring improvements. The sectors with the lowest total labour requirements are Coal (S02), Petroleum Products Manufacturing (S12), and Gas (incl. Nat Gas, LPG and CSG) (S04) Sectors in ranking poistions35 to 37 respectively. The latter group is among sectors with advanced production technology because of their specialised and sophisticated operations (Table 7.22).Regarding other sectors of the economy Education, Health and Community Services (S38), Government Administration, Defence, Public Order and Safety (S37), and Other Commercial Services including Waste Management (S39) in ranking positions 1, 2 and 3 in the Australian economy are the highest labour intensive sectors (see Appendix VII, Table VII-14).

Almost all of the electricity generation sectors (sector codes S21 to S25 except S26) and Electricity Transmission and Distribution Sector (S27) as well as Rural Water Supply (S31) are the top ranking sectors (ranked 1 to 7 respectively) with the highest un-weighted total factor inputs in Australia (ranging from 1.0535 to 1.4343) (Table 7.22). Among these sectors, Electricity

Generation by Hydro (S24) is the most primary factors intensive sector with a total backward linkage index of 1.4343. This Sector together with Coal (S02) and Gas (incl. Nat Gas, LPG and CSG) (S04) have the highest total gross profit indices. The Electricity Transmission and Distribution (S27) followed by Electricity Generation by Hydro (S24) and Electricity Generation by Coal (S21) also have the highest net taxes linkage indices. Therefore, the strong linkages of these IOI is an evidence of their high contribution to the Australian economy by providing employment, and contributing to government revenues through net taxes. However, Other Mineral Mining (S06) followed by Rural Water Supply (S31), and Coal (S02) Sectors have the highest imports linkages showing that high economic leakages occur through these sectors into overseas markets. For example Petroleum Products Manufacturing (S12) has the highest Imports linkages (average total of 0.4117 over the study period), in ranking position 4 after Coal Products Manufacturing (S13) and Machinery, Transport and Machinery Products (S19) in the economy, while its un-weighted inter-industry cumulative linkages is in the low ranking position 30. This finding implies three reasons: first, the sector is dependent on overseas markets for its inter-industry inputs for its production because domestic oil supply is not sufficient; second, the Sector's production technology is not advanced enough to compete with overseas refinery plants to produce locally; or third, the Sector is benefitting from the more competitive overseas market and cheaper refinery products (specifically the Asian refinery plants) which readily might not find further investments in advanced technology as an option. Literature shows that lack of access to advanced technology is the main reasons of highest level of imports (DITR 2007).

7.4 Final Demand Total Linkages

The final demand cumulative linkages (Figure 7.1, Q3) are of forward type because the goods and services supplied by various supply sectors are consumed by the recipient final demand sectors for final uses. In this section, the final demand linkages (Table 7.23) are referred to as FD-FL.

To keep the discussion of results at sector level more inter-related, the FD-FL results are discussed in details for the same sector, Gas (incl. Nat Gas, LPG and CSG) (S04) by reviewing Table 7.22 and Table 7.23. Also, the finding highlights for IOI and other sectors of economy are discussed by help of Table 7.23 and Table VII-15 in Appendix VII over the period 1975 to 2015.

The total final demand forward linkages of the Gas Sector with Households follows a declining pattern over the period 1975-2014 (Figure 7.14). The gas supply is much higher over the period 1975 to 1990 (average FD-FL of 0.8577). However, over the period 1990 to 1993 it drops significantly by 0.4429 index points (~52% change), followed by further decline of 53% reaching to low index of 0.1931 in 2014-15 (Table 7.21). The reasons for this rapid decline are related to: depleting gas resources as discussed in Chapter 3, historical analysis, as also recently reported by AEMO (2017a); and the expansion of the exports market confirming previous findings through entropy and concentration linkage indices (as discussed in Chapter 6). The gas exports linkages

Table 7.23: Final demand un-weighted average total forward linkages, IOI, 1975-2015

Sector	Sector Code	Households	Government	Private	Public Enterprise	General Government	Changes In Inventories	Exports	UnWtd Total FD-FL Indicies	UnWtd Inter-industry Total FL Indices	UnWtd Grand Total FL Indices
Coal	S02	0.2336 (32)	0.0410 (33)	0.0688 (33)	0.0148 (27)	0.0126 (33)	0.0181 (4)	0.6897 (1)	**1.0787 (9)**	**0.8811 (28)**	**1.9598 (21)**
Crude Oil	S03	0.4240 (25)	0.0518 (29)	0.0842 (30)	0.0129 (30)	0.0147 (30)	0.0322 (2)	0.3332 (6)	**0.9531 (12)**	**1.281 (7)**	**2.2341 (10)**
Nat Gas	S04	0.5358 (20)	0.0961 (15)	0.1394 (17)	0.0267 (16)	0.0258 (14)	0.0171 (5)	0.4592 (4)	**1.3 (4)**	**1.2614 (9)**	**2.5613 (4)**
Explor. Mining	S05	0.1699 (35)	0.0789 (19)	0.2662 (7)	0.0136 (29)	0.0143 (31)	0.0158 (7)	0.4189 (5)	**0.9775 (11)**	**1.2404 (12)**	**2.2179 (11)**
Oth. Mining	S06	0.0799 (37)	0.0186 (38)	0.1077 (24)	0.023 (18)	0.0224 (19)	0.0138 (10)	0.6485 (2)	**0.9138 (33)**	**0.8882 (27)**	**1.802 (28)**
Petro. Prod. Mfg	S12	0.5160 (21)	0.0662 (25)	0.1050 (25)	0.0156 (26)	0.0182 (22)	0.0116 (13)	0.2177 (10)	**0.9503 (13)**	**1.0553 (19)**	**2.0056 (18)**
Coal Prod. Mfg	S13	0.3432 (27)	0.0697 (22)	0.2335 (8)	0.0384 (11)	0.0400 (7)	0.0147 (9)	0.3271 (7)	**1.0666 (10)**	**1.4122 (2)**	**2.4787 (7)**
Elec. Gen. Coal	S21	0.7879 (3)	0.1457 (4)	0.1735 (11)	0.0404 (8)	0.0286 (10)	0.0069 (21)	0.1708 (15)	**1.3538 (2)**	**1.3874 (3)**	**2.7412 (2)**
Elec. Gen. Oil	S22	0.7204 (7)	0.0897 (17)	0.1346 (18)	0.0309 (14)	0.0230 (16)	0.0098 (16)	0.1774 (13)	**1.1858 (6)**	**1.2947 (6)**	**2.4805 (6)**
Elec. Gen. Nat. Gas	S23	0.7604 (5)	0.1303 (7)	0.1632 (14)	0.0408 (7)	0.0271 (13)	0.0064 (23)	0.1464 (19)	**1.2747 (5)**	**1.2807 (8)**	**2.5553 (5)**
Elec. Gen. Hydro	S24	0.8106 (2)	0.1446 (5)	0.1734 (12)	0.0390 (10)	0.0283 (11)	0.0064 (24)	0.164 (16)	**1.3663 (1)**	**1.3844 (4)**	**2.7507 (1)**
Elec. Gen. Renew.	S25	0.8109 (1)	0.0696 (23)	0.1253 (19)	0.0358 (13)	0.0227 (17)	0.0028 (32)	0.0933 (27)	**1.1605 (7)**	**0.9262 (21)**	**2.0867 (15)**
Elec. Gen Oth. Fuel	S26	0.7588 (6)	0.0053 (39)	0.0799 (31)	0.0365 (12)	0.0157 (28)	0.0001 (39)	0.0072 (39)	**0.9034 (39)**	**0.4512 (39)**	**1.3546 (39)**
Elec. T&D	S27	0.7853 (4)	0.1383 (6)	0.1685 (13)	0.0399 (9)	0.0279 (12)	0.0066 (22)	0.1623 (17)	**1.3289 (3)**	**1.3433 (5)**	**2.6721 (3)**
Gas Supply	S28	0.6622 (9)	0.0879 (18)	0.1394 (16)	0.0262 (17)	0.0248 (15)	0.0055 (27)	0.1397 (21)	**1.0857 (8)**	**1.1781 (13)**	**2.2639 (9)**
Upstrm Water	S29	0.6176 (14)	0.1089 (12)	0.0954 (29)	0.0182 (23)	0.0165 (25)	0.0038 (30)	0.0621 (31)	**0.9225 (23)**	**1.4644 (1)**	**2.387 (8)**
Urb Water	S30	0.6236 (11)	0.1122 (9)	0.0971 (27)	0.0188 (20)	0.0168 (23)	0.0026 (33)	0.0519 (34)	**0.9231 (21)**	**0.8945 (26)**	**1.8176 (25)**
Rurl Water	S31	0.5515 (18)	0.0748 (20)	0.0789 (32)	0.0121 (33)	0.0133 (32)	0.0157 (8)	0.1714 (14)	**0.9177 (28)**	**1.0978 (16)**	**2.0155 (17)**
Water Serv.	S32	0.6183 (13)	0.1092 (11)	0.0956 (28)	0.0183 (22)	0.0165 (24)	0.0037 (31)	0.0609 (32)	**0.9226 (22)**	**0.9011 (24)**	**1.8237 (24)**

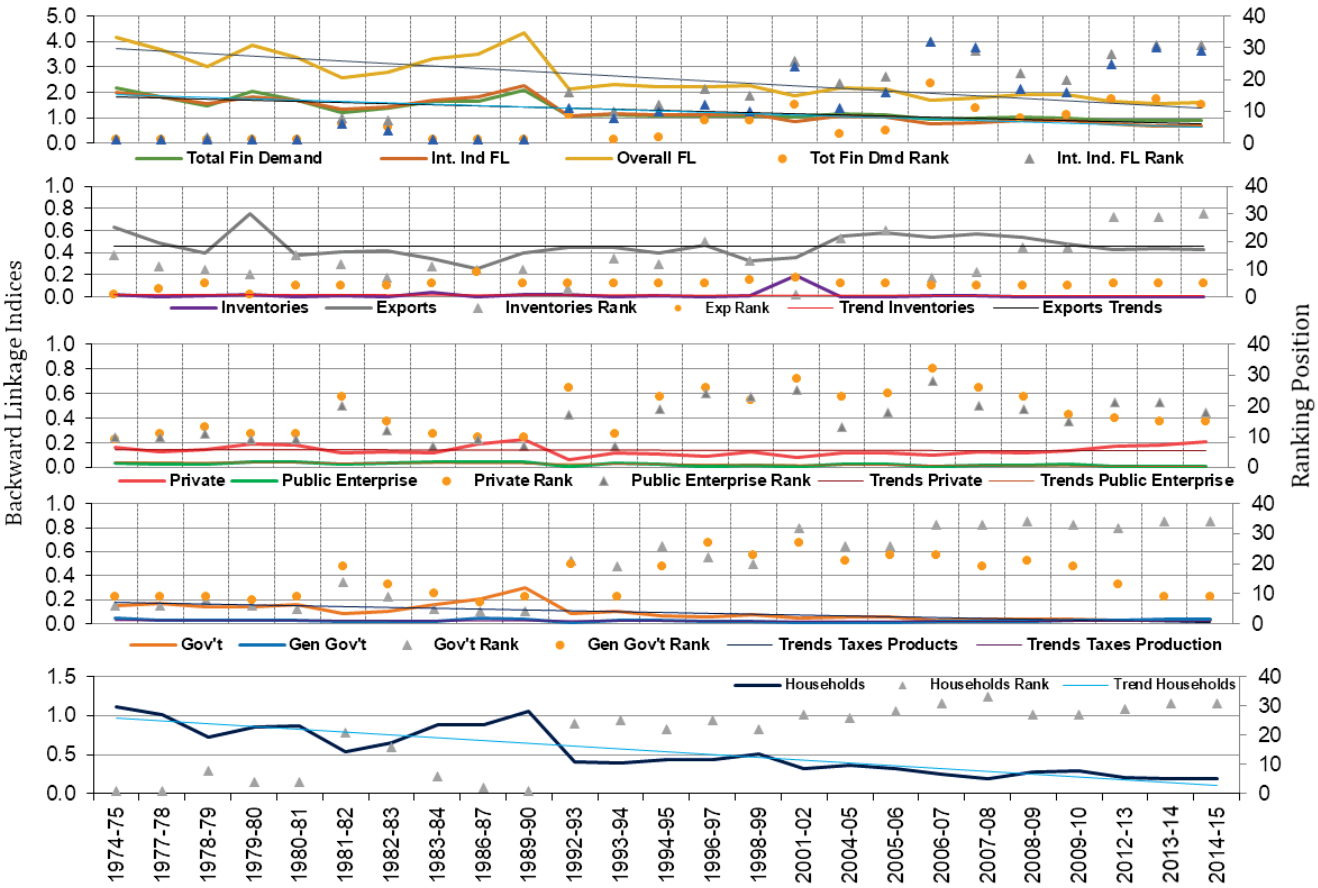
Source: Results obtained from the IO Four-Quadrant Analysis Framework.

started to rise over the period 2004-05 to 2014-15 (average index of 0.5057) in comparison to the earlier period 1983-84 to 2001-02 (average index of 0.3840) by about 32% (Table 7.22). Global environmental concerns about issues associated with the coal consumptions as well as depletion of primary energy resources influenced expansion of Australian gas exports market.

Also, the overall average cumulative forward linkages of the Gas Sector (S04) with the sectors of final demand declines over the study period. Moreover, the grand total cumulative forward linkages of the Gas Sector (inter-industry plus final demand forward linkages) is downward tracking too. From the inter-industry analysis perspective, the less consumption of Gas apart from the abovementioned reasons could be due to adoption of less inputs intensive advanced production technologies by gas consuming sectors. However, the findings that grand total forward linkage indices of the Gas Sector is declining is alarming, because of possible impacts slowing down induced economic activities in other sectors calling for improvements through policy intervention.

With respect to other IOI and major sectors of the economy (Table 7.23 and Table VII-15 in

Figure 7.14: Final demand un-weighted total forward linkages, Gas Sector (S04), 1975-2015



Source: Results obtained from the model developed in this research.

Appendix VII), the results show that all electricity generation sectors, and the Electricity Transmission and Distribution Sector (S27) have the strongest forward linkages with Households (measured by the magnitude of their linkage indices). Although the production level of Electricity Generation by Renewables (S25) in comparison to other electricity generation types is relatively small, nevertheless the results reveal that the Sector has the strongest supply linkages with Households (FD-FL = 0.8109, Rank = 1). A possible reason could be related to Households' direct access to electricity generation by rooftop solar systems which their outputs are readily available for final uses. The next high ranking electricity sectors are: Electricity Generation by Hydro (S24) (Rank 2), Electricity Generation by Coal (S21) (Rank 3), Electricity Transmission and Distribution (S27) (Rank 4), Electricity Generation by Gas (S23) (Rank 5), Electricity Generation by Other Fuels (S26) (Rank 6), and Electricity Generation by Oil Products (S22) (Rank 7). The next group of sectors with high total forward linkages are: Textile, clothing, footwear and leather (S08) (Rank 8), Gas Supply (S28) (Rank 9), and Food, Beverage and Tobacco (S07) (Rank 10). These results intuitively expected too.

The sectors which on average had the highest forward linkages to the final demand category are: Government Administration, Defence, Public Order and Safety (S37) index=0.8125, Rank=1); Education, Health and Community Services (S38) (index=0.5536, Rank=2): Other Commercial

Services (S39) (index 0.2444, Rank 3); followed by all electricity sectors: Electricity Generation by Coal (S21) (Rank 4), Electricity Generation by Hydro (S24) (Rank 5), Electricity Transmission and Distribution (S27) (Rank 6), and Electricity Generation by Gas (S23) (Rank 7).

In terms of exports the following sectors on average have the highest cumulative forward linkages with the Exports Sector of final demand: Coal (S02), Other Mineral Mining (S06), Basic Non-Ferrous Metal Manufacturing (S18), Gas (incl. Nat. Gas, LPG and CSG) (S04), Exploration and Mining Services (S05), Crude Oil (S03), Coal Products (S13), Agriculture, Forestry and Fishing (S01), Transport and Storage Services (S35), and Petroleum Products Manufacturing (S12).

The ten ranking sectors with the highest average total forward linkages with the final demand Private Sector are: Construction (S33), Non-Metallic and Mineral Products (S15), Machinery and Transport Products (S19), Other Metal Products (S18), Iron and Steel (S16), Wood Products (S10), Exploration and Mining Support Services (S05), Coal Products Manufacturing (S13), Other Manufacturing (S20), and Pulp, Paper, and Paperboard Manufacturing (S09).

Figure 7.15 and Figure 7.16 show a comparative analysis of overall primary factors (factors) and overall final demands linkages trends, and sectoral ranking trends for Gas (incl. Nat Gas, LPG and CSG) Sector (S04). Similar graphs for all IOI are presented in Appendix VII, Figures VII-57 to VII-80. A summary describing the pattern of change in IOI linkages and sectoral trends are given by Table 7.24, and the results are discussed below.

Figure 7.15: Un-weighted primary factors total BL and ranks, Gas (S04), 1975-2015

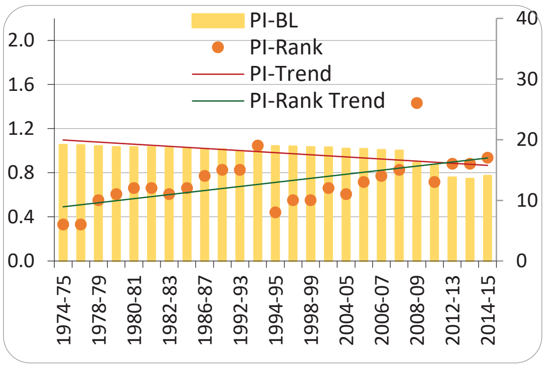
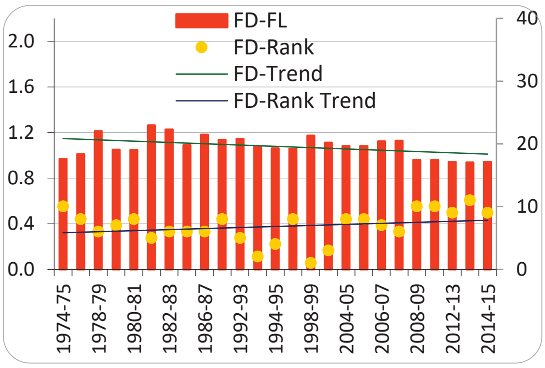


Figure 7.16: Un-weighted final demand total FL and ranks, Gas (S04), 1975-2015



Source: This author's analysis based on the model developed in Chapter 4.

For the Gas (incl. Nat Gas, LPG and CSG) Sector (S04), its primary factors backward linkages trends decline over the study period (▼, see Table 7.24 and Figure 7.15) implying lower consumption of primary factors for production implying adoption of advanced production technologies. Also, the trends associated with the Sector's ranking positions decline over the study period (▼) implying improvements in its ranking position relative to other sectors. Also, the Sector's final demand linkages trends sharply decline over the period showing availability of less supply to sectors of final demand for final uses - for the reasons which discussed earlier. Moreover, the Sector's ranking trends related to final demand linkages increasing implying that the Sector relative to other sectors moved to lower ranking positions over the study period.

Table 7.24 shows that primary factors and final demand linkages trends for the following sectors followed increasing pattern over the study period in comparison to other sectors: Electricity Generation by Oil Products (S22), Electricity Generation by Hydro (S24), Electricity Generation by Renewables (S25), and Electricity Transmission and Distribution Sector (S27). The results imply that production by these sectors is more primary input intensive contributing to employment, government revenues through taxes and profits while at the same time the sectors make more supply available to sectors of final demand for final uses.

Table 7.24: Primary factors and final demand total linkages trends, IOI, 1975-2015

Sector	Sector Code	Primary Inputs Total Backward Linkages (BL) Trends (PI-BL)	PI-BL Rank Trends	Final Demand Total Forward Linkages (FL) Trends (FD-FL)	FD-FL Rank Trends
Coal	S02	▲	▼	▽	△
Crude Oil	S03	▼	▲	▽	▲
NAT Gas	S04	▼	▽	▼	▲
Explor. Mining	S05	▽	▲	▽	▽
Oth. Mining	S06	▽	△	⌃	△
Petro. Prod. Mfg	S12	▼	▲	▽	▲
Coal Prod. Mfg	S13	▼	▲	⌃	⌃
Elec. Gen. Coal	S21	▲	△	▲	⌃
Elec. Gen. Oil	S22	▲	▼	▲	▼
Elec. Gen. Nat. Gas	S23	▲	△	▼	▲
Elec. Gen. Hydro	S24	▲	▽	▲	▼
Elec. Gen. Renew.	S25	▲	▼	▲	▼
Elec. Gen. Oth. Fuel	S26	▼	△	▽	⌃
Elec. T&D	S27	▲	▼	▲	⌃
Gas Supply	S28	▼	△	△	▽
Upstrm Water	S29	⌃	⌃	▽	△
Urb Water	S30	▽	△	⌃	△
Rural Water	S31	▽	△	▽	▲
Water Serv.	S32	▽	▼	▼	△

▲ linkage-inc. ▼ linkage-dec. △ linkage-slight-inc. ▽ linkage-slight-dec. ⌃ linkage-stable
▼ rank-dec. ▲ rank-Inc. ▽ rank-slight-dec. △ rank-slight-inc. ⌃ rank-stable

Source: This author's analysis based on the model developed in Chapter 4.

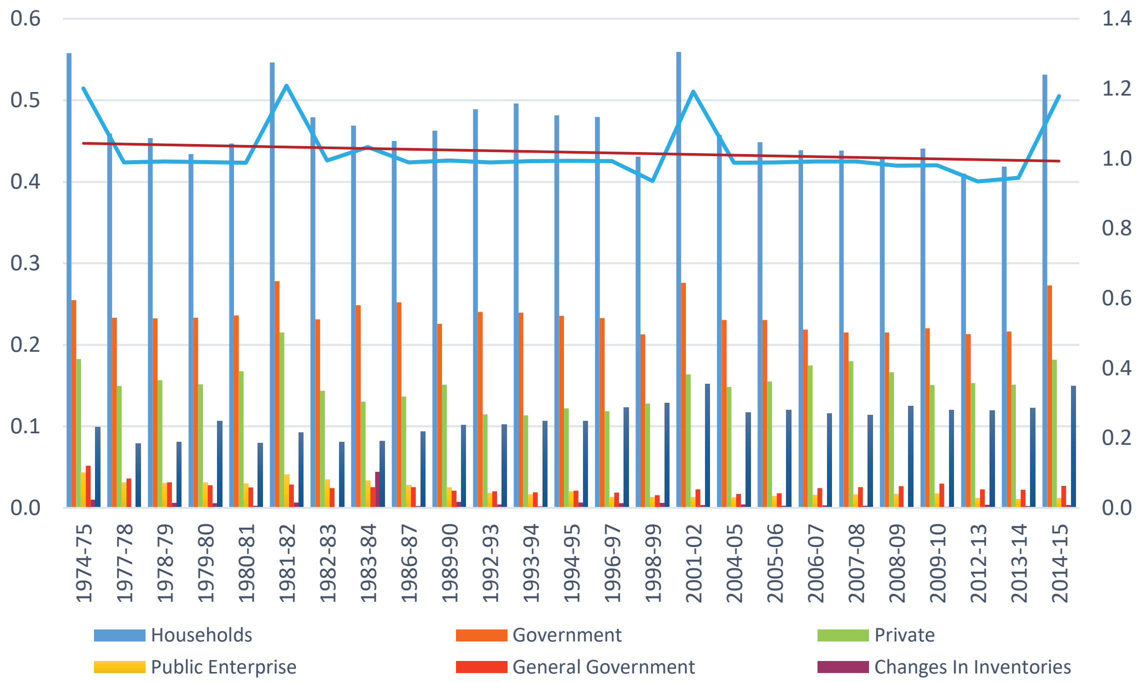
Therefore, these findings together with those discussed in section 7.3 and 7.4 show that the sectors which have the highest total primary factor linkages, also have the highest cumulative overall final demand linkages (e.g. the electricity sectors). Therefore, these sectors are important in the economy inducing economic activity in both upstream and downstream sectors respectively. Therefore, from policy perspective these sectors can be further developed. The historical trends in Table 7.24 confirms discussions and findings in sections 7.3 and 7.4 respectively.

7.5 Linkages of Final Demand Sectors with Primary Factors

Because final demand sectors in addition to purchases from the inter-industry sectors also directly purchase primary factors (PF), the linkages can be measured in quadrant four of IO tables (Figure 7.1, Q4) by the IO Four-Quadrant Linkage Analysis Framework whose formulation provided in Chapter 4. This research refers to these linkages by the parameter term PF-FD Linkages. Direct-purchases of primary factors, for example by Households, could be hire of labour for gardening, cleaning, child care or other domestic uses in homes. Also, when Households purchase any goods and services they contribute to net taxes, imports, and the producers' profit as returns of capital. For example, Households in comparison to other sectors of final demand in 2014-15 spend a total of 3.0403 units of their income on primary factors purchases comprised of 0.5313 units of income on direct hire of labour for household helps; 0.6031 units contributing to the producers profit; 0.7469 - the highest - in taxes for purchases made; and 0.4736 units of income (the second highest) on consumed imported products or products which contained imported raw materials.

Figure 7.17 shows the pattern of un-weighted cumulative direct-purchases of labour (measured by Compensation of Employees) by each sector of the final demand. The pattern of cumulative linkages of direct-purchases slightly decreases over the period while on average continues with an average index of 1.0181. Overall, Households are the highest purchasers followed by the Private, Exports, Government Sectors. The Exports Sector shows an increasing trends for purchase of labour services implying expansion of the Sector.

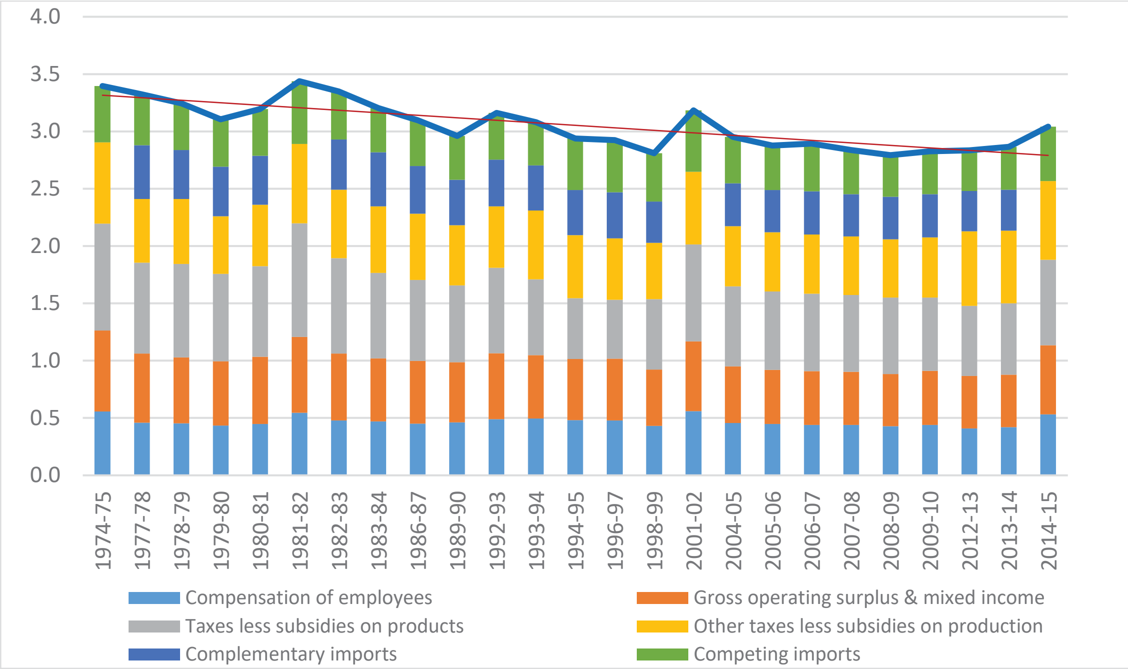
Figure 7.17: Unweighted total direct hire of labour by final demand sectors, 1975-2015



Source: This author's analysis based on the model developed in this research.

Also, Figure 7.18 shows the pattern of purchases of primary factor items by each sector of final demand. Overall, total direct purchases of primary factors by sectors of final demand follows a declining pattern over the study period. Total purchases was the highest in 1982-83, 2001-02, and 2014-15, however in decreasing pattern, showing relatively higher consumers' confidence and hence willingness to spend in those years. Overall, purchases contributing to competing and complementary imports, taxes on production slightly decreased over the period, while purchases

Figure 7.18: Direct purchases of primary factors by sectors of final demand, 1975-2015



Source: This author's analysis based on the model developed in Chapter 4.

contributing to taxes on products, gross profits and returns to capital remained almost the same over the period 1975-2015.

Table 7.25 shows overall-average purchases of primary factors by sectors of final demand over the period 1975-2015. It shows that on average Households followed by the Private and Government Sectors are the highest direct purchases of primary factors. Also, these linkages

Table 7.25: Overall-average purchases of primary factors by final demand, 1975-2015

	Compensation of employees	Gross operating surplus & mixed income	Taxes less subsidies on products	Other taxes less subsidies on production	Complementary imports	Competing imports	**Total Direct Purchases (FL)**
Primary Factors	**Average Direct Purchases of Primary Factors**						
Households	0.4683	0.5417	0.7182	0.5704	0.3354	0.4190	**3.0530**
Government	0.2359	0.1103	0.0208	0.1446	0.1124	0.0756	**0.6995**
Private	0.1523	0.1641	0.1805	0.1564	0.1480	0.2218	**1.0231**
Public Enterprise	0.0220	0.0235	0.0053	0.0212	0.0455	0.0280	**0.1455**
General Government	0.0251	0.0269	0.0086	0.0244	0.0475	0.0312	**0.1637**
Changes In Inventories	0.0056	0.0092	0.0032	0.0066	0.0335	0.0091	**0.0671**
Exports	0.1088	0.1797	0.0521	0.1257	0.1679	0.2139	**0.8480**
Unweighted Total	**1.0181**	**1.0553**	**0.9886**	**1.0492**	**0.8902**	**0.9987**	

Source: Results obtained from the model developed in Chapter 4.

resulted in above average contributions to producers' gross profits (1.0553 index points), taxes less subsidies on production (1.0492), and competing imports (~ 1.0000) as a result of direct hiring of labour services (1.0181) as well as purchases of produced goods and services. Table VII-17 in Appendix VII, presents full details of PF-FD Linkages over the period of study.

7.6 A Proposed Sectoral Classification System (SCS)

Rasmussen (1956) and Hirschman (1958) suggested "Key" Sector classification method based on the criteria described in Chapters 4 and 5. However, there are sectors in the economy which are equally as important as the key sectors; or sectors demonstrating an above average BL and FL but marginally fail on the acceptable level of coefficient of variability (COV or the proposed C-COV); and other combinations as described in Table 7.26 requiring a more descriptive sectoral classification. Therefore, this research suggests a method based on the process flow described by Figure 7.19 so that sectors are classified into more suitable classes. The proposed method is based on a Linkage Strength Evaluation Score (LSES) algorithm, which evaluates the magnitudes of both BL and FL indices in conjunction with the size of the proposed variability index for each sector (see Chapter 5 for C-COV formulation) as well as other scores which are assigned during the evaluation process. Based on the evaluation outcomes, each sector's class is determined.

Table 7.26: The proposed sectoral classification assessment

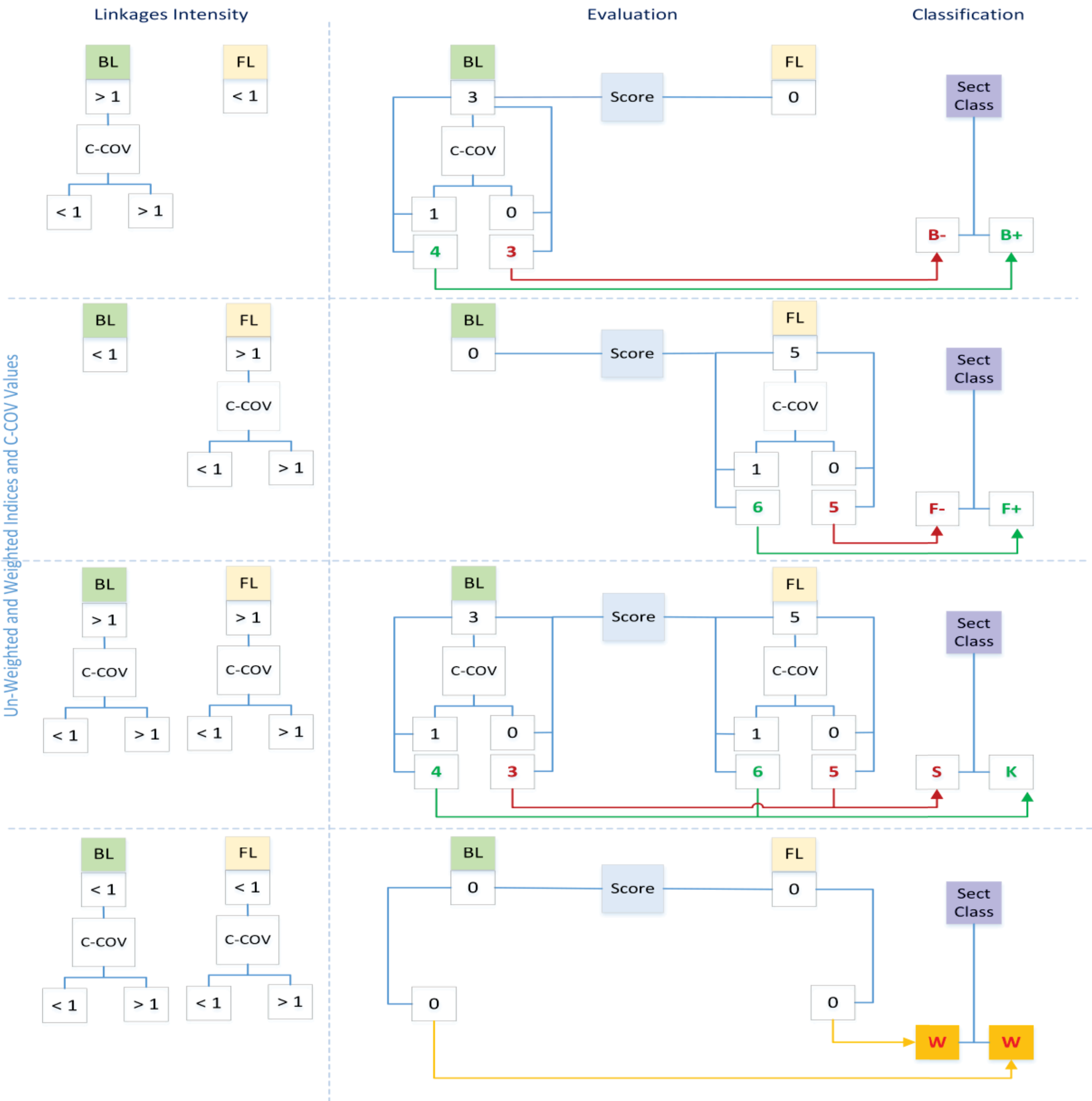
BL ≥ 1	BL < 1	FL ≥ 1	FL < 1	BL C-COV < 1	BL C-COV ≥ 1	FL C-COV < 1	FL C-COV ≥ 1	Sector Class	Description
●		●		●		●		K	Key Sector
●		●		●				S	Strong Sector
●		●				●		S	Strong Sector
●		●						S	Strong Sector
●			●	●				B+	Very Strong Backwars Linkages
●			●		●			B-	Less Strong Backward Linages
	●	●				●		F+	Very Strong Forward Linkages
	●	●					●	F-	Less Strong Forward Linages
	●		●					W	Wak Sector

Differences between the Proposed and Traditional Sectoral Classification Systems - There are two major differences. First, the proposed system extends sectoral classification beyond the traditional four categories of Key, Strong BL, Strong FL, and Weak sectors (Table 7.26); second, it modifies the traditional three-parameter sectoral evaluation algorithm (FL, BL, and variability index) to a score-based evaluation algorithm to more precisely classify each sector. The proposed system provides more insights into the nature of sectoral linkages, and the overall economic impacts of each sector in the economy, useful for making sound policy and investments decisions.

Table 7.27 and Table 7.28 show the results of proposed *Un-weighted Sectoral Classification Systems* and proposed *Integrated Un-weighted and Weighted Sectoral Classification System* over the period 1975-2015 respectively. Also, in Appendix VII, Tables VII-18 to VII-21 provide comparison results, namely, the results of traditional un-weighted sectoral classification system

(Table VII-18); weighted results of the proposed classification system based on the Reformulated, and Traditional System of Weights (SOW) (Tables VII-19 and VII-20 respectively), and the proposed integrated unweighted and weighted method based on the Traditional SOW and COV (Table VII-21) (see Chapter 5 for weighting methods).

Figure 7.19: The process-flow of proposed sectoral classification system



The proposed *Integrated Un-weighted and Weighted Sectoral Classification System*, is a preferred system because it takes into account the evolving nature of linkages by incorporating both technological and structural characteristics of the comprising IO coefficients with which backward and forward linkages are estimated over the period of study. Therefore, sectoral classes are more reflective of the economic impacts of each sector in the economy. The proposed *Unweighted Sectoral Classification System* treats each sector in the economy equally (see Chapter 5). The results of weighted and unweighted sectoral classification in this research are different but consistent with results obtained in different economies because of differences between technical and policy-based linkages. For example see Shuja et al. (2008).

Traditional un-weighted sectoral classification system (Appendix VII, Table VII-18) identifies many sectors as “key” sectors making it difficult to direct policy decisions to the most probable “key” sectors for achieving optimum economic outcomes. But, the results of proposed Un-weighted Classification System (Table 7.27), although for some sectors are the same as the results obtained by the traditional system, it classifies sectors with more distinguished level of granularity which is needed for policy purposes. For example, by analysing classification results for some of the IOI, it is found that both traditional and proposed un-weighted sectoral classification systems classify electricity sectors as key sectors over the period 2001-02 to 2014-15. However, the classification by the proposed system is more relevant over the earlier period given less maturity of the electricity sector. For example, the traditional system classifies the Electricity Generation by Renewables (S25) inconsistently as ‘weak’, ‘strong forward-oriented’, and ‘strong backward-oriented’ sector over the early period 1975 to 1995, while the proposed system consistently classifies it as ‘weak’ which is more relevant to the early stages of development of this Sector; or in case of Coal Sector (S02), the traditional system classifies it as a ‘strong backward-oriented’ sector over the downturn mining period of 2012-2015, while the proposed system classifies it as a ‘weak’ sector more in alignment with real life situation of less backward and less forward coal mining activities. Although some improved outcomes are achieved by the proposed unweighted sectoral classification system, yet insufficient. The reason is that the importance of each sector in the economy (see Chapter 5) is not taken into account. Therefore, the slightly improved results still suffer from the equal treatment of the sectors. However, by applying the preferred Integrated Un-weighted and Weighted Sectoral Classification System, it is found that the results are more useful for policy purposes (Table 7.28) because they are more descriptive of the economic nature of each sector; the key sectors are identified more precisely; and strong sectors are identified by plus and minus tolerances as described in Table 7.28. Therefore, the outcomes of a sectoral-class impact analysis of policy scenarios are more meaningful. The assumption of incorporating sectoral importance into the proposed sectoral classification system by weighting approach, does not alone generate fully useful results. For example, the weighted results of the proposed sectoral classification system (utilising Traditional SOW and COV) show the status of majority of the Australian sectors as ‘weak’ (Appendix VII, Table VII-20). The strong sectors identified by this method are: Construction (S33); Wholesale and Retail Trades (S34); Transport and Storage Services (S35) (S35 also classified as a key sector); Communication, Finance, Property and Business Services (S36); Government Administration, Defence, Public Order and Safety (S37); Education, Health and Community Services (S38); and Other Commercial Services including Waste Management (S39). In contrast, by analysing the weighted results of the proposed sectoral classification method (utilising Reformulated SOW), it is found that sectoral classes are more consistent, and evenly distributed over the study period (Appendix VII, Table VII-19). Nevertheless, the classification results for most of the sectors are reported as ‘weak’. These results suggest that sectoral classification outcomes just based on weighting system may sacrifice reality.

Table 7.27: Results of proposed un-weighted sectoral classification system (incorporating C-COV), 1975 to 2015

Sectors / Yr	Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
Ag., Forest & Fish'g	S01	W	W	W	W	W	W	B+	W	B+	W	W	W	B-	B-	B-	W	W	W	S	S	B+	W	W	W	W
Coal	S02	F+	F+	F+	F+	F+	F+	F+	F+	W	W	W	W	B+	B+	B+	W	B+	W	B+	B+	W	W	W	W	W
Crude Oil	S03	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F+	F+	F+	F+	W
Nat Gas	S04	F-	F-	F+	F+	F-	F+	F+	F-	F-	F-	F+	F+	F+	F+	F+	W	F+	F+	W	W	W	W	W	W	W
Explor. Mining	S05	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	K	K	K	K	W	B+	W	W	W	W
Oth. Mining	S06	W	W	F+	F+	F+	W	W	W	W	W	B+	B+	W	B+	B+	W	W	W	W	W	W	W	W	W	W
Food & Bev	S07	B-	B-	B-	B-	B-	B-	B-	B-	B-	B-	B+	B-	B-	B-	B-	B-	B-	B-	B-	B-	B+	B+	W	W	W
Textile & Clothing	S08	B-	B-	B-	B-	B-	B-	B-	W	B-	B-	W	B-	B-	B+	B+	B-	W	W	W	W	W	W	W	W	W
Pulp & Paper Mfg	S09	S	B-	S	S	S	S	S	B+	F-	S	F+	F-	S	S	S	S	F-	F-	K	F-	F+	F+	F+	F+	F+
Wood Prod.	S10	S	B+	S	S	S	S	S	B+	S	S	S	S	S	S	S	S	S	S	S	S	S	S	F-	F-	F-
Print & Pub.	S11	K	K	B+	B+	K	K	K	K	K	B+	B+	K	S	F-	S	S	K	K	K	K	W	W	W	W	W
Petro. Prod. Mfg	S12	S	K	K	K	K	K	K	S	K	B-	S	S	F+	K	F+	K	K	K	F+	F+	W	W	W	W	F+
Coal Prod. Mfg	S13	F+	F+	F+	F+	F+	F+	F+	F+	K	K	K	F+	F+	F+	K	K	F+	F+	F+	F+	F+	F+	F+	F+	F+
Chem. Prod.	S14	S	B-	S	S	S	S	S	B-	S	S	B-	S	S	S	F-	S	F-	F-	F-	F-	W	W	W	W	W
Non-Metal & Min. Prod.	S15	S	S	S	S	S	S	S	S	S	B+	S	S	S	S	S	S	S	S	S	S	S	F-	F-	F-	F-
Iron & Steel Mfg	S16	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	F+	F-	F-	F+
Non-Ferrous Mfg	S17	B-	B-	B-	B-	B-	B-	B-	B-	B-	B-	B+	B-	B-	B-	B-	B-	B-	B-	B-	B-	B-	B+	B+	B+	B+
Oth. Metal Prod.	S18	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	S	S	K	S	S	S	S	S	S	K	F+	F+	F+	F+
Mach. & Transp Prod.	S19	B-	B-	B-	B-	B-	B-	B-	B-	B-	B+	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W
Mfg Oth.	S20	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	W	W	W	W	W	W	W	W
Elec. Gen. Coal	S21	F-	S	S	S	S	S	S	S	S	S	S	F+	B+	F-	S	S	S	S	S	S	S	S	S	S	S
Elec. Gen. Oil	S22	W	F+	F+	F+	W	F+	F+	F+	F+	F+	F-	F-	B+	K	K	K	S	K	S	S	S	S	S	S	S
Elec. Gen. Nat. Gas	S23	S	S	S	S	S	S	S	S	S	S	S	K	K	S	S	B+	S	S	K	B+	S	S	S	S	S
Elec. Gen. Hydro	S24	F-	F-	F-	F-	F-	F-	S	S	S	F-	S	F+	K	F-	F-	F-	S	S	S	S	S	S	S	S	S
Elec. Gen. Renew.	S25	W	W	W	W	W	W	W	W	W	W	W	W	B+	B+	W	B+	B+	B+	S	S	S	S	S	S	S
Elec. Gen Oth. Fuel	S26	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. T&D	S27	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	S	F+	W	F-	F-	F-	S	S	S	S	S	S	S	S	S
Gas Supply	S28	W	W	F+	F+	F+	F+	K	F+	F+	K	K	F+	F+	F+	F+	K	K	K	F+	F+	K	S	F-	F-	F-
Upstrm Water	S29	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-
Urb Water	S30	W	W	W	W	W	W	W	W	W	F-	F-	W	W	B-	W	W	W	W	B-	B-	W	W	W	W	W
Rurl Water	S31	S	S	S	S	S	S	S	F+	F+	S	S	S	S	B-	B-	F-	F+	F-	F-	S	F+	F+	S	F+	F+
Water Serv.	S32	W	W	W	W	W	W	W	W	W	F-	F+	W	W	W	W	W	B+	B+	B+	B+	B+	W	W	W	W
Const.	S33	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B-	B-	B-	B-	B-	B-	B-	B-	B-	B-	W	W	B+
Wsale & Retail	S34	W	W	W	W	W	W	W	W	W	W	W	W	B-	B-	B-	B+	B+	B+	B+	B+	W	W	W	W	W
Trsprt & Storage Serv.	S35	W	B+	B+	B+	B+	W	W	W	W	W	W	B+	S	S	B-	B+	B+	B+	B+	B+	W	W	W	W	W
Comm, Fin. & Bus. Serv.	S36	W	W	W	W	W	W	W	W	W	W	W	W	F-	F-	F-	F-	F-	F-	W	W	W	W	W	W	W
Govt Admin	S37	B+	W	W	W	W	W	W	W	W	B-	B+	B-	B+	B+	B+	B+	B+	B+	W	W	W	W	W	W	W
Edu, Hlth & Cmty Serv.	S38	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Oth. Comml Serv.	S39	W	W	W	W	W	W	W	B+	W	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	W	W	W	W	W

K Key Sector; S Strong Sector; B+ Very Strong BL; B- Less Strong BL; F+ Very Strong FL; F- Less Strong FL; W Weak Sector

Source: Results generated by the model developed in Chapter 4.

Table 7.28: Results of proposed integrated un-weighted and weighted sectoral classification system (incorporating RSOW and C-COV), 1975 to 2015

Sectors / Yr	Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
Ag., Forest & Fish'g	S01	S	S	S	S	F-	S	S	S	S	S	S	S	S	S	S	F-	S	F-	S	S	S	F-	S	S	B+
Coal	S02	F+	S	S	K	S	S	S	K	S	F+	F+	F+	B+	B+	B+	W	B+	W	B+	B+	W	W	B+	B+	B+
Crude Oil	S03	F+	S	S	S	S	S	S	S	S	S	S	S	F+	S	S	S	S	S	S	S	K	K	F+	F+	W
Nat Gas	S04	F+	S	S	F+	F+	S	S	F+	S	F+	F+	F+	F+	F+	F+	W	F+	F+	W	W	W	W	W	W	W
Explor. Mining	S05	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	K	K	K	K	W	B+	W	W	W	W
Oth. Mining	S06	F+	F+	S	S	K	S	S	F+	S	F+	K	K	F+	S	K	F+	F+	F+	F+	F+	K	F+	F+	K	W
Food & Bev	S07	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	K	B+	S	B+
Textile & Clothing	S08	B+	S	S	S	S	S	S	S	S	B-	B-	B-	B-	B+	B+	B+	W	W	W	W	W	W	W	W	W
Pulp & Paper Mfg	S09	S	B+	S	S	S	S	S	B+	S	S	F+	F+	S	S	S	S	F+	F+	K	F+	F+	F+	F+	F+	F+
Wood Prod.	S10	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Print & Pub.	S11	K	K	K	B+	K	K	K	K	K	B+	B+	K	S	S	S	S	K	K	K	K	W	W	W	W	W
Petro. Prod. Mfg	S12	S	K	S	K	K	S	S	S	S	B-	S	S	F+	K	F+	K	K	K	F+	F+	W	W	W	W	F+
Coal Prod. Mfg	S13	F+	F+	S	F+	F+	S	S	F+	S	K	K	F+	F+	F+	K	K	F+	F+	F+	F+	F+	F+	F+	F+	F+
Chem. Prod.	S14	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	F+	F+	K	F+	S
Non-Metal & Min. Prod	S15	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Iron & Steel Mfg	S16	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	F+	F+	F+	F+
Non-Ferrous Mfg	S17	B+	S	S	S	S	S	S	S	S	S	B+	S	B-	B-	S	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+
Oth. Metal Prod.	S18	B+	S	B+	K	K	K	K	K	S	K	S	S	S	K	S	S	S	S	S	S	K	K	K	K	K
Mach. & Transp Prod.	S19	S	S	B-	S	S	S	S	S	S	S	S	S	S	S	S	F-	S	K	B+	W	B+	W	B+	B+	B+
Mfg Oth.	S20	B+	B+	S	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	W	W	W	W	W	W	W	W
Elec. Gen. Coal	S21	F-	S	S	S	S	S	S	S	S	S	S	S	B+	F-	S	S	S	S	S	S	S	S	S	S	S
Elec. Gen. Oil	S22	W	F+	F+	F+	W	S	S	F+	S	F+	F+	F+	B+	K	K	K	S	K	S	S	S	S	S	S	S
Elec. Gen. Nat. Gas	S23	S	S	S	S	S	S	S	S	S	S	S	K	K	S	S	B+	S	S	K	B+	S	S	S	S	S
Elec. Gen. Hydro	S24	F+	F-	S	F+	F+	S	S	S	S	F+	S	F+	K	F+	F+	F+	S	S	S	S	S	S	S	S	S
Elec. Gen. Renew.	S25	W	W	F+	W	W	B+	B+	W	B+	W	W	W	B+	B+	W	B+	B+	B+	S	S	S	S	S	S	S
Elec. Gen Oth. Fuel	S26	W	W	F+	W	W	B+	B+	W	B+	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. T&D	S27	F-	S	S	S	S	S	S	S	S	S	S	S	B+	F-	S	S	S	S	S	S	S	S	S	S	S
Gas Supply	S28	W	W	F+	F+	F+	S	S	F+	S	K	K	F+	F+	F+	F+	K	K	K	F+	F+	K	S	F+	F+	F+
Upstrm Water	S29	F+	F+	S	F+	F+	S	S	F+	S	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+
Urb Water	S30	W	W	F+	W	W	B-	B-	W	B-	F+	F+	W	W	B+	W	W	W	W	B+	B+	W	W	W	W	W
Rurl Water	S31	S	S	S	S	S	S	S	F+	S	S	S	S	S	B+	B+	F+	F+	F+	F+	S	F+	F+	S	F+	F+
Water Serv.	S32	W	W	W	W	W	B+	B+	W	B+	F+	F+	W	W	W	W	W	B+	B+	B+	B+	B+	W	W	W	W
Const.	S33	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	S	S	S	S	S	S	S	S	S	S	S	S	S
Wsale & Retail	S34	B-	B+	B+	B+	B+	W	F+	S	W	F+	F+	F+	S	S	S	S	S	S	S	S	S	S	S	S	S
Trsprt & Storage Serv.	S35	B+	B+	B+	B+	K	F+	F+	S	F+	F+	F+	S	S	S	S	S	K	S	K	K	S	F+	S	S	S
Comm, Fin. & Bus. Serv	S36	S	B+	B+	B+	B-	W	W	B-	W	W	W	W	F+	F+	F+	F+	F+	F+	B-	B-	B-	B+	W	W	W
Govt Admin	S37	S	B+	B+	B+	B+	W	W	B+	W	S	B+	S	B+	B+	B+	B+	B+	B+	W	W	W	W	W	W	W
Edu, Hlth & Cmty Serv.	S38	B+	B+	B+	B+	B+	W	W	B+	W	W	W	W	W	W	W	W	B+	B+	W	W	B+	B+	B+	B+	B+
Oth. Comml Serv.	S39	W	B+	B+	B+	B+	W	W	B+	W	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	W	W	K	K	S

K Key Sector; S Strong Sector; B+ Very Strong BL; B- Less Strong BL; F+ Very Strong FL; F- Less Strong FL; W Weak Sector

Source: Results generated by the model developed in Chapter 4.

Stability of Sectoral Strength over the Study Period – The classification results, irrespective of the classification method, show pattern of change over the study period. These results are consistent with the changes in underlying sectoral classification parameters as described earlier. These parameters change over time to reflect improvements in production technologies or changes in final demand. Nevertheless, the major sectors of the economy mostly retained their class over time. For example, energy sectors remained as very strong, or as "key" sectors; water, services sectors, construction, iron and steel, non-ferrous metal manufacturing, transport, agriculture, and food and beverage sectors are among the strong sectors details of which can be referred to in Table 7.28 in comparison to aforementioned tables presented in Appendix VII.

7.7 Summary of Key Findings

- The importance of majority of the sectors to final demand and to their upstream supply sectors increased over the study period, except for petroleum products manufacturing because of high usage of imported petroleum products based on cost considerations. Also, the importance of natural energy-resource sectors and exploration and mining services to their downstream demand sector, and thus to value added, increased except for urban water, sewerage and drainage, gas supply, and electricity transmission and distribution (T&D) sectors. Possible reasons for the decrease in direct importance of the electricity T&D may relate to closedown of old coal-powered plants; and shortage of gas supply to gas-powered electricity plants.
- The overall linkage intensity of the electricity transmission and distribution (T&D) with its upstream supply sectors increased over the study period (3rd in rank after electricity generation by gas and electricity generation by coal in the 1st and 2nd rank respectively), enabling it to stably maintain its forward linkages with its downstream demand sectors. This is an expected result because the overall average total backward linkages of all electricity generation plants - particularly the aforementioned two - followed an increasing pattern over the study period, implying low productivity perhaps due to their outdated production technology. Therefore, the productivity of electricity T&D sector is highly linked to the advanced technologies and improved production in its upstream power plants while the sector itself also benefits from accessing more advanced transmission and distribution technologies.
- The supply pattern of electricity generation from renewable sources increased over the study period confirming similar finding through linkage indicators forward MIC (15, in the 5th rank out of 39), and above average forward concentration indices demonstrating large number of sales transactions to its downstream sectors. From a policy perspective, the development of this sector may reveal its further potential for higher electricity generation given the aforementioned issues with electricity generation by other fuel types.
- The top 10 sectors with the highest intra-industry share in total backward linkage indices are majority of the electricity generation sectors (on average ~53%) and electricity T&D (63%) as

well as other major sectors of economy including construction (58%), communication and business services (79%), and agriculture (59%). However, there are sectors whose nearly all inputs are provided through internal transactions such as upstream water supply being a renewable resource in hydrologic cycle (100%) and electricity generation by other fuel (~100%). Moreover, all of these sectors have the highest intra-industry shares in total forward linkages, which means, as a result of a unitary change in their value added they make most of their supply available for own use before distributing the rest as inputs to other sectors. Therefore, overall, these sectors are highly reliant on their own production and mostly self-sufficient, requiring less than 50% inputs from other sectors. These findings are also linked to sectoral classification. Because, as found in this research, the above sectors are classified as weak because of their smaller inter-industry linkage indices, however, they are strategic sectors because of their specialised services, as further confirmed for majority of these sectors by above average backward and forward entropy indices (Chapter 6). Therefore, from a policy point of view these sectors can be considered for further development.

- The sectors with small intra-industry shares of cumulative backward linkages have developed strong linkages with their upstream supply sectors. The non-ferrous metal manufacturing (43%), sewerage and drainage (45%), gas supply (46%), exploration and mining support services (47%), and urban water supply (49%) are in this category.
- Communication, finance, and business services (in the 1st rank) has the highest magnitudinal share in backward linkages (25 out of 39 sector), followed by construction, electricity generation by coal, other mineral mining, and crude oil. The top 5 sectors which significantly dependent on inputs from communication, finance and business services are: exploration and mining support services, sewerage and drainage, gas supply, construction, and government administration and defence. These findings imply that production of one unit output by these sectors is highly dependent on inputs from the communication and business services, and most of the production costs are related to products and services provided by this sector; and from a policy perspective, investing in communication, finance and business services is useful because other sectors are dependent on it generating high economic activity in the whole economy. However, the pattern of contribution changes over time depending on evolutionary stage of each sector. For example, the need for communication, finance and business services increases by adopting more advanced technology, or diversifying product lines.
- The sectors with the highest share in cumulative forward linkages of 30 to 35 sectors of the Australian economy (out of 39) are communication, finance, and Business Services; wholesale and retail trade; construction; electricity generation by coal; and chemical production. These sectors are the recipients of the highest sectoral supply available to them for more production.
- The traditionally estimated weighted linkage indices found to be very low in magnitude in comparison to reasonable results produced by the proposed reformulated weighting alternative. First, the traditional approach appears to underestimate the impacts of one unit

increase in final demand on supply sectors; second, making it difficult to properly identify the important sectors such as sectors with strong forward or strong backward linkages and the key sectors. For example, crude oil, other mineral mining, and electricity generation by coal are classified as weak sectors. However, under the reformulated system of weights (Chapter 5), these sectors are classified as forward-oriented sectors which also intuitively makes more sense. Both methods, however classify electricity T&D as forward-oriented; third, some of the indices through traditional weighting method appear not aligned with the expectation. For example, the upstream water supply has nil weighting in traditional method implying that the sector does not have any importance in the economy; or the importance of intra-industry linkages for about 53% of IOI are reported nil which sacrifices reality; and forth, the two methods are useful for evaluating the impacts of weights on alternative policy scenarios.

- The two weighting methods generated close results with some ranking differences in 2008-09. For example, both methods identified construction; wholesale and retail trades; communication, and business services; food and beverage; education, health and community services; and government administration as the most important sectors in terms of inducing economic activity in other sectors, for creating employment, increased household income, higher government revenue through taxes, and for providing higher producer gross profit.
- Also, both methods identified the top ranking contributors to purchases and sales transactions and the recipient supply and demand sectors similarly (section 7.2). Nevertheless, the outcomes of the reformulated method sensibly proved more aligned with the importance of the recipient sector's activity, for example, agriculture is the most significant contributor to the food sector; or petroleum products manufacturing is the most significant contributor to the transport sector. But, traditional method identifies communication and business services as the most significant contributors to transport sector.
- IOI with the highest total labour requirements are exploration and mining services, electricity generation by hydro, and sewerage and drainage (ranked 4th, 5th and 7th respectively) over the study period. This finding implies that production technology in these sectors is labour intensive, and that it requires improvement. The sectors with the lowest total labour requirements are coal, petroleum products manufacturing, and natural gas in ranking positions 35 to 37 respectively. The latter group is among sectors with advanced production technology because of specialised and sophisticated operation. Also, the significantly labour intensive non-IO sectors are education, health and community services; public administration, and defence; and commercial services including waste management (ranked 1st to 3th respectively).
- Almost all of the electricity generation sectors and electricity T&D as well as rural water supply are the top ranked sectors, with the highest total factor inputs in Australia. Among these sectors, electricity generation by hydro is the most primary factor (PF) intensive. This sector together with coal and natural gas have the highest total gross profit indices. The electricity T&D, electricity generations by hydro and by coal also have the highest net tax linkages.

Because of their strong PF linkages, these sectors largely contribute to the Australian economy through employment and taxes. However, other mineral mining, rural water and coal sectors have the highest imports linkages implying high economic leakages to the overseas markets.

- The total forward linkages of natural gas with households rapidly decline over the study period because of depleting gas resources as discussed in Chapter 3 (historical analysis) and also recently confirmed by AEMO (2017a, 2017b); and expansion of gas exports market confirming previous findings through entropy and concentration linkage indices (Chapter 6). The gas export linkages rose (by about 32%) over the period 2005 to 2015, in comparison to the earlier period 1984-2002. Global environmental concerns related to coal CO2 emissions and depletion of energy resources has influenced expansion of Australian gas exports market. Also, the grand total forward linkages of the natural gas sector (inter-industry plus final demand forward linkages) is downward tracking. From an inter-industry dimension, the decline could be related to the adoption of more advanced technologies by gas consuming sectors. However, the overall declining pattern is alarming which may slowdown economic activities in the country calling for improvements through appropriate policies.
- The sectors with overall highest total forward linkages to the final demand category - in ranking positions 1 to 7 - are government administration including defence, public order and Safety; education, health and community services; commercial services including waste management, and almost all electricity sectors. Notably, electricity generation by renewables, in comparison to other electricity generation types, although relatively small, has the strongest supply linkages with households because of direct access to electricity generated by rooftop solar systems whose outputs are readily available for final use. The next group of sectors with strong linkages with households are textile, clothing, footwear and leather; gas supply; and food, beverage and tobacco (as intuitively expected).
- Households are direct purchasers of labour (e.g., for gardening, cleaning, child care or other domestic uses), followed by Private, Exports, and Government sectors of final demand. Overall, direct purchases of primary factors by sectors of final demand declined over the study period. The highest direct purchases were in 1982-83, 2001-02, and 2014-15 but in decreasing pattern, due to higher consumers' confidence, and hence willingness to spend in those years. These linkages resulted in above average contribution to producer gross profits (index of 1.0553), taxes less subsidies on production (1.0492), and competing imports (~1.0000) as a result of direct hiring of labour services (1.0181) and purchases of produced goods and services.
- The proposed and traditional sectoral classification systems classify electricity as the key sector over the period 2001-02 to 2014-15. However, the proposed system is more relevant to the earlier periods given the less maturity of the sector. For example, the traditional system classifies electricity generation by renewables inconsistently as weak, and strong forward- and backward-oriented over the period 1975 to 1995, while the proposed system consistently

classifies the sector as weak considering the early maturity of this sector; or in the case of coal sector, the traditional system classifies it as a strong backward-oriented over the downturn mining boom period 2012-2015, while the proposed system classifies it as weak more in alignment with real life situation of less backward and less forward coal mining activities.

- The outcome of the proposed integrated weighed and unweighted sectoral classification system is more useful for policy purposes because both technical and policy dimensions of the linkages are taken into account to identify a sector's class, thus providing better understanding of the nature of each sector in the economy. This system has classified energy sectors as strong (S) or as *key* sectors (K), which have stably retained over the study period (section 7.6). Also, sectors like water, services sector, construction, iron and steel, non-ferrous metal manufacturing, transport, agriculture, and food and beverage are classified as strong sectors of the Australian economy.

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8 MULTIPLIERS, ELASTICITY, AND FINAL DEMAND

To get further insights into the nature of linkages, this chapter investigates the impacts of policy, investment decisions, and economic 'shocks' on key socio-economic indicators, for example, households income, employment, output, and value added multipliers. Economic 'shocks' in this context refers to unexpected changes in final demand, exports, government spending and revenue, or investment demand. At the macroeconomic level, the linkages for IOI are examined for the period 1975-2015 using multiplier analysis models presented in Chapter 4. These linkages are then compared with those obtained through MICs, and the sectoral interdependency descriptors - Concentration and Entropy Linkage Indices (Chapter 6), and the IO Four-Quadrant Linkage (Chapter 7) - to develop deeper insights into the nature of linkages.

This Chapter also develops estimates of linkage-elasticities (as discussed in Chapter 4) over two consecutive periods of input-output transactions, in order to investigate the adequacy of sectoral supply in response to increased outputs in other sectors of economy. Finally, through final demand input-output transformation approach (see Chapter 4) it is identified to what extent production sectors indirectly respond to final demand, and to what extent jobs are linked to these sectors.

This Chapter is organised as follows. The results of multipliers analysis are discussed in Section 8.1. Linkage-elasticities and their policy implications are discussed in Section 8.2. Production and job linkages associated with final demand are described in Section 8.3. Section 8.4 presents the major findings of this chapter.

8.1 Multipliers

This section discusses the impact of economic 'shocks' (as introduced above) on final demand over the period 1975 to 2015, in terms of Direct, Indirect and Induce Effects using Type I (Production-Output) and Type II (Income-Output) multipliers, estimated by developing both open and closed Leontief demand driven models (Chapter 4).

8.1.1 Output Multipliers

The estimated output multipliers for the year 2014-15 are presented in Table 8.1. The numbers in the table can be interpreted as follows. AU$1m of increase in final demand for the output of Electricity T&D Sector (S27) resulted in a cumulative impact (output multipliers) of $AU13.88m of induced effects, and AU$7.24m (direct and indirect - Type I effects) through linkages in the whole economy.

Table 8.1: Output multipliers, 2014-15 (AU$m)

	Sectors	Code	Type I Direct	Type I Indirect	Type I Total	Induced	Type II
High	Elec. T&D	S27	0.871	6.371	7.243	13.878	21.114
	Elec. Gen. Hydro	S24	0.624	5.350	5.973	11.099	17.072
	Elec. Gen. Coal	S21	0.672	5.166	5.839	10.508	16.347
	Elec. Gen. Oil	S22	0.544	4.832	5.376	10.181	15.556
	Elec. Gen. Renew.	S25	0.506	4.586	5.092	9.733	14.825
Medium	Elec. Gen. Nat. Gas	S23	0.525	3.171	3.695	6.264	9.960
	Govt Admin	S37	0.398	1.567	1.965	5.335	7.300
	Edu, Hlth & Cmty Serv.	S38	0.258	1.238	1.497	5.574	7.071
	Non-Ferrous Mfg	S17	0.820	2.277	3.097	3.555	6.652
	Wsale & Retail	S34	0.456	1.534	1.990	4.062	6.052
	Const.	S33	0.684	1.799	2.483	3.417	5.900
	Oth. Comml Serv.	S39	0.495	1.525	2.019	3.755	5.774
	Water Serv.	S32	0.512	1.568	2.080	3.607	5.688
	Wood Prod.	S10	0.562	1.741	2.303	3.287	5.590
	Rurl Water	S31	0.297	1.561	1.859	3.544	5.403
	Coal	S02	0.596	1.653	2.249	3.152	5.400
	Non-Metal & Min. Prod.	S15	0.556	1.660	2.216	3.086	5.301
	Urb Water	S30	0.287	1.585	1.872	3.428	5.299
	Explor. Mining	S05	0.429	1.377	1.806	3.449	5.255
	Trsprt & Storage Serv.	S35	0.512	1.513	2.025	3.153	5.178
	Food & Bev	S07	0.594	1.734	2.327	2.692	5.020
Low	Print & Pub.	S11	0.384	1.461	1.845	3.025	4.870
	Oth. Metal Prod.	S18	0.451	1.511	1.962	2.905	4.867
	Pulp & Paper Mfg	S09	0.406	1.704	2.110	2.660	4.770
	Comm, Fin. & Bus. Serv.	S36	0.392	1.362	1.753	2.852	4.605
	Oth. Mining	S06	0.433	1.576	2.009	2.526	4.535
	Iron & Steel Mfg	S16	0.380	1.522	1.902	2.520	4.422
	Gas Supply	S28	0.636	1.741	2.377	2.016	4.393
	Ag., Forest & Fish'g	S01	0.533	1.581	2.114	2.222	4.337
	Chem. Prod.	S14	0.350	1.357	1.706	1.729	3.435
	Crude Oil	S03	0.257	1.287	1.544	1.705	3.249
	Mfg Oth.	S20	0.240	1.317	1.557	1.640	3.197
	Elec. Gen Oth. Fuel	S26	0.001	1.001	1.002	2.151	3.153
Very Low	Coal Prod. Mfg	S13	0.479	1.340	1.818	1.092	2.910
	Nat Gas	S04	0.173	1.236	1.409	1.398	2.807
	Petro. Prod. Mfg	S12	0.380	1.270	1.650	0.905	2.556
	Mach. & Transp Prod.	S19	0.196	1.169	1.364	1.142	2.506
	Textile & Clothing	S08	0.112	1.134	1.246	0.798	2.044
	Upstrm Water	S29	0.136	1.021	1.157	0.000	1.157

Source: Results obtained from the model developed in this research as discussed in Chapter 4.

A high value of output multiplier indicates high dependence of a sector on domestic intermediate inputs; a lower value indicates greater leakages from the economy. Usually, less self-sufficient sectors in terms of ability to source required intermediate outputs locally, show lower output multipliers. Type I output multipliers, and total backward linkages obtained by development of IO Four-Quadrant Linkage Analysis Framework (IOFQLAF) (Chapter 4 and 7) are exactly the same (Appendix VIII, Table VIII.1). This section discusses additional information obtained by estimating Type II, indirect and induced output multiplier effects, through the application of closed IO model (as discussed in Chapter 4). Also, this research presents multipliers for each input-output reference year, and overall averages for the entire study period. Because overall averages are subject to extreme values, this research applies a measure of variability, namely, Comparable Coefficient of Variance (C-COV) (Chapter 5), so that outliers are identified and multiplier results are discussed accurately. The variability indices for majority of the sectors are found to be significantly below the benchmark average over the study period. However, electricity sectors responded to the variability assessment satisfactorily over two distinct periods: 1975 to 2008, and 2009 to 2015 over which the electricity multipliers were more uniformly spread. These two periods are separated by the GFC (2007-08). Therefore, in this research, these periods are referred to as pre-GFC, and post-GFC. The evaluation of multiplier variability over the post-GFC period for all sectors, including the electricity sector, reveals that 95% of the Australian sectors (37 out of 39) have more stable multipliers in comparison to the 86% over the full period of the study (1975-2015). Therefore, post-GFC multipliers are used as the preferred set of values for analysing the policy impacts of multipliers, and for detailed discussions at the sectoral level. The reason for higher multiplier stability is related to the decreasing pattern of sectoral backward linkages over the full period of study (see Chapter 7). This pattern implies access to more advanced production technologies. Also, Federal Government's spending in the post-GFC period strengthened key infrastructure and households spending which induced production and other economic activity in the whole economy.

Analysis reveals that overall average output multiplier values for all electricity sectors are significantly different in the pre-GFC (1975 to 2008) and post-GFC period (2009-2015) periods (Table 8.2). These multipliers are in relative ranking positions 1 to 7 in comparison to other sectors covering Type I and Type II as well as the derived direct, indirect, and induced output multiplier effects. The electricity sectors include all generator sectors (S21 to S26) and Electricity Transmission and Distribution (S27) sector. For example, Table 8.2 shows that Electricity Generation by Coal (S21), in ranking position one, exhibits an overall average Type II multiplier of 5.005 over the period 1975-2008, in comparison with the multiplier of 14.0517 in ranking position three, over the period 2009-2015; or the average induced multiplier effects of 3.023 against 9.0008 over the aforementioned periods, and the same ranking positions respectively. Similar comments can be made for other electricity sectors (Table 8.3). Also, through this comparative analysis, it is found that: the ranking order of these sectors changes over the two periods; and the variability of post-2008 output multipliers is relatively lower than that of pre-2008, implying that multiplier analysis over the 2009-2015 period is also relatively more reliable.

One of the reasons for higher post-GFC multipliers is changes in final demand as a result of economic stimulus (economic 'shock') over the period 2008 to 2010. This stimulus used developing major infrastructure and other sectors of the economy, as well as providing financial assistance to eligible households to encourage spending, which in turn increased demand for electricity too. Another reason for changes in post-GFC electricity output multipliers is

Table 8.2: Electricity sectors, output multipliers, 1975-2015

		Overall Average Type II			Overall Average Type I		
IOI Sector	Sec Code	1975-2008	2009-2015	1975-2015	1975-2008	2009-2015	Overall Avg
Elec. Gen. Coal	S21	5.005 (1)	14.0517 (3)	6.8143 (2)	1.982 (2)	5.051 (3)	2.5958 (1)
Elec. Gen. Oil	S22	4.2173 (5)	13.5218 (4)	6.0782 (4)	1.5803 (6)	4.7002 (4)	2.2043 (6)
Elec. Gen. Nat. Gas	S23	4.8801 (2)	9.2235 (6)	5.7488 (6)	2.3051 (1)	3.6127 (6)	2.5666 (2)
Elec. Gen. Hydro	S24	4.8092 (3)	15.3068 (2)	6.9087 (1)	1.7917 (3)	5.3789 (2)	2.5091 (4)
Elec. Gen. Renew.	S25	4.2568 (4)	13.3396 (5)	6.0734 (5)	1.6474 (4)	4.6139 (5)	2.2407 (5)
Elec. Gen Oth. Fuel	S26	3.2412 (7)	3.0908 (7)	3.2111 (7)	1.0134 (7)	1.0024 (7)	1.0112 (7)
Elec. T&D	S27	3.3681 (6)	17.8601 (1)	6.2665 (3)	1.6219 (5)	6.1739 (1)	2.5323 (3)

Table 8.3: Electricity sectors, output multiplier effects, 1975-2015

		Overall Average Direct			Overall Average Indirect			Overall Average Induced		
IOI Sector	Sec Code	1975-2008	2009-2015	Overall Avg	1975-2008	2009-2015	Overall Avg	1975-2008	2009-2015	Overall Avg
Elec. Gen. Coal	S21	0.4606 (2)	0.6303 (2)	0.4945 (2)	1.5214 (2)	4.4207 (3)	2.1013 (2)	3.023 (1)	9.0008 (3)	4.2185 (2)
Elec. Gen. Oil	S22	0.2871 (6)	0.5198 (5)	0.3336 (6)	1.2932 (6)	4.1804 (4)	1.8707 (6)	2.637 (3)	8.8216 (4)	3.8739 (3)
Elec. Gen. Nat. Gas	S23	0.6816 (1)	0.5971 (4)	0.6647 (1)	1.6235 (1)	3.0156 (6)	1.9019 (4)	2.575 (5)	5.6108 (6)	3.1822 (6)
Elec. Gen. Hydro	S24	0.3673 (3)	0.605 (3)	0.4148 (3)	1.4244 (3)	4.7739 (2)	2.0943 (3)	3.0175 (2)	9.9279 (2)	4.3996 (1)
Elec. Gen. Renew.	S25	0.3302 (4)	0.5018 (6)	0.3645 (5)	1.3172 (5)	4.112 (5)	1.8762 (5)	2.6095 (4)	8.7257 (5)	3.8327 (4)
Elec. Gen Oth. Fuel	S26	0.0077 (7)	0.0012 (7)	0.0064 (7)	1.0057 (7)	1.0011 (7)	1.0048 (7)	2.2278 (6)	2.0884 (7)	2.1999 (7)
Elec. T&D	S27	0.2908 (5)	0.7839 (1)	0.3894 (4)	1.3311 (4)	5.39 (1)	2.1429 (1)	1.7462 (7)	11.6862 (1)	3.7342 (5)

Source: Results generated by the model developed in Chapter 4.

introduction of photovoltaic (PV) solar energy to alleviate supply crisis particularly in peak seasonal periods in Australia requiring access to more advanced production technologies. These developments show: the steady and responsible economic policies of the Australian governments; the positive impacts of boosting the economy in time of crisis by injecting significant amount of funds; and improving electricity generation capacity in the country which did not occur in the pre-GFC period of 1975 to 2008.

Notably, Electricity Generation by Coal (S21) and Electricity Transmission and Distribution (S27) exhibit significantly high Type II output multipliers particularly over the most recent period of 2013 to 2015, meaning that as a result of one unit increase in final demand for the outputs of either of these sectors, productions from all sectors through linkages significantly increase in the whole economy. Also, because of induced household effects the production in these Sectors increase beyond direct and indirect effects.

Therefore, based on the above discussion, Table 8.4 and Table 8.5 identify the top 15 high ranking sectors in terms of Type II and Type I output multipliers.

Comparison of the two Tables shows that six electricity sectors Electricity Transmission and Distribution (S27, Rank=1), Electricity Generation by Hydro (S24, Rank=2), Electricity Generation by Coal (S21, Rank=3), Electricity Generation by Oil Products (S22, Rank=4), Electricity Generation by Renewables (S25, Rank=5), and Electricity Generation by Natural Gas (S23, Rank=6) are in the same ranking positions for both Type II and Type I output multipliers respectively. However, when sectors are ranked based on Type I multipliers (direct and indirect impacts), the order of the remaining nine sectors in Table 8.4 and Table 8.5 is changed. The Government Administration, Defence, Public Order and Safety (S37); and the Education, Health and Community Services (S38) no longer are listed in Table 8.5. The reason for loss of ranking by the latter two sectors is their small Type I multiplier values (1.9507 and 1.5201 respectively), while they have high induced multipliers (5.0780 and 5.4420 respectively). Also, Basic Non-Ferrous Metal Manufacturing (S17), and Construction (S33) Sectors moved to higher ranks; a few new sectors such as Gas Supply (S28); Food, Beverage, and Tobacco (S07); as well as IOI sectors Rural Water Supply (S31) and Water Services (Sewerage & Drainage) (S32) are include to the high ranking list in Table 8.5 too. Also, it is observed that the induced multipliers of 85% of the sectors follow the same ranking order as Type II multipliers.

Similarly, indirect multipliers of 98% of the sector followed the same ranking order of Type I. Based on the above results, it is concluded that in spite of the overall magnitude of the output multipliers (Type II), this is their cumulative indirect and induced components that play an important role in policy evaluations. Because these components show the intensity of the linkages of a sector with the rest of the economy including households. Likewise, in case of Type I multipliers, their indirect component shows the degree of interconnectedness with the rest of the sectors in the whole economy. Therefore, for evaluating socio-economic dimensions, for example improving households' income, the focus on induced component, as one of the several linkage indicators, would provide useful insights for making informed policy decisions. Likewise, the indirect component shows the "ripple effects" of production inducements in the rest of the economy due to linkages with the rest of the sectors. Therefore, the policy impacts of multipliers on economic growth, job creation and development of quality life for citizens through generation of higher income for households can be analysed in details.

These results demonstrate the usefulness of the sectors listed in Table 8.4 and Table 8.5 for policy objectives aimed at economic development, because of the ability of these sectors to induce economic activity in linked sectors; and also, policies focused at assisting sectors to adopt advanced technologies for higher production capacity. These results are consistent with those obtained by other linkage descriptors discussed in Chapters 6 and 7. The details of output multipliers for all sectors of the economy are presented in Appendix VIII, Table VIII.2.

Figures 8.1 to 8.5 show the rate of change in indirect output multipliers (indexed, 1975=100) for electricity; primary energy resources, mining and exploration services; water sectors; and other major sectors (non-IOI) which appeared as high ranking sectors in Table 8.5.

Comparing to the 1975 levels, the indirect multipliers of the electricity sectors in 1993-94 remain almost the same (Figure 8.1). For example, the indirect multipliers of Electricity Generation by

Table 8.4: High ranking type II overall average output multipliers, 2009 to 2015

		Output Multipliers				
		Type I			Induced	Type II
Sectors	Sec Code	Direcrt	Indirect	Total		
Elec. T&D	S27	0.7839	5.3900	6.1739	11.6862	17.8601
Elec. Gen. Hydro	S24	0.6050	4.7739	5.3789	9.9279	15.3068
Elec. Gen. Coal	S21	0.6303	4.4207	5.0510	9.0008	14.0517
Elec. Gen. Oil	S22	0.5198	4.1804	4.7002	8.8216	13.5218
Elec. Gen. Renew.	S25	0.5018	4.1120	4.6139	8.7257	13.3396
Elec. Gen. Nat. Gas	S23	0.5971	3.0156	3.6127	5.6108	9.2235
Govt Admin	S37	0.4188	1.5319	1.9507	5.0780	7.0287
Edu, Hlth & Cmty Serv.	S38	0.2643	1.2561	1.5204	5.4420	6.9624
Non-Ferrous Mfg	S17	0.8268	2.2133	3.0401	3.2389	6.2789
Rurl Water	S31	0.4707	1.6863	2.1570	3.9796	6.1366
Wsale & Retail	S34	0.4643	1.5253	1.9896	3.9489	5.9384
Const.	S33	0.6747	1.7721	2.4468	3.3676	5.8143
Water Serv.	S32	0.5419	1.5934	2.1353	3.6148	5.7501
Oth. Comml Serv.	S39	0.4984	1.5213	2.0197	3.6865	5.7062
Urb Water	S30	0.3445	1.6107	1.9552	3.5263	5.4815

Table is arranged on Type II column in descending order.
Source: Results obtained from the model developed in this research

Table 8.5: High ranking type I overall average output multipliers, 2009 to 2015

		Output Multipliers				
		Type I			Induced	Type II
Sectors	Sec Code	Direcrt	Indirect	Total		
Elec. T&D	S27	0.7839	5.3900	6.1739	11.6862	17.8601
Elec. Gen. Hydro	S24	0.6050	4.7739	5.3789	9.9279	15.3068
Elec. Gen. Coal	S21	0.6303	4.4207	5.0510	9.0008	14.0517
Elec. Gen. Oil	S22	0.5198	4.1804	4.7002	8.8216	13.5218
Elec. Gen. Renew.	S25	0.5018	4.1120	4.6139	8.7257	13.3396
Elec. Gen. Nat. Gas	S23	0.5971	3.0156	3.6127	5.6108	9.2235
Non-Ferrous Mfg	S17	0.8268	2.2133	3.0401	3.2389	6.2789
Const.	S33	0.6747	1.7721	2.4468	3.3676	5.8143
Gas Supply	S28	0.6341	1.7320	2.3661	2.1103	4.4764
Food & Bev	S07	0.6025	1.7322	2.3347	2.7415	5.0762
Wood Prod.	S10	0.5473	1.6890	2.2363	3.2390	5.4752
Non-Metal & Min. Prod.	S15	0.5561	1.6591	2.2152	3.0476	5.2628
Rurl Water	S31	0.4707	1.6863	2.1570	3.9796	6.1366
Iron & Steel Mfg	S16	0.5212	1.6338	2.1550	2.5081	4.6631
Water Serv.	S32	0.5419	1.5934	2.1353	3.6148	5.7501

Table is arranged on Type I column in descending order.
Source: Results obtained from the model developed in this research.

Figure 8.1: Indirect output multiplier, Electricity Sector, 1975-2015 (Index, 1975=100)

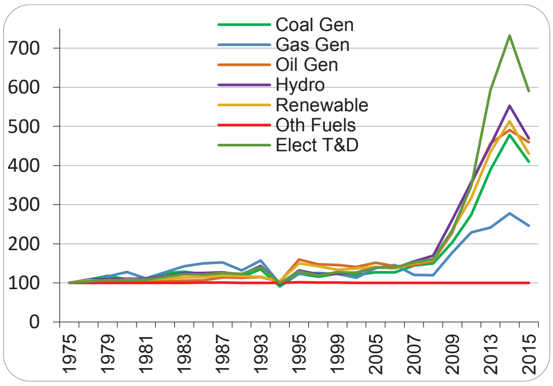
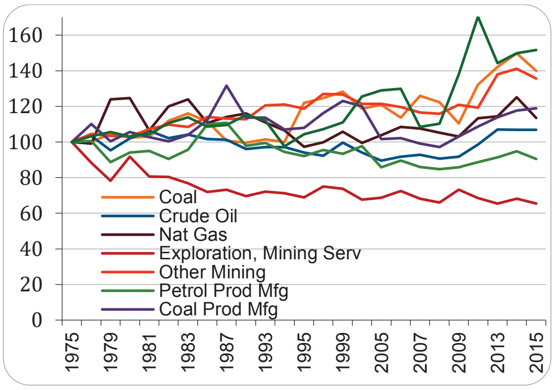


Figure 8.2: Indirect output multipliers, Energy and Services Sectors, 1975-2015 (Index, 1975=100)



Source: This author's analysis based on the model developed in this research.

Figure 8.3: Indirect output multipliers, Water Sectors (Index, 1975=100)

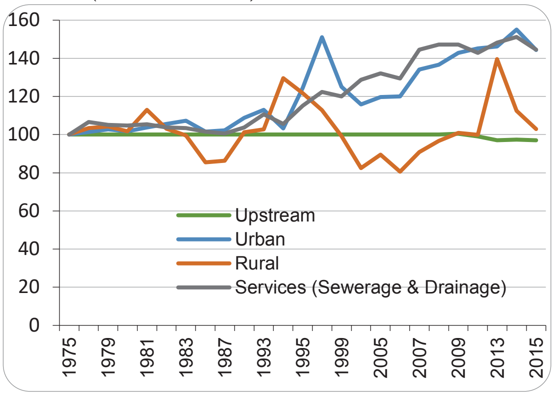
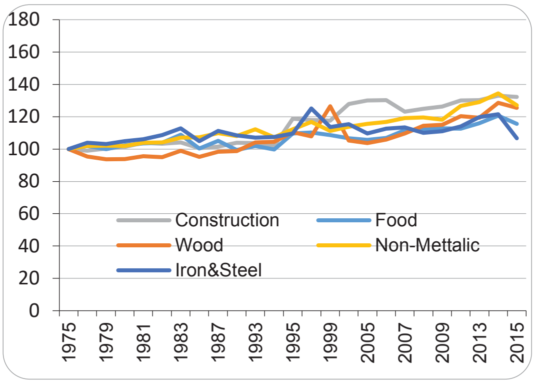


Figure 8.4: Indirect output multipliers, Major Sectors, 1975-2015 (Index, 1975=100)



Source: This author's analysis based on the model developed in this research.

Coal (S21) declined by about 9% (the highest); or of Electricity Generation by Renewables (S25) increased by about 5% (the highest). This implies that change in final demand for electricity sector output in 1993-94 could not generate enough economic activity in other sectors, in comparison to other years. The reason for the 1993-94 drop in growth rate of indirect output multipliers is decrease in electricity demand by the linked sectors, because of the Australian recession in 1991 and its subsequent economic slowdown. Also, a series of reforms over the period 1993 to 1994 potentially created uncertainty in production levels. For example, the reforms of 1993-94: unbundling electricity sector public monopoly; electricity pricing and regulations; and start of competitive wholesale and retail electricity market enabling trading across state borders. Overall the rate of growth for indirect multipliers remained almost stable over the period 1975 to 2008. However, from 2009 onwards, the indirect multipliers of all electricity sectors showed significant growth reaching a maximum growth rate in 2014 being five to seven times higher than their 1975 level. The increases are justified based on the earlier discussion on post-GFC emerging trends.

Indirect output multipliers of Electricity T&D (S27) show the highest growth rate over the period 2009-2015, followed by Electricity Generation by Hydro (S24), Electricity Generation by Coal (S21), Electricity Generation by Oil (S22), Electricity Generation by Renewables (S25), and Electricity Generation by Gas (S23) (Figure 8.1). The indirect output multiplier for Electricity Generation by Other fuels (S26) is the lowest of all generation types. However, over the period 1975 to 1993 the rate of change for indirect output multipliers of Electricity Generation by Gas (S23) is the highest, followed by Electricity Generation by Coal (S21), and Electricity T&D (S27).

In comparison to other IOI, the relative rate of change for indirect output multipliers of Exploration and Mining Support Services (S05) is the lowest (Figure 8.2). However, Gas Supply (S28) shows relatively higher rate of change followed by Coal (S02), and Other Mineral Mining (S06). The relative rate of change for indirect multipliers of Gas (incl. Nat Gas, LPG and CSG) (S04); Crude Oil (incl. condensate) (S03); and Petroleum Products (S12) are at average level.

Regarding water sectors, the relative rate of change for indirect output multipliers of Rural Water

Supply (S31) is less than other IOI demonstrating an overall stable pattern of change. The rate of growth for indirect multipliers of Water Services (Sewerage and Drainage) (S32) is lower than Urban Water Supply (S30) over the period 1975 to 1999, but over the period 2000 to 2015 it grows at higher rate (Figure 8.3). Both S30 and S32 follow similar increasing pattern of change over the period 1975-2015. The reason for increase in magnitude of indirect multipliers is due to linkages of S30 and S32 with other sectors mainly with Construction (S33) sector as a result of increased residential and industrial developments demanding water and water services.

Figure 8.4 shows major sectors of the economy with higher indirect output multipliers relative to other sectors. The pattern of change for indirect output multipliers of these sectors can be described over two distinct periods: 1957 to 1997, and 1999 to 2015. In the former period, the highest rate of change is attributed to Iron and Steel (S16), followed by Non-Metallic and Mineral Products (S15) in comparison to other sectors. But, over the period 1995-2015, Construction (S33) exhibit the highest rate of change while S15 maintains its second highest rate of change. Over the second period, Iron and Steel (S16) is in the third highest before S15 until 2007, however, during the post-GFC period, the rate of change for indirect multipliers of in Iron and Steel (S16) drops the lowest indicating that a unitary change in final demand for its outputs is not going to induce much production activity in other sectors. The reason for higher indirect output multipliers since 2000 is attributed to the construction boom in Australia started with 2000 Olympic Games' major construction project in Australia followed by high residential and industrial construction activities in the country in subsequent years.

Except Food, Beverage and Tobacco (S07), the rest of sectors shown in Figure 8.4 are closely interconnected. Therefore, through direct and indirect output multiplier intensities (the same as total backward linkages as discussed in Chapter 7), they can generate relatively high economic activity in the whole country. This finding leads to conclusion that for policy purposes, it is useful to focus on a group of sectors which are closely interlinked in order to maximise returns of capital, or to achieve policy objectives focused on economic development particularly times of crisis.

Figures 8.5 to 8.8 show the relative change in induced output multipliers over the period 1975 to 2015 for the IOI and other major sectors of the economy which are identified in Table 8.4.

For the induced effects of output multipliers, all electricity generator sectors except Electricity Generation by Other Fuels (S26) show significantly higher rate of growth over the post-GFC period in comparison to the pre-GFC period. It is found that induced multipliers of Electricity Transmission and Distribution Sector (S27) grow at significantly faster rate than those of electricity generator sectors implying high pressure on electricity generation sectors to satisfy subsequent supply requirements of Electricity Transmission and Distribution (S27) in order to respond to a unitary change in final demand (Figure 8.5).

Table 8.6 shows the rate of change for induced output multipliers (indexed to 1975) in about five

Figure 8.5: Induced output multiplier, Electricity Sector, 1975-2015 (Index, 1975=100)

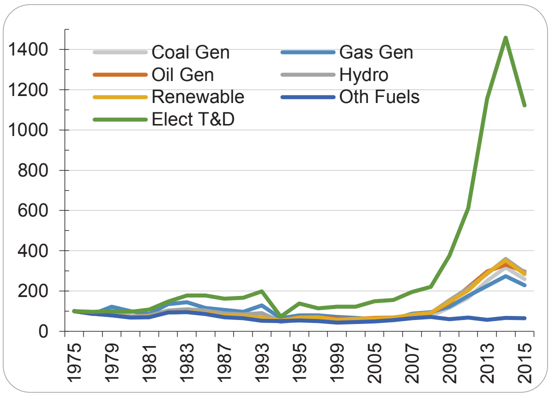


Figure 8.6: Induced output multipliers, Other Energy Sectors, 1975-2015 (Index, 1975=100)

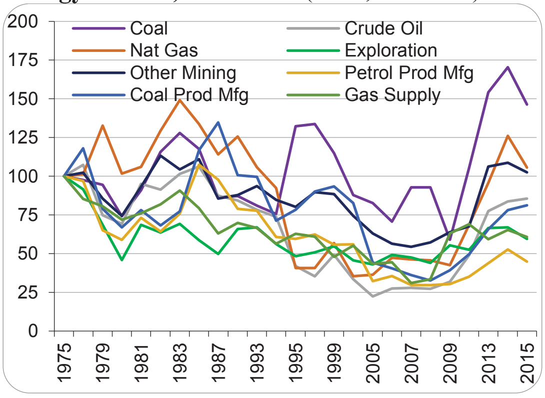


Figure 8.7: Induced output multipliers, Water Supply and Services (Index, 1975=100)

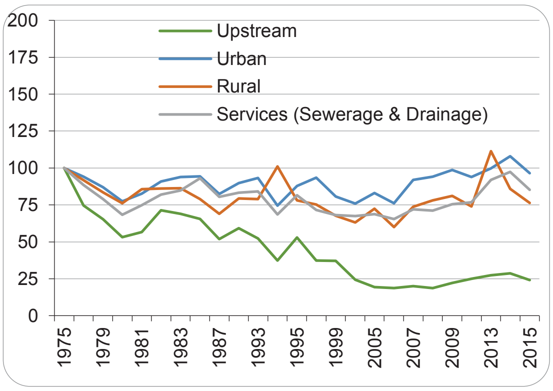
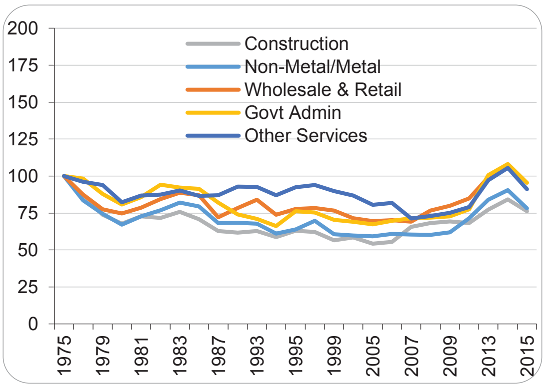


Figure 8.8: Induced output multipliers, Other Major Sectors, 1975-2015 (Index, 1975=100)



Source: This author's analysis based on the model developed in Chapter 4.

yearly intervals (full details, Appendix VIII, Table VIII.3). The growth rate of induced multipliers of electricity sectors are the highest over the period 2009 to 2015 in spite of overall decreasing trends. For other IOI, the overall induced output multipliers for Coal (S02), and Urban Water (S31) follow an increasing pattern. Also, induced multipliers of Coal (S02) grow at faster rate over the post-GFC period because of the mining boom and higher exports. The induced activities of the Coal Sector is found relatively high in 1983, 1994 to 1999 too. The induced multipliers of Urban Water was the highest in 2014 because of urbanisation constructing new homes.

Output multipliers in themselves are of no particular interest in a socio-economic context, because they only show the linkage intensities between each sector and the rest of the economy. Also, these intensities need to be interpreted in context to be meaningful. For example, a lower output multipliers imply greater leakages from the economy attributed to less self-sufficient sectors in terms of locally being able to provide their required intermediate outputs. However, sectors like Upstream Water Supply (S29) has the lowest output multipliers (and also the lowest backward linkages as discussed in Chapter 7), because it is not dependent on any other sector of the economy for its main source of supply, rain. But, because it supplies water to urban, rural and water services sectors it has acquired values for its linkages and multiplier that need to be interpreted in context.

Table 8.6: Induced output multipliers[1], 1975-2015 (Indexed, 1975=100)

Sectors	Code	1974-75	1980-81	1986-87	1994-95	1998-99	2004-05	2009-10	2014-15	Trends
Coal	S02	100.00	90.86	86.30	132.30	114.92	82.64	105.43	145.72	▲
Crude Oil	S03	100.00	95.08	87.42	41.89	49.19	22.39	49.07	85.63	▼
Nat Gas	S04	100.00	105.99	114.12	40.75	56.85	36.38	68.69	105.51	▼
Explor. Mining	S05	100.00	68.65	49.90	48.45	54.81	43.02	52.51	59.42	▼
Oth. Mining	S06	100.00	93.21	85.48	80.16	88.53	62.97	67.57	102.40	▼
Petro. Prod. Mfg	S12	100.00	73.18	97.75	59.55	55.80	32.15	35.08	44.80	▼
Coal Prod. Mfg	S13	100.00	78.12	134.72	78.37	93.51	44.16	49.64	81.14	▼
Elec. Gen. Coal	S21	100.00	75.99	81.45	59.05	55.06	56.31	166.56	259.42	▼
Elec. Gen. Oil	S22	100.00	72.32	77.67	71.26	63.12	66.96	218.85	296.26	▼
Elec. Gen. Nat. Gas	S23	100.00	86.09	106.23	79.43	71.16	60.66	176.70	229.32	▼
Elec. Gen. Hydro	S24	100.00	78.23	88.07	61.31	55.83	62.25	214.25	291.79	▼
Elec. Gen. Renew.	S25	100.00	72.80	77.76	68.79	57.73	63.84	203.21	284.67	▼
Elec. Gen Oth. Fuel	S26	100.00	70.22	70.31	53.04	43.26	48.65	67.49	65.33	▼
Elec. T&D	S27	100.00	108.01	162.32	137.81	122.64	149.55	611.39	1121.50	▼
Gas Supply	S28	100.00	76.12	63.03	62.91	47.89	43.48	69.13	60.70	▼
Upstrm Water	S29	100.00	56.51	51.89	52.97	37.07	19.31	25.02	24.17	▼
Urb Water	S30	100.00	82.67	82.48	87.79	80.76	83.09	93.81	96.53	▲
Rurl Water	S31	100.00	85.61	69.05	78.01	67.75	72.35	74.00	76.37	▼
Water Serv.	S32	100.00	74.74	80.42	81.59	68.16	68.81	76.87	85.18	▼
Non-Metal & Min. Prod.	S15	100.00	72.83	68.18	63.86	60.75	59.24	71.35	78.12	▼
Const.	S33	100.00	72.75	62.84	62.95	56.47	54.25	68.23	76.19	▼
Wsale & Retail	S34	100.00	78.48	72.04	77.64	76.71	69.51	84.86	96.03	⇕
Govt Admin	S37	100.00	85.76	82.03	76.18	70.32	67.33	77.43	95.48	▼
Edu, Hlth & Cmty Serv.	S38	100.00	85.33	80.72	84.72	80.51	74.37	81.56	92.46	▼
Oth. Comml Serv.	S39	100.00	86.70	86.97	92.38	89.75	80.61	78.95	91.20	▼

[1] Sectors with the highest Induced Output Multipliers

▲ Increase ▲ Slight Inc. ▼ Decrease ▼ Decrease ⇕ Stable

Source: Results obtained from the model developed in this research.

8.1.2 Employment Multipliers

Employment multipliers in this research are expressed in terms of number of jobs created, as measured in terms of Full Time Equivalent (FTE) (see Chapter 4 for details).

Literature defines employment multipliers slightly different. Normally it is defined as the measure of total change in employment as a result of producing an additional unit of output to satisfy the Final Demand of a given sector. However, authors like Deller et al. (1993) define it as the total change in employment as a result of unitary change in the labour needs of a given sector. Because the labour requirements is linked to the generation of additional unit of outputs, and in turn output is closely linked to the unitary change in final demand, it appears that both definitions are similar.

Table 8.7 presents employment multipliers for all sectors for 2014-15. The Table suggests that Other Manufacturing (S20) created the highest number of jobs (389,106) in 2014-15, as a result of producing 1000 units of output to meet increased final demand for the sector. Of this, 17,374 jobs were created directly within the Sector, and 314,687 jobs were created in other sectors. Additionally, 57,039 new jobs were generated because of household induced effects.

The application of labour intensive technology is the main reason for the high employment multiplier in the Sector. Other labour intensive sectors (with high direct employment multipliers) are Education, Health & Community Services (S38); Pulp, Paper & Paperboard Manufacturing

Table 8.7: Employment multipliers, 2014-15

Band	Code	Sectors	Employment Multipliers					Type II Rank
			Type I			Induced	Type II	
			Direct	Indirect	Total			
High	S20	Mfg Oth.	17.374	314.688	332.063	57.046	389.109	1
	S38	Edu, Hlth & Cmty Serv.	7.108	54.345	61.454	81.985	143.439	2
	S39	Oth. Comml Serv.	5.953	48.816	54.769	45.472	100.241	3
	S09	Pulp & Paper Mfg	6.096	50.188	56.284	31.004	87.288	4
	S37	Govt Admin	4.675	29.287	33.962	50.642	84.603	5
	S34	Wsale & Retail	5.155	35.386	40.541	42.596	83.137	6
	S27	**Elec. T&D**	**1.481**	**24.341**	**25.822**	**35.215**	**61.037**	**7**
	S16	Iron & Steel Mfg	4.205	23.425	27.631	20.982	48.613	8
	S08	Textile & Clothing	5.851	33.098	38.950	9.350	48.300	9
	S10	Wood Prod.	3.223	19.155	22.377	21.226	43.604	10
Medium	**S24**	**Elec. Gen. Hydro**	**1.180**	**15.367**	**16.547**	**22.259**	**38.806**	**11**
	S05	**Explor. Mining**	**3.155**	**12.992**	**16.146**	**22.392**	**38.538**	**12**
	S11	Print & Pub.	3.055	13.933	16.988	18.601	35.590	13
	S21	**Elec. Gen. Coal**	**1.119**	**13.988**	**15.107**	**20.084**	**35.191**	**14**
	S01	Ag., Forest & Fish'g	3.137	16.112	19.248	13.954	33.202	15
	S33	Const.	2.456	13.464	15.920	17.182	33.102	16
	S22	**Elec. Gen. Oil**	**1.106**	**12.569**	**13.675**	**19.202**	**32.877**	**17**
	S35	Trsprt & Storage Serv.	2.755	12.330	15.086	17.734	32.820	18
	S28	**Gas Supply**	**2.842**	**15.949**	**18.791**	**11.695**	**30.486**	**19**
	S25	**Elec. Gen. Renew.**	**1.067**	**11.285**	**12.352**	**17.751**	**30.103**	**20**
	S19	Mach. & Transp Prod.	3.570	13.057	16.626	8.307	24.934	21
	S07	Food & Bev	1.998	9.438	11.436	10.791	22.227	22
	S18	Oth. Metal Prod.	1.927	6.863	8.790	11.363	20.153	23
	S15	Non-Metal & Min. Prod.	1.792	7.094	8.886	11.067	19.953	24
	S36	Comm, Fin. & Bus. Serv.	2.009	5.924	7.933	11.763	19.696	25
Low	**S30**	**Urb Water**	**1.638**	**7.677**	**9.315**	**7.136**	**16.451**	**26**
	S32	**Water Serv.**	**1.325**	**4.176**	**5.501**	**9.570**	**15.071**	**27**
	S17	Non-Ferrous Mfg	1.163	5.444	6.607	7.859	14.466	28
	S02	**Coal**	**1.164**	**4.187**	**5.351**	**7.386**	**12.737**	**29**
	S23	**Elec. Gen. Nat. Gas**	**0.689**	**4.329**	**5.018**	**7.598**	**12.616**	**30**
	S14	Chem. Prod.	1.735	4.455	6.190	6.023	12.213	31
	S06	**Oth. Mining**	**1.331**	**4.027**	**5.358**	**6.676**	**12.034**	**32**
	S31	**Rurl Water**	**1.159**	**5.079**	**6.238**	**4.684**	**10.921**	**33**
Very Low	**S03**	**Crude Oil**	**0.556**	**0.625**	**1.182**	**1.924**	**3.106**	**34**
	S29	**Upstrm Water**	**1.605**	**1.377**	**2.982**	**0.000**	**2.982**	**35**
	S04	**Nat Gas**	**0.467**	**0.262**	**0.729**	**1.309**	**2.038**	**36**
	S13	**Coal Prod. Mfg**	**0.408**	**0.345**	**0.753**	**0.889**	**1.643**	**37**
	S12	**Petro. Prod. Mfg**	**0.408**	**0.225**	**0.633**	**0.739**	**1.371**	**38**
	S26	**Elec. Gen Oth. Fuel**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**39**

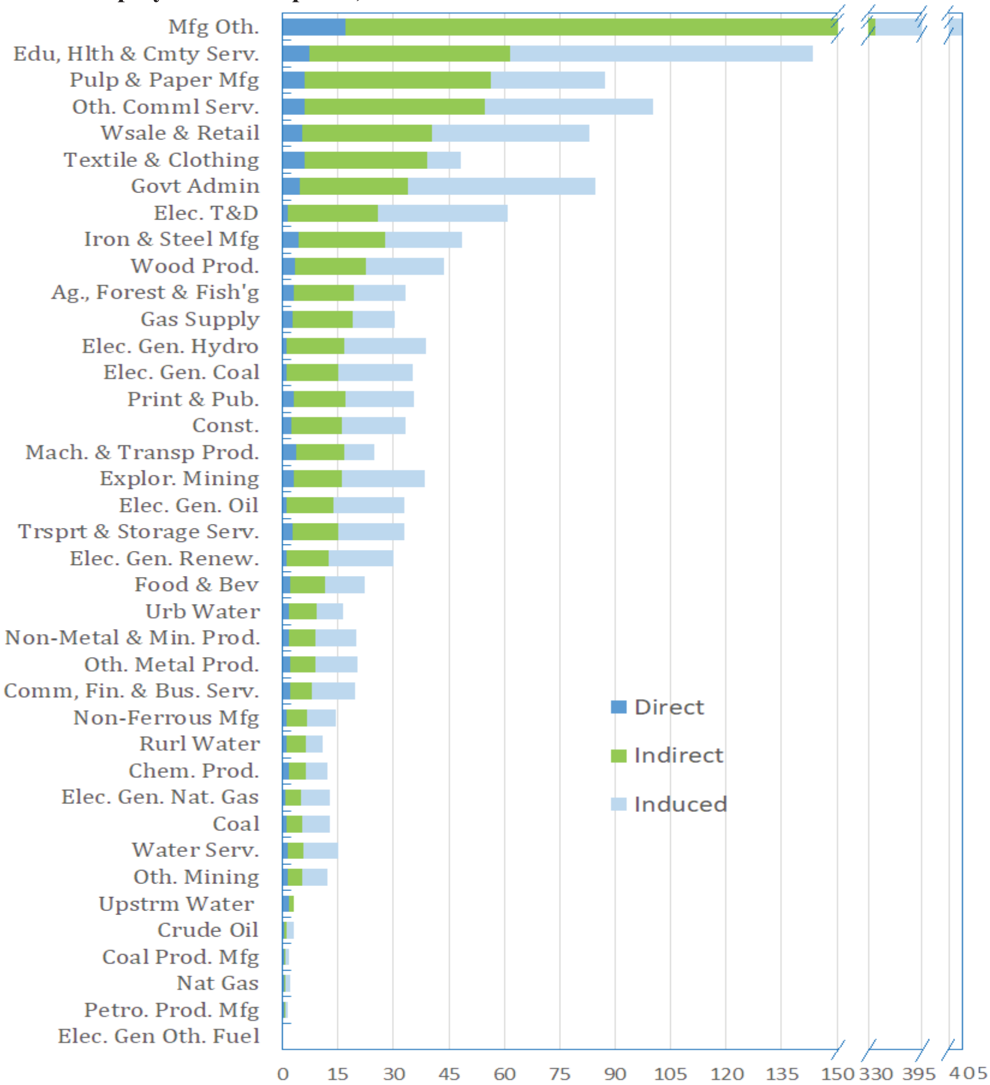
Note: a) IOI are shown in bold.

Source: Results obtained from the model developed in Chapter 4.

(S09); Other Commercial Services including Waste Management (S39); and Textile, clothing, footwear and leather (S08). The employment multipliers for other sectors are shown in the Table. Additionally, Table 8.7 classifies sectors in terms of employment generation capacity into four bands: High, Medium, Low, and Very Low. Among IOI, Electricity T&D (S27) with rank 7 is in band one. In terms of other IOI, Electricity Generation by Hydro (S24, Rank=11), Exploration and Mining Support Services (S05, Rank=12), Electricity Generation by Coal (S21, Rank=14), Electricity Generation by Oil (S22, Rank=17), Gas Supply (S28, Rank=19), and Electricity Generation by Renewables (S25, Rank=20) are in the Medium employment band. The IOI in the Very Low band, because of the highly specialised nature of jobs in comparison to other sectors, naturally did not create significant employment. For example, Upstream Water Supply (S29) does not depend on any inter-industry, or induced inputs by households' services; or the production by Electricity Generation by Other Fuels (S26) is very low in comparison to other sectors.

Figure 8.9 shows the sectors in order of high to low capacity to create jobs in other sectors (indirect employment multipliers) because of linkages with the rest of the economy in 2014-15.

Figure 8.9: Employment multipliers, 2014-15



Source: This author's analysis based on the model developed in Chapter 4.

The results show that while Manufacturing (S20) and Education, Health and Community Services (S38) retain their highest ranking position, the ranking position of other sectors slightly change. For example, Other Commercial Services including Waste Management (38) which was in ranking position 3 now moves to ranking position 4; or Electricity T&D (S27) moves from ranking position 7 to the eighth position. Nevertheless, all top 10 high employer sectors in Band 1 (Table 8.7) influence the highest level of job creation in other sectors.

Also, Education, Health and Community Services (S38) is the highest employer of household services, followed by Other Manufacturing (S20), and Government Administration, Defence, Public Order and Safety (S37) as the Sectors expand in the economy. It is concluded that the top ten sectors with the highest Type II employment multipliers (grand total job creation capacity) are normally strongest sectors in terms of indirect and induced employment multipliers with minor differences in ranking positions. Also, it is found that in accordance to supply and demand influences, technological improvements, and domestic and international forces, the economic sectors employment capacity vary over the period of study to respond to change.

Figure 8.10 shows that as a result of one unit change in final demand for the output of each electricity sector, the indirect employments in Electricity Generation by Renewables (S25) increases at a much faster rate in Australia in comparison to other generation types. The second in the rank is Electricity Generation by Oil Products (S22), followed by Electricity T&D (S27). Relative change in indirect employment multipliers of Electricity Generation by Coal (S21) is the lowest over the period 1975 to 2008. However, over the post-GFC period it slightly increases.

Figure 8.10: Indirect employment multipliers, electricity sector, 1975-2015 (Index, 1975=100)

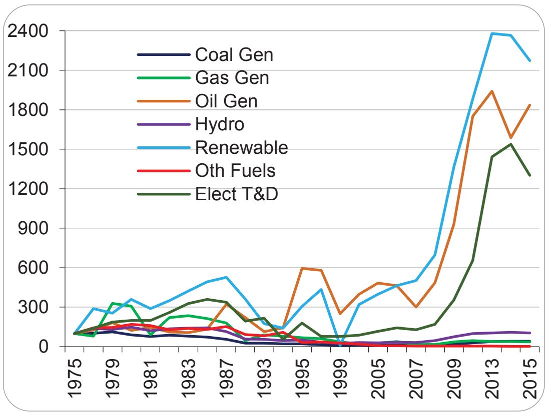
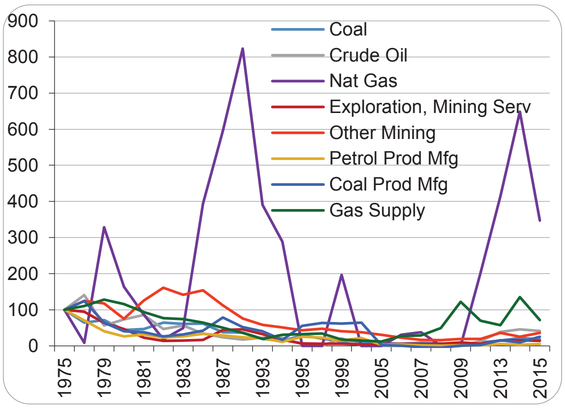


Figure 8.11: Indirect employment multipliers, Other Energy Sectors, 1975-2015 (Index, 1975=100)



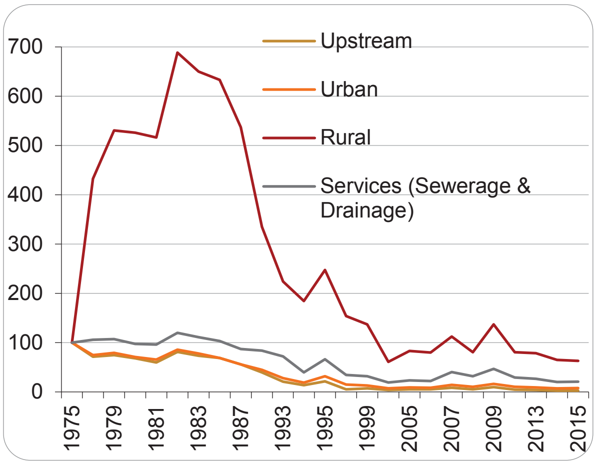
Source: This author's analysis based on the model developed in this research.

The reason for lower indirect employment in S21is access to advanced labour-saving technology in comparison to other generator types. The indirect employment multipliers of Electricity Generation by Hydro (S24) is relatively more than coal-powered generators over the study period, but not significantly different. These findings are consistent with those concluded through output multipliers, and analysis of backward linkages by IO Four-Quadrant Linkage Analysis.

Figure 8.11, and Appendix VIII, Table VIII.6 show growth rate of indirect employment multipliers (indexed to 1975) for other energy IOI over the study period. The indirect employment multipliers of the Gas (incl. Nat Gas, LPG and CSG) (S04) Sector followed an overall increasing pattern of growth. The Sector shows the highest indirect employment multipliers in 1990 by nearly 8.5 times of the 1975 level because of linkages with larger number of gas consuming sectors as a result of gas availability in most part of the country. However, the multiplier effects sharply declined over the period 1990 to 1995, and remained at overall lowest level until 2009 when once again sharply increased reaching to nearly 6.5 times of the 1975 level in 2014. The reason for rapid decline in indirect employments was high exports during the period impacting the Gas availability for domestic use as earlier discussed in Chapter 7.

Figure 8.12 shows indirect employment multiplier trends for the water sectors. The rate of change in indirect employment is the highest for Rural Water Supply (S31) followed by Water Services (Sewerage & Drainage) (S32), and Urban Water Supply (S30). Water Supply Upstream (S29) shows the lowest rate of change in indirect employment because its major linkages are with the environment, rain. The indirect employment in rural water reached its peak in 1982 because of

Figure 8.12: Indirect employment multipliers, Water Sector, 1975-2015
(Index, 1975=100)



Source: This author, based on the model developed in Chapter 4.

the focus of state governments to develop infrastructure such as dams and rural supply schemes including irrigation (see Chapter 3). However, this pattern declined sharply reaching to below the 1975 level in 2002 which therefrom followed saw-tooth pattern to 2015. The reason for decline in indirect employment multipliers is related to reforms started in early 1980s, water management polices of government in 1990s, The National Water Initiative (NWI) in 2005, and subsequent wave of reforms on cost recovery and water allocation systems in rural settings (Chapter 3). These reforms shifted the focus in improving water management than the pre 1980s significant water infrastructure development which were conducive of employment in the linked sectors.

Indirect employment multipliers over the study period for all sectors decreased except for Coal (S02), Crude Oil (S03) and Gas (incl. Nat Gas, LPG and CSG) (S04) which followed an increasing pattern over the period (see Appendix VIII, Table VIII.4 for details).

Also, the historical trends of the induced employment multipliers for Gas (incl. Nat Gas, LPG and CSG) (S04) slightly decreased; Electricity Generation by Oil (S22) remained stable; Electricity Generation by Renewable (S25), and Electricity T&D (S27) increased; and Urban Water Supply slightly increased over the study period. The induced employment multipliers for the rest of IOI declined over the period (see Appendix VIII, Table VIII.5 for details).

8.1.3 Income Multipliers

Table 8.8 shows income multipliers for IOI and other sectors of economy in 2014-15. This Table shows that in 2014-15 about 18% (7 out of 39 sectors) of Australian economy was in high income multiplier band comprising 71% of electricity sectors (five out of seven), and petroleum and coal products manufacturing sectors. For example, Electricity Generation by Coal (S21) generated the highest change (AU$31m) income as a result of one unit (AU$1m) increase in final demand for its outputs. Of this total about AU$0.1m was paid as salaries to the employees working in this Sector. AU$12.2m was generated through linkages with other sectors in the economy. Moreover, an additional AU$19m was paid in wages and salaries by all sectors in the economy to households for non-industry services required for producing outputs. Income multipliers for other sectors are shown in the table.

Table 8.8: Income multipliers, 2014-15 (AU$m)

			Income Multipliers					
			Type I			Induced	Type II	Type II Rank
	Sector	Sec Code	Direct	Indirect	Type I			
High	**Elec. Gen. Coal**	**S21**	**0.093**	**12.160**	**12.253**	**18.696**	**30.949**	**1**
	Elec. Gen. Hydro	**S24**	**0.107**	**11.108**	**11.216**	**17.113**	**28.328**	**2**
	Coal Prod. Mfg	**S13**	**0.013**	**10.957**	**10.969**	**16.737**	**27.706**	**3**
	Elec. T&D	**S27**	**0.155**	**9.658**	**9.812**	**14.972**	**24.784**	**4**
	Elec. Gen. Oil	**S22**	**0.130**	**8.384**	**8.514**	**12.991**	**21.505**	**5**
	Petro. Prod. Mfg	**S12**	**0.015**	**7.649**	**7.664**	**11.694**	**19.358**	**6**
	Elec. Gen. Renew.	**S25**	**0.141**	**7.394**	**7.535**	**11.497**	**19.033**	**7**
Medium	Non-Ferrous Mfg	S17	0.069	6.167	6.237	9.516	15.752	8
	Elec. Gen. Nat. Gas	**S23**	**0.136**	**5.052**	**5.188**	**7.915**	**13.103**	**9**
	Gas Supply	**S28**	**0.053**	**4.939**	**4.992**	**7.617**	**12.609**	**10**
Low	Pulp & Paper Mfg	S09	0.100	3.150	3.250	4.959	8.209	11
	Ag., Forest & Fish'g	S01	0.094	2.934	3.027	4.619	7.646	12
	Urb Water	**S30**	**0.101**	**2.654**	**2.755**	**4.204**	**6.959**	**13**
	Coal	**S02**	**0.147**	**2.605**	**2.752**	**4.200**	**6.952**	**14**
	Food & Bev	S07	0.126	2.615	2.741	4.182	6.923	15
	Oth. Mining	**S06**	**0.118**	**2.604**	**2.722**	**4.153**	**6.875**	**16**
	Const.	S33	0.167	2.499	2.667	4.069	6.736	17
	Rurl Water	**S31**	**0.099**	**2.495**	**2.595**	**3.959**	**6.553**	**18**
	Non-Metal & Min. Prod.	S15	0.158	2.339	2.497	3.810	6.306	19
	Wood Prod.	S10	0.171	2.280	2.452	3.741	6.193	20
	Chem. Prod.	S14	0.092	2.307	2.400	3.661	6.061	21
	Iron & Steel Mfg	S16	0.146	2.033	2.179	3.325	5.505	22
	Crude Oil	**S03**	**0.105**	**1.990**	**2.096**	**3.197**	**5.293**	**23**
	Mfg Oth.	S20	0.105	1.881	1.986	3.031	5.017	24
	Trsprt & Storage Serv.	S35	0.207	1.774	1.981	3.023	5.004	25
	Water Serv.	**S32**	**0.238**	**1.697**	**1.935**	**2.952**	**4.887**	**26**
	Oth. Metal Prod.	S18	0.196	1.720	1.916	2.924	4.840	27
	Nat Gas	**S04**	**0.095**	**1.784**	**1.879**	**2.867**	**4.747**	**28**
	Oth. Comml Serv.	S39	0.270	1.538	1.808	2.758	4.565	29
	Mach. & Transp Prod.	S19	0.083	1.716	1.799	2.745	4.543	30
	Print & Pub.	S11	0.217	1.571	1.788	2.728	4.516	31
	Comm, Fin. & Bus. Serv.	S36	0.212	1.550	1.762	2.688	4.450	32
	Textile & Clothing	S08	0.061	1.625	1.685	2.571	4.256	33
	Wsale & Retail	S34	0.329	1.272	1.601	2.443	4.045	34
	Explor. Mining	**S05**	**0.295**	**1.241**	**1.536**	**2.343**	**3.878**	**35**
Very Low	Govt Admin	S37	0.483	0.946	1.430	2.182	3.611	36
	Edu, Hlth & Cmty Serv.	S38	0.632	0.532	1.164	1.776	2.940	37
	Elec. Gen Oth. Fuel	**S26**	**0.285**	**0.717**	**1.002**	**1.528**	**2.530**	**38**
	Upstrm Water	**S29**	**0.000**	**0.000**	**0.000**	**0.000**	**0.000**	**39**

Note: IOI are shown in bold.
Source: Results obtained from the model developed in this research.

In 2014-15, 74% of the sectors (29 out of 39) were in the low income multipliers band as classified by this research. The income generation capacity of these sectors varied between AU$2.5m to AU$8m as a result of AU$1m change in final demand. Upstream Water Supply (S29) does not generate any income because it does not depend on inter-industry or households services as discussed earlier.

The top ten sectors with the highest direct income multipliers are: Education, Health and Community Services (S38); Government Administration, Defence, Public Order and Safety (S37); Wholesale and Retail Trades (S34); Exploration and Mining Support Services (S05); Electricity Generation by Other Fuel (S26); Other Commercial Services including Waste Management (S39); Water Services (Sewerage & Drainage) (S32); Printing, publishing other than music and Internet (S11); Communication, Finance, Property and Business Services (S36), and Transport and Storage Services (S35). This means that, if final demand for products of these sectors were to increase by one unit, the portion of that unit which will go to compensating employees in each of these sectors would be the highest relative to other sectors of the economy. For example, as a result of AU$1m increase in final demand for products and services of Education, Health and Community Services (S38), about AU$.63m would go towards wages and salaries in the Sector, being the highest relative to other sectors in the economy. These sectors do not follow the ranking order of the sectors in the High income band, because the direct income multipliers are closely dependent on labour requirements for producing one unit output. In contrast, the results show that the sectors in the High income multipliers band (Table 8.8) have the highest capacity, in the same ranking positions, to generate both income in other sectors because of linkages, and to generate household income because of utilising household services toward production.

The change in indirect income multipliers over the study period shown by Figure 8.13 to 8.16.

Figure 8.13: Indirect income multipliers, Electricity Sector, 1975-2015 (Index, 1975=100)

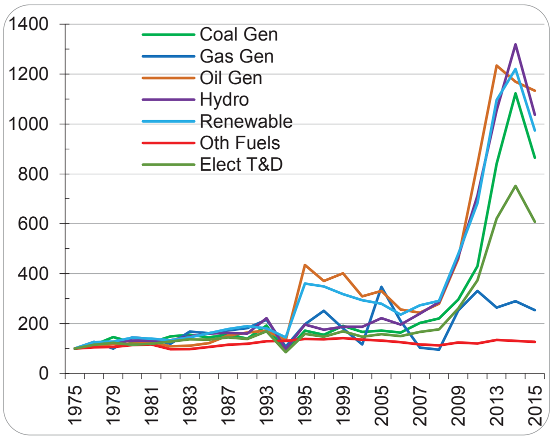


Figure 8.14: Indirect income multipliers, Other Energy Sectors, 1975-2015 (Index, 1975=100)

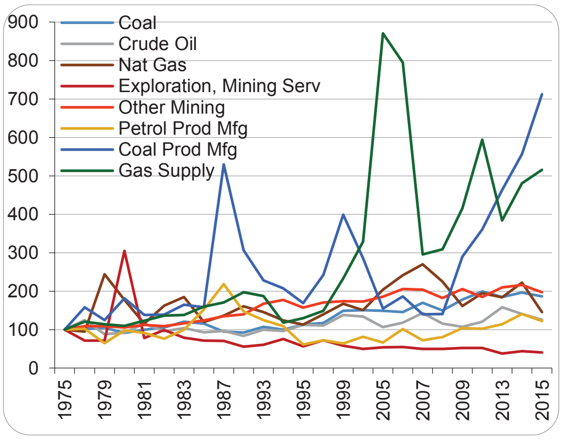


Figure 8.15: Indirect income multipliers, Water Sector, 1975-2015 (Index, 1975=100)

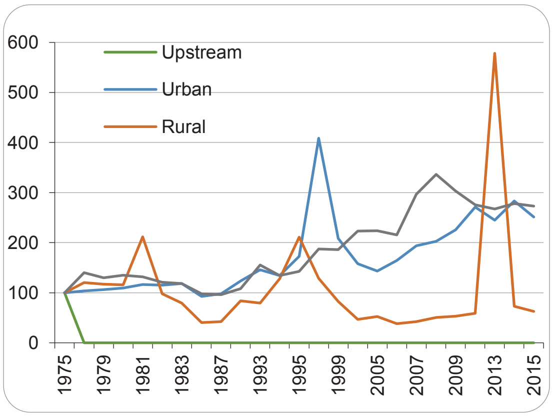
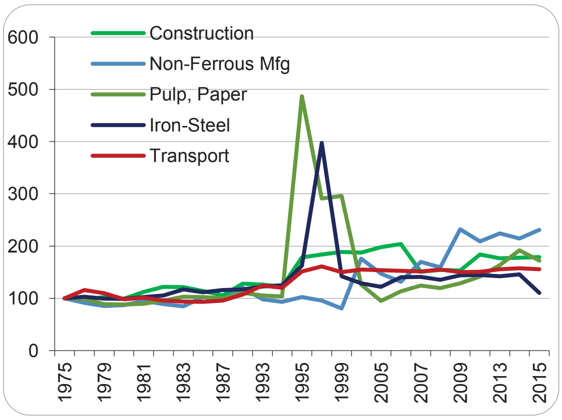


Figure 8.16: Indirect income multipliers, Other Sectors, 1975-2015 (Index, 1975=100)



Source: This author, based on the model developed in this research.

Figure 8.13 shows that from 1994 to 2015 indirect income multipliers of Electricity Generation by Oil (S22) grows at relatively faster rate, followed by Electricity Generation by Renewables (S25), Electricity Generation by Hydro (S24), Electricity Generation by Coal (S21), and

Electricity T&D (S27) respectively. The indirect income multipliers of Electricity Generation by Other Fuel (S26) grows at the lowest rate, followed by Electricity generation by Gas (S23). The reason for the latter is small electricity production by S26 in comparison to other electricity generation sectors; and inadequate level of gas for domestic use, because of increasing trends in gas exports over the study period. These results are consistent with cumulative compensation of employees coefficients estimated by IO Four-Quadrant Linkage Analysis as discussed in chapter 7. Also, these sectors are changing rank within their band identified in Table 8.8.

Regarding other IOI, Figure 8.14 shows higher rate of change in indirect income multipliers of Gas Supply (S28), followed by Coal Products Manufacturing (S13); Gas (incl. Nat Gas, LPG and CSG) (S04); Petroleum Products Manufacturing (S12); and Exploration and Mining Support Services (S05) which is relatively the lowest in this group of sectors. Majority of these sectors developed specialised linkage with other sectors of economy. Therefore, it is possible that indirect income multipliers are influenced by major contributor sectors as identified in Chapter 7; and also the level of specialised employment services required through upstream and downstream linkages. For example, the indirect income generation through linkages of Exploration and Mining Services (S05) is much lower than other sectors because of the highly specialised nature of the employment in this sector, and generally in energy sectors. This research has found that the more integrated a sector is with the rest of the economy, the larger is number of sectoral linkages, and in turn more capacity to generate income through indirect employments in other sectors.

The rate of change in direct income multipliers of Sewerage & Drainage (S32) is more than Urban Water Supply (S30), conforming to the employment and output multipliers as discussed before.

In comparison to non-IOI, indirect income multipliers grow faster in Construction (S33); Pulp, Paper and Paperboard Manufacturing (S09); Basic Non-Ferrous Metal Manufacturing (S17); Iron and Steel Manufacturing (S16); and Transport and Storage Services (S35) indicating that these sectors through linkages with other sectors can effectively create income in the economy.

Table 8.9 shows the rate of change for indirect income multipliers in around five yearly intervals, (full details presented in Appendix VIII, Table VIII.7).

The growth rate of indirect multipliers for majority of the sectors are increasing over the study period except for Exploration and Mining Support Services (S05) which is decreasing. The overall growth rate for Petroleum Products Manufacturing slightly decreases over the period; Rural Water Supply (S31) is stable; and that of Upstream Water Supply is zero as discussed earlier.

Because of the indirect multiplier activities and their “flow-on effect” the supply sectors need to hire more labour for production of additional inputs. As a result, the level of household incomes (or the induced incomes) increases which re-spend on final demand to buy goods and services.

Figures 8.17 to 8.20 show the induced income results. The level of household (labour) spending is based on Marginal Propensity to Consume (MPC), or Marginal Propensity to Save (MPS).

Also, direct estimate of the induced income effects is difficult requiring detailed information beyond the scope of this research. The analysis in this research is based on the formulation described in Chapter 4.

Table 8.9: Indirect income multipliers, 1975 to 2015 (indexed, 1975=100)

Sectors	Code	1974-75	1980-81	1986-87	1993-94	1998-99	2004-05	2009-10	2014-15	Trends
Coal	S02	100.00	100.08	95.09	99.48	148.88	149.10	199.13	186.47	▲ (Inc.)
Crude Oil	S03	100.00	115.48	96.46	96.48	138.37	106.80	120.95	125.57	▲ (Slight Inc.)
Nat Gas	S04	100.00	115.22	136.42	123.98	167.50	203.91	195.12	145.28	▲ (Inc.)
Explor. Mining	S05	100.00	77.98	70.56	75.42	58.45	53.55	51.95	40.17	▼ (Dec.)
Oth. Mining	S06	100.00	112.35	134.58	177.43	174.17	185.87	184.57	196.99	▲ (Inc.)
Petro. Prod. Mfg	S12	100.00	91.11	218.26	109.27	63.49	66.11	102.34	122.60	▼ (Slight Inc.)
Coal Prod. Mfg	S13	100.00	137.69	529.32	207.04	399.25	154.67	360.82	712.01	▲ (Inc.)
Elec. Gen. Coal	S21	100.00	123.29	156.16	87.38	190.15	171.72	428.95	865.10	▲ (Inc.)
Elec. Gen. Oil	S22	100.00	123.54	152.39	133.46	401.84	330.75	838.46	1133.23	▲ (Inc.)
Elec. Gen. Nat. Gas	S23	100.00	138.39	173.20	107.11	180.90	347.06	330.20	254.04	▲ (Slight Inc.)
Elec. Gen. Hydro	S24	100.00	130.97	163.02	97.03	186.37	221.26	712.09	1037.44	▲ (Inc.)
Elec. Gen. Renew.	S25	100.00	138.72	178.05	144.94	317.26	279.40	682.87	973.94	▲ (Inc.)
Elec. Gen Oth. Fuel	S26	100.00	116.47	115.01	130.16	141.51	130.96	120.29	126.79	⇅ (Slight Inc.)
Elec. T&D	S27	100.00	119.23	144.13	85.09	168.43	157.44	373.17	608.38	▲ (Inc.)
Gas Supply	S28	100.00	122.95	170.72	117.92	233.21	870.54	593.57	515.57	▲ (Inc.)
Upstrm Water	S29	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	‡ (Zero)
Urb Water	S30	100.00	116.42	97.67	134.36	208.63	143.04	270.88	251.22	▲ (Inc.)
Rurl Water	S31	100.00	211.68	42.38	128.21	82.62	52.52	59.14	62.54	⇅ (Slight Inc.)
Water Serv.	S32	100.00	132.02	96.16	134.55	186.08	224.12	275.83	273.33	▲ (Inc.)
Pulp & Paper Mfg	S09	100.00	89.57	100.16	103.60	2961.80	94.89	141.67	172.37	▲ (Inc.)
Iron & Steel Mfg	S16	100.00	102.31	115.83	125.32	142.44	122.09	144.48	110.51	▲ (Inc.)
Non-Ferrous Mfg	S17	100.00	95.15	96.87	93.45	80.66	146.87	208.82	231.16	▲ (Inc.)
Const.	S33	100.00	112.31	105.59	122.34	188.59	197.97	183.82	179.23	▲ (Inc.)
Trsprt & Storage Serv.	S35	100.00	100.94	95.63	120.02	150.47	154.01	150.80	155.69	▲ (Inc.)

▲ Inc. ▲ Slight Inc. ▼ Dec. ▼ Slight Inc. ⇅ Slight Inc. ‡ Zero

Source: This author's analysis based on the outcomes of the model developed in this research.

For electricity sectors, induced income effects was the highest by Electricity Generation by Hydro (S24) followed by Electricity Generation by coal (S21). The lowest was by Electricity Generation by Other Fuels (S26) followed by Electricity Generation by Gas (S23) over the study period. Regarding other IOI, the induced income effects changed at the highest rate by Gas Supply (S28) followed by Coal Products Manufacturing (S13), Gas (incl. Nat Gas, LPG and CSG) (S04), and Other Mineral Mining (S06). The lowest rate of change is observed in Exploration and Mining Services (S05). These results are similar to the pattern discussed for indirect income multipliers.

The induced household income generation through non-industry linkages was the highest by Water Supply Urban (S30) followed by the Water Services (Sewerage & Drainage) (S32).

The growth rate for majority of other major sectors of the economy is below the 1975 starting point over the study period, except for Construction (S33) which shows relatively the highest growth rate over the period 1995 to 2015, because of increased dwelling and industrial construction activities over the period (Figure 8.20). The reason for decline in induced income is adoption of advanced technologies reducing the need for household services. This finding is also confirmed by the analysis of Most Important Coefficients (MIC), Concentration, and Entropy indices (Chapter 6), and Backward Linkages (Chapter 7). However, in 2009 pattern of growth started reaching the peak in 2014 by nearly 1.5 times of the 1975 level for some sectors followed by slight decline in 2015. The sectors with relatively higher rate of growth in induced income effects over the period 2009-2015 are Pulp, Paper and Paperboard (S09); Construction (S33);

Figure 8.17: Induced income multipliers, Electricity Sector, 1975-2015 (Index, 1975=100)

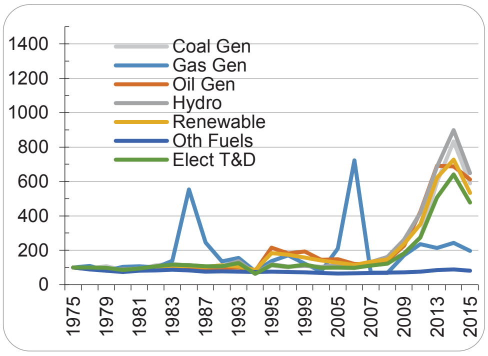


Figure8.18: Induced income multipliers, Other Energy Sectors, 1975-2015 (Index, 1975=100)

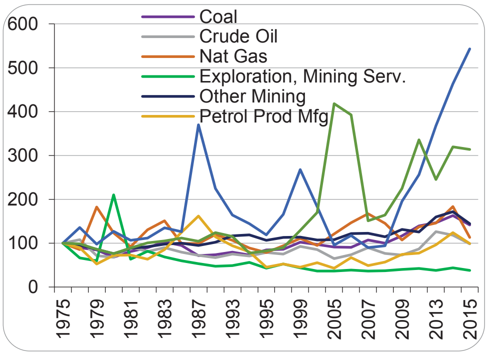


Figure 8.19: Induced Income Multipliers, Water Sector, 1975-2015 (Index, 1975=100)

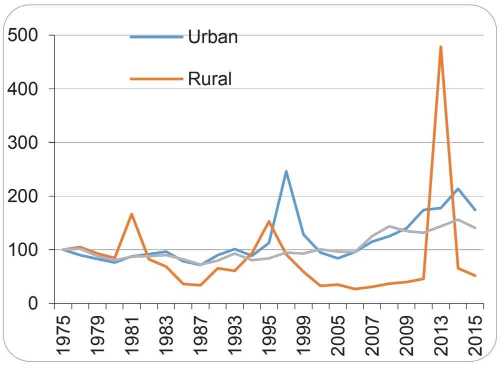
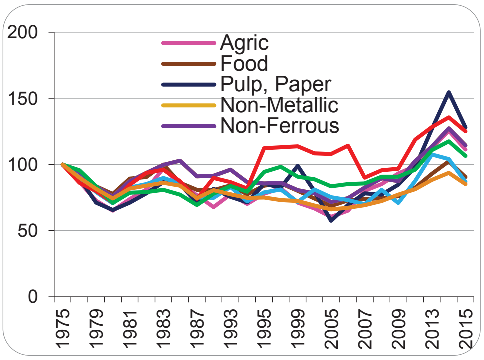


Figure 8.20: Induced Income Multipliers, Major Sectors, 1975-2015 (Index, 1975=100)



Source: This author, based on the model developed in Chapter 4.

Basic Non-Ferrous Metal (S17); Agriculture, Forestry and Fishing (S01); Transport and Storage services (S35); Other Manufacturing (S20); Food and Beverage (S07); Education, Health and Community Services (S38); and Non-Metallic and Mineral Products (S15) respectively.

Table 8.10 shows overall rate of change in induced income multipliers in about five yearly intervals over the study period (see Appendix VIII, Table VIII.9 for full details). The results show that the growth-rate for Food, Beverage and Tobacco (S07); Textile, clothing, footwear and leather (S08); Other Metal Products (S18); and Education, Health and Community Services (S38) decline over the period. The growth-rate trends of Machinery, Transport and Machinery Products (S19); Other Manufacturing (S18); and Government Administration, Defence, Public Order and Safety (S37) remain stable over the study period. The growth-rate trends of the remaining major sectors of the economy (non-IOI) follow an increasing pattern. The overall pattern of growth rates for Basic Non-Ferrous Metal Manufacturing (S17); Construction (S33); Pulp, Paper and Paperboard Manufacturing (S09); and Non-Metallic and Mineral Products (S15) are sharply increased in comparison to other non-IOI sectors over the study period. These sectors can induce economic activity in other sectors and suitable for policy objectives aimed at developing the economy.

Table 8.10: Overall induced income multipliers, 1975-2015

Sectors	Sec Code	1974-75	1980-81	1986-87	1993-94	1998-99	2004-05	2009-10	2014-15	Trends
Coal	S02	100.00	80.57	71.75	72.78	101.81	90.95	139.02	142.27	△
Crude Oil	S03	100.00	91.21	72.51	70.89	92.96	64.74	86.79	98.40	⇕
Nat Gas	S04	100.00	91.67	99.08	89.08	111.11	120.98	136.78	112.87	△
Explor. Mining	S05	100.00	63.70	53.21	56.29	43.98	36.55	42.08	37.70	▼
Oth. Mining	S06	100.00	88.27	94.55	119.05	113.59	107.95	125.18	144.66	△
Petro. Prod. Mfg	S12	100.00	73.07	161.81	80.20	45.54	42.81	77.27	99.48	▽
Coal Prod. Mfg	S13	100.00	106.70	370.03	144.49	267.81	95.19	256.37	542.93	▲
Elec. Gen. Coal	S21	100.00	91.98	104.83	62.18	117.41	97.39	275.42	589.21	▲
Elec. Gen. Oil	S22	100.00	85.83	92.56	79.33	193.52	147.28	423.22	610.96	▲
Elec. Gen. Nat. Gas	S23	100.00	107.09	245.81	77.28	122.21	209.42	235.06	197.08	△
Elec. Gen. Hydro	S24	100.00	93.87	104.74	66.38	108.30	115.48	417.06	649.28	▲
Elec. Gen. Renew.	S25	100.00	92.71	103.77	84.73	157.05	127.88	351.87	534.12	▲
Elec. Gen Oth. Fuel	S26	100.00	80.64	75.21	74.01	72.35	64.84	75.70	81.40	▼
Elec. T&D	S27	100.00	94.82	106.75	63.60	117.20	100.66	274.39	476.87	▲
Gas Supply	S28	100.00	89.26	104.36	77.01	128.80	417.97	335.73	313.76	▲
Upstrm Water	S29	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	‡
Urb Water	S30	100.00	87.34	71.57	88.96	127.99	84.19	174.28	174.39	▲
Rurl Water	S31	100.00	166.21	33.66	93.75	58.80	35.03	45.57	51.62	⇕
Water Serv.	S32	100.00	86.80	72.38	80.31	92.76	96.58	131.64	140.58	▲
Ag., Forest & Fish'g	S01	100.00	73.72	76.70	70.17	71.14	60.44	98.83	111.37	▲
Food & Bev	S07	100.00	89.37	80.79	77.43	80.11	68.66	82.53	90.59	▼
Textile & Clothing	S08	100.00	79.74	79.69	80.74	87.28	68.47	78.52	74.47	▼
Pulp & Paper Mfg	S09	100.00	71.15	71.06	71.38	99.04	57.44	98.00	127.96	▲
Non-Metal & Min. Prod.	S15	100.00	87.27	90.95	86.57	80.57	71.66	102.64	114.42	△
Iron & Steel Mfg	S16	100.00	81.34	83.23	87.15	94.46	74.16	101.03	85.45	▲
Non-Ferrous Mfg	S17	100.00	76.33	72.28	68.52	58.35	91.66	151.31	180.27	▲
Oth. Metal Prod.	S18	100.00	86.12	81.09	75.06	90.22	68.12	82.04	87.66	▼
Mfg Oth.	S20	100.00	82.61	74.99	72.13	71.70	75.23	87.58	86.97	⇕
Const.	S33	100.00	84.73	74.14	81.75	113.87	108.06	118.87	125.11	▲
Trsprt & Storage Serv.	S35	100.00	78.75	69.37	79.31	90.85	83.42	96.04	106.59	▲
Govt Admin	S37	100.00	74.10	71.41	91.27	80.93	69.29	80.19	86.88	⇕
Edu, Hlth & Cmty Serv.	S38	100.00	81.84	74.63	74.70	72.39	66.06	81.34	85.20	▼

▲ Inc. ▼ Dec. △ Slight Inc ▽ Slight Dec ⇕ Stable ‡ Zero

Source: This author's analysis based on the outcomes of the model developed in this research.

8.1.4 Value Added Multipliers

The Type I value added multipliers are the same as value added linkages obtained through IO Four-Quadrant Linkage Analysis Framework (IOFQLAF). Table 8.11 compares the results of these two approaches for the IO reference years 2008-09 and 2014-15. The main reason for the equivalence of multipliers by these two approaches are: application of open IO model in both methods; and formulation of total value added linkages as alternatives to Type I value added multipliers (see Chapter 4). The value added multipliers can be regarded as the returns to primary factors of production (land, labour and capital). From a policy perspective, value added multipliers are useful for either developing certain sectors in the regional areas, or by establishing a new sector to take the advantage of local resources such as land, wood, or other products that are native to the area to increase the value added of a region's raw materials

The estimated value added multipliers for the year 2014-15 are presented in Table 8.12. The numbers in the table can be interpreted as follows. AU$1m of increase in final demand for the output of Electricity T&D (S27) resulted in AU$8.635m cumulative impact (value added multipliers) comprising AU$0.537 direct, AU$3.891 indirect, and AU$4.891 induced related to

Table 8.11: VA multipliers and IOFQLAF linkages, 2008-09 & 2014-15 (AU$m)

		Un-Weighted, Not Normalised			
		2008-09		2014-15	
Sectors	Sec Code	VA Multipliers (Type I)	IOFQLAF (Open IO Model)	VA Multipliers (Type I)	IOFQLAF (Open IO Model)
Ag., Forest & Fish'g	S01	0.8681	0.8682	0.9314	0.9314
Coal	S02	0.9579	0.9580	0.9823	0.9823
Crude Oil	S03	0.6626	0.6629	0.7491	0.7491
Nat Gas	S04	0.7015	0.7134	0.7576	0.7686
Explor. Mining	S05	0.8979	0.8979	0.9254	0.9254
Oth. Mining	S06	0.7908	0.7909	0.9922	0.9924
Food & Bev	S07	0.7602	0.7603	0.8078	0.8079
Textile & Clothing	S08	0.3468	0.3468	0.2046	0.2046
Pulp & Paper Mfg	S09	0.4376	0.4378	0.6758	0.6760
Wood Prod.	S10	0.7992	0.7993	0.8609	0.8609
Print & Pub.	S11	0.7914	0.7915	0.7966	0.7967
Petro. Prod. Mfg	S12	0.4552	0.4554	0.3925	0.3927
Coal Prod. Mfg	S13	0.3989	0.3990	0.4559	0.4561
Chem. Prod.	S14	0.4781	0.4785	0.4852	0.4854
Non-Metal & Min. Prod.	S15	0.7861	0.7864	0.8483	0.8485
Iron & Steel Mfg	S16	0.6235	0.6236	0.6063	0.6064
Non-Ferrous Mfg	S17	0.8892	0.8896	1.1559	1.1562
Oth. Metal Prod.	S18	0.7082	0.7083	0.6879	0.6880
Mach. & Transp Prod.	S19	0.3210	0.3210	0.2618	0.2618
Mfg Oth.	S20	0.4235	0.4235	0.3971	0.3972
Elec. Gen. Coal	S21	1.8258	1.8263	3.3088	3.3093
Elec. Gen. Oil	S22	1.8240	1.8244	3.2740	3.2744
Elec. Gen. Nat. Gas	S23	1.4203	1.4255	2.1447	2.1463
Elec. Gen. Hydro	S24	2.1248	2.1255	3.5130	3.5135
Elec. Gen. Renew.	S25	1.8721	1.8726	3.1555	3.1559
Elec. Gen Oth. Fuel	S26	0.9941	0.9941	0.9905	0.9905
Elec. T&D	S27	1.7915	1.7925	4.4256	4.4265
Gas Supply	S28	0.8924	0.8925	0.9647	0.9648
Upstrm Water	S29	0.0000	0.0000	0.0000	0.0000
Urb Water	S30	0.9595	0.9596	1.1595	1.1596
Rurl Water	S31	1.0124	1.0125	1.2229	1.2230
Water Serv.	S32	0.9006	0.9007	1.0351	1.0352
Const.	S33	0.8891	0.8892	0.9001	0.9001
Wsale & Retail	S34	0.9052	0.9053	0.9829	0.9829
Trsprt & Storage Serv.	S35	0.8054	0.8055	0.8834	0.8835
Comm, Fin. & Bus. Serv.	S36	0.9380	0.9380	0.9707	0.9707
Govt Admin	S37	0.9388	0.9388	1.0958	1.0959
Edu, Hlth & Cmty Serv.	S38	0.9338	0.9339	0.9644	0.9644
Oth. Comml Serv.	S39	0.8480	0.8481	0.9393	0.9393

Source: Results generated by the model developed in this research.

the household labour and services to satisfy the final demand. The sectors with the highest value added multipliers are in High Band in Table 8.12.

Comparison of Table 8.1 (output multipliers) and Table 8.12 (value added multipliers) reveals that majority of the sectors either are in the same ranking position, or move to a higher or lower ranking positions. For example, in both Tables, all of the High Band electricity sectors are in the same ranking positions; and majority of the sectors in Medium Band either are in the same ranking positions or move to close proximity positions. Based on these observations, it is concluded that IOI, and other sectors of the economy with high output multipliers, particularly those in the High multipliers band in this research, are domestically self-sufficient sectors, and their outputs are translated into high value added in the economy. Moreover, the results show that the indirect and induced value added multiplier effects of the sectors in the High Band category follow the same ranking order of their total value added multipliers (Type II). The electricity sectors have both the highest indirect and induced value added effects (Table 8.13), which means that these sectors generate value added indirectly in other sectors because of linkages; and also generate value added in the economy because of households' services to satisfy a unitary change in final demand.

Table 8.12: Value added multipliers, 2014-15 (AU$m)

			Unweighted, Not Normalised					
			Type I			Induced	Type II	Type II Rank
	Sectors	Sec Code	Direct	Indirect	Total			
High	Elec. T&D	S27	0.537	3.891	4.427	4.208	8.635	1
	Elec. Gen. Hydro	S24	0.373	3.141	3.514	3.339	6.853	2
	Elec. Gen. Coal	S21	0.325	2.986	3.310	3.177	6.488	3
	Elec. Gen. Oil	S22	0.452	2.823	3.275	3.074	6.349	4
	Elec. Gen. Renew.	S25	0.489	2.667	3.156	2.945	6.101	5
Moderate	Elec. Gen. Nat. Gas	S23	0.471	1.674	2.145	1.951	4.097	6
	Govt Admin	S37	0.599	0.497	1.096	1.917	3.013	7
	Edu, Hlth & Cmty Serv.	S38	0.734	0.230	0.964	2.041	3.005	8
	Wsale & Retail	S34	0.508	0.475	0.983	1.462	2.445	9
	Non-Ferrous Mfg	S17	0.090	1.066	1.156	1.196	2.352	10
	Water Serv.	S32	0.481	0.555	1.035	1.278	2.313	11
	Oth. Comml Serv.	S39	0.439	0.500	0.939	1.352	2.291	12
	Explor. Mining	S05	0.543	0.383	0.925	1.256	2.182	13
	Const.	S33	0.311	0.589	0.900	1.238	2.138	14
	Coal	S02	0.409	0.580	0.990	1.123	2.113	15
	Wood Prod.	S10	0.266	0.595	0.861	1.166	2.027	16
	Trsprt & Storage Serv.	S35	0.420	0.463	0.883	1.139	2.022	17
	Comm, Fin. & Bus. Serv.	S36	0.580	0.390	0.971	1.036	2.007	18
Low	Non-Metal & Min. Prod.	S15	0.287	0.562	0.848	1.093	1.941	19
	Rurl Water	S31	0.700	0.523	1.223	0.715	1.938	20
	Urb Water	S30	0.710	0.450	1.160	0.771	1.930	21
	Oth. Mining	S06	0.520	0.472	0.992	0.888	1.880	22
	Print & Pub.	S11	0.397	0.400	0.797	1.077	1.874	23
	Elec. Gen Oth. Fuel	S26	0.989	0.001	0.991	0.792	1.782	24
	Food & Bev	S07	0.222	0.585	0.808	0.956	1.763	25
	Oth. Metal Prod.	S18	0.289	0.399	0.688	1.043	1.731	26
	Ag., Forest & Fish'g	S01	0.440	0.492	0.931	0.787	1.719	27
	Gas Supply	S28	0.362	0.603	0.965	0.728	1.693	28
	Pulp & Paper Mfg	S09	0.126	0.550	0.676	0.900	1.576	29
	Iron & Steel Mfg	S16	0.171	0.435	0.607	0.883	1.489	30
	Crude Oil	S03	0.485	0.264	0.749	0.612	1.362	31
	Nat Gas	S04	0.558	0.200	0.758	0.497	1.254	32
	Chem. Prod.	S14	0.182	0.303	0.485	0.614	1.100	33
Very Low	Mfg Oth.	S20	0.161	0.236	0.397	0.581	0.978	34
	Coal Prod. Mfg	S13	0.077	0.379	0.456	0.386	0.842	35
	Petro. Prod. Mfg	S12	0.091	0.301	0.393	0.320	0.713	36
	Mach. & Transp Prod.	S19	0.117	0.145	0.262	0.412	0.674	37
	Textile & Clothing	S08	0.099	0.105	0.205	0.283	0.487	38
	Upstrm Water	S29	0.000	0.000	0.000	0.000	0.000	39

Source: Results obtained from the model developed in Chapter 4.

Table 8.13 shows that Electricity Generation by Other Fuel (S26) directly generates the highest value added (0.989, Rank=1) for each AU$1m increase in final demand for its outputs, followed by Education, Health and Community Services (S38); Urban Water Supply (S30); Rural Water Supply (S31); and Government Administration, Defense, Public Order and Safety (337) in ranking positions two to five respectively. In terms of indirect generation of new value added in the whole economy, after electricity sectors, Basic Non-Ferrous Metal Manufacturing (S17), followed by Gas Supply (S28), and Wood Products (S10) are the highest contributors. In terms of induced effects, after major electricity sectors, Education, Health and Community Services (S38) in raking position 6, followed by Electricity Generation by Gas (S23), Government Administration, Defense, Public Order and Safety (S37), and Wholesale and Retail Trades (S9) are the highest generators of new value added in the whole economy.

Table 8.13: Top 15 sectors with the highest multipliers, 2014-15

Sector	Code	Direct	Indirect	Induced
Elec. T&D	S27	0.537 (9)	3.891 (1)	4.208 (1)
Elec. Gen. Hydro	S24		3.141 (2)	3.339 (2)
Elec. Gen. Coal	S21		2.986 (3)	3.177 (3)
Elec. Gen. Oil	S22		2.823 (4)	3.074 (4)
Elec. Gen. Renew.	S25	0.489 (12)	2.667 (5)	2.945 (5)
Edu, Hlth & Cmty Serv.	S38	0.734 (2)		2.051 (6)
Elec. Gen. Nat. Gas	S23	0.471 (15)	1.674 (6)	1.951 (7)
Govt Admin	S37	0.600 (5)		1.917 (8)
Wsale & Retail	S34	0.508 (11)		1.462 (9)
Oth. Comml Serv.	S39			1.352 (10)
Water Serv.	S32	0.481 (14)	0.555 (14)	1.278 (11)
Explor. Mining	S05	0.543 (8)		1.256 (12)
Const.	S33		0.589 (10)	1.238 (13)
Non-Ferrous Mfg	S17		1.066 (7)	1.196 (14)
Wood Prod.	S10		0.595 (9)	1.166 (15)
Gas Supply	S28		0.603 (8)	
Food & Bev	S07		0.585 (11)	
Coal	S02		0.580 (12)	
Non-Metal & Min. Prod.	S15		0.562 (13)	
Pulp & Paper Mfg	S09		0.550 (15)	
Elec. Gen Oth. Fuel	S26	0.989 (1)		
Urb Water	S30	0.710 (3)		
Rurl Water	S31	0.700 (4)		
Comm, Fin. & Bus. Serv.	S36	0.580 (6)		
Nat Gas	S04	0.558 (7)		
Oth. Mining	S06	0.520 (10)		
Crude Oil	S03	0.485 (13)		

Note: Numbers in brackets represent the ranking order.

Source: Results obtained from the model developed in Chapter 4.

The sectors in the Very Low value added band (Table 8.12) such as Other Manufacturing (S20); Coal Products Manufacturing S13); Petroleum Products Manufacturing (S12); Machinery, Transport and Machinery Products (S19); Textile, clothing, footwear and leather (S08); and Upstream Water Supply have very low direct, indirect and induced value added effects consistent with earlier discussions of the linkages in Chapter 8. Except the Upstream Water supply that depends on the environment for its inputs, the rest of the sectors in this band cannot generate much indirect and induced new value added in the whole economy because of their specialised and limited number of linkages, to other sectors of the economy as discussed in Chapter 7.

In terms of overall value added multipliers over the study period, Figures 8.21 to Figure 8.26 show the pattern of relative change for both indirect and induced value added multipliers. The results show that Gas (incl. Nat Gas, LNG and CSG) (S04) through linkages generates the highest new value added as a result of unitary increase in its final demand in the whole economy over the period 1975 to 1990. However, the Australian recession in 1990 affected demand and the Sector's production dropped below the 1975 production level. As a result, the Sector's indirect value added effects declined. Since 1995 its production increased and thus its value added. These results are consistent with the output multipliers results, which described earlier in this Chapter. The next in the rank is Other Mineral Mining (S06) Sector, followed by Gas Supply (S28).

The sectors with the lowest indirect value added multiplier are Exploration and Mining Support Services (S05), followed by Petroleum products manufacturing (S12). The latter results are consistent with the linkages estimated through IOFQLAF; and consistent with output multipliers, and the high level of imports by the Petroleum products (S12) as discussed in Chapter 7.

The induced value added multipliers results are similar to indirect value added multiplier with minor differences. Appendix VIII, Tables VIII.10, and Table VIII.11 provide details of induced and indirect value added multipliers over the period 1975 to 2015.

Figure 8.21: Indirect value added multipliers, Electricity Sector, 1975-2015 (Index, 1975=100)

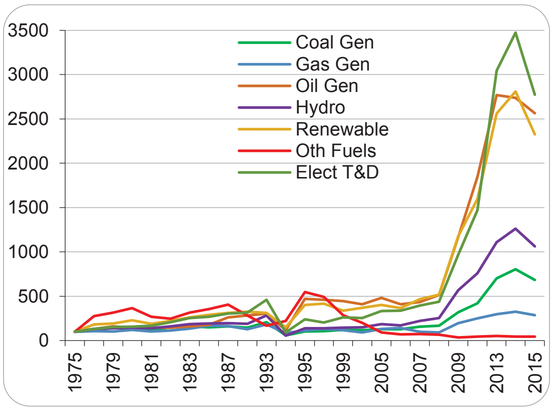


Figure8.22: Indirect value added multipliers, Other Energy, 1975-2015 (Index, 1975=100)

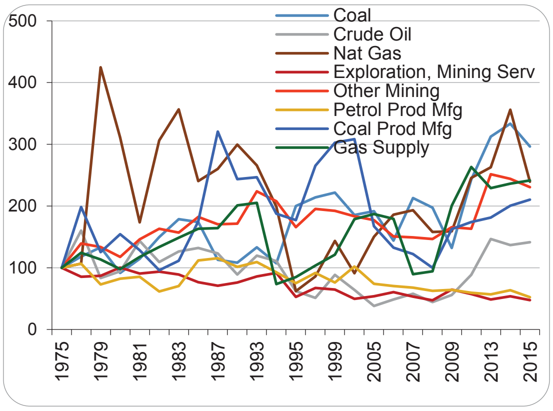


Figure 8.23: Indirect value added multipliers, Electricity, 1975-2015 (Index, 1975=100)

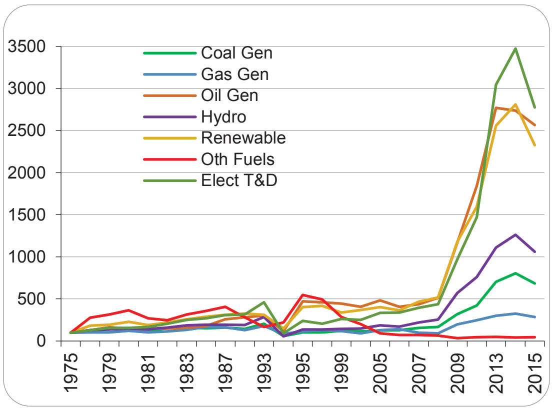


Figure 8.24: Indirect value added multipliers, Energy Sectors, 1975-2015 (Index, 1975=100)

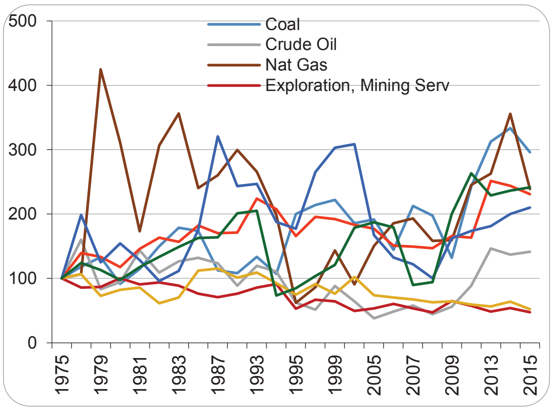


Figure 8.25: Indirect value added multipliers, Water Sector, 1975-2015 (Index, 1975=100)

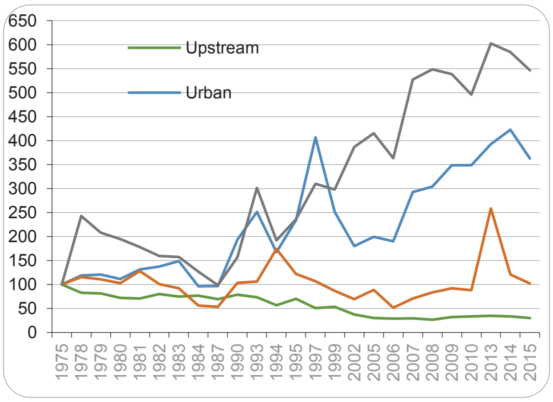
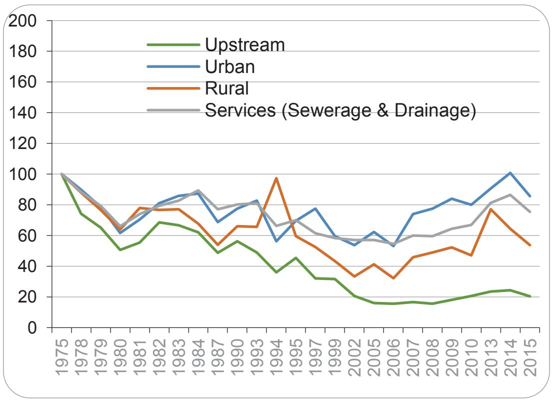


Figure 8.26: Indirect value added multipliers, Major Sectors, 1975-2015 (Index, 1975=100)



Source: This author, based on data from model developed in this research.

8.1.5 Multiplier Relationships, and Policy Impacts

Because output multipliers only show the degree of inter-sectoral linkages, they are not useful for socio-economic policies unless they are translated into economy-wide impacts, for example, new employment or new income multipliers. The literature shows that output multipliers sometimes are used as a preferred tool to justify development policies for sectors of interest either because they produce larger magnitudes in comparison with income and employment multipliers in some economies; or when the underlying data for estimating income and employment multipliers are not readily available. For example see Miernyk (1965), Richardson (1985), Greig (1999), and Baumol & Blinder (1985). According to Archer (1984) the use of output multipliers alone are misleading, and not useful as a policy and planning tool.

In order to investigate which sectors' output multipliers in the context of this research is translated into new employment, income, and value added multiplier effects for policy and investments purposes, Table 8.15 is developed. This Table is based on the output multipliers, multiplier bands, and the sectoral ranking orders in Table 8.1. Each of these sectors, then compared with the sectors in the same classification band in Table 8.8 for employment effects, Table 8.9 for income effects, and Table 8.13 for value added effects in order to identify the sectors whose outputs have been conducive to generating new employment, new income, and new value added multiplier effects in the whole economy. The out-of-band results are not considered in this comparison in order to maintain focus on the economic ranking of output multipliers, and their magnitudes. For example, the Rural Water Supply (S30) which is in the Low Value Added Multiplier Band in Table 8.13 is not considered in the comparison, because the Sector is in the Medium Output Multiplier Band in Table 8.1. This approach assists to determine the degree with which output multipliers within their ranking hierarchy can be used as a policy tool.

The outcomes of this investigation reveal that Electricity Transmission and Distribution (S27); Printing, publishing other than music and Internet (S11); Other Mineral Mining (S06); Chemical Products (S14); and Upstream Water Supply (S29) Sectors can generate new outputs, employment, income and value added in the whole economy as a result of unitary change in final demand. In fact, Electricity T&D is the only sector which generates the highest level of aforementioned multiplier effects consistently over the study period. Therefore, for policy purposes reliance on output multipliers of these sectors as marked in Table 8.14 is fully appropriate. It is noteworthy that output translation into employment and income need to be considered in the context of the study and the sector(s) involved. For example, if the focus of the policy is on employment in a sector with high output multiplier capability, sectors like Electricity T&D (S27), Construction (S33), Non-Metallic and Mineral Products (S15), to name a few, are more suitable than high ranking output multiplier sectors with new income generation capacity, for example Electricity Generation by Hydro (S24) (Table 8.14).

Development of robust policies, and investments and planning decisions need to be based on measures beyond just multipliers results. The reason is that multipliers provide just one aspect of the multi-dimensional knowledge of linkages (as discussed in Chapters 6, 7). Also, employment and income multipliers suffer from estimation issues particularly in periods of slow economic

Table 8.14: Output multipliers translated into socio-economic types, 2014-15

			Multipliers Relationships				
	Sectors	Sec Code	Output	Employment	Income	Value Added	Policy Usefulness
High	Elec. T&D	S27	●	●	●	●	Fully Useful
High	Elec. Gen. Hydro	S24	●		●	●	Mostly Useful
High	Elec. Gen. Coal	S21	●		●	●	Mostly Useful
High	Elec. Gen. Oil	S22	●		●	●	Mostly Useful
High	Elec. Gen. Renew.	S25	●		●	●	Mostly Useful
Medium	Elec. Gen. Nat. Gas	S23	●		●	●	Mostly Useful
Medium	Govt Admin	S37	●			●	Useful, Conditional
Medium	Edu, Hlth & Cmty Serv.	S38	●			●	Useful, Conditional
Medium	Non-Ferrous Mfg	S17	●		●	●	Mostly Useful
Medium	Wsale & Retail	S34	●			●	Useful, Conditional
Medium	Const.	S33	●	●		●	Mostly Useful
Medium	Oth. Comml Serv.	S39	●			●	Useful, Conditional
Medium	Water Serv.	S32	●			●	Useful, Conditional
Medium	Wood Prod.	S10	●			●	Useful, Conditional
Medium	Rurl Water	S31	●				Not useful for socio-econ.
Medium	Coal	S02	●			●	Useful, Conditional
Medium	Non-Metal & Min. Prod.	S15	●	●			Useful, Conditional
Medium	Urb Water	S30	●				Not useful for socio-econ.
Medium	Explor. Mining	S05	●	●		●	Mostly Useful
Medium	Trsprt & Storage Serv.	S35	●	●		●	Mostly Useful
Medium	Food & Bev	S07	●	●			Useful, Conditional
Low	Print & Pub.	S11	●	●	●	●	Fully Useful
Low	Oth. Metal Prod.	S18	●		●	●	Mostly Useful
Low	Pulp & Paper Mfg	S09	●		●	●	Mostly Useful
Low	Comm, Fin. & Bus. Serv.	S36	●		●		Useful, Conditional
Low	Oth. Mining	S06	●	●	●	●	Fully Useful
Low	Iron & Steel Mfg	S16	●		●	●	Mostly Useful
Low	Gas Supply	S28	●			●	Useful, Conditional
Low	Ag., Forest & Fish'g	S01	●		●	●	Mostly Useful
Low	Chem. Prod.	S14	●	●	●	●	Fully Useful
Low	Crude Oil	S03	●		●	●	Mostly Useful
Low	Mfg Oth.	S20	●		●		Useful, Conditional
Low	Elec. Gen Oth. Fuel	S26	●			●	Useful, Conditional
Very Low	Coal Prod. Mfg	S13	●	●		●	Mostly Useful
Very Low	Nat Gas	S04	●	●			Useful, Conditional
Very Low	Petro. Prod. Mfg	S12	●	●		●	Mostly Useful
Very Low	Mach. & Transp Prod.	S19	●			●	Useful, Conditional
Very Low	Textile & Clothing	S08	●			●	Useful, Conditional
Very Low	Upstrm Water	S29	●	●	●	●	Fully Useful

Fully Useful; Mostly Useful; Useful, Conditional; Not useful for socio-econ.

Source: This author's analysis based on the outcomes of the model developed in this research.

growth when governments try to tighten spending. Also, the induced income effects which are measured by closed IO models over-estimate the income multipliers because not all extra incomes earned by households are spent in the economy. Moreover, reliance on just indirect multipliers effects may underestimates the benefits to the economy as extra households incomes will encourage additional spending on goods and services. According to Oosterhaven et al. (1986), using indirect and induced multiplier effects as the upper and lower bounds of correct indirect effects in the economy is more useful to policy and investments decisions, as they were discussed in this chapter too. Additionally, in terms of employment multipliers, policy decisions is proved more useful to be based on physical measure of jobs rather than monetary outcomes. Therefore, to overcome these limitations and issues, this research recommends to base policy and investment decisions on array of linkages descriptors, historical trends, and scenario analysis to incorporate comprehensive linkages information into policy development and decision-making processes.

There are divided views on suitability of multipliers for policy decisions. For example, the Australian Bureau of Statistics, ABS (2017e) has stopped production of multiplier reports since 1998-99 because of considerable debate in the user community on their suitability for policy impacts of projects which linked to government industry assistance. In contrast, there are other IO practitioners and users, for example Lewis (1988), Deller et al. (1993), Batini et al. (2014), World Bank (2015), Scottish Government (2015) which regard multipliers as the main tool for assessment of economic impact. This research regards application of multipliers insightful for preliminary policy analysis, while maintains its earlier views on collective analysis of linkages, for which multipliers are a part only. Moreover, this research recommends estimation of multipliers to study impacts of alternative policies or "exogenous shock" (discussed earlier) in the economy at the national or state levels. Nevertheless, the choice of multipliers and their regional dimensions are very important considerations. For example, the national multipliers which are estimated by this research are not suitable for alternative policy impact investigation at the state or regional levels. That is, the impact of an exogenous change for example in agriculture sector may prove more significant in a regional areas (using the local data to estimate multipliers) in comparison to the impact of the change in construction sector in state or national settings.

8.2 Linkage Elasticities

Two types of linkage elasticities are discussed in this section: 1) Elasticity of Sectoral Supply Response; and 2) Elasticity of Final Demand-Value Added Response (FD-VA) based on formulations described in Chapter 5.

8.2.1 Elasticity of Sectoral Supply Response (ESSR)

The ESSRs provide useful knowledge of inter-sectoral linkages by describing the degree of flexibility of a sector's supply response when faced with an increase in inter-industry demand. For example, Cuello (1992) found that it is not sufficient to know that a sector has strong backward or forward linkages; rather information is needed to know how flexibly it responds to an increase in demand. Table 8.15 represents the ESSRs in form of traffic light indicators over the period 1975 to 2015. In this Table, sectoral flexible supply responses (elastic supply) are shown in green; below average elasticities in orange; and inelastic supply responses in red. Also, Table VIII.12 in Appendix VIII show the elasticity indices (e_s) for each sector over the study period. For example, the e_s value of 4.9 for Electricity Generation by Natural Gas (S04) over the two consecutive years 2014-15 (t), and 2013-14 ($t-1$) - shown in column 2015-14 - are interpreted as: 1% increase in electricity supplied to intermediate sectors resulted in 4.9% increase in intermediate inputs into the electricity supply sector over the period 2013-14, and 2014-15 stimulating activities in other sectors of the economy over the period; or for Urban Water Supply (S30) with the e_s value of -5.6 over the consecutive periods 2008-09 and 2007-08 (represented by 2009-2008) it is interpreted as: 1% increase in water sector's total intermediate uses resulted in 5.60% decrease in water supply to other inter-industry sectors (the negative results means that the water sector needed to increase its intermediate uses more than 1% to be able to satisfy demand by other sectors). The elasticity indices (in absolute terms), in the context of this research, mainly compared with average index of one (i.e. $\Delta z_i/\Delta z_j = 1$) (see Chapter 5 for details), and the results are interpreted to determine the nature of sectoral elasticity which is shown by an appropriate traffic light indicator (Table 8.15).

The results show that only 32% of the Australian sectors respond flexibly to additional demand over two consecutive years; 37% respond below average; and the remaining 33% fail to respond because of inelastic supply. In comparison, over the two consecutive input-output periods 2007-08 and 2006-07, which was affected by GFC, only 26% of the sectors elastically responded to additional demand, while the responses of 31% of the sectors were below average, and about 44% of the sectors fail to respond because of their inelastic supply (Table 8.15). These overall percentages, more or less, apply to each set of the two consecutive years over the study period. (Table 8.15). For example, over the two consecutive years 2013-14 and 2014-15, the most recent input-output years, about 39% of the sectors respond to additional demand elastically; about 49% respond below average; and the supply-response of the remaining 13% is inelastic. The sectors whose response to additional demand is above average over the aforementioned period are: Agriculture, Forestry and Fishing (S01); Textile, clothing, footwear and leather (S08); Coal Products Manufacturing Sector (S13); all of the electricity sectors (S21 to S27); Rural Water Supply (S31); Construction (S33); Wholesale and Retail Trades (S34); and Government Administration, Defence, Public Order and Safety (S37). The sectors which identified with inelastic supply in this period are: Exploration and Mining Services (S05) because of slow down of mining activities impacting its operation (see Chapter 7); Pulp, Paper and Paperboard (S09); Basic Non-Ferrous Metal (S17); Gas Supply (S28); and Upstream Water Supply (S29).

Figure 8.27 shows sectoral classification in terms of overall severity of inelastic supply (shown in red) in High, Medium and Low categories. The Low category contains sectors whose elasticity of sectoral supply change to inelastic less than five times (out of the 24 set of two consecutive estimation years) over the study period (Table 8.15). Sectors whose supply elasticity estimated inelastic between 10 to 15 times over the period are placed in High Severity Category. The rest of the sectors in Medium category show inelastic supply between 5 to 9 times over the periods.

Sectors with the highest supply flexibility (10 to 16 times out of 24 estimations over the study

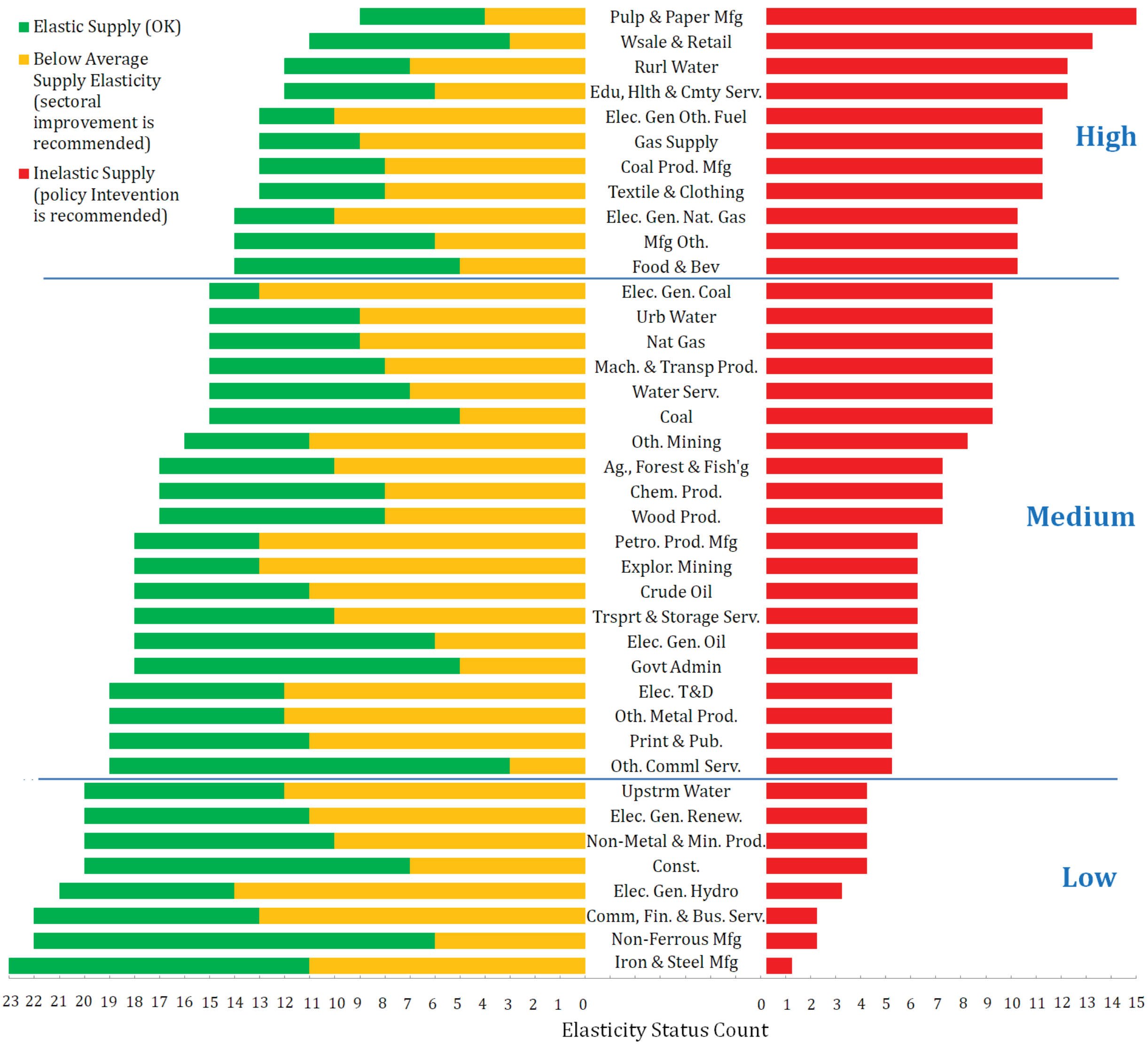
Table 8.15: Elasticity of sectoral supply, 1975 - 2015

Sector Name	Sect Code	2015-14	2014-13	2013-10	2010-09	2009-08	2008-07	2007-06	2006-05	2005-01	2002-99	1999-97	1997-95	1995-94	1994-93	1993-90	1990-87	1987-84	1984-83	1983-82	1982-81	1981-80	1980-79	1979-78	1978-75
Ag., Forest & Fish'g	S01	🟢	🟢	🟢	🟡	🟡	🟡	🟡	🟡	🟢	🟢	🔴	🔴	🟡	🟢	🔴	🔴	🟡	🟡	🔴	🔴	🟡	🟡	🔴	🟢
Coal	S02	🟡	🟢	🟡	🔴	🟡	🟢	🟢	🟢	🟡	🟢	🟢	🔴	🔴	🟢	🔴	🟢	🟢	🔴	🔴	🔴	🟡	🔴	🔴	🟢
Crude Oil	S03	🟡	🟡	🟢	🔴	🟡	🔴	🟢	🟢	🟡	🟡	🔴	🟡	🟢	🟡	🟢	🔴	🟡	🔴	🟡	🟡	🟢	🔴	🟡	🟢
Nat Gas	S04	🟡	🔴	🟡	🟡	🟢	🔴	🔴	🟡	🟡	🟢	🟡	🔴	🔴	🟡	🔴	🟢	🔴	🟢	🟡	🔴	🟢	🟢	🔴	🟡
Explor. Mining	S05	🔴	🟢	🟢	🔴	🟡	🟡	🟢	🟡	🟡	🟡	🔴	🟡	🟡	🟢	🔴	🟢	🟡	🔴	🔴	🟡	🟡	🟡	🟡	🟡
Oth. Mining	S06	🟡	🟢	🟡	🟡	🔴	🔴	🟢	🟢	🟡	🟡	🟡	🟡	🔴	🔴	🔴	🟡	🟡	🟡	🟢	🔴	🔴	🟢	🔴	🟡
Food & Bev	S07	🟡	🟢	🟢	🟢	🟡	🟢	🔴	🔴	🟢	🟡	🟢	🔴	🟢	🔴	🔴	🟢	🔴	🔴	🔴	🟡	🔴	🟢	🟡	🔴
Textile & Clothing	S08	🟢	🔴	🔴	🟡	🔴	🟢	🔴	🟡	🟡	🟡	🔴	🟢	🔴	🔴	🔴	🟡	🟢	🟡	🟡	🔴	🔴	🟡	🟢	🔴
Pulp & Paper Mfg	S09	🔴	🟡	🟡	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🟢	🔴	🔴	🟢	🟡	🔴	🟢	🔴	🔴	🟢	🔴	🟡	🔴	🔴
Wood Prod.	S10	🟡	🟡	🟡	🟡	🔴	🟢	🔴	🟢	🟢	🟡	🟡	🟡	🟡	🟢	🔴	🟢	🟢	🔴	🟢	🔴	🔴	🟢	🔴	🟢
Print & Pub.	S11	🟡	🟡	🟡	🔴	🔴	🟡	🟢	🟡	🟢	🟡	🟢	🟢	🟡	🔴	🟡	🟢	🟢	🟡	🔴	🟢	🟡	🔴	🟡	🟢
Petro. Prod. Mfg	S12	🟡	🟡	🔴	🟡	🟡	🟢	🟡	🟢	🟢	🟡	🔴	🔴	🟡	🔴	🟢	🟡	🟡	🟡	🟡	🔴	🟢	🟡	🔴	🟡
Coal Prod. Mfg	S13	🟢	🟡	🟢	🟢	🔴	🔴	🟢	🟢	🔴	🟡	🟡	🔴	🟡	🔴	🟡	🟡	🔴	🔴	🟡	🔴	🔴	🟡	🔴	🔴
Chem. Prod.	S14	🟡	🟡	🟡	🟢	🟢	🟢	🔴	🟡	🟢	🔴	🔴	🟡	🟡	🔴	🟡	🔴	🟢	🔴	🟢	🔴	🟡	🟢	🟢	🟢
Non-Metal & Min. Prod.	S15	🟡	🟡	🟡	🟡	🔴	🔴	🔴	🟢	🟡	🟢	🟢	🟢	🟢	🔴	🟡	🟢	🟡	🟡	🟢	🟢	🟡	🟢	🟢	🟡
Iron & Steel Mfg	S16	🟡	🟡	🟡	🟢	🟢	🟢	🟡	🟡	🟢	🟢	🟢	🟢	🟢	🟡	🟢	🟡	🟡	🟡	🟡	🔴	🟢	🟡	🟢	🟢
Non-Ferrous Mfg	S17	🔴	🟢	🟢	🟡	🟢	🟢	🟢	🔴	🟢	🟡	🟡	🟢	🟡	🟢	🟢	🟡	🟢	🟡	🟢	🟢	🟢	🟢	🟢	🟢
Oth. Metal Prod.	S18	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🟢	🟢	🟡	🔴	🟢	🔴	🟡	🟡	🟢	🔴	🟢	🔴	🟡	🟡	🟢	🔴
Mach. & Transp Prod.	S19	🟡	🔴	🟡	🔴	🔴	🔴	🟡	🔴	🟢	🟡	🟢	🟢	🟢	🟢	🔴	🟡	🟢	🔴	🟡	🟡	🔴	🟡	🔴	🟢
Mfg Oth.	S20	🟢	🟡	🟡	🟡	🟡	🟡	🟢	🔴	🟢	🔴	🔴	🔴	🟢	🟢	🔴	🔴	🟢	🔴	🟡	🔴	🔴	🟢	🟢	🔴
Elec. Gen. Coal	S21	🟢	🟡	🟢	🟡	🟡	🔴	🟡	🔴	🟡	🔴	🟡	🔴	🔴	🟡	🟡	🔴	🟡	🔴	🟡	🟡	🔴	🔴	🟡	🟡
Elec. Gen. Oil	S22	🟢	🟢	🟢	🟡	🟢	🔴	🟢	🔴	🟡	🟢	🟢	🔴	🔴	🟡	🟢	🟢	🔴	🟡	🟡	🟢	🟢	🟢	🔴	🟡
Elec. Gen. Nat. Gas	S23	🟢	🟢	🟢	🟡	🟡	🔴	🔴	🔴	🟡	🔴	🟢	🔴	🔴	🟡	🔴	🟡	🔴	🟡	🟡	🔴	🟡	🟡	🔴	🟡
Elec. Gen. Hydro	S24	🟢	🟡	🟢	🟡	🟢	🟡	🟡	🟡	🟡	🟢	🟡	🔴	🔴	🟡	🟡	🔴	🟢	🟡	🟡	🟡	🟢	🟢	🟡	🟡
Elec. Gen. Renew.	S25	🟢	🟡	🟢	🟡	🟢	🟡	🟢	🟡	🟢	🟢	🟢	🔴	🟡	🟢	🔴	🔴	🔴	🟡	🟡	🟡	🟡	🟢	🟡	🟡
Elec. Gen Oth. Fuel	S26	🟢	🟡	🟡	🔴	🟡	🔴	🟡	🟡	🟡	🟡	🔴	🔴	🔴	🟢	🔴	🔴	🔴	🟡	🟡	🟡	🔴	🟢	🔴	🔴
Elec. T&D	S27	🟢	🟡	🟢	🟡	🟢	🔴	🟡	🔴	🟡	🔴	🟡	🔴	🔴	🟡	🟡	🟢	🟢	🟢	🟡	🟡	🟡	🟢	🟡	🟡
Gas Supply	S28	🔴	🟡	🔴	🟡	🔴	🔴	🔴	🔴	🔴	🔴	🟢	🔴	🔴	🟡	🟢	🟡	🟢	🟢	🟡	🟡	🟡	🔴	🟡	🟡
Upstrm Water	S29	🔴	🟡	🔴	🔴	🔴	🟡	🟢	🟢	🟡	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟢	🟢	🟢	🟡	🟢	🟢
Urb Water	S30	🟡	🟡	🔴	🔴	🔴	🟡	🟡	🟢	🟡	🟢	🔴	🔴	🔴	🔴	🟡	🟡	🟢	🔴	🟢	🟢	🟡	🟢	🔴	🟡
Rurl Water	S31	🟢	🔴	🟡	🔴	🟢	🔴	🟡	🔴	🔴	🔴	🟢	🟡	🔴	🔴	🟢	🟡	🔴	🔴	🔴	🟡	🔴	🟢	🟡	🟡
Water Serv.	S32	🟡	🟢	🟡	🔴	🟢	🔴	🟡	🔴	🟡	🟢	🔴	🔴	🟢	🟢	🟡	🟢	🔴	🔴	🟢	🟡	🔴	🟢	🔴	🟡
Const.	S33	🟢	🟢	🟡	🟢	🟢	🟡	🟢	🟡	🟡	🔴	🟡	🟡	🟢	🟢	🟡	🔴	🟢	🟢	🔴	🟢	🔴	🟢	🟢	🟢
Wsale & Retail	S34	🟢	🔴	🟢	🔴	🟡	🔴	🔴	🔴	🟡	🟡	🔴	🟢	🟢	🔴	🔴	🔴	🔴	🔴	🔴	🔴	🟢	🟢	🟢	🟢
Trsprt & Storage Serv.	S35	🟡	🟢	🟡	🔴	🟢	🟡	🔴	🟢	🟡	🟡	🟢	🟡	🟢	🔴	🔴	🟢	🟡	🟡	🟢	🔴	🟡	🔴	🟢	🟡
Comm, Fin. & Bus. Serv.	S36	🟡	🟡	🟡	🟢	🟡	🟢	🟢	🟡	🟢	🟡	🟢	🟢	🟡	🔴	🟡	🟢	🟡	🟡	🔴	🟡	🟡	🟡	🟢	🟢
Govt Admin	S37	🟢	🟢	🟢	🟢	🟢	🔴	🟢	🟢	🟡	🟡	🟡	🟢	🟢	🟢	🔴	🟢	🟡	🔴	🟢	🔴	🟡	🔴	🔴	🟢
Edu, Hlth & Cmty Serv.	S38	🟡	🔴	🔴	🔴	🟡	🟢	🔴	🔴	🟡	🟢	🔴	🔴	🔴	🟢	🟢	🟡	🔴	🔴	🟢	🔴	🔴	🟢	🟡	🟡
Oth. Comml Serv.	S39	🟡	🟢	🟡	🟢	🔴	🟡	🟢	🟢	🟢	🟢	🟢	🔴	🟢	🔴	🔴	🟢	🟢	🔴	🟢	🟢	🟢	🟢	🟢	🟢

🟢 OK 🔴 Inelastic Supply, policy intevention is recommended 🟡 below average results, sectoral improvements needed

Source: Results generated by the model developed in this research.

Figure 8.27: Elasticity of Sectoral Supply, sectoral status, 1975 to 2015



Source: This author's analysis based on the model developed in Chapter 4.

period, the green segments on the graph) are: Other Commercial Services including Waste. Management (S39), and Basic Non-Ferrous Metal (S17) each with 16 times elastic supply status; Government Administration, Defence, Public Safety (S37), and Construction (S33) each with 13 times; Electricity Generation by Oil Products (S22), and Iron and Steel (S16) each with 12 times; Coal Mining (S02), and Non-Metallic and Mineral Products (S15) each with 10 times

These sectors are equally distributed in Low (S17, S33, S16, S15), and Medium (S39, S37, S22, S02) categories. The remaining sectors in the Low which responded to additional demand with less failure are: Communication, Finance, and Business Services (S36); Basic Non-Ferrous Metal (S17); Electricity Generation by Hydro (S24); Electricity Generation by Renewables (S25); and Upstream Water Supply (S29). The usefulness of this group of sectors - those in the Low category, and the sectors with the highest supply flexibility - is that in addition to the strength of their backward and forward linkages; majority have forward MICs (Most Important Coefficients) linkages (Chapter 6) as well as being the top Contributor to linkages of other sectors, for example

S36, S39, electricity sectors, S17, S29, S16 and S15, to name a few (Chapter 7). This means that these sectors play an important role in the economy to support increases in final demand. Therefore, they are useful for economic development and investments purposes too.

In contrast, the sectors in the High Inelastic Category such as: Pulp, Paper and Paperboard (S09); Wholesale and Retail Trades (S34); Rural Water Supply (S31); Education, Health and Community Services (S38); Electricity Generation by Other Fuels (S26); Gas Supply (S28); Coal Product Manufacturing (S13); Textile, clothing, footwear and leather (S08); and Electricity Generation by Natural Gas (S23); Other Manufacturing (S20); and Food and Beverage (S07) cannot effectively utilise the linkages placing production in other sectors at risk. Some of these sectors, for example S13, S23 and S31 are linked with forward MICs to other sectors, however because of their high risk inelastic supply jeopardise production in downstream sectors. The supply constraints of Electricity Generation by Gas (S23) is impacted by its backward MIC with its upstream Gas (S04) Sector whose supply is predicted to fall much lower from mid-2018 onwards (AEMA 2017). This complex knowledge of linkages play fundamental role in policy decisions. The full set of supply elasticity indices given in Appendix VIII, Table VIII.13.

The reasons for inflexible supply-responses to unitary increases in final demand can be interpreted as: *i*) impacts of economic events as discussed in Chapter 7; *ii*) the impacts of supply-specific factors affecting the supply sectors. For example, according to Roger (2008) factors such as price of relevant resources, production technology, prices of other goods, number of linked sectors (discussed in Chapter 6), expectation of future price, governments' taxes and subsidies, government restrictions on imports, and industry regulations can impact sectoral supply; *iii*) inelastic upstream sectoral supply linkages as discussed in case of Electricity Generation by Gas, and Gas (S04); and *vi*) lack of investments to develop the sectoral production capacity.

It is assumed that the sectors in the Low inelastic supply category, potentially could improve their supply elasticity more readily than those in Medium and High categories. Policy approaches to transform inelastic and below average supply elasticities are briefly discussed section 8.2.3, policy implication of elasticity measures.

8.2.2 Elasticity of Sectoral Final Demand-Value Added (FD-VA) Response

The developed FD-VA complements the supply elasticity measures (formulation in Chapter 4). Table 8.16 shows the FD-VA sectoral elasticity results represented by traffic light indicators. Table VIII.13 in Appendix VIII shows total value added elasticity indices (e_v) for all sectors, while Table VIII.14 presents elasticity indices of compensation of employees (e_w), gross profits elasticity (e_p), and taxes on production (e_T) over the study period. These indices in comparison to average indices ($\Delta v_j/\Delta f_i = 1$), provide a useful tool to assess the elasticity of sectoral value added in terms of availability of primary inputs towards production of the required inputs needed by other sectors as a result of increases in final demand . The index of below one, is interpreted

Table 8.16: Final Demand - Value Added elasticities by sector, 1975-2015

Sector	Sect Code	2015-14	2014-13	2013-10	2010-09	2009-08	2008-07	2007-06	2006-05	2005-01	2002-99	1999-97	1997-95	1995-94	1994-93	1993-90	1990-87	1987-84	1984-83	1983-82	1982-81	1981-80	1980-79	1979-78	1978-75
Ag., Forest & Fish'g	S01	🔴	🔴	🟡	🟡	🟡	🟢	🟢	🟢	🟡	🟢	🔴	🟡	🔴	🔴	🟡	🟢	🟢	🟡	🟢	🔴	🟡	🟡	🟢	🟡
Coal	S02	🔴	🟢	🔴	🟢	🟢	🟢	🟢	🟢	🟡	🟢	🟢	🟢	🔴	🟢	🟡	🟢	🟡	🟡	🟡	🔴	🟢	🔴	🔴	🟢
Crude Oil	S03	🟢	🟢	🔴	🔴	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🟢	🟡	🟢	🟢	🟢	🟡	🟡	🔴	🔴	🟡	🔴	🟢	🟡
Nat Gas	S04	🔴	🔴	🟡	🟢	🟢	🔴	🟡	🟡	🟢	🟡	🟡	🔴	🟢	🟡	🔴	🟡	🟡	🟢	🟡	🟢	🟡	🟢	🟢	🟡
Explor. Mining	S05	🟡	🔴	🟡	🔴	🔴	🟡	🟡	🟡	🟡	🟢	🟡	🟡	🟡	🔴	🔴	🔴	🟢	🔴	🔴	🟡	🟢	🔴	🟡	🔴
Oth. Mining	S06	🟢	🟡	🟡	🟡	🔴	🟡	🟢	🟡	🟢	🟡	🟡	🔴	🔴	🔴	🔴	🟡	🟡	🟢	🟡	🔴	🔴	🟢	🔴	🟢
Food & Bev	S07	🔴	🟢	🔴	🟢	🟢	🔴	🟡	🟡	🟢	🔴	🔴	🔴	🔴	🟢	🟡	🟢	🟡	🟡	🔴	🟡	🟡	🟡	🔴	🔴
Textile & Clothing	S08	🟡	🟢	🔴	🔴	🟢	🔴	🟢	🟢	🔴	🟢	🟡	🟢	🟡	🟡	🟡	🔴	🟡	🟡	🟡	🟡	🔴	🔴	🟢	🔴
Pulp & Paper Mfg	S09	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🔴	🔴	🟡	🔴	🔴	🟡	🟡	🔴	🔴	🟡	🔴	🟡	🔴	🔴	🟡
Wood Prod.	S10	🟡	🔴	🟡	🟡	🟡	🔴	🔴	🔴	🟡	🟡	🟡	🟡	🟢	🟡	🔴	🔴	🟡	🟡	🟢	🟡	🔴	🔴	🟡	🟡
Print & Pub.	S11	🟡	🟢	🟢	🔴	🔴	🔴	🟡	🟡	🟡	🟡	🔴	🟡	🟡	🟢	🟡	🟡	🟢	🔴	🔴	🔴	🔴	🟡	🟡	🟡
Petro. Prod. Mfg	S12	🔴	🟡	🟢	🟢	🟢	🟡	🔴	🟢	🟢	🟡	🟡	🟡	🟢	🔴	🟢	🔴	🔴	🟢	🔴	🟢	🟢	🔴	🔴	🟡
Coal Prod. Mfg	S13	🟡	🟡	🟡	🔴	🔴	🔴	🔴	🟡	🔴	🟢	🟡	🟡	🟢	🟢	🟢	🔴	🟢	🟡	🔴	🟢	🟡	🔴	🔴	🟡
Chem. Prod.	S14	🟡	🟢	🟢	🟢	🔴	🟢	🟡	🔴	🟡	🔴	🔴	🟢	🟡	🔴	🔴	🟡	🔴	🟡	🟢	🔴	🔴	🔴	🔴	🟡
Non-Metal & Min. Prod.	S15	🔴	🔴	🔴	🟡	🔴	🟡	🔴	🔴	🟡	🔴	🔴	🔴	🔴	🔴	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🟢	🔴	🔴
Iron & Steel Mfg	S16	🟡	🟡	🟡	🟡	🟡	🔴	🟡	🟢	🟡	🟡	🟢	🟢	🟢	🔴	🟢	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟢	🟡
Non-Ferrous Mfg	S17	🟢	🔴	🟢	🟡	🟢	🟢	🟢	🔴	🟢	🔴	🔴	🟢	🟡	🟢	🔴	🟢	🟢	🟡	🟢	🟢	🟡	🟢	🔴	🟢
Oth. Metal Prod.	S18	🟡	🔴	🔴	🟡	🔴	🔴	🟡	🟡	🟡	🟢	🟢	🟡	🟢	🔴	🟡	🟡	🟡	🟡	🟢	🔴	🟡	🟡	🔴	🟡
Mach. & Transp Prod.	S19	🔴	🟡	🟡	🟢	🟢	🔴	🟡	🔴	🟡	🔴	🔴	🟡	🟢	🟢	🔴	🟡	🟢	🔴	🔴	🟡	🟢	🟢	🟡	🔴
Mfg Oth.	S20	🟢	🔴	🟢	🔴	🟢	🟡	🟢	🟡	🔴	🔴	🔴	🟡	🟡	🟢	🔴	🟢	🟡	🟡	🟡	🟢	🔴	🟡	🟡	🔴
Elec. Gen. Coal	S21	🟡	🟢	🔴	🟡	🔴	🔴	🟢	🔴	🟡	🔴	🟡	🟡	🟡	🟡	🟡	🟢	🔴	🟢	🟡	🔴	🟢	🟢	🔴	🟡
Elec. Gen. Oil	S22	🟢	🟡	🟢	🔴	🔴	🔴	🔴	🟢	🟡	🟢	🟢	🟡	🔴	🟢	🔴	🔴	🟡	🟡	🟢	🟢	🔴	🔴	🔴	🔴
Elec. Gen. Nat. Gas	S23	🔴	🔴	🟢	🟢	🟢	🟡	🟢	🟢	🟢	🟡	🟢	🟡	🔴	🟡	🔴	🔴	🔴	🔴	🔴	🔴	🟢	🔴	🟡	🔴
Elec. Gen. Hydro	S24	🔴	🟢	🟢	🟡	🔴	🟢	🟢	🟡	🔴	🟢	🟡	🟡	🔴	🟡	🟡	🔴	🔴	🟡	🟢	🟡	🟢	🟡	🟡	🟡
Elec. Gen. Renew.	S25	🟢	🟡	🟢	🟡	🔴	🟢	🟡	🟢	🟢	🔴	🔴	🟡	🟡	🟢	🟢	🟡	🟡	🟡	🔴	🟢	🟢	🟡	🟡	🟢
Elec. Gen Oth. Fuel	S26	🟢	🟡	🟡	🟡	🟡	🟡	🟢	🟢	🟢	🟡	🟢	🟡	🟡	🟢	🟡	🟢	🟡	🟡	🟢	🟢	🟢	🟢	🟡	🟢
Elec. T&D	S27	🔴	🟢	🟢	🟡	🔴	🔴	🟡	🔴	🟡	🟢	🟡	🟡	🟡	🟡	🟡	🔴	🔴	🟡	🟡	🔴	🟡	🟢	🟡	🔴
Gas Supply	S28	🔴	🟡	🟢	🔴	🟢	🔴	🔴	🔴	🔴	🔴	🟡	🔴	🔴	🔴	🟡	🟡	🔴	🟢	🔴	🟡	🔴	🔴	🔴	🟢
Upstrm Water	S29	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡	🟡
Urb Water	S30	🟡	🟡	🟢	🟢	🔴	🟡	🟢	🟡	🟢	🟢	🔴	🔴	🟢	🟡	🟡	🟡	🟡	🟢	🟢	🟢	🟡	🟢	🔴	🟢
Rurl Water	S31	🔴	🟢	🔴	🔴	🔴	🔴	🟢	🟢	🔴	🟡	🟢	🟢	🔴	🟡	🟡	🟡	🟡	🟢	🟢	🔴	🔴	🟡	🟡	🟡
Water Serv.	S32	🟡	🟢	🟢	🔴	🟡	🔴	🟢	🟢	🟡	🟡	🟡	🔴	🟢	🟡	🔴	🟡	🟡	🟢	🟢	🟢	🟢	🟢	🟢	🟡
Const.	S33	🔴	🟢	🟡	🔴	🟡	🟡	🟢	🟡	🟡	🔴	🟡	🟢	🔴	🟢	🟡	🔴	🟡	🟢	🟡	🟢	🟡	🟡	🔴	🟡
Wsale & Retail	S34	🟡	🟡	🟢	🟢	🔴	🔴	🟡	🔴	🟢	🟡	🟡	🔴	🟡	🟡	🔴	🔴	🟡	🟡	🟡	🔴	🔴	🔴	🟡	🟢
Trsprt & Storage Serv.	S35	🟢	🔴	🟢	🔴	🟡	🟡	🟢	🔴	🟡	🟡	🟡	🟡	🔴	🔴	🟡	🔴	🟡	🟡	🔴	🔴	🟢	🟢	🟡	🔴
Comm, Fin. & Bus. Serv.	S36	🟡	🟡	🟡	🟢	🟡	🟢	🔴	🟢	🟢	🟡	🟢	🟢	🟡	🔴	🟡	🟢	🟡	🔴	🟢	🟡	🟡	🟡	🟢	🟢
Govt Admin	S37	🟢	🟡	🟢	🟢	🟡	🔴	🟢	🟢	🟢	🟢	🟡	🟢	🔴	🟢	🟡	🔴	🟡	🔴	🟡	🔴	🟡	🟢	🔴	🔴
Edu, Hlth & Cmty Serv.	S38	🟡	🟡	🟢	🟢	🟡	🟡	🟡	🟢	🟡	🟢	🟡	🟢	🔴	🟢	🟢	🔴	🟢	🟡	🟡	🔴	🟡	🟢	🟢	🟡
Oth. Comml Serv.	S39	🟡	🟡	🟡	🟢	🟢	🔴	🔴	🟡	🟢	🟢	🟢	🟡	🟡	🔴	🟡	🟡	🟢	🟢	🟢	🟢	🟡	🟢	🟢	🟢

🟢 OK 🔴 Inelastic Supply, policy intevention is recommended 🟡 below average results, sectoral improvements needed

Source: Results generated by the model developed in this research.

as inflexibility of the sector's value added to sufficiently respond to increased demand for its inputs. For example, Gas (incl. Nat Gas, LPG and CSG) (S04) Sector with elasticity values of $e_v = -2.06$, $e_w = -5.66$, $e_p = -1.49$, $e_T = 7.77$ (see Table VIII.14, Appendix VIII) over two consecutive periods of 2013-14 and 2014-15 are interpreted as follows: as a result of 1% increase in final demand of the Gas Sector, the primary factor inputs to the sector decreased overall.

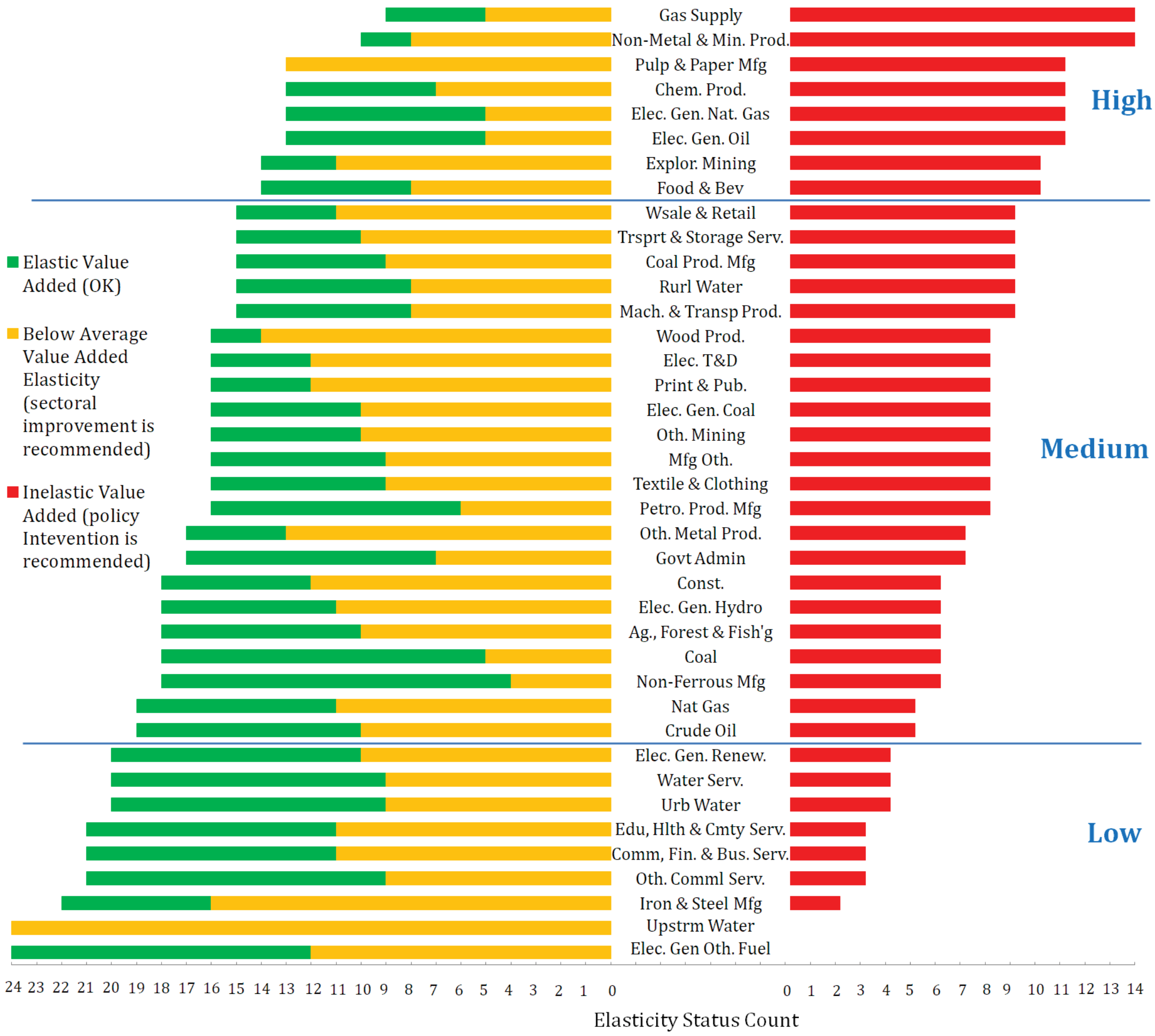
The reason for this overall decrease is due to 5.66% decrease in wages, 1.49% decrease in capital input, and 7.77% increase in taxes. The negative value added in this case means that the cost of primary factors of production is reduced because possibly more intermediate inputs are used. However, the Input-Output assumption is that as the production of outputs increases the required primary factors need to be increased proportionally.

The overall average FD-VA elasticity results over the period 1975 to 2015 show that only 29% of the Australian sectors can flexibly provide above average value added inputs towards their additional production as inputs to other sectors, because of increases in final demand; 41% of the sectors respond with below average elasticity; and the remaining 30% have inelastic value added unable to produce the required inputs for being supplied to their downstream sectors (Table 8.16, and Table VIII.13 in Appendix VIII). These percentages approximately apply to each set of the two consecutive years over the study period. For example, over the two consecutive years 2013-14 and 2014-15 about 23% of the sectors have elastic value added; elasticity response of about 44% the sectors is below average; and 33% experience inelastic supply. The sectors whose response to value added as a result of increases in final demand is above average over this period are: Crude Oil (incl. condensate) (S03); Other Mineral Mining (S06); Basic Non-Ferrous Metal (S17); Other Manufacturing (S20); Electricity Generation by Renewables (S25); Electricity Generation by Other Fuels (S26); Transport and Storage Services (S35); and Government Administration, Defence, Public Order and Safety (S37). The reason for flexibility of value added response in these sectors is mainly related to capital intensive nature of energy, mineral, and mining sectors; and the high human services requirements of government administration sectors. Also, it is found that some of the previously identified sectors with elastic supply such as S25, S26, S35 and S37 are among the group of sectors with flexible value added elasticity. Similar findings apply to other elasticity estimation sets of two consecutive years' data. Therefore, it is concluded that there is a direct relationship between elasticity of supply and elasticity of value added as further discussed below. This finding is supported by IO assumption that as the production increases the required primary factors need to be increased proportionally.

Figure 8.28 shows IOI, and other sectors of economy grouped into three categories of High, Medium and Low based on overall severity of each sector's inelastic value added indices over the period 1975 to 2015. Similar classification details as previously described apply here too.

Each sector's value added elasticity status change over the period 1975 to 2015 for economic and technology reasons which discussed earlier. The top 10 sectors with the highest count of relatively stable elastic value added status over the study period are: Basic Non-Ferrous Metal Manufacturing (S17), 14 out of 24, followed by Coal Mining (S02), 13 out of 24; Other Commercial Services (S39) and Electricity Generation by Other Fuels (S26) each with 12 out of 24; Urban Water Supply (S30), and Water Services (Sewerage & Drainage) (S32) each with 11 times out of 24; Petroleum Products (S12); Government Administration, Defence, Public Safety

Figure 8.28: Overall sectoral elasticity of Final Demand-Value Added Response, 1975-2015



Source: This author, based on the model developed in this research.

(S37); Electricity Generation by Renewables (S25); Communication, Finance, and Business Services (S36); and Education, Health and Community Services (S38) each with 10 out of 24.

The results of the supply and value added elasticity indices for each sector over the same elasticity estimation periods show that not necessarily a low performing sector in terms of supply response would also demonstrate the same inflexibility in terms of primary factors needed for increasing additional supply, and vice versa. Therefore, this research has evaluated sectoral elasticities in details in order to investigate how these elasticities are interlinked, and in what way the poor performing sectors can be assisted. For this purpose, Final Demand - Value Added elasticity indices are extended (as discussed earlier); and sectoral classes are compared and contrasted.

Comparison of the sectors in the Low category in both Figure 8.27 (supply elasticity) and Figure 8.28 (value added elasticity) shows four sector in common: Upstream Water (S29), Electricity generation by Renewables (S25); Communication, Finance and Business Services (S36); and Iron and Steel (S16). These results reveal a direct relationship between elasticity performances. That is, these sector not only flexibly respond to additional demand by supplying the required inputs to the linked downstream sectors, also, they flexibly provide additional primary inputs which are needed for producing the extra supply. Furthermore, occurrences of inelastic supply, and inelastic value added for these sectors are low (about 17%, 4 times out of 24 estimations). Furthermore, similar comparison for Medium and High categories identifies two groups of sectors whose both supply and value added follow the same performances pattern. These sectors are shown in Table 8.17. The results of these comparisons reveal that for the identified sectors the supply, and value added elasticity performances are directly interlinked. That is, in part, if a sector's supply elasticity is poorly estimated, it is because of its poor value added performance, and vice versa.

Table 8.17: Sectors with both supply and value added inelasticities, 1975-2015

Low		Medium		High	
Sector	Code	Sector	Code	Sector	Code
Upstrm Water	S29	Elec. Gen. Coal	S21	Gas Supply	S28
Elec. Gen Oth. Fuel	S26	Nat Gas	S04	Elec. Gen. Nat. Gas	S23
Comm, Fin. & Bus. Serv.	S36	Mach. & Transp Prod.	S19	Pulp & Paper Mfg	S09
Iron & Steel Mfg	S16	Coal	S02	Food & Bev	S07
		Oth. Mining	S06		
		Ag., Forest & Fish'g	S01		
		Wood Prod.	S10		
		Petro. Prod. Mfg	S12		
		Crude Oil	S03		
		Trsprt & Storage Serv.	S35		
		Govt Admin	S37		
		Elec. T&D	S27		
		Oth. Metal Prod.	S18		
		Print & Pub.	S11		

The outcomes of elasticity analysis are useful in examining policy impact of supply and value added elasticities on scenarios aimed at economic development where effective sectoral performance, particularly at the supply side, is an important consideration. The reason is that the impact analysis of backward and forward linkages alone is not sufficient, rather information is needed to know how flexibly sectors respond to increase in demand through these linkages.

8.2.3 Policy Implication of Elasticity Measurements

The elasticity estimates in this research shows that first, the IOI and other sectors of the economy, particularly those in the Medium and High categories, do not demonstrate stable patterns of providing adequate supply to other sectors and value added inputs required for additional production in response to increases in final demand over the study period; second, the associated elasticity indices are highly inelastic; and third, there is a group of 22 sectors (Table 8.17) whose both supply and value added has considerably shifted into inelastic status over the study period. Therefore, the above findings calls for policy intervention and sectoral assistance to improve the supply elasticity of these sectors, initially by prioritising assistance to the group of 22 sectors.

Improving supply elasticity is very important because the literature shows that structural inflation would occur due to rigidity of sectors responding to increased demand for their supply which is used as inputs by other sectors towards their production, for example see Cuello (1992).

Some of the measures that could improve supply and value added elasticity include: increasing production capacity by adopting advanced competitive technologies through government assisted financial programs; encouraging and further developing public-private-partnership to strengthen investments in strategic sectors; improving the raw materials storage and distribution systems; develop sectoral multi-tasking and multi-skilling workforce; establishing new industries to take advantage of local resources such as land, wood, or other products that are native to the area to improve sectoral value added elasticity, to add value to local resources and raw materials, and to increase responsiveness to increases in final demand; improving primary inputs elasticities such as labour by providing additional incentives to skilled workforce in areas of need, or for hiring; reducing production costs through subsidies, lower taxes on production; restricting competitive imports of products and raw materials to reduce economic leakages as well as to increase domestic multipliers; and considering product diversification particularly in energy sector whose production are influenced by non-renewable nature of these resources.

8.3 Linkages by Final Demand Transformation Approach

This section presents the results of cumulative inputs into final demand through sectoral linkages as estimated by the final demand transformation approach (see Chapter 5 for formulation). This approach, cumulatively tracks inputs flowing into final demand from each of the contributing sectors. The reason for accounting inputs to final demand is that, satisfying final demand is not confined just to products from one supply sector, rather final demand sales is represented by supply from a cluster of contributing sectors including a main provider sector in the economy. Therefore, the final demand accounting overcomes the shortcomings of the existing IO accounting framework which despite cumulatively tracking every sectoral inputs for production, it cannot readily enable tracking of all direct and indirect inputs to final demand. For example, the electricity sector supplies some of its output to final demand, and also to manufacturing sectors through linkages. The latter sectors add value to the electricity's input by producing own products for supplying to final demand without crediting the electricity sector's inputs to final demand. Therefore, the actual total electricity that gone into final demand is not fully accounted for.

From a policy perspective, the outcome presented in this section is important because: first, it allows to understand the level of dependency of the Australian economy on its key production sectors for supporting final demand (Tables 8.18, 8.20); second, in conjunction with the standard IO accounting approach, it provides comparative estimates of each sector's value added, and its income component (Tables 8.19, 8.21); and third, reveal the extent by which jobs in other sectors are linked to the production sectors that are producing for the final demand (Tables 8.19 to 8.21). For example, Swenson (2014) reported the advantage of the final demand apportioning procedure because of its ability to determine total job linkages to key sectors in the Iowa State's economy. The results of Final Demand Input-Output Transformation Approach are given in Tables 8.18 to 8.21 for 2008-09 and 2014-15 respectively. These Tables show the cumulative magnitude of sectoral sales (inputs) flowing into final demand sales as sectors produce for final demand. The column totals (outputs, value added, households' incomes, and the number of jobs) are exactly the same as the original direct input-output accounting table totals (Tables 8.18 and 8.20), but each row of the Tables now inform how much of the whole economy flows through a particular sector as it sells to final demand.

This is an improvement over the existing direct accounting approach which only shows the amount which is provided by a supply sector (row sector i) to the final demand. By comparing the results in direct accounting table with the final demand IO accounting table, it is possible to demonstrate how the economy apparently is behaving versus how it is by considering the flow of intermediate inputs through different sectors. For example, sectors through their backward linkages demand additional inputs from their upstream sectors to respond to a unitary increases in final demand for their outputs; but many of the supplying sectors do not sell to final demand - they exist to supply intermediate inputs to sectors, or they only sell to households and therefore have a very few exports, or linkages with final demand. Retail and wholesale trade are good examples, as are the full range of business services. Accordingly, as they are not selling to final demand, the vast majority of purchases from them find their way into either industries producing for final demand or into households (which supply the labour for producing goods and services). Hence, their transformed total output (and value added) is much less than it originally appeared.

This transformation is merely a linkage device to show which and by how much sectoral activity in an economy is flowing into satisfying final demand for goods and services. For example, in 2014-15, the Gas (incl. Nat Gas, LPG and CSG) (S04) has direct output of AU$29.797b and pays AU$16.612b in value added. Also, the Sector generates 8,180 jobs, and creates total households income of AU$3.304b. But using the final demand input-output transformation, it is observed that Sector ultimately accounts for AU$39.354b billion in sectoral output - considering all other sectors' contributions to its production - and AU$19.741b in value added. Moreover, in reality it generates 10,979 jobs and creates a total households' income of AU$9.846b. These results are significantly higher than what are shown through the existing direct IO accounting model.

The final demand transformation result, therefore, act as a multiplier that underscores the

Table 8.18: Final demand IO summary table for Australia, 2008-09 (AU$m)

Final Demand Input-Output Transformation Approach

Sector Name	Sector Code	Total Sectoral Output	Percent of Total	Total Value Added	Percent of Total	Total Households Income	Percent of Total	Total Jobs (FTE)	Percent of Total
Ag., Forest & Fish'g	S01	49,136	1.65	20,552	1.60	8,915	1.30	207,381	2.25
Coal	S02	162,203	5.44	86,497	6.72	37,521	5.46	82,429	0.89
Crude Oil	S03	15,967	0.54	8,049	0.63	3,492	0.51	4,724	0.05
Nat Gas	S04	21,750	0.73	11,017	0.86	4,779	0.70	5,914	0.06
Explor. Mining	S05	22,944	0.77	9,767	0.76	4,237	0.62	52,139	0.57
Oth. Mining	S06	133,544	4.48	58,586	4.55	25,414	3.70	128,213	1.39
Food & Bev	S07	68,537	2.30	24,498	1.90	10,627	1.55	134,169	1.46
Textile & Clothing	S08	7,969	0.27	2,244	0.17	973	0.14	14,752	0.16
Pulp & Paper Mfg	S09	1,053	0.04	307	0.02	133	0.02	4,626	0.05
Wood Prod.	S10	4,827	0.16	1,876	0.15	814	0.12	14,862	0.16
Print & Pub.	S11	6,503	0.22	2,812	0.22	1,220	0.18	15,304	0.17
Petro. Prod. Mfg	S12	8,911	0.30	2,708	0.21	1,175	0.17	1,397	0.02
Coal Prod. Mfg	S13	293	0.01	87	0.01	38	0.01	36	0.00
Chem. Prod.	S14	41,834	1.40	12,785	0.99	5,546	0.81	43,180	0.47
Non-Metal & Min. Prod.	S15	1,225	0.04	477	0.04	207	0.03	2,385	0.03
Iron & Steel Mfg	S16	9,140	0.31	2,931	0.23	1,271	0.19	14,295	0.16
Non-Ferrous Mfg	S17	136,836	4.59	46,157	3.59	20,022	2.91	82,229	0.89
Oth. Metal Prod.	S18	14,695	0.49	5,304	0.41	2,301	0.33	26,372	0.29
Mach. & Transp Prod.	S19	162,886	5.46	40,266	3.13	17,467	2.54	200,203	2.17
Mfg Oth.	S20	9,390	0.32	2,847	0.22	1,235	0.18	77,209	0.84
Elec. Gen. Coal	S21	11,889	0.40	5,366	0.42	2,328	0.34	16,427	0.18
Elec. Gen. Oil	S22	213	0.01	104	0.01	45	0.01	292	0.00
Elec. Gen. Nat. Gas	S23	2,361	0.08	906	0.07	393	0.06	2,442	0.03
Elec. Gen. Hydro	S24	714	0.02	315	0.02	137	0.02	1,195	0.01
Elec. Gen. Renew.	S25	1,120	0.04	541	0.04	234	0.03	1,598	0.02
Elec. Gen Oth. Fuel	S26	347	0.01	242	0.02	105	0.02	0	0.00
Gas Supply	S28	50	0.00	21	0.00	9	0.00	218	0.00
Urb Water	S30	4,147	0.14	1,883	0.15	817	0.12	10,783	0.12
Rurl Water	S31	178	0.01	85	0.01	37	0.01	220	0.00
Water Serv.	S32	4,176	0.14	1,724	0.13	748	0.11	10,849	0.12
Const.	S33	662,112	22.21	261,118	20.28	113,269	16.48	1,891,981	20.52
Wsale & Retail	S34	146,955	4.93	66,663	5.18	28,917	4.21	848,658	9.21
Trsprt & Storage Serv.	S35	128,228	4.30	54,024	4.20	23,435	3.41	389,652	4.23
Comm, Fin. & Bus. Serv.	S36	121,726	4.08	61,072	4.74	26,492	3.86	322,787	3.50
Govt Admin	S37	308,041	10.33	148,170	11.51	64,274	9.35	1,685,232	18.28
Edu, Hlth & Cmty Serv.	S38	308,477	10.35	164,843	12.81	71,506	10.41	2,670,625	28.97
Oth. Comml Serv.	S39	36,832	1.24	15,928	1.24	6,909	1.01	253,465	2.75
	Value Added	0	0.00	0	0.00	0	0.00	0	0.00
	Households	363,532	12.20	164,537	12.78	200,104	29.12	0	0.00
	Total	**2,980,741**	**100.00**	**1,287,307**	**100.00**	**687,146**	**100.00**	**9,218,243**	**100.00**

Table 8.19: Direct industrial activity summary, 2008-09 (AU$m)

Direct Input-Output Accounting Approach

Sector Code	Total Sectoral Output	Percent of Total	Total Value Added	Percent of Total	Total Households Income	Percent of Total	Total Jobs (FTE)	Percent Total Jobs
S01	77,803	2.61	31,986	2.48	8279	1.20	304,804	3.31
S02	68,293	2.29	47,991	3.73	5280	0.77	32,215	0.35
S03	32,312	1.08	18,027	1.40	1826	0.27	8,873	0.10
S04	22,010	0.74	12,516	2.48	950	0.14	5,555	0.06
S05	18,930	0.64	7,139	0.55	5144	0.75	39,928	0.43
S06	89,274	3.00	40,298	3.13	7769	1.13	79,560	0.86
S07	109,078	3.66	25,180	1.96	15470	2.25	198,208	2.15
S08	24,301	0.82	4,302	0.33	2391	0.35	41,755	0.45
S09	5,023	0.17	802	0.06	417	0.06	20,491	0.22
S10	15,076	0.51	4,840	0.38	2795	0.41	43,087	0.47
S11	41,296	1.39	18,345	1.43	9064	1.32	90,208	0.98
S12	48,720	1.63	4,141	0.32	722	0.11	7,090	0.08
S13	651	0.02	69	0.01	12	0.00	75	0.00
S14	81,151	2.72	14,601	1.13	8013	1.17	77,751	0.84
S15	20,812	0.70	6,752	0.52	3633	0.53	37,606	0.41
S16	31,089	1.04	5,442	0.42	3170	0.46	45,137	0.49
S17	63,296	2.12	8,845	0.69	3059	0.45	35,307	0.38
S18	39,819	1.34	12,480	0.97	7871	1.15	66,335	0.72
S19	176,322	5.92	21,942	1.70	15690	2.28	201,164	2.18
S20	16,520	0.55	3,341	0.26	2018	0.29	126,084	1.37
S21	31,781	1.07	13,900	1.08	4457	0.65	40,759	0.44
S22	879	0.03	475	0.04	152	0.02	1,120	0.01
S23	4,243	0.14	1,105	0.09	354	0.05	4,075	0.04
S24	2,941	0.10	1,298	0.10	416	0.06	4,569	0.05
S25	3,233	0.11	1,690	0.13	542	0.08	4,280	0.05
S26	441	0.01	439	0.03	141	0.02	0	0.00
S28	2,628	0.09	1,032	0.08	213	0.03	10,651	0.12
S30	7,750	0.26	4,086	0.32	1055	0.15	18,703	0.20
S31	706	0.02	382	0.03	98	0.01	809	0.01
S32	7,312	0.25	2,589	0.20	1719	0.25	17,634	0.19
S33	393,437	13.20	130,673	10.15	82303	11.98	1,043,564	11.32
S34	335,464	11.25	164,705	12.79	112864	16.42	1,798,263	19.51
S35	156,659	5.26	64,074	4.98	32534	4.73	441,883	4.79
S36	638,098	21.41	370,097	28.75	147506	21.47	1,570,651	17.04
S37	121,479	4.08	66,749	5.19	54704	7.96	616,896	6.69
S38	193,192	6.48	133,588	10.38	117526	17.10	1,552,519	16.84
S39	98,725	3.31	41,389	3.22	26987	3.93	630,634	6.84
Total	**2,980,741**	**100.00**	**1,287,307**	**100.00**	**687,146**	**100.00**	**9,218,243**	**100.00**

Source: Results obtained from the model developed in this research.

Table8.20: Final demand IO summary table for Australia, 2014-14 (AU$m)

Final Demand Input-Output Transformation Approach

Sector Name	Sector Code	Total Sectoral Output	Percent of Total	Total Value Added	Percent of Total	Total Households Income	Percent of Total	Total Jobs (FTE)	Percent of Total
Ag., Forest & Fish'g	S01	65,352	1.86	28,845	1.83	14,386	1.53	205,669	2.13
Coal	S02	120,648	3.44	52,710	3.35	26,289	2.79	126,229	1.31
Crude Oil	S03	29,394	0.84	13,879	0.88	6,922	0.74	12,991	0.13
Nat Gas	S04	39,354	1.12	19,741	1.26	9,846	1.05	10,979	0.11
Explor. Mining	S05	18,981	0.54	9,303	0.59	4,640	0.49	57,270	0.59
Oth. Mining	S06	199,107	5.67	93,511	5.95	46,639	4.95	258,168	2.67
Food & Bev	S07	79,758	2.27	29,326	1.86	14,626	1.55	133,480	1.38
Textile & Clothing	S08	4,425	0.13	866	0.06	432	0.05	5,683	0.06
Pulp & Paper Mfg	S09	519	0.01	155	0.01	77	0.01	1,704	0.02
Wood Prod.	S10	4,884	0.14	1,871	0.12	933	0.10	11,901	0.12
Print & Pub.	S11	9,812	0.28	4,199	0.27	2,094	0.22	23,678	0.24
Petro. Prod. Mfg	S12	6,763	0.19	1,897	0.12	946	0.10	1,285	0.01
Coal Prod. Mfg	S13	210	0.01	61	0.00	30	0.00	40	0.00
Chem. Prod.	S14	41,010	1.17	12,931	0.82	6,450	0.68	37,866	0.39
Non-Metal & Min. Prod.	S15	1,679	0.05	655	0.04	327	0.03	2,352	0.02
Iron & Steel Mfg	S16	2,844	0.08	928	0.06	463	0.05	6,966	0.07
Non-Ferrous Mfg	S17	116,529	3.32	41,060	2.61	20,479	2.17	118,640	1.23
Oth. Metal Prod.	S18	13,689	0.39	5,098	0.32	2,542	0.27	19,138	0.20
Mach. & Transp Prod.	S19	118,966	3.39	28,084	1.79	14,007	1.49	131,009	1.36
Mfg Oth.	S20	7,500	0.21	2,109	0.13	1,052	0.11	54,176	0.56
Elec. Gen. Coal	S21	12,205	0.35	4,942	0.31	2,465	0.26	6,854	0.07
Elec. Gen. Oil	S22	204	0.01	93	0.01	47	0.00	214	0.00
Elec. Gen. Nat. Gas	S23	3,262	0.09	1,525	0.10	761	0.08	788	0.01
Elec. Gen. Hydro	S24	1,375	0.04	582	0.04	290	0.03	864	0.01
Elec. Gen. Renew.	S25	1,320	0.04	626	0.04	312	0.03	1,109	0.01
Elec. Gen Oth. Fuel	S26	10	0.00	7	0.00	3	0.00	0	0.00
Gas Supply	S28	507	0.01	215	0.01	107	0.01	1,015	0.01
Urb Water	S30	2,680	0.08	1,447	0.09	722	0.08	4,493	0.05
Rurl Water	S31	130	0.00	73	0.00	36	0.00	93	0.00
Water Serv.	S32	2,343	0.07	1,111	0.07	554	0.06	3,811	0.04
Const.	S33	835,212	23.79	325,890	20.72	162,538	17.26	2,014,317	20.84
Wsale & Retail	S34	154,533	4.40	73,095	4.65	36,456	3.87	772,057	7.99
Trsprt & Storage Serv.	S35	125,783	3.58	55,337	3.52	27,599	2.93	320,936	3.32
Comm, Fin. & Bus. Serv.	S36	199,864	5.69	102,567	6.52	51,155	5.43	380,974	3.94
Govt Admin	S37	372,372	10.61	189,214	12.03	94,371	10.02	1,755,498	18.16
Edu, Hlth & Cmty Serv.	S38	410,562	11.69	229,345	14.58	114,386	12.15	2,937,385	30.39
Oth. Comml Serv.	S39	44,478	1.27	20,281	1.29	10,115	1.07	245,730	2.54
	Value Added	0	0.00	0	0.00	0	0.00	0	0.00
	Households	462,733	13.18	219,118	13.93	266,555	28.31	0	0.00
	Total	**3,511,000**	**100.00**	**1,572,696**	**100.00**	**941,653**	**100.00**	**9,665,361**	**100.00**

Table 8.21: Direct industrial activity summary, 2014-15 (AU$m)

Direct Input-Output Accounting Approach

Sector Code	Total Sectoral Output	Percent of Total	Total Value Added	Percent of Total	Total Households Income	Percent of Total	Total Jobs (FTE)	Percent Total Jobs
S01	87,056	2.48	38,275	2.43	9511	1.01	269,874	2.79
S02	48,907	1.39	20,019	1.27	8382	0.89	50,404	0.52
S03	26,792	0.76	12,990	0.83	3289	0.35	11,664	0.12
S04	29,767	0.85	16,612	2.43	3304	0.35	8,180	0.08
S05	18,244	0.52	9,901	0.63	6269	0.67	54,221	0.56
S06	102,577	2.92	53,335	3.39	14054	1.49	131,013	1.36
S07	115,943	3.30	25,793	1.64	16980	1.80	191,133	1.98
S08	26,572	0.76	2,637	0.17	1873	0.20	33,615	0.35
S09	4,253	0.12	537	0.03	495	0.05	13,747	0.14
S10	16,073	0.46	4,275	0.27	3210	0.34	38,582	0.40
S11	31,641	0.90	12,566	0.80	8010	0.85	75,213	0.78
S12	48,329	1.38	4,416	0.28	849	0.09	9,042	0.09
S13	1,264	0.04	97	0.01	19	0.00	237	0.00
S14	80,181	2.28	14,624	0.93	8626	0.92	72,925	0.75
S15	23,920	0.68	6,859	0.44	4398	0.47	33,005	0.34
S16	15,736	0.45	2,696	0.17	2678	0.28	37,958	0.39
S17	41,756	1.19	3,765	0.24	3364	0.36	41,876	0.43
S18	37,071	1.06	10,721	0.68	8478	0.90	51,050	0.53
S19	173,165	4.93	20,315	1.29	16654	1.77	187,840	1.94
S20	15,857	0.45	2,551	0.16	1949	0.21	112,829	1.17
S21	80,188	2.28	26,024	1.65	8735	0.93	44,356	0.46
S22	1,750	0.05	791	0.05	265	0.03	1,805	0.02
S23	20,656	0.59	9,725	0.62	3264	0.35	4,915	0.05
S24	9,509	0.27	3,543	0.23	1189	0.13	5,886	0.06
S25	9,491	0.27	4,642	0.30	1558	0.17	7,849	0.08
S26	63	0.00	63	0.00	21	0.00	0	0.00
S28	7,037	0.20	2,548	0.16	431	0.05	13,885	0.14
S30	10,972	0.31	7,790	0.50	1290	0.14	18,117	0.19
S31	1,267	0.04	886	0.06	147	0.02	887	0.01
S32	8,964	0.26	4,307	0.27	2488	0.26	14,364	0.15
S33	454,183	12.94	141,210	8.98	88576	9.41	1,078,981	11.16
S34	372,266	10.60	189,250	12.03	142791	15.16	1,832,026	18.95
S35	178,005	5.07	74,760	4.75	42987	4.57	447,382	4.63
S36	898,413	25.59	521,446	33.16	221980	23.57	1,686,896	17.45
S37	143,149	4.08	85,758	5.45	80629	8.56	664,755	6.88
S38	252,495	7.19	185,387	11.79	185999	19.75	1,779,453	18.41
S39	117,490	3.35	51,582	3.28	36912	3.92	639,396	6.62
Total	**3,511,000**	**100.00**	**1,572,696**	**100.00**	**941,653**	**100.00**	**9,665,361**	**100.00**

Aggregate Sector Elect. T&D (S27) which is the sum of S21 to S26; and Upstrm Wtr Supply (S29), the sum of S30 and S31 were not included to prevent double counting.

Source: Results generated by the model developed in this research.

Table 8.22: Base sectors in Australian economy, 2014-15

		2008-09				2014-15			
Sector	**Code**	**Outputs**	**VA**	**Housholds**	**Jobs**	**Outputs**	**VA**	**Housholds**	**Jobs**
Coal	S02	2.38	1.80	7.11	2.56	2.47	2.63	3.14	2.50
Crude Oil	S03					1.10	1.07	2.10	1.11
Nat Gas	S04					1.32	1.19	2.98	1.34
Explor. Mining	S05	1.21	1.37	0.82	1.31	1.04	0.94	0.74	1.06
Oth. Mining	S06	1.50	1.45	3.27	1.61	1.94	1.75	3.32	1.97
Non-Ferrous Mfg	S17	2.16	5.22	6.54	2.33	2.79	10.91	6.09	2.83
Const.	S33	1.68	2.00	1.38	1.81	1.84	2.31	1.84	1.87
Govt Admin	S37	2.54	2.22	1.17	2.73	2.60	2.21	1.17	2.64
Edu, Hlth & Cmty Serv.	S38	1.60	1.23	0.61	1.72	1.63	1.24	0.61	1.65

Source: This author, based on the model developed in Chapter 4.

economic base of the Australian economy that is measured when the final demand result is divided by the original direct result ($FD/Direct$). Some multiplier values, like for the abovementioned example will be greater than 1.0 because they are primarily satisfying external demand. However, Wholesale and Retail Trades (S34) for example, shows a multiplier ratio of 0.42 for total outputs. This Sector exists to satisfy internal demand, not the external demand, therefore, would have a multiplier value that is much less than 1.0. The same can be interpreted for many industries in the model. Table 8.22 shows the sectors with a 1.0 or greater value (FD / Direct). These sectors are classified as Base (or Basic) sectors, and those less than 1.0 are classified as Supplier-to-Base, which exist to supply base sectors, or those that supply households.

Table 8.22 shows that the sectors whose FD/Direct ratio is above one is also relatively capable of creating more production as inputs to final demand, more contribution to value added, households income and jobs creation in the economy, and hence useful for policy and planning purposes.

Based on the Final Demand IO Transformation Approach, it is found that in 2014-15, the Australian economy was heavily dependent on the following key production sectors and service providers in terms of producing the highest level of input to the final demand: Construction (S33); Households for non-industry based services; Education, Health and Community Services (S38); Government Administration, Defence, Public Order and Safety (S37); Communication, Finance, Property and Business Services (S36); Other Mineral Mining (S06); Wholesale and Retail Trades (S34); Transport and Storage Services (S35); Coal (S02); Machinery, Transport and Machinery Products (S19); Basic Non-Ferrous Metal Manufacturing (S17) respectively (Table 8.19) . The same sectors, with slight change in ranking order, identified as the key contributors to final demand in 2008-09 too (Table 8.18). Similar pattern is prevailed over the period 1975 to 2015. The above sectors were also the key contributors to value added and generating income for households. Also, the Final Demand IO Transformation reveals that jobs in other sectors were linked to the same production sectors that were producing for the final demand (Tables 8.18 and 8.20). The direct IO accounting approach also provides similar sectoral pattern in terms of contribution to value added, however, in comparison to final demand approach, it cannot provide more accurate estimates of cumulative inputs to final demand, and generation of income for households, and job creations.

The Final Demand IO Transformation outcomes could have been further enhanced if the actual estimates of households' income by each sector were available. This research recommends further investigation into this area, perhaps through value added national accounts. Also, it is recommended that Australian Bureau of Statistics include collection of this data in its IO surveys.

8.4 Summary of Key Findings

- Out of 39 sectors, 12.8% are in the High band. High band is classified in this research as sectors that show the largest total direct, indirect and induced output multiplier effects. For example, output multipliers for sectors in the High band for 2014-15, range between 21.114 and 14.825. 41% of the sectors are in the Medium band (9.960 to 5.02), 30.8% in the Low band (4.870 to 3.153), and 15.4% in the Very Low band with output multipliers ranging from 2.910 to 1.157.
- Out of these sectors, output multipliers for Electricity Transmission and Distribution (T&D) (S27) have the highest impact as they consistently translate into positive socio-economic outcomes as reflected in new employment, income and value added multipliers over the study period, through linkages with other sectors as a result of one unit increase in final demand. This outcome indicates that reliance on output multipliers of Electricity T&D (S27) for policy objectives that are aimed at generating new employment and income is appropriate. Other sectors which exhibited similar characteristics to S27 are Printing, Publishing other than Music and Internet (S11); Other Mineral Mining (S06); Chemical Products (S14); and Upstream Water Supply (S29) Sectors.
- Output translation into employment, income and value added need to be considered in the context of the study and the sector(s) involved. For example, if the focus of the policy is on employment in a sector with high output multiplier capability, then sectors such as Electricity T&D (S27), Construction (S33), and Non-Metallic and Mineral Products (S15) are more suitable than top ranking output multiplier sectors with new income and value added generation capacity only, for example, Electricity Generation by Hydro (S24) (Section 8.1.5).
- The overall output multipliers of the electricity sectors are significantly higher and more stable in the post-GFC period (2009-2015), in relative ranking positions 1 to 7, in comparison to pre-GFC (1975-2008). The mjor reasons are changes to final demand as a result of economic stimulus over the period 2008-10 which increased demand for electricity; and the post-GFC declining pattern of electricity sectors' backward linkages implying access to more advanced technologies as evidenced by the introduction of photovoltaic solar energy and other renewable technologies; and increased electricity generation capacity which did not occur in pre-GFC period.

- Employment multipliers in 2014-15 in the High band range from 389,109 to 43,604 jobs; Other Manufacturing (S20) created the highest number of jobs (389,106) as a result of producing 1000 unit of output to respond to increased final demand for the sector. The next in the rank are Education, Health and Community Services (S38) with 143,439 jobs; Other Commercial Services (S39) (100,241); Pulp and Paper (S09) (87,288); and Government Administration, Defence, and Public Safety (S37) (84,603). Electricity T&D (S27) in this band in 7th rank with 61,037 jobs, and Wood Products (S10) in the 10th rank with 43,604. Application of labour intensive technology is the main reason for the high number of jobs in these sectors.
- Almost all of the electricity generation sectors are in the Medium employment band (38,806 to 19,696 jobs), with Electricity Generation by Hydro (S24) being the highest in the band. Electricity Generation by Gas (S23) is in the Low band (12,616 jobs). Natural energy resource-sectors in the Very Low band (3,106 to 2,038 jobs) because of their specialised workforce and access to highly advanced labour saving technologies. More importantly, the aforementioned sectors have the highest indirect and induced employment multiplier effects.
- 18% of the sectors (7 out of 39) were in the High income multiplier band in 2014-15, comprising 71% of electricity sectors, and Petroleum and Coal Products Manufacturing (S12, S13). Electricity Generation by Coal (S21) generated the highest total direct, indirect and induced income (AU$31m) per AU$1m additional outputs to meet increased final demand for coal.
- Also, 64% of the sectors were in the Low income multiplier band, and 10.3% in the Very Low and 7.7% in the Medium band. Water sectors (S30, S31 and S32) were in the Low band, generating income between AU$6.959m to AU$4.887m. Government Administration, Defence and Safety (S37); Education, Health and Community Services; and Electricity Generation by Other Fuels (S26) in the Very Low band, generating between AU$3.611m to AU$2.530m of income having the highest direct income multipliers implying that one unit increase in final demand for their output, the high portion of that one unit goes to wages for employees.
- Compared to other generation types, the indirect income multipliers of Electricity Generation by Renewables (S25) (in 2nd rank) and Generation by Hydro (S24) (in 3rd rank) grew at relatively faster rate over the period 1975-2015 generating higher income in other sectors through linkages.
- The value added multipliers of natural gas (S04) over the period 1975-2015 are the highest, although they declined slightly over the period. The sectors with the lowest value added multipliers are Exploration and Mining Services (S05) and Petroleum Products Manufacturing (S12). These results are consistent with the linkage indices estimated through IO Four-Quadrant Linkage Analysis Framework. Also the high level of imports by S12 and its very low output multipliers are responsible for the lowest value added multipliers of the sector.

- The sectors with highly inelastic supply and value added linkages over the study period such as Rural Water Supply (S31), Coal Product Manufacturing (S13), and Electricity Generation by Natural Gas (S23) (ranked 3rd, 7th and 9th respectively) are in group of 20 sectors imposing high risks to downstream production sectors. The reason is that they are linked through the Most Important Forward Coefficients (Forward MICs - see Chapters 4 and 6) to other sectors. This complex and critical situation calls for policy intervention aiming at effective sectoral performance at supply-side to adequately respond to input requirements of other sectors as a result of change in final demand for outputs.
- Final demand IO transformation reveals that the Australian economy in 2014-15 was heavily dependent on the following key production and service provider sectors in terms of producing the highest level of inputs to the final demand: Construction (S33); Households for non-industry based services; Education, Health and Community Services (S38); Government Administration, Defence and Public Safety (S37); Communication, Finance, and Business Services (S36); Other Mineral Mining (S06); Wholesale and Retail Trades (S34); Transport and Storage Services (S35); Coal (S02); Machinery and Transport Products (S19); Basic Non-Ferrous Metal (S17). Similar pattern was prevailed over the period 1975-2015 with slight change in ranking order. The above sectors were also the key contributors to value added and generating income for households. Also, the jobs in other sectors were linked to the same production sectors that were producing for the final demand.
- In comparison to final demand approach, the direct IO accounting approach also provides similar sectoral pattern as above in terms of contribution to value added, however, it cannot provide more accurate estimates of cumulative inputs to final demand, generation of income for households, and job creations.

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9 LINKAGES: SCENARIO ANALYSIS (2015-2050)

The main objective of this chapter is to illustrate how the analytical methodologies developed in this research (Chapters 4 and 5) could be employed to analyse the impacts of major infrastructure policy initiatives on the evolution of future linkages. Estimates of future backward and forward linkages should constitute invaluable bases for the policy makers to analyse the impacts of policy initiatives on the economy and to design appropriate future infrastructure policies. The case-in-point for policy initiative for this purpose is provided by the recently announced National Energy Guarantee (NEG) Scheme of the Australian Government (Turnbull, 2017) (details in section 9.1 of this Chapter). Three scenarios, based on alternatives sets of energy technologies and assumptions are developed, namely, Base Case Scenario, Renewable-Supreme (Alternative Scenario 1), and Exports-Dominant (Alternative Scenario 2) (Section 9.2). The backward and forward linkages for these scenarios are analysed for the period 2015-2050 (section 9.3). Section 9.4 presents the main findings of this chapter.

9.1 National Energy Guarantee (NEG) Scheme

The NEG Scheme (adopted in October 2017) is a major policy initiative of the Australian Government (Turnbull, 2017). It aims to achieve security of energy supply, at affordable prices, while ensuring that Australia meets its commitments under the Paris Accord (DEE 2017). These aims are proposed to be achieved through a range of provisions, for example, support for base load coal infrastructure, investments in renewable energy, and creation of appropriate governance arrangements for implementing the Scheme. The key future parameters and underlying assumptions of this Scheme are introduced in the next section. It is however pertinent to mention here that various provisions of the Scheme have the potential to affect macroeconomic outcomes (i.e. economy-wide impacts) in a variety of, yet unknown, ways. It is an explicit objective of this Chapter to illustrate how the impacts of this Scheme will be reflected in the backward and forward linkages and how these linkages could assist with policy refinement.

9.2 Future Scenarios

This research considers three future scenarios, namely, Base Case Scenario, Renewable-Supreme (Alternative Scenario 1), and Exports-Dominant (Alternative Scenario 2). These scenarios differ from each other in terms of relative shares of fuel for electricity production, fuel consumption by transport sector, composition of final demand categories, net trade and exports of energy resources (coal, oil, natural gas), and efficiency improvements in petroleum products manufacturing sector.

The key parameters for the three scenarios are presented in Table 9.1, and the underlying assumptions are discussed as follows.

Electricity Fuel Shares

The Base Case Scenario assumes that by 2035 the share of electricity generation from renewable sources would be 36%, composed of 12% from Hydro and 24% from other renewable sources; and 64% from non-renewable sources (coal, oil, and natural gas) - in alignment with the National Energy Guarantee (NEG) Scheme. It is assumed that electricity generation targets set by NEG will be maintained in 2050. Further, under the Base Case, it is assumed that the share of electricity generation by natural gas in 2015 - at around 20% based on BREE (2014) - will continue over the period 2015 to 2050. However the future targets are different from BREE's (2014) estimated decline of 14% in natural gas by 2035 and continuing at same rate to 2050. The reason for maintaining the gas share at the 2015 levels is two-fold: first, no gas share of electricity generation was specified by the NEG; second, the Australian Government has provided support for increasing gas supply for domestic use before it is being exported. Therefore, the assumed increases in natural gas supply aims to examine if the observed declining trend of gas supply over the period 1975-2015 (discussed in Chapter 7), particularly for electricity generation by gas, can be reversed. Additionally, AEMO (2017a) has projected reduction of gas supply starting summer 2018. In light of the NEG and its support for increasing the gas supply, it appears that maintaining the 2015 gas share for the Base Case over 2015-2050 is reasonable (Table 9.1). In conjunction with the NEG targets, the remaining electricity fuel shares of coal, oil, and renewable sources are estimated by adapting the related projections by BREE (2014) over the period 2015-2050.

The Renewable-Supreme alternative scenario however assumes higher levels of electricity generation from renewable sources, at the expense of coal-based electricity generation (assuming wider adoption of low-emissions generating technologies by electricity generators and retailers). This assumption is justified on the basis that under the NEG Scheme electricity retailers are free to choose the technology type to meet their emission obligations. Also, the Scheme specifies that "*electricity retailers must buy or generate with a set level of emission intensity*" so that under NEG Scheme emission intensity targets can be set flexibly. It implies the need for a wider adoption of required technologies over time to enable the aforementioned flexibility.

In comparison to the Base Case, the Renewable-Supreme alternative scenario assumes that 40 % of electricity will be generated from renewable sources in 2035, and a significantly larger share (80%) in 2050. The remaining 60 and 20 percent generation will be from non-renewable sources in 2035 and 2050, respectively. In conjunction with the Renewable-Supreme parameters, the estimate breakdown of electricity generation by coal, oil, gas, hydro and other renewable sources are made by adapting the BREE (2014) estimated data for 2035 and 2050.

Table 9.1: Scenarios Trends/Assumptions, 2015-2050 (%)

		Base Case		Renewable-Supreme (Alternative 1)		Export-Dominant (Alternative 2)	
Parameters	**2015**	**2035**	**2050**	**2035**	**2050**	**2035**	**2050**
Electricty Fuel Shares[1]						Same as Alternative 1	
Renewable Energy[1]							
Hydro	7.4	**12.0**	**12.0**	6.0	5.4		
Other[2]	7.9	**24.0**	**24.0**	34.0	74.6		
Total[1]	*15.4*	***36.0***	***36.0***	**40.0**	**80.0**		
Non-Renewable[3]							
Coal	63.9	43.5	43.5	43.5	4.6		
Oil	1.2	0.0	0.0	1.0	0.9		
Nat. Gas	19.6	**20.6**	**20.6**	15.6	14.5		
Total[3]	*84.6*	***64.0***	***64.0***	***60.0***	***20.0***		
Transport Fuel Shares[4]						Same as Alternative 1	
Coal	0.7	0.7	0.7	0.7	0.7		
Oil[4]	87.2	**85.2**	**85.2**	**56.3**	**16.3**		
Gas[5]	3.1	3.1	3.1	3.1	3.1		
Electricity[6]	9.1	**11.1**	**13.1**	**40.0**	**80.0**		
Exports[7]							
		%avg annual growth rate					
Coal		**2.2**	**0.0**	Same as Base Case		Same as Base Case	
Oil[8]		**2.9**	**1.7**	Same as Base Case		Same as Base Case	
Gas		**5.9**	**0.6**	Same as Base Case		**8.0**	**2.5**
Final Demand (FD)[9]		Trends: b/o 1975-2015 totals f each sector & each category of FD		Same as Base Case		Same as Base Case	
		%avg annual growth rate					
C		**1.2**	**1.3**	Same as Base Case		Same as Base Case	
G		**1.2**	**1.3**	Same as Base Case		Same as Base Case	
I-Prv		**1.5**	**1.4**	Same as Base Case		Same as Base Case	
I-Pub		**1.0**	**0.4**	Same as Base Case		Same as Base Case	
I-Govt		**1.0**	**1.3**	Same as Base Case		Same as Base Case	
Exp		**1.7**	**1.4**	Same as Base Case		**1.9**	**1.6**
Efficiency improvement in Petroleum Prod. Mfg.		Same as 2015 No improvemnet		Same as Base Case Same as Base Case		**4%** improvement above the Base Case by 2050	

Notes

[1] The 2035 and 2050 Base Case total renewable target, and the generation levels by hydo and other renewable sources were given by NEG (2017). Electricity generation fuel shares of the Base Case were estimated in conjunction with Table 10 (p.34) in BREE (2014) - Electricty generation by enerrgy type.

[2] Other renewable energy includes wind, bioenergy, solar and geothermal sources.

[3] Only the *total* non-renewable targets for the Base Case years 2035 and 2050 given by NEG (2017)

[4] Oil share of fuel consumption by the Transport sector for the Base Case is assumed to decrease by 2% in 2035 and remain the same in 2050. Transport Fuel Shares are estimated by the scenario model based on the 2015 cumulative coefficients for transport sector.

[5] Gas includes Natural Gas (S04) and Gas Supply (S28) sectors respectively.

[6] Electricty share of fuel consumption by the Translport Sector for Base Case is assumed to increase by 2% in 2035 and further 2% by 2050.

[7] Exports values in Base Case scenario are estimated based on BREE (2014), the future estimates of net trade in energy.

[8] Oil represents crude oil, other refinery feedstock and petroleum products.

[9] C = Households' Consumption; G= Government Spending; I-Prv = Investment by Private Sector; I-PE = Investment by Public Enterprise; I-G = Investment by General Government; and E = Exports

Source: This author's compilation based on various sources discussed in section 9.2 and the footnotes above.

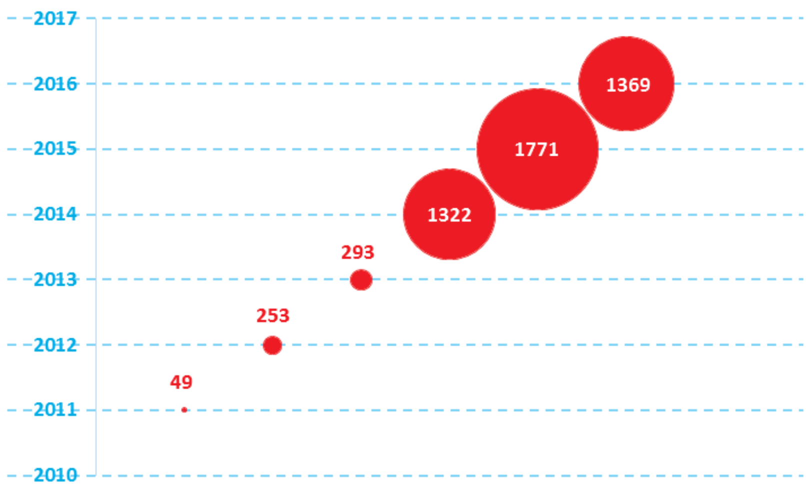
Under the Exports-Dominant scenario, fuel shares for electricity generation are assumed to be the same as the Renewable-Supreme scenario. This will enable comparative assessment be made of the impacts of both renewable technologies and increased exports on the economy.

Transport Fuel Shares - The 2015 transport sector fuel consumptions (coal, oil, gas and electricity) are estimated by the scenario models which are developed by this research. For the Base Case scenario, the share of electricity consumption by the Transport and Storage Services (S35) in 2035 is assumed at 11.1% - a 2% increase above the 2015 level (9.1%); and a further 2% increase in 2050 (13.1%) because of increasing adoption of eVehicle technology as justified in the following discussion. The increases in electricity consumption will reduce oil consumption by petrol and diesel powered vehicles proportionally, to 85.2% in 2030 and 2050. The consumption of coal and gas fuels is assumed to remain at the 2015 levels over the period 2035 to 2050, because of their low shares - 0.7% and 3.1% respectively.

The Renewable-Supreme scenario however assumes that the share of electricity as transport fuel will increase substantially, to 40% of total fuel consumption in 2035, and 80% in 2050 - a substantial increase from the Base Case levels as discussed earlier. Also, in comparison to the Base Case, the percentage of oil consumption by transport sector (S35) will decrease significantly, to 56.3% in 2030, and to 16.3% in 2050 because of high electricity consumption. Under the Exports-Dominant scenario, transport fuel shares are assumed to remain the same as the Renewable-Supreme scenario.

The increase in electricity consumption is justified based on the increasing trends towards the adoption of electric vehicles (eVehicles). According to CWA (2017), ECA (2017), and NTC (2017) the global sales of eVehicles is growing rapidly. For example, the 2016 sales were 40% higher than in 2015. In Australia, the growth rate of sales was 34% over the same period. However, comparison of the Australian sales figure in 2015 (1,771) with the 2011 (49) shows a 36 times increase (Figure 9.1). Also, majority of the purchasers are businesses and private sectors. For example, according to the CWA (2017), 64% and 34% of eVehicle purchases in 2016 were made by the business and private sector respectively (these percentages are referred to as receptivity indicators).

Figure 9.1: Pattern of adopting eVehicles in Australia, 2011-2016



Source: Adapted from CWA (2017)

In addition, IEA (2017) has estimated that two million eVehicles are currently on the roads across the world which will increase substantially in the future. Table 9.2 shows the Australian and global projections of eVehicles over the period 2030 to 2040. For example, according to ENA & CSIRO (2014, 2017), 20% of the existing petrol and diesel powered light vehicle fleet in Australia - according to the ABS (2017d) about 17.5 million - will be electric cars in 2035 (about 3.5 million), and above 40% by 2050.

Table 9.2: Australian and global future of eVehicles uptake, 2030 to 2050

	Study	Year	eVehicles Uptake Rate
Australian projections	Network Transformation Roadmap (ENA & CSIRO 2015, 2017)	2035	20% of light vehicle fleet
		2050	42% of light vehicle fleet
	Pathways to Deep Decarbonisation in 2050 (CWA 2014)	2030	45% of light vehicle fleet
	Zero Carbon Australia, Electric Vehicles (BZE 2016)	2030	100% of passenger car fleet
	Australia's emission projections 2016 (DEE 2016)	2030	14% of light vehicle purchases
	Projections for the National Electricity Market (AEMO & Energeia 2016)	2025	6.5 to 27% of new light vehicle purchases
		2036	16 to 45% of new light vehicle purchases
Global Projections	Global EV Outlook 2016 (IEA 2016)	2030	10% of light vehicle fleet
	Bloomberg NEF 2016	2040	25% of light vehicle fleet

Source: CWA (2017)

Therefore, based on the current pattern of adoption of eVehicle technology, it is envisaged that the number of eVehicles over the period 2035-2050 will increase significantly, thus resulting in higher consumption of electricity by the Transport and Storage Sector (S35).

Exports - This research incorporates the BREE (2014) forecasts of net trade in coal, oil and gas over the period 2015 to 2050 (Table 9.3) - as proxies to estimate the future exports of coal, oil and gas under different scenarios, for the year 2035 and 2050. Also, the average annual growth rate percentages of coal, oil and gas exports in 2035 and 2050 are estimated with reference to 2015 exports values. The exports and the percentage average annual growth rates for the Renewable-Supreme and Exports-Dominant scenarios are based on the Base Case scenario estimates as shown in Table 9.1 and discussed below.

In the Base Case scenario, the average annual growth rate for coal exports is estimated at 2.2% over the period 2015-2035, and nil over the period 2035-2050. The same growth rates are assumed to continue in Renewable-Supreme and Exports-Dominant alternative scenarios.

Also, in the Base Case scenario, the projected average annual growth rates for oil exports, as calculated by the scenario model, are 2.9% over the period 2015-2035, and 1.7% over the period 2035-2050. The same average growth rates are assumed for Renewable-Supreme and Exports-Dominant alternative scenarios.

Table 9.3: Net trade in energy, Base Case growth, 2015 to 2050

Sector	2015 (PJ)	2035 (PJ)	2049-50 (PJ)	% avg yearly growth 2015 to 2050
Coal	11386	17428	17496	1.2
Oil	-1576	-2810	-3608	2.4
LPG	24	-48	-7	
LNG	1500	4703	5144	3.6
Total	**11334**	**19272**	**19026**	**1.5**

Source: BREE (2014). Oil represents crude oil, other refinery feedstock and petroleum products.
Proxy variables used to measure future amount of coal, oil and gas exports in the context of this research.

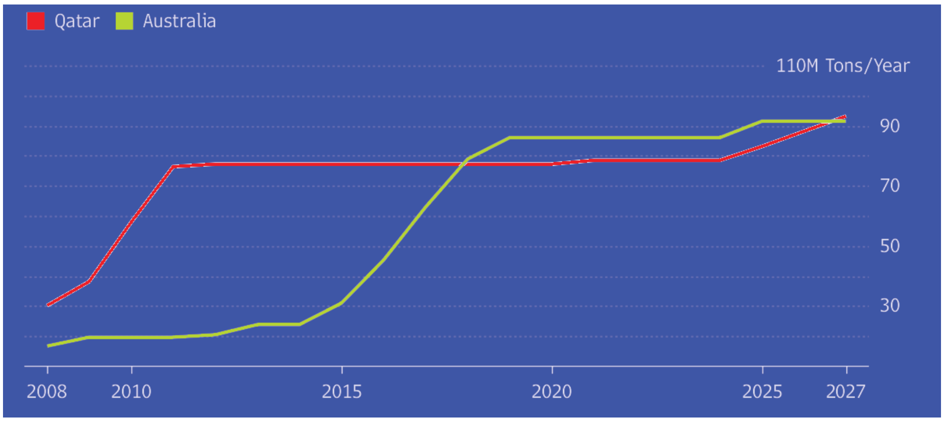
The gas net trade will grow at an average annual rate of 5.9% in the Base Case scenario over the period 2015-2035, and by 0.6% over the period 2035-2050. The Export-Dominant scenario however assumes that gas exports in 2035 will increase by one and a half times of the corresponding year's amount in the Base Case scenario. This assumption will increase the annual growth rate of the gas exports from 5.9% in Base Case scenario, to 8.0% in the Export-Dominant scenario in 2035. Additionally, the gas exports in Exports-Dominant scenario in 2050 is assumed to be twice as the corresponding amount in Base Case scenario. This assumption will increase the annual growth rate of the gas exports from 0.6% in the Base Case scenario to 2.5% in Export-Dominant scenario in 2050. Also, such high levels of natural gas exports will assist with investigating the impacts of gas exports on domestic consumption.

The justification for increased gas exports in Exports-Dominant scenario is based on the abundance of natural gas in Australia, and the recent Australian Government announcements for near future increases in gas exports. For example, the Department of Industry, Innovation, and Sciences (DIIS 2017) has announced Australia's plan to increase its gas export by 16% from mid-2018 - published by Reuter (2017b) and Bloomberg (2017). Furthermore, DIIS (2017) has forecasted an additional 74 million tons of LNG export by June 2019 which is 41% higher year-on-year. Also, Bloomberg (2017) published the Australian LNG export forecasts to 2027 (Figure 9.2) attributing further export increases to the start of new projects including Chevron Corp's Wheatstone LNG in Western Australia and Inpex Corp's Ichthys LNG off Northern Territory which are planned for 2018. According to DIIS (2017) forecast, LNG will get ahead of metallurgical coal as Australia's largest export after iron ore in 2018-19. The abovementioned increases in gas export potentially could place Australia in the first global gas export position by 2050. According to the AEMO (2016), Australia is currently the second global exporter of natural gas after Qatar.

The increased gas exports assumption of the abovementioned scenarios, will allow analysis of future gas linkages, the impacts of gas exports on domestic use (section 9.3.2), and the impacts on the Australian economy as a whole (Section 9.4).

Final Demand - The future estimates of each category of final demand in the Base Case scenario in 2035 and 2050 are based on the trends over the period 1975-2015. However, the estimation of

Figure 9.2: Australia's future gas export to 2027



Source: Adapted from Bloomberg (2017)

exports of coal, oil and gas will follow the assumptions and proxy data considerations as discussed earlier. Accordingly, the average annual growth rates for each category of final demand are estimated for 2035 and 2050 with reference to 2015 (Table 9.1.

The final demand parameters for the Renewable-Supreme scenario are assumed to be the same as in the Base Case - to maintain the focus, which is, evaluation of the impacts of renewable technologies on future linkages. Similarly, the Exports-Dominant scenario assumes the same final demand annual average growth rates as in the Base Case except, for the exports category. The exports category, in this scenario, is impacted by the previous assumptions of increasing gas exports by one and a half times of the Base Case level in 2035, and twice as much as the Base Case level in 2050. The gas export assumptions, together with the estimated coal and oil exports, based on net trade proxy data, would determine overall export levels in the Exports-Dominant scenario. Based on the assumed export levels the impacts of increased exports on future sectoral linkages and in the economy as a whole can be assessed. As a result, annual average growth rate for overall exports changed from 1.7% in Base Case in 2035, to 1.9% in Export-Dominant scenario in 2035. Likewise, the of annual average growth rate of overall exports increased from 1.4% in the Base Case scenario in 2050, to 1.6% in Export-Dominant scenario in 2050.

Efficiency Improvement in Petroleum Products Manufacturing Sector - To increase the supply of domestically produced refined products, the efficiency of the Petroleum Products Manufacturing Sector (S12) in Export-Dominant scenario is assumed to improve by 4% above the Base Case by 2050. This improvement is considered because of the increasing trends in imports of refined products, in absolute and indexed terms, over the period 1975-2017 (see Chapters 7 and 8 for more details).

It is assumed that by investing 2% above the 2035 Base Case, and a further 2% by 2050, imports will be offset by an overall 4%. The increase in capital (normally measured in terms of gross profits & mixed incomes as reported in IO Tables) is assumed to be a good proxy for the investment parameter. In 2015, the Capital input ratio for Petroleum Products Manufacturing

(S12) was estimated at 13%, and imports at 87% of the technological inputs to the Sector. Therefore, in Export-Dominant scenario in 2035, capital is increased by 2% above the 2015 Base Case level (to 15%), and a further 2% increase by 2050 (to 17%). These investment increases are assumed to offset imports by 2% (to 85%) in 2035, and a further 2% decrease (to 83%) in 2050.

9.3 Scenario Results, 2015 to 2050

This section analyses the impacts of three scenarios in terms of backward and forward linkages, key sectors, and GDP at aggregate and disaggregate levels (i.e. divisional components of GDP, namely, labour, capital and net trade).

9.3.1 Backward Linkages

Tables 9.4 and 9.5 show backward linkage indices for each infrastructure of interest in this research (highlighted) and for other sectors of the economy. Table 9.6, also compares changes in backward linkages within, and between, each of the three scenarios over the period 2015-2050.

Table 9.5 provides inter-scenario comparisons in 2035 and 2050. Additionally, these Tables group sectoral backward linkages into three categories: strong (above average with an assumed tolerance of ± 0.05); moderate ($\cong$ 0.80 to $<$ 0.95) and weak ($<$ 0.80). These Tables assist with examining the impacts of each scenario on the development of future linkages.

In the Base Case scenario, backward linkage indices for majority of the sectors change only marginally over the period 2015-2035 (in the range -2.1% to +1.2%), except for the Electricity Transmission and Distribution (S27), with the highest decrease (-4.7%), and Upstream Water Supply (S29) with the highest increase (+4.3%) (Tables 9.4 and 9.6). Sectors corresponding to the lower limit of the above range are Electricity Generation by Oil (S22), Electricity Generation by Other Fuel (S25), and Electricity Generation by Hydro (S25); and sectors associated with the upper limit are: Transport and Storage Services (S35) (1.2%); Electricity Generation by Other Fuel (S26) (1.1%); and the Gas Supply Sector (S28) (1%). The backward linkages of all electricity generation sectors will change in the range of -2.1% to -1.1% over the Base Case period 2015-2035.

Further, backward linkage indices change, over the period 2015-2050, in the range -2.2% to +1.4%, for majority of the sectors in the Base Case scenario, except for Electricity Transmission and Distribution Sector (S27) where indices decline by -4.8%, and Upstream Water Supply Sector (S29) where indices increase by about 8%, significantly higher than 2035 level.

Over the period 2035-2050, in Base Case scenario, the change in backward linkages is almost negligible for all sectors (in the range -0.1 to -0.04%), with the upper and lower limits belonging to Electricity Transmission and Distribution (S27) and Wood Products (S10) Sectors respectively. The only exceptions are: Upstream Water Supply (S29), with the highest change (3.5%), and Transport and Storage Sector (S35) (0.24%).

Table 9.4: Backward linkages, 2015-2050

				Backward Linkages						% Change								
				Base Case		Renewable-Supreme		Exports-Dominant		Base Case			Renewable-Supreme			Exports-Dominent		
	Code	Sector	2015	2035	2050	2035	2050	2035	2050	2035 w/r 2015	2050 w/r 2015	2050 w/r 2035	2035 w/r 2015	2050 w/r 2015	2050 w/r 2035	2035 w/r 2015	2050 w/r 2015	2050 w/r 2035
Strong	S21	Elec. Gen. Coal	1.881	1.847	1.845	1.836	1.758	1.837	1.758	-1.85	-1.92	-0.07	-2.40	-6.57	-4.27	-6.57	-6.55	-4.27
	S24	Elec. Gen. Hydro	1.869	1.830	1.828	1.818	1.729	1.818	1.730	-2.12	-2.18	-0.07	-2.73	-7.49	-4.89	-7.49	-7.47	-4.88
	S27	Elec. T&D	1.756	1.673	1.672	1.652	1.466	1.652	1.466	-4.73	-4.80	-0.07	-5.96	-16.53	-11.24	-16.53	-16.53	-11.23
	S22	Elec. Gen. Oil	1.679	1.644	1.642	1.633	1.552	1.633	1.553	-2.13	-2.20	-0.07	-2.76	-7.56	-4.94	-7.56	-7.54	-4.93
	S25	Elec. Gen. Renew.	1.591	1.557	1.556	1.547	1.471	1.548	1.471	-2.13	-2.19	-0.07	-2.76	-7.56	-4.93	-7.56	-7.54	-4.93
	S17	Non-Ferrous Mfg	1.349	1.352	1.351	1.352	1.359	1.352	1.360	0.25	0.19	-0.06	0.24	0.79	0.55	0.79	0.84	0.56
	S23	Elec. Gen. Nat. Gas	1.306	1.292	1.291	1.286	1.254	1.287	1.254	-1.08	-1.15	-0.07	-1.49	-3.97	-2.52	-3.97	-3.94	-2.52
	S33	Const	1.183	1.194	1.194	1.196	1.221	1.197	1.222	0.96	0.90	-0.06	1.13	3.25	2.10	3.25	3.30	2.11
	S28	Gas Supply	1.139	1.151	1.150	1.152	1.176	1.152	1.177	1.01	0.94	-0.06	1.08	3.22	2.12	3.22	3.27	2.13
	S07	Food & Bev	1.086	1.095	1.094	1.097	1.117	1.098	1.118	0.81	0.75	-0.05	1.00	2.84	1.82	2.84	2.88	1.83
	S10	Wood Prod.	1.060	1.068	1.068	1.072	1.090	1.072	1.091	0.71	0.67	-0.04	1.05	2.81	1.74	2.81	2.86	1.75
	S02	Coal	1.044	1.053	1.052	1.055	1.075	1.055	1.075	0.82	0.77	-0.05	1.05	2.93	1.87	2.93	2.98	1.88
	S15	Non-Metal & Min.	1.020	1.027	1.026	1.029	1.046	1.029	1.046	0.70	0.65	-0.05	0.93	2.58	1.63	2.58	2.62	1.64
	S01	Ag., Forest & Fish'g	0.994	1.002	1.002	1.004	1.023	1.004	1.023	0.86	0.80	-0.06	1.01	2.92	1.89	2.92	2.97	1.90
	S35	Trsprt & Storage S	0.956	0.967	0.970	1.009	1.065	1.010	1.065	1.19	1.43	0.24	5.57	11.36	5.49	11.36	11.41	5.49
	S32	Water, Sev.	0.960	0.967	0.967	0.968	0.983	0.968	0.983	0.71	0.65	-0.06	0.76	2.30	1.53	2.30	2.35	1.53
	S39	Oth. Comml Serv.	0.943	0.950	0.950	0.951	0.968	0.952	0.968	0.80	0.74	-0.06	0.89	2.63	1.73	2.63	2.68	1.74
Moderate	S34	Wsale&Retail	0.923	0.930	0.929	0.932	0.947	0.932	0.948	0.76	0.70	-0.05	0.93	2.65	1.71	2.65	2.70	1.71
	S18	Other Metal Prod.	0.919	0.927	0.926	0.929	0.947	0.929	0.947	0.84	0.79	-0.05	1.07	3.00	1.91	3.00	3.05	1.92
	S06	Oth. Mining	0.919	0.925	0.925	0.926	0.939	0.926	0.939	0.65	0.58	-0.06	0.69	2.08	1.39	2.08	2.13	1.39
	S09	Pulp & Paper Mfg	0.921	0.923	0.923	0.924	0.929	0.924	0.930	0.27	0.21	-0.05	0.31	0.93	0.62	0.93	0.98	0.63
	S37	Govt Admin	0.892	0.897	0.896	0.897	0.908	0.897	0.909	0.58	0.52	-0.06	0.62	1.88	1.25	1.88	1.93	1.26
	S13	Coal Prod. Mfg	0.863	0.872	0.871	0.873	0.890	0.873	0.891	0.96	0.90	-0.06	1.06	3.13	2.05	3.13	3.18	2.06
	S16	Iron & Steel Mfg	0.865	0.870	0.869	0.871	0.882	0.871	0.883	0.60	0.54	-0.06	0.70	2.03	1.33	2.03	2.08	1.34
	S05	Explor. Mining	0.861	0.869	0.869	0.870	0.888	0.870	0.888	0.97	0.91	-0.06	1.04	3.12	2.05	3.12	3.17	2.06
	S11	Print & Pub.	0.849	0.854	0.854	0.856	0.869	0.856	0.869	0.69	0.63	-0.05	0.82	2.38	1.54	2.38	2.43	1.55
	S36	Comm, Fin. & Bus.	0.836	0.844	0.843	0.845	0.862	0.845	0.862	0.96	0.90	-0.06	1.05	3.12	2.05	3.12	3.17	2.05
	S30	Water, Urb	0.820	0.823	0.822	0.822	0.826	0.822	0.827	0.29	0.22	-0.07	0.19	0.75	0.56	0.75	0.79	0.57
	S14	Chem. Prod.	0.801	0.808	0.808	0.810	0.825	0.810	0.825	0.85	0.80	-0.05	1.03	2.95	1.90	2.95	3.00	1.91
	S31	Water, Rurl	0.800	0.801	0.801	0.800	0.802	0.800	0.802	0.14	0.07	-0.07	-0.04	0.16	0.20	0.16	0.21	0.21
	S12	Petro. Prod. Mfg	0.786	0.794	0.793	0.794	0.811	0.795	0.811	0.98	0.92	-0.06	1.07	3.17	2.08	3.17	3.22	2.09
Weak	S03	Crude Oil	0.730	0.737	0.737	0.738	0.752	0.738	0.753	0.93	0.87	-0.06	1.01	3.01	1.98	3.01	3.06	1.99
	S20	Mfg Oth.	0.726	0.732	0.732	0.733	0.745	0.733	0.746	0.79	0.73	-0.06	0.86	2.58	1.70	2.58	2.63	1.71
	S38	Edu, Hlth & Cmty S	0.714	0.721	0.721	0.722	0.736	0.722	0.737	0.96	0.90	-0.06	1.05	3.12	2.05	3.12	3.17	2.06
	S04	Nat Gas	0.661	0.667	0.666	0.667	0.680	0.667	0.680	0.89	0.82	-0.06	0.94	2.82	1.86	2.82	2.87	1.87
	S19	Mach. & Transp Pr	0.653	0.659	0.659	0.659	0.673	0.660	0.673	0.98	0.92	-0.06	1.04	3.13	2.06	3.13	3.18	2.07
	S29	Water, Upstrm	0.563	0.587	0.608	0.588	0.623	0.575	0.607	4.26	7.89	3.47	4.32	10.50	5.93	10.50	7.71	5.52
	S08	Textile & Clothing	0.591	0.597	0.596	0.597	0.608	0.597	0.609	0.92	0.85	-0.07	0.94	2.87	1.91	2.87	2.92	1.92
	S26	Elec. Gen Oth. Fuel	0.488	0.493	0.493	0.493	0.505	0.494	0.505	1.11	1.03	-0.07	1.11	3.41	2.27	3.41	3.46	2.28

Source: Results generated by the scenarios model developed in this research.

Table 9.5: Backward linkages, %change (2035, 2050)
(inter-scenario, same year comparison)

			Backward Linkages						% Change					
			Base Case		Renewable-Supreme (RS)		Exports-Dominant (ED)		RS w/r BC		ED w/r BC		ED w/r RS	
	Code	Sector	2035	2050	2035	2050	2035	2050	2035	2050	2035	2050	2035	2050
Strong	S21	Elec. Gen. Coal	1.847	1.845	1.836	1.758	1.837	1.758	-0.56	-4.74	-0.54	-4.72	0.02	0.03
	S24	Elec. Gen. Hydro	1.830	1.828	1.818	1.729	1.818	1.730	-0.63	-5.43	-0.61	-5.40	0.02	0.02
	S27	Elec. T&D	1.673	1.672	1.652	1.466	1.652	1.466	-1.30	-12.33	-1.30	-12.33	0.00	0.00
	S22	Elec. Gen. Oil	1.644	1.642	1.633	1.552	1.633	1.553	-0.65	-5.48	-0.63	-5.46	0.02	0.02
	S25	Elec. Gen. Renew.	1.557	1.556	1.547	1.471	1.548	1.471	-0.65	-5.49	-0.63	-5.47	0.02	0.02
	S17	Non-Ferrous Mfg	1.352	1.351	1.352	1.359	1.352	1.360	-0.01	0.60	0.03	0.65	0.04	0.04
	S23	Elec. Gen. Nat. Gas	1.292	1.291	1.286	1.254	1.287	1.254	-0.41	-2.86	-0.38	-2.83	0.02	0.03
	S33	Const	1.194	1.194	1.196	1.221	1.197	1.222	0.16	2.33	0.20	2.38	0.04	0.05
	S28	Gas Supply	1.151	1.150	1.152	1.176	1.152	1.177	0.07	2.26	0.11	2.31	0.04	0.05
	S07	Food & Bev	1.095	1.094	1.097	1.117	1.098	1.118	0.19	2.07	0.23	2.11	0.04	0.05
	S10	Wood Prod.	1.068	1.068	1.072	1.090	1.072	1.091	0.34	2.12	0.38	2.17	0.04	0.05
	S02	Coal	1.053	1.052	1.055	1.075	1.055	1.075	0.22	2.14	0.26	2.19	0.04	0.05
	S15	Non-Metal & Min. Pr	1.027	1.026	1.029	1.046	1.029	1.046	0.23	1.91	0.27	1.96	0.04	0.05
	S01	Ag., Forest & Fish'g	1.002	1.002	1.004	1.023	1.004	1.023	0.15	2.10	0.19	2.15	0.04	0.05
	S35	Trsprt & Storage Ser	0.967	0.970	1.009	1.065	1.010	1.065	4.33	9.79	4.36	9.83	0.04	0.04
	S32	Water, Sev.	0.967	0.967	0.968	0.983	0.968	0.983	0.05	1.64	0.09	1.69	0.04	0.05
	S39	Oth. Comml Serv.	0.950	0.950	0.951	0.968	0.952	0.968	0.09	1.88	0.13	1.93	0.04	0.05
Moderate	S34	Wsale&Retail	0.930	0.929	0.932	0.947	0.932	0.948	0.17	1.94	0.21	1.98	0.04	0.05
	S18	Other Metal Prod.	0.927	0.926	0.929	0.947	0.929	0.947	0.23	2.19	0.27	2.24	0.04	0.05
	S06	Oth. Mining	0.925	0.925	0.926	0.939	0.926	0.939	0.04	1.49	0.08	1.54	0.04	0.05
	S09	Pulp & Paper Mfg	0.923	0.923	0.924	0.929	0.924	0.930	0.04	0.72	0.08	0.77	0.04	0.04
	S37	Govt Admin	0.897	0.896	0.897	0.908	0.897	0.909	0.04	1.36	0.08	1.41	0.04	0.05
	S13	Coal Prod. Mfg	0.872	0.871	0.873	0.890	0.873	0.891	0.10	2.22	0.14	2.26	0.04	0.05
	S16	Iron & Steel Mfg	0.870	0.869	0.871	0.882	0.871	0.883	0.10	1.49	0.14	1.53	0.04	0.05
	S05	Explor. Mining	0.869	0.869	0.870	0.888	0.870	0.888	0.07	2.19	0.11	2.24	0.04	0.05
	S11	Print & Pub.	0.854	0.854	0.856	0.869	0.856	0.869	0.13	1.73	0.17	1.78	0.04	0.05
	S36	Comm, Fin. & Bus. Se	0.844	0.843	0.845	0.862	0.845	0.862	0.09	2.20	0.13	2.25	0.04	0.05
	S30	Water, Urb	0.823	0.822	0.822	0.826	0.822	0.827	-0.10	0.52	-0.07	0.57	0.04	0.04
	S14	Chem. Prod.	0.808	0.808	0.810	0.825	0.810	0.825	0.18	2.14	0.22	2.19	0.04	0.05
	S31	Water, Rurl	0.801	0.801	0.800	0.802	0.800	0.802	-0.18	0.09	-0.14	0.14	0.04	0.04
	S12	Petro. Prod. Mfg	0.794	0.793	0.794	0.811	0.795	0.811	0.09	2.23	0.13	2.28	0.04	0.05
Weak	S03	Crude Oil	0.737	0.737	0.738	0.752	0.738	0.753	0.08	2.12	0.12	2.17	0.04	0.05
	S20	Mfg Oth.	0.732	0.732	0.733	0.745	0.733	0.746	0.07	1.83	0.11	1.88	0.04	0.05
	S38	Edu, Hlth & Cmty Se	0.721	0.721	0.722	0.736	0.722	0.737	0.09	2.20	0.13	2.25	0.04	0.05
	S04	Nat Gas	0.667	0.666	0.667	0.680	0.667	0.680	0.05	1.98	0.09	2.03	0.04	0.05
	S19	Mach. & Transp Pro	0.659	0.659	0.659	0.673	0.660	0.673	0.06	2.19	0.10	2.24	0.04	0.05
	S29	Water, Upstrm	0.587	0.608	0.588	0.623	0.575	0.607	0.05	2.42	-2.10	-0.16	-2.15	-2.53
	S08	Textile & Clothing	0.597	0.596	0.597	0.608	0.597	0.609	0.02	2.00	0.06	2.05	0.04	0.05
	S26	Elec. Gen Oth. Fuel	0.493	0.493	0.493	0.505	0.494	0.505	0.00	2.35	0.04	2.40	0.04	0.05

Source: Results from the scenarios model developed in this research.

From these results of the Base Case Scenario, one can infer the following:

- Existing production technologies for majority of sectors will not significantly change into more input intensive production technologies which are characterised by higher sectoral backward linkages. Therefore, as the NEG objectives under the Base Case scenarios are unfolding, it will be expected that production technologies will remain stable and almost unchanged over the scenario period considering that Australia, as a developed country, has currently access to the latest production technologies;
- Relatively largest changes in backward linkages of Upstream Water Supply (S29) (about 8%, nearly 4% over the 2035 level) by 2050 will be dependent on rain and water availability in dams and other reservoirs, assuming that water cycle systems in which the Sector is functioning (see Chapter 3). This implies that generation of electricity by hydro may divert natural flow of the water in the water cycle systems, placing Upstream Water Supply Sector under strain. Therefore, the water supply sector will not be able to respond adequately to input-demand by major sectors including Electricity Generation by Hydro (S24) because of the NEG renewable-share; Urban Water Supply (S30), and Sewerage & Drainage (S32) Sectors because of urbanisation and increased population by 2050 (see section 9.3.2).
- The increase in backward linkages of Transport Sector (S35) (1.4%) over the period 2015-2050 - in the 2nd rank after Upstream Water supply (S29) - will be due to the adoption of eVehicle technology which will raise the electricity share of the Sector's fuel consumption over the period;
- The relatively highest decrease in backward linkages of Electricity Transmission and Distribution (T&D) (S27) by -4.7% will be related to the higher level of electricity generation from renewable sources, at the expense of fossil fuel electricity generators. This implies that electricity generated by renewable sources such as photovoltaic (PV) solar panels or wind energy are directly accessible for final use by households, industries, or electricity retailers as generators under the NEG Scheme. Therefore, in this situation, only excess electricity, above the final use, is exported to the gird, which in turn will reduce the input requirements of Electricity T&D Sector from its upstream electricity provider sectors. Additionally, electricity generation by fossil fuel generators are reduced. Therefore, the overall inputs to the Electricity T&D Sector (S27) are reduced which is reflected in the Sector's backward linkage indices.
- The decreasing pattern of change in backward linkages of all electricity generation sectors (in the range of -2.1% to -1.1%) implies that first, as the Electricity Generation by Renewable Sector (S25) evolves over time, its initial capital and labour requirement intensities will be reduced which in turn will lower its backward linkages; and second, as the share of electricity generation by renewables is increased the share of generation by other fuel sources in aggregate electricity production are reduced. As a result, the share of fossil fuel powered generators in final demand is reduced, which in turn will impact - in terms of input requirements - the sectoral ability to induce more economic activities in other sectors in response to a unitary increase in final demand for

electricity. This is the characteristic of sectors with less strong backward linkages. This outcome implies achievement of the NEG's Emissions Reduction Guarantee under the Base Case scenario.

Compared to the Base Case, the backward linkages in Renewable-Supreme scenario will change for majority of the sectors at similar rate over the period 2015 to 2035 (from -2.8% to +1.1% against -2.1% to +1.1% in the Base Case), with the exception of the Electricity T&D Sector (S27) which will change at the higher rate of about -6%, the Water Supply Upstream (S29) at slightly lower rate of +4.3%, and the Transport and Storage Services (S35) at +5.6% nearly 5 times higher.

Comparison of the 2050 backward linkage indices in Renewable-Supreme scenario with the reference year 2015 however shows significant change in future indices for majority of the sectors from -7.6% to +3.4% when compared to the results over the period 2015 to 2035 (-2.8% to +1.1%). Similar to the Base Case scenario, in Renewable-Supreme also the Transmission and Distribution Sector (S27) at -16.5%; Water Supply, Upstream at +10.5%; and Transport and Storage Services (S35) at +11.4% are the outperforming sectors in terms of developing stronger linkages. The latter changes are significantly higher than the period 2015-35 in this Scenario.

Likewise, the change in backward linkages in Renewable-Supreme over the period 2035-2050 are significantly higher (between -4.9% to +2.3%) in comparison to the Base Case (-0.07% to -0.04%). Similarly, the Electricity T&D (S27) at -11.2%, Upstream Water Sector at +5.9%, and Transport and Storage Services at +5.5% show higher rates of change relative to majority of the sectors. Similar to the Base Case, in Renewable-Supreme scenario, the backward linkages of all electricity generator sectors are declined in the range of -4.9% to -2.5%.

In comparison to the Base Case and Renewable-Supreme scenarios, the Exports-Dominant scenario shows significantly higher rates of change in backward linkages for all sectors. In this Scenario, the future backward linkages for majority of sectors change between -7.6 and +3.4, against -2.8 to +1.1 in Renewable Supreme, and similar range in the Base Case. Likewise, in this scenario, the Electricity T&D Sector (S27) exhibits the highest decrease in backward linkages (-16.5%), and Transport and Storage Services Sector (S35) – highest increase (+11.4%). Moreover, the rate of change in backward linkages of Water Supply Upstream (S29) is 10.5%, the highest across all scenarios over 2015 to 2035. However, for this Sector the backward linkages in 2050 increased by 7.7% which is slightly lower than the other two scenarios over the period (+10.5% in Renewable Supreme, and +7.9% in the Base Case).

The higher rate of changes in backward linkages in this Scenario are mainly related to its relatively extensive assumed future parameters: first, the native assumptions of the Scenario including significant increases in natural gas exports, and efficiency improvements in Petroleum Manufacturing Sector; and second, incorporating assumptions from other two scenarios. For example, electricity fuel shares, and transport fuels shares of the Renewable-Supreme scenarios, and some assumptions from the Base Case as described in Table 9.1. These cumulative assumptions would change a larger number of input coefficients based on which backward linkage indices, and subsequently the relative change in linkages, are calculated.

A declining pattern in the changes of backward linkages both within, and across, scenarios over the period 2015-2050 (Figure 9.3) was observed in almost all electricity sectors. Such a pattern was not identified in other sectors. Rather, the remaining sectors demonstrated an increasing pattern in the changes of backward linkages.

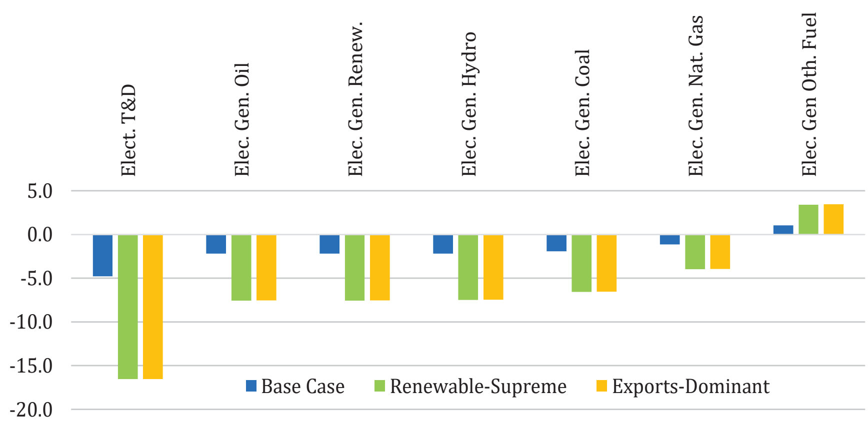
In the category of sectors with above average backward linkages (Strong), Transport (S35), Construction (S33), Gas Supply (S28), Coal (S02) and Agriculture (S01) gained relatively the highest increases in the same rank across all scenarios over the period. In this category, the highest increases occurred in the Exports-Dominant and Renewable-Supreme, in the range of 3 to 11.4%.

In the Moderate category, the highest increases in backward linkages across all three scenarios are attributed to Petroleum Products Manufacturing (S12); Coal Products Manufacturing (S13); Exploration and Mining Support Services (S05); Communication, Finance, Property and Business Services (S36) and Metal Products, Other (S18) respectively. In this category the highest rate of change occur in Renewable-Supreme and Exports-Dominant, in the range of 3.1 to 3.5%.

In the Weak sectors category, the highest change in backward linkages across all scenarios are in Upstream Water Supply (S29); Electricity Generation by Other Fuel (S26); Machinery and Products (S19); Education, Health and Community Services (S38), and Crude Oil (S03) respectively. The highest increase occurred in Renewable-Supreme between 3 to 10.5% followed by the Exports-Dominant, between 3.1 to about 8%.

The increases in backward linkages means development of new or stronger linkages with other sectors as a result of scenarios' future parameters. Also, higher linkage indices show ability of the sectors to induce more economic activities in other sectors of the economy.

Figure 9.3: Change in electricity sectors' backward linkages, 2015-2050



Source: This author, based on the scenarios model developed in this research

A summary of intra- and inter-scenario comparison of change in backward linkages are given in Table 9.6 over the scenario period.

Table 9.6: Summary %change, backward linkage by scenarios, 2015 to 2050

	Sector	Base Case	Renewable-Supreme	Exports-Dominant
2035 w/r 2015	Majority	-2.1 to +1.1	-2.8 to +1.1	-7.6 to +3.4
	Strong	-4.7 to +1.2	-6.0 to 5.6	-16.5 to +11.4
	Moderate	0.1 to 1.0	-0.04 to 1.1	0.2 to 3.2
	Weak	0.8 to 4.3	+0.90 to 4.3	2.6 to 10.5
	Elect. T&D (S27)	-4.7	-6%	-16.5
	All Elect. Prod. (Ex. Pro. Oth. Fuel)	-2.1 to -1.1 (+1.1)	-2.8 to -1.5 (+1.1)	-7.6 to -4 (+3.4)
	Wtr, Supl. Upstrm (S29)	+4.3	+4.3	10.5
	Transp. (S35)	+1.2	+5.6%	11.4
2050 w/r 2015	Majority	-2.2 to '+1.0	-7.6 to +3.4	-7.5 to +3.4
	Strong	-4.8 to '+1.4	-16.5 to 11.4	-16.5 to +11.4
	Moderate	0.1 to 0.9	0.2 to 3.2	+0.2 to +3.2
	Weak	0.7 to 7.9	2.6 to 10.5	2.6 to 7.7
	Elect. T&D (S27)	-4.8	-16.5	-16.5
	All Elect. Prod. (Ex. Pro. Oth. Fuel)	-2.2 to -1.2 (+1%)	-7.6 to -4 (3.4)	-7.5 to -4 (+3.5)
	Wtr, Supl. Upstrm (S29)	+7.9	+10.5	7.7
	Transp. (S35)	+1.4	+11.4	11.4
2050 w/r 2035	Majority	-0.1 to -0.04	-4.94 to +2.3	-4.9 to +2.3
	Strong	-0.1 to +0.2	-11.2 to 5.5	-11.2 to 5.5
	Moderate	-0.1 to -0.05	0.2 to 2.1	0.2 to 2.1
	Weak	-0.1 to +3.5	1.7 to 5.9	1.7 to 5.5
	Elect. T&D (S27)	-0.07	-11.24	-11.2
	All Elect. Prod. (Ex. Pro. Oth. Fuel)	-0.07	-4.94 to -2.5 (2.3)	-4.9 to -2.5 (+2.3)
	Wtr, Supl. Upstrm (S29)	+3.5	+5.9	5.5
	Transp. (S35)	+0.24	+5.5	5.5

Note: Figures are rounded to one digit where possible.
Source: This author's analysis based on the scenarios model developed in this research.

Based on the Renewable-Supreme and Exports-Dominant scenario results, the main points are as follows:

- The increase in backward linkages of most of the sectors, particularly moderate and weak sectors across the three scenarios, means: first, the ability of the each scenario to develop backward linkages further; second, sectoral potential to induce more economic activity in other sectors because of changes in final demand. Therefore, the economy as a whole will improve. Third, sectors with strong backward linkages can be considered in policy decisions aimed at economic development, while sectors with moderate to weak backward linkages which have demonstrated highest increases in their backward linkages, could be considered in policies focused at improving sectors of the economy for higher productivity.
- The Renewable-Supreme Scenario results will support the NEG targets beyond those specified in the Base Case scenarios (Table 9.1) implying that the Emission Guarantee Objective of the NEG Scheme can be achieved sustainably under the assumed targets.
- The increasing pattern of change in backward linkages of Transport (S35) within, and across, scenarios is due to predicted increases in eVehicles in 2035 and 2050 respectively (Table 9.2).

Higher adoption rates will significantly increase the electricity share of the Sector's fuel consumption. This outcome, together with generation of more electricity from renewable sources imply achievement of the Australia's emissions targets based on Paris Accord (DEE 2017).

- The change in backward linkages of Upstream Water Supply (S29) is relatively high over the scenario period because of the assumed renewable energy targets through hydro. This result suggests that more focus needs to be placed on electricity generation from Solar and Wind, rather than Hydro. The reason is to prevent disturbances to the natural water cycle system through which the Sector's input requirements are provided (Chapter 3, historical analysis).
- Significant drop in backward linkages of Electricity T&D (S27) is directly related to the flexibility to increase renewables targets. This outcome further demonstrates that emissions target as specified by the NEG is "*not directly linked to absolute abatement but flexibility to set emissions intensity target*" which requires flexibly in setting renewable energy targets.
- In comparison with the Base Case and Renewable-Supreme scenarios, the change in backward linkages in Export-Dominant scenario, over 2015-2050, is significantly higher, because of its larger number of assumed future parameters including those used in the other two scenarios.

The inter-scenario comparisons of backward linkages for 2035-2050 shows which scenario develops backward linkages further, given each scenario's underlying future parameters. Table 9.5 shows detailed results, while Table 9.7 provide summaries in terms of the ranges within which linkages are changed. The summary Table shows that by comparing the Exports-Dominant and Renewable-Supreme (ED w/r RS) scenarios in 2035, there are almost no differences between the backward linkages; and in 2050, negligible. In contrast, when backward linkages in each of these two scenarios are compared with the Base Case in 2035, the inter-scenario magnitudinal differences are relatively significant. For example, in 2035, the linkages in Export-Dominant and Renewable-Supreme are similarly greater than the Base Case (e.g. -1.30 to 4.3% for sectors with strong backward linkages against the 0.00 to +0.04 under ED w/r RS); or, the linkages of Transport and Storage Services (S35) in each of the two scenarios increase by almost the same percentages (4.3%) against +0.04 under ED w/r RS.

However, the linkages significantly change when the Exports-Dominant and Renewable-Supreme Scenarios are compared with the Base Case in 2050 (i.e. ED w/r BC and RS w/r BC). The 2050 comparisons of ED w/r BC reveals that sectors with strong backward linkages experience the highest change in their linkages within the range -12.33 to +9.8%, nevertheless the percentage of change in ED w/r BC and RS w/r BC are almost similar.

The impacts of scenarios in development of linkages in Transport (S35) has been significant. Table 9.8 shows a significant increasing pattern for electricity inputs (measured by cumulative inverse coefficients of upstream electricity supply sector) to the transport sector in future periods.

Table 9.7: Summary inter-scenario %change, backward linkages, 2035 and 2050

Year	Sector	Renewable-Supreme w/r Base Case (RS-BC)	Exports-Dominant w/r Base Case (ED-BC)	Exports-Dominant w/r Renewable-Supreme (ED-RS)
2035	Majority	-1.30 to 0.34	-0.63 to 0.38	0.00 to +0.04
	Strong	-1.30 to 4.33	-1.30 to +4.36	0.00 to +0.04
	Moderate	-0.18 to +0.23	-0.14 to +0.27	+0.04
	Weak	-2.15 to +0.04	-2.10 to +0.13	0.00 to 0.09
	Elect. T&D (S27)	-1.30	-1.30	0.00
	All Elect. Prod. (Ex. Pro. Oth. Fuel)	-0.65 to -0.041	-0.63 to -0.38	+0.02
	Wtr, Supl. Upstrm (S29)	+0.05	-2.1	-2.15
	Transp. (S35)	+4.30	+4.36	+0.04
2050	Majority	-5.50 to +2.42	-5.47 to -2.83	0.02 to +0.04
	Strong	-12.33 to +9.79	-12.33 to +9.83	0.00 to 0.05
	Moderate	+0.09 to +2.23	+0.14 to +2.28	+0.04 to +0.05
	Weak	-2.53 to +0.05	-0.16 to +2.40	+1.83 to +2.42
	Elect. T&D (S27)	-12.33	-12.33	0.00
	All Elect. Prod. (Ex. Pro. Oth. Fuel)	-5.49 to -2.86	-5.47 to -2.83	+0.02 to +0.03
	Wtr, Supl. Upstrm (S29)	+2.42	-0.16	-2.53
	Transp. (S35)	+9.79	+9.83	+0.04

Source: This author's analysis based on the scenarios model developed in this research.

Table 9.8: Electricity requirements of transport sector, 2015-2050

	Base Case	Renewable-Supreme	Exports-Dominant
2015	0.0157	0.0157	0.0157
2035	0.0176	0.0480	0.0480
2050	0.0197	0.0886	0.0885
% change 2035 w/r 2015	12%	206%	206%
% change 2050 w/r 2015	26%	465%	464%

Source: Results obtained from the scenarios model developed in this research.

The Base Case Scenario results in 2050 show that to satisfy a unitary increase in transport final demand, the electricity sector needs to supply 26% more electricity in comparison to the 2015 levels. However, based on the scenarios' assumptions (Table 9.1) the electricity inputs to Renewable-Supreme and Exports-Dominant Scenarios in 2050 will be on average about 460%, nearly 18 time, higher than the inputs in the base year 2015. This shows development of strong linkages between the electricity sector and transport sector under the latter two scenarios because of assumed increase in eVehicles in 2050.

Main points arising from comparing the Scenarios over the period 2015-2050 are as follows:

- A scenario comparison of backward linkages in 2035 and 2050 confirm pervious findings which were obtained with reference to the base year 2015 providing additional information on the ability of each scenario to further develop backward linkages.
- The inter-scenario comparison of backward linkages in Export-Dominant and Renewable-Supreme Scenarios in 2035 (Table 9.7) shows nil, or negligible increases, in linkage magnitudes. However, the changes in backward linkages are slightly higher when the 2050 linkage indices are compared. In particular the magnitude of the backward linkages in weak sectors increases in the

range of +1.8 to +2.4 in 2050 in comparison with 0.00 to 0.09% in 2035. This implies the effectiveness of the assumptions in Exports-Dominant scenario to create economic activities in weak sectors too.

- Overall, the linkages in Exports-Dominant Scenarios are stronger than in Renewable-Supreme;
- The magnitude of backward linkages increase at significantly higher rates in sectors with strong backward linkages than sectors with moderate to weak backward linkages. This means that irrespective of scenario assumptions these sectors can perform well in the economy. Therefore, from policy perspective these sectors can assist with achievement of the policy objectives satisfactorily.

9.3.2 Forward Linkages

Tables 9.9 shows forward linkage indices and compares the rate of change within and between the scenarios over the period 2015 to 2050. Also, Table 9.10 provides inter-scenario comparisons of forward linkages with reference to the *same* future year (2035, 2050).

The sectoral grouping based on the size of forward linkages is in accordance to the same criteria which was described in the section 9.3.1 (backward linkages). The impacts of each scenario on development of the future forward linkages are discussed as follows.

In comparison with 2015, the forward linkage indices of the Electricity Transmission and Distribution Sector (S27) in the Base Case scenario in 2035 declines by -2.6% (Table 9.9), because of a drop in the supply of electricity by the majority of its provider sectors in the range of -2.0% to -1.3% over the period. The reduction in electricity supply by fossil-fuel powered generation plants is in alignment with the NEG Scheme. However, it is observed that the among generation sectors, the forward linkages for both Electricity Generation by Hydro (S24), and the Electricity Generation by Renewables (S25) also decline by almost the same magnitude (-2% over the period). The latter outcome is attributed to low renewable energy targets in the Base Case against the 64% generation targets by fossil fuels under the NEG Scheme. The magnitude of change in forward linkages of the latter sectors in Renewable-Supreme scenario however is relatively significant, +2.5% in 2035 and +4.7% in 2050 (Table 9.9). These results show an accelerated growth rate of 88% in production of renewable energy in Renewable-Supreme scenario from 2035 to 2050. In comparison to the previous two scenarios, the Exports-Dominant scenario yet shows much higher magnitude of change in forward linkages of the Electricity Generation by Hydro (S24) by 4.6% in 2035 and 4.8% in 2050, and in the Electricity Generation by Renewables (S25) by an average of 4.8% both in 2035 and 2050. The higher magnitude of change in forward linkages in Renewable-Supreme and Exports-Dominant scenarios is attributed to higher renewable targets in these two scenarios. The latter outcomes have significantly improved the forward linkages of the Electricity Transmission and Distribution Sector (S27) in these two scenarios by an average increases of +2.2% in Renewable-Supreme, and +2.6% in Exports-Dominant scenarios in 2030 and 2050 respectively.

Table 9.9: Forward linkages, 2015-2050 (% change)

				Forward Linkages						%change											
				Base Case		Renewable-Supreme		Exports-Dominant		Base Case			Renewable-Supreme			Exports-Domient					
	Code	Sector	2015	2035	2050	2035	2050	2035	2050	2035 w/r 2015	2050 w/r 2015	2050 w/r 2035	2035 w/r 2015	2050 w/r 2015	2050 w/r 2035	2035 w/r 2015	2050 w/r 2015	2050 w/r 2035			
Strong	S22	Elec. Gen. Oil	1.488	2.334	2.306	1.523	1.530	1.525	1.533	56.801	54.921	-1.199	2.355	2.781	0.415	2.781	2.980	0.487			
	S24	Elec. Gen. Hydro	1.422	1.394	1.394	1.458	1.487	1.459	1.490	-2.002	-1.967	0.036	2.502	4.562	2.010	4.562	4.748	2.076			
	S29	Water, Upstrm	1.400	1.397	1.392	1.423	1.426	1.425	1.430	-0.209	-0.562	-0.354	1.678	1.903	0.221	1.903	2.151	0.313			
	S28	Gas Supply	1.381	1.376	1.368	1.355	1.349	1.359	1.355	-0.379	-0.928	-0.551	-1.890	-2.326	-0.445	-2.326	-1.854	-0.242			
	S21	Elec. Gen. Coal	1.368	1.343	1.343	1.404	1.465	1.405	1.468	-1.818	-1.822	-0.004	2.625	7.140	4.400	7.140	7.347	4.482			
	S25	Elec. Gen. Renew.	1.314	1.287	1.288	1.346	1.375	1.348	1.377	-1.998	-1.961	0.037	2.495	4.663	2.115	4.663	4.849	2.181			
	S27	Tlec. T&D	1.312	1.278	1.278	1.337	1.346	1.339	1.348	-2.609	-2.599	0.011	1.890	2.534	0.632	2.534	2.708	0.694			
	S15	Non-Metal & Min. Prod.	1.296	1.271	1.271	1.297	1.298	1.299	1.302	-1.862	-1.861	0.001	0.121	0.217	0.096	0.217	0.483	0.198			
	S13	Coal Prod. Mfg	1.324	1.262	1.259	1.286	1.248	1.272	1.225	-4.711	-4.910	-0.209	-2.857	-5.757	-2.986	-5.757	-7.497	-3.715			
	S16	Iron & Steel Mfg	1.319	1.242	1.250	1.267	1.275	1.269	1.278	-5.804	-5.221	0.619	-3.902	-3.295	0.633	-3.295	-3.064	0.722			
	S10	Wood Prod.	1.231	1.217	1.222	1.241	1.247	1.243	1.250	-1.079	-0.727	0.355	0.863	1.326	0.459	1.326	1.602	0.564			
	S31	Water, Rurl	1.193	1.188	1.185	1.210	1.212	1.212	1.215	-0.482	-0.736	-0.255	1.435	1.604	0.166	1.604	1.852	0.259			
	S09	Pulp & Paper Mfg	1.263	1.188	1.184	1.211	1.211	1.213	1.214	-5.999	-6.262	-0.280	-4.173	-4.159	0.014	-4.159	-3.906	0.116			
	S18	Other Metal Prod.	1.172	1.150	1.148	1.173	1.171	1.175	1.173	-1.887	-1.977	-0.093	0.126	-0.063	-0.188	-0.063	0.147	-0.111			
	S12	Petro. Prod. Mfg	1.052	1.031	1.029	1.029	0.984	1.031	0.987	-1.941	-2.117	-0.180	-2.156	-6.420	-4.358	-6.420	-6.147	-4.247			
	S23	Elec. Gen. Nat. Gas	1.034	1.017	1.017	1.065	1.089	1.067	1.094	-1.688	-1.683	0.005	2.962	5.340	2.309	5.340	5.778	2.468			
	S01	Ag., Forest & Fish'g	0.982	1.004	1.013	1.022	1.037	1.024	1.039	2.188	3.168	0.959	4.073	5.541	1.410	5.541	5.801	1.505			
	S36	Comm, Fin. & Bus. Serv.	0.982	0.967	0.964	0.988	0.979	0.989	0.982	-1.517	-1.863	-0.351	0.584	-0.329	-0.907	-0.329	-0.045	-0.797			
	S11	Print & Pub.	0.994	0.949	0.948	0.968	0.969	0.970	0.971	-4.466	-4.641	-0.183	-2.549	-2.528	0.022	-2.528	-2.255	0.130			
	S03	Crude Oil	1.006	0.967	0.943	0.960	0.899	0.962	0.902	-3.869	-6.297	-2.525	-4.550	-10.678	-6.420	-10.678	-10.368	-6.284			
	S14	Chem. Prod.	0.959	0.945	0.942	0.964	0.962	0.965	0.965	-1.430	-1.725	-0.299	0.511	0.341	-0.169	0.341	0.626	-0.059			
Moderate	S08	Textile & Clothing	0.807	0.854	0.897	0.871	0.918	0.873	0.920	5.746	11.173	5.133	7.911	13.696	5.361	13.696	14.014	5.472			
	S05	Explor. Mining	0.922	0.897	0.896	0.916	0.887	0.917	0.890	-2.758	-2.905	-0.151	-0.739	-3.807	-3.091	-3.807	-3.514	-2.945			
	S32	Water, Sev.	0.895	0.894	0.895	0.914	0.917	0.915	0.920	-0.127	-0.023	0.104	2.057	2.456	0.390	2.456	2.749	0.502			
	S30	Water, Urb	0.883	0.890	0.887	0.910	0.909	0.912	0.912	0.782	0.395	-0.384	3.031	2.918	-0.109	2.918	3.216	0.003			
	S35	Trsprt & Storage Serv.	0.894	0.871	0.868	0.889	0.883	0.890	0.886	-2.530	-2.929	-0.410	-0.586	-1.233	-0.651	-1.233	-0.944	-0.536			
	S33	Const.	0.866	0.847	0.846	0.865	0.861	0.867	0.864	-2.168	-2.290	-0.125	-0.136	-0.554	-0.419	-0.554	-0.247	-0.297			
	S39	Oth. Comml Serv.	0.803	0.780	0.778	0.796	0.791	0.797	0.794	-2.818	-3.126	-0.318	-0.877	-1.449	-0.577	-1.449	-1.147	-0.456			
	S19	Mach. & Transp Prod.	0.770	0.750	0.748	0.767	0.768	0.768	0.770	-2.699	-2.892	-0.198	-0.455	-0.306	0.150	-0.306	0.001	0.271			
Weak	S07	Food & Bev	0.709	0.726	0.737	0.739	0.754	0.740	0.756	2.368	3.985	1.580	4.264	6.336	1.987	6.336	6.612	2.089			
	S06	Oth. Mining	0.714	0.731	0.720	0.745	0.737	0.746	0.739	2.456	0.955	-1.465	4.404	3.331	-1.028	3.331	3.609	-0.927			
	S34	Wsale&Retail	0.738	0.711	0.709	0.725	0.722	0.727	0.725	-3.625	-3.879	-0.263	-1.725	-2.113	-0.395	-2.113	-1.811	-0.274			
	S04	Nat Gas	0.778	0.668	0.676	0.666	0.674	0.620	0.598	-14.196	-13.099	1.279	-14.447	-13.343	1.290	-13.343	-23.142	-3.452			
	S20	Mfg Oth.	0.689	0.662	0.668	0.675	0.683	0.676	0.685	-3.918	-3.090	0.862	-2.078	-0.872	1.231	-0.872	-0.599	1.339			
	S02	Coal	0.698	0.630	0.654	0.652	0.568	0.653	0.570	-9.793	-6.378	3.785	-6.691	-18.677	-12.845	-18.677	-18.356	-12.679			
	S26	Elec. Gen Oth. Fuel	0.659	0.650	0.651	0.680	0.704	0.681	0.706	-1.309	-1.246	0.064	3.197	6.898	3.586	6.898	7.097	3.657			
	S17	Non-Ferrous Mfg	0.646	0.608	0.602	0.620	0.616	0.621	0.618	-5.850	-6.831	-1.042	-4.055	-4.618	-0.587	-4.618	-4.353	-0.482			
	S37	Govt Admin.	0.564	0.558	0.558	0.568	0.570	0.569	0.571	-1.194	-1.163	0.031	0.673	0.963	0.288	0.963	1.227	0.388			
	S38	Edu, Hlth & Cmty Serv.	0.472	0.466	0.466	0.475	0.477	0.475	0.478	-1.178	-1.299	-0.122	0.605	1.042	0.434	1.042	1.247	0.507			

Source: Results generated by the scenarios model developed in this research.

Table 9.10: Forward linkages, % change, 2035, 2050
(inter-scenario, same year comparison)

			Forward Linkages						%change					
			Base Case		Renewable-Supreme (RS)		Exports-Dominant (ED)		RS w/r BC		ED w/r BC		ED w/r RS	
	Code	Sector	2035	2050	2035	2050	2035	2050	2035	2050	2035	2050	2035	2050
Strong	S22	Elec. Gen. Oil	2.334	2.306	1.523	1.530	1.525	1.533	-34.723	-33.656	-34.643	-33.528	0.122	0.194
	S24	Elec. Gen. Hydro	1.394	1.394	1.458	1.487	1.459	1.490	4.596	6.661	4.714	6.850	0.113	0.177
	S29	Water, Upstrm	1.397	1.392	1.423	1.426	1.425	1.430	1.891	2.480	2.046	2.729	0.152	0.243
	S28	Gas Supply	1.376	1.368	1.355	1.349	1.359	1.355	-1.517	-1.412	-1.242	-0.936	0.280	0.483
	S21	Elec. Gen. Coal	1.343	1.343	1.404	1.465	1.405	1.468	4.525	9.128	4.644	9.339	0.114	0.193
	S25	Elec. Gen. Renew.	1.287	1.288	1.346	1.375	1.348	1.377	4.584	6.757	4.702	6.947	0.113	0.178
	S27	Tlec. T&D	1.278	1.278	1.337	1.346	1.339	1.348	4.620	5.270	4.733	5.448	0.108	0.169
	S15	Non-Metal & Min. Prod.	1.271	1.271	1.297	1.298	1.299	1.302	2.021	2.118	2.188	2.389	0.164	0.266
	S13	Coal Prod. Mfg	1.262	1.259	1.286	1.248	1.272	1.225	1.945	-0.891	0.822	-2.721	-1.102	-1.846
	S16	Iron & Steel Mfg	1.242	1.250	1.267	1.275	1.269	1.278	2.019	2.033	2.172	2.276	0.150	0.238
	S10	Wood Prod.	1.217	1.222	1.241	1.247	1.243	1.250	1.963	2.068	2.134	2.346	0.168	0.272
	S31	Water, Rurl	1.188	1.185	1.210	1.212	1.212	1.215	1.926	2.356	2.081	2.607	0.152	0.245
	S09	Pulp & Paper Mfg	1.188	1.184	1.211	1.211	1.213	1.214	1.943	2.244	2.109	2.514	0.163	0.264
	S18	Other Metal Prod.	1.150	1.148	1.173	1.171	1.175	1.173	2.051	1.953	2.186	2.167	0.132	0.210
	S12	Petro. Prod. Mfg	1.031	1.029	1.029	0.984	1.031	0.987	-0.220	-4.396	-0.045	-4.117	0.175	0.292
	S23	Elec. Gen. Nat. Gas	1.017	1.017	1.065	1.089	1.067	1.094	4.730	7.143	5.002	7.589	0.260	0.416
	S01	Ag., Forest & Fish'g	1.004	1.013	1.022	1.037	1.024	1.039	1.845	2.300	2.001	2.552	0.153	0.247
	S36	Comm, Fin. & Bus. Serv.	0.967	0.964	0.988	0.979	0.989	0.982	2.133	1.563	2.310	1.852	0.173	0.285
	S11	Print & Pub.	0.949	0.948	0.968	0.969	0.970	0.971	2.006	2.216	2.181	2.502	0.171	0.280
	S03	Crude Oil	0.967	0.943	0.960	0.899	0.962	0.902	-0.708	-4.676	-0.508	-4.345	0.202	0.347
	S14	Chem. Prod.	0.945	0.942	0.964	0.962	0.965	0.965	1.969	2.102	2.146	2.392	0.173	0.284
Moderate	S08	Textile & Clothing	0.854	0.897	0.871	0.918	0.873	0.920	2.047	2.269	2.225	2.555	0.175	0.279
	S05	Explor. Mining	0.897	0.896	0.916	0.887	0.917	0.890	2.077	-0.929	2.234	-0.627	0.154	0.305
	S32	Water, Sev.	0.894	0.895	0.914	0.917	0.915	0.920	2.186	2.479	2.365	2.772	0.175	0.286
	S30	Water, Urb	0.890	0.887	0.910	0.909	0.912	0.912	2.232	2.514	2.413	2.810	0.177	0.289
	S35	Trsprt & Storage Serv.	0.871	0.868	0.889	0.883	0.890	0.886	1.994	1.747	2.175	2.045	0.178	0.293
	S33	Const.	0.847	0.846	0.865	0.861	0.867	0.864	2.077	1.777	2.267	2.091	0.186	0.309
	S39	Oth. Comml Serv.	0.780	0.778	0.796	0.791	0.797	0.794	1.996	1.732	2.185	2.043	0.185	0.306
	S19	Mach. & Transp Prod.	0.750	0.748	0.767	0.768	0.768	0.770	2.306	2.663	2.497	2.979	0.187	0.308
Weak	S07	Food & Bev	0.726	0.737	0.739	0.754	0.740	0.756	1.852	2.261	2.015	2.526	0.160	0.260
	S06	Oth. Mining	0.731	0.720	0.745	0.737	0.746	0.739	1.901	2.353	2.071	2.629	0.167	0.269
	S34	Wsale&Retail	0.711	0.709	0.725	0.722	0.727	0.725	1.972	1.837	2.162	2.151	0.186	0.308
	S04	Nat Gas	0.668	0.676	0.666	0.674	0.620	0.598	-0.293	-0.282	-7.224	-11.557	-6.951	-11.307
	S20	Mfg Oth.	0.662	0.668	0.675	0.683	0.676	0.685	1.916	2.288	2.088	2.570	0.169	0.275
	S02	Coal	0.630	0.654	0.652	0.568	0.653	0.570	3.439	-13.136	3.649	-12.794	0.204	0.395
	S26	Elec. Gen Oth. Fuel	0.650	0.651	0.680	0.704	0.681	0.706	4.566	8.246	4.689	8.448	0.118	0.186
	S17	Non-Ferrous Mfg	0.608	0.602	0.620	0.616	0.621	0.618	1.907	2.376	2.082	2.660	0.172	0.278
	S37	Govt Admin.	0.558	0.558	0.568	0.570	0.569	0.571	1.890	2.151	2.055	2.419	0.162	0.262
	S38	Edu, Hlth & Cmty Serv.	0.466	0.466	0.475	0.477	0.475	0.478	1.805	2.371	1.938	2.579	0.130	0.203

Source: Results generated by the scenarios model developed in this research.

In Base Case Scenario however the supply of electricity (measured by forward linkages) by the Electricity Generation by Oil Sector (S22) increases by 56% over the scenario period. Given the very small share of this sector in overall electricity generation system (~0.2%), its production growth in NEG Scheme is relatively insignificant.

The change in forward linkages for all of the electricity sectors in the Base Case scenario in 2050 closely follow the 2035 pattern as discussed above. Additionally, forward linkages of these sectors show nil growth over the period 2035 - 2050 in the Base Case scenario.

In the Base Case Scenario in 2035 and 2050, the forward linkages of the natural gas (S04) decrease on average by about -14%; Coal Sector (S02) by an average -8.1%; Crude Oil (S03) by an average -5.2%; and Petroleum Products Manufacturing (S12) by an average -2.3%.

Reduction in forward linkages of the aforementioned sectors means lower availability (supply) of sectoral products to other sectors of the economy including fossil fuel powered plants and the Transport and Storage Services (S35). This outcome implies less carbon dioxide emissions, in alignment with the Emissions Guarantee Objective of the NEG Scheme in the Base Case scenario.

The declining patterns of change in fossil fuel consumption continues in Renewable-Supreme and Exports-Dominant Scenarios over the study period (Table 9.10). For example, in Export-Dominant Scenario, the forward linkages of the Coal Sector (S02) in 2035 decline rapidly by -18.7% compared to 2015 and by -18.4% in 2050. This is a sharp decline with a magnitudinal average of -18.5% in 2035 and 2050, in spite of the assumed increases in exports. Likewise, in Export-Dominant Scenarios in 2050, the forward linkages of the Gas (incl. Nat Gas, LPG and CSG) Sector (S04) decline strongly (by -23.1%) despite a doubling of Gas exports in 2050 as against its 2015 exports level. The estimated overall reduction in Gas supply could have declined at a higher magnitude if the 20% gas share of electricity fuel shares in 2015 was not assumed to continue in Base Case over the period 2035-2050, and similarly was not maintained at an average 15% level in Renewable-Supreme and Exports-Dominant Scenarios (see Section 9.2, electricity fuel shares; and Table 9.1, scenario parameters).

The declining pattern of natural gas and petroleum products supply impacts inter-industry sectors which depend on adequate supply of these commodities for their economic activities as well as the sectors of final demand for consumptions. Table 9.11 estimates the impacts of rapid decline in natural gas supply on Electricity Production by Nat. Gas (S23), and aggregate inter-industry and 'other sectors' of economy. Also, Table 9.12 provides similar estimates for final demand at both sectoral and aggregate levels.

The supply of natural gas to the Electricity Generation by Nat. Gas Sector (S23) strongly declines across all scenarios over the period 2015-2050. Comparison of the Base Case and Exports-Dominant Scenarios reveals that the gas supply is reducing at an accelerated amount of about

135% from 2015 to 2050. The gas availability for the electricity sector (S23) is slightly lower over the period 2015-2035 in majority of the scenarios, while the highest reductions are observed in Exports-Dominated Scenarios. The gas supply to other sectors of economy is impacted negatively in the range -13% to -21%, slightly lower than the percentage change for the inter-industry sectors.

Table 9.11: Natural Gas forward linkages with inter-industry sectors, 2015-50

	Electricity Generation by Nat Gas (S23)			Other Sectors		
	Base Case	Renewable-Supreme	Exports-Dominant	Base Case	Renewable-Supreme	Exports-Dominant
2015	0.0442	0.0442	0.0442	0.7341	0.7341	0.7341
2035	0.0317	0.0261	0.0206	0.6361	0.6397	0.5990
2050	0.0331	0.0275	0.0182	0.6433	0.6470	0.5800
% change 2035 w/r 2015	**-28%**	**-41%**	**-53%**	**-13%**	**-13%**	**-18%**
% change 2050 w/r 2015	**-25%**	**-38%**	**-59%**	**-12%**	**-12%**	**-21%**

	Inter-Industry		
	Base Case	Renewable-Supreme	Exports-Dominant
2015	0.7783	0.7783	0.7783
2035	0.6678	0.6659	0.6196
2050	0.6764	0.6745	0.5982
% change 2035 w/r 2015	**-14%**	**-14%**	**-20%**
% change 2050 w/r 2015	**-13%**	**-13%**	**-23%**

Table 9.12: Gas forward linkages with sectors of final demand, 2015-2050

	Households			Exports		
	Base Case	Renewable-Supreme	Exports-Dominant	Base Case	Renewable-Supreme	Exports-Dominant
2015	0.2300	0.2300	0.2300	0.4694	0.4694	0.4694
2035	0.1573	0.1512	0.1181	0.6295	0.6435	0.7247
2050	0.1656	0.1574	0.1022	0.6127	0.6300	0.7669
% change 2035 w/r 2015	**-32%**	**-34%**	**-49%**	**34%**	**37%**	**54%**
% change 2050 w/r 2015	**-28%**	**-32%**	**-56%**	**31%**	**34%**	**63%**

	Final Demand (Other)			Total Final Demand		
	Base Case	Renewable-Supreme	Exports-Dominant	Base Case	Renewable-Supreme	Exports-Dominant
2015	0.3182	0.3182	0.3182	1.0176	1.0176	1.0176
2035	0.2150	0.2153	0.1680	1.0017	1.0101	1.0107
2050	0.2239	0.2242	0.1454	1.0023	1.0117	1.0144
% change 2035 w/r 2015	**-32%**	**-32%**	**-47%**	**-2%**	**-1%**	**-1%**
% change 2050 w/r 2015	**-30%**	**-30%**	**-54%**	**-2%**	**-1%**	**0%**

Source: Results obtained from the scenarios model developed in this research.

The natural gas supply to Households and other sectors of final demand reduces almost at the same percentages that the gas exports increase, while the overall impacts on final demand because of the counteracting effects are negligible (-2% to 0.0% across all scenarios). This shows that a small increase in final demand has large impacts on domestic sectors of economy, including sectors of final demand.

The gas supply to Households strongly decline across all scenarios over the period 2015-2050 from -28% in Base Case Scenario to a significantly larger reduction of -56% in Exports-Dominant

Scenario. However, when the availability of gas for exports in Base Case and Exports-Dominant Scenarios are compared, it is observed that the gas supply is increased at accelerating growth rate of about 105% from 2015 to 2050.

The percentage increases in gas exports in Base Scenario and in Exports-Dominant scenario exactly confirm the assumed increases in the gas exports in the latter scenario (Table 9.1).

The impact of reduction in forward linkages of the Gas (S04) with the whole economy varies within the range -7% to -10% across all scenarios over the period 2015 to 2050 (Table 9.13). The reason for observing the much lower magnitudinal change at the economy level in comparison to the change seen at the sectoral level (or a smaller segment of the economy) is due to the aggregate impacts of inter-industry and final demand sectors concealing information at a detailed level.

Table 9.13: Impact of change in Gas forward linkage in economy, 2015-2050

	Overall = Int-Ind + Fin Dmd		
	Base Case	Renewable-Supreme	Exports-Dominant
2015	1.7959	1.7959	1.7959
2035	1.6696	1.6759	1.6303
2050	1.6786	1.6861	1.6126
% change 2035 w/r 2015	**-7%**	**-7%**	**-9%**
% change 2050 w/r 2015	**-7%**	**-6%**	**-10%**

Source: Results obtained from the scenarios model developed in this research.

The impacts of reduction in forward linkages of Petroleum Products Manufacturing (S12) on inter-industry sectors (-2% in Base Case to -6% in Exports-Dominant Scenarios) in 2050 is the strongest decline when compared with total final demand and economy-wide impacts.

The impacts of the change in forward linkages of the Sector on the final demand as a whole is nil in Renewable-Supreme and in Exports-Dominant scenarios (Table 9.14).

Table 9.14: Change in forward linkages of Petroleum Prod. Mfg, 2015-2050

	Inter-Industry			Final Demand		
	Base Case	Renewable-Supreme	Exports-Dominant	Base Case	Renewable-Supreme	Exports-Dominant
2015	1.0517	1.0517	1.0517	1.0094	1.0094	1.0094
2035	1.0313	1.0290	1.0308	0.9924	1.0097	1.0097
2050	1.0294	0.9842	0.9870	0.9925	1.0080	1.0077
% change 2035 w/r 2015	**-2%**	**-2%**	**-2%**	**-2%**	**0%**	**0%**
% change 2050 w/r 2015	**-2%**	**-6%**	**-6%**	**-2%**	**0%**	**0%**

	Overall = Int-Ind + Fin Dmd		
	Base Case	Renewable-Supreme	Exports-Dominant
2015	2.0611	2.0611	2.0611
2035	2.0237	2.0388	2.0405
2050	2.0220	1.9922	1.9948
% change 2035 w/r 2015	**-2%**	**-1%**	**-1%**
% change 2050 w/r 2015	**-2%**	**-3%**	**-3%**

Source: Results obtained from the scenarios model developed in this research.

The change in forward linkages of the electricity sector with the Transport and Storage Services Sector (S35) follows a significant increasing pattern across all scenarios impacted by increasing rate of adopting electric vehicle technologies by 2050. Table 9.15 shows the supply linkages of the electricity sector with the transport sector over the period 2015 to 2050.

In comparison to 2015, it is estimated that the electricity availability for the Transport and Storage Supply Sector (S35) in Renewable-Supreme and Exports-Dominant Scenarios in 2050 will increase by about 340%, which is significantly higher than the level of increase under the Base Case Scenario (68%) in the same year.

Table 9.15: Supply of electricity to the transport sector, 2015-2050

	Forward Linkages (Electricity and Transport)		
	Base Case	**Renwable-Supreme**	**Exports-Dominant**
2015	0.1243	0.1243	0.1243
2035	0.1990	0.3309	0.3308
2050	0.2083	0.5466	0.5460
% change 2035 w/r 2015	60%	166%	166%
% change 2050 w/r 2015	68%	340%	339%

Source: Results obtained from the scenarios model developed in this research.

The change in forward linkages of other sectors of the economy are summarised in Table 9.16, and are briefly discussed as follows.

The forward linkages of Upstream Water Supply (S29) decrease (about -2%) in the Base Case over the scenario period. However, the consumption of water is increased under the Renewable-Supreme and the Exports-Dominant Scenarios almost equally by an average +2.1% in 2035 and 2050. The possible increase in the Sector's forward linkages could be related to higher water use by other sectors of economy including hydroelectric power plants.

The forward linkages of the Textile, Clothing, Footwear and Leather Sector (S08) show the highest percentage change in the range of +5.7% to +13.7% across all scenarios in 2035, and +11.2% to +14.0% in 2050. In Base Case Scenario, the Sector demonstrates an accelerated growth of 96.5% from 2035 to 2050 implying that its outputs are more available as inputs to other sectors for new economic activities. The growth, however, drops to 73.4% under the Renewable-Supreme, and to a significantly low (2.2%) in Exports-Dominant scenario.

In Base Case scenario in 2050, among sectors with above average forward linkages the Agriculture, Forestry and Fishing (S01) is the only sector with the highest gain in its forward linkages by 3.2%. The forward linkages of the remaining sectors in this category decreased in the range of -6.3% to -0.6%. The 59% increase in Electricity Generation by Oil Sector (S22) in this category was considered negligible because of its relatively small sectoral size in the economy.

In Export-Dominant scenario however the forward linkages of the Agriculture, Forestry and Fishing Sector (S01) increase the highest by +5.8%.

Table 9.16: Forward linkages, intra and inter-scenario comparison, 2015-2050

		% Change in Forward Linkages		
	Sector	Base Case	Renewable-Supreme	Exports-Dominant
2035 w/r 2015	Majority	-6.0 to +2.5	-6.7 to +4.4	-6.4 to +7.3
	Strong	-6.0 to +56.8	-4.6 to +4.1	-10.7 to +7.1
	Moderate	-2.8 to +5.7	-0.9 to +7.9	-3.8 to +13.7
	Weak	-14.2 to +2.5	-14.4 to +4.4	-18.7 to +6.9
	Elect. T&D (S27)	-2.6	+1.9	+2.5
	All Elect. Prod. (Ex. Elec. Gen by Oil)	-2.0 to -1.3	+1.9 to +3.2	+2.7 to +7.1
	Elect. Gen. Oil (S22)	+56.8	+2.4	+2.8
	Nat. Gas (S04)	-14.2	-14.4	-13.3
	Coal (S02)	-9.8	-6.7	-18.7
	Crude Oil (S02)	-3.9	-4.6	-10.7
	Water, Upstrm (S29)	-2.0	+1.7	+1.9
	Transp. (S35)	-2.5	-0.6	-1.2
	Textile & Clothing (S08)	+5.7	+7.9	+13.7
2050 w/r 2015	Majority	-6.8 to +4.0	-6.4 to +7.1	-7.5 to +7.3
	Strong	-6.3 to +54.9	-10.7 to +7.1	-10.4 to +7.3
	Moderate	-3.1 to +11.2	-3.8 to +13.7	-3.5 to +14.0
	Weak	-13.1 to +4.0	-18.7 to +6.9	-23.1 to +7.1
	Elect. T&D (S27)	-2.6	+2.5	+2.7
	All Elect. Prod. (Ex. Elec. Gen by Oil)	-2.0 to -1.2	+2.5 to +6.9	+2.7 to +7.3
	Elect. Gen. Oil (S22)	+54.9	+2.8	+3.0
	Nat. Gas (S04)	-13.1	-13.3	-23.1
	Coal (S02)	-6.4	-18.7	-18.4
	Crude Oil (S02)	-6.3	-10.7	-10.4
	Water, Upstrm (S29)	-0.6	+2.5	+2.2
	Transp. (S35)	-2.9	-1.2	-0.9
	Textile & Clothing (S08)	11.2	13.7	+14.0
2050 w/r 2035	Majority	-2.5 to -0.1	-6.4 to +5.4	-6.1 to +7.3
	Strong	-2.5 to +1.0	-6.4 to +4.4	-6.3 to +4.5
	Moderate	-0.4 to +5.1	-3.1 to +5.4	-2.9 to +5.5
	Weak	-1.5 to +3.8	-12.8 to +3.6	-12.7 to +3.7
	Elect. T&D (S27)	0.00	+0.6	+0.7
	All Elect. Prod. (Ex. Elec. Gen by Oil)	0.00 to -1.2	+0.6 to +3.6	+0.5 to +4.5
	Elect. Gen. Oil (S22)	-1.2	+3.6	+0.5
	Nat. Gas (S04)	+1.3	+1.3	-3.5
	Coal (S02)	+3.8	-12.8	-12.7
	Crude Oil (S02)	-2.5	-6.4	-6.3
	Water, Upstrm (S29)	-0.4	+0.2	+0.3
	Transp. (S35)	-0.4	-0.7	-0.5
	Textile & Clothing (S08)	+5.1	+5.4	+5.5

Source: This author's analysis based on the scenarios model developed in this research.

The forward linkages which have demonstrated the highest negative change in the group of strong (above-average) sectors in both Renewable-Supreme and in Exports-Dominant scenarios in 2050 belong to: Crude Oil (S03) by nearly -11%; Petroleum Products Manufacturing (S12) by -6.4%; Coal Products Manufacturing (S13) by -5.8%; Iron and Steel Manufacturing (S16) by -4.2%; and Printing, publishing other than music and Internet (S11) by -3.3% respectively. The latter sectors in both scenarios are in the same ranking positions as above.

The decline in Petroleum Products Manufacturing (S12) requires attention because of its high level of imports as discussed in Chapters 7 and 8. The efficiency of this sector could potentially be improved beyond the assumptions specified in the Exports-Dominant scenario (Table 9.1).

According to Department of Industry, Innovations, and Science (DIIS 2016), the decline in supply of Iron and Steel Manufacturing (S16) could be impacted by international economic conditions on the Australian economy. Advanced economies, such as the United States and Japan, are struggling to return to their pre-Global Financial Crisis (GFC) growth rates. China's economy continues to grow strongly, albeit below the double-digit highs of past years. The Brexit vote, which saw Britain vote to leave the European Union (EU), has added to global uncertainty, and highlights the growing unease around international trade. Together, these issues are affecting demand for three of the Australia's top exports - iron ore, coal and natural gas. The change in forward linkages are summarised in Table 9.16.

Table 9.17 summarises the intra-scenario analysis of change in forward linkages with reference to the same future year (2035, or 2050) in each scenario.

Table 9.17: Forward linkages, inter-scenario analysis, 2035 and 2050

	Sector	Renewable-Supreme w/r Base Case (RS-BC)	Exports-Dominant w/r Base Case (ED-BC)	Exports-Dominant w/r Renewable-Supreme (ED-RS)
2035	Majority	-1.5 to +2.3	-1.2 to +3.6	-1.1 to +0.3
	Strong	-34.7 to +4.7	-34.6 to 5.0	-1.1 to +0.3
	Moderate	+2.0 to +2.3	+2.2 to + 2.5	+0.2
	Weak	-0.3 to +4.6	-7.2 to +4.7	-7.0 to +0.2
	Elect. T&D (S27)	+4.6	+4.7	+0.1
	All Elect. Prod. (Ex. Elec. Gen by Oil)	+4.5 to +4.7	+4.7 to +5.0	+0.1 to +0.3
	Elect. Gen. Oil (S22)	-34.7	-34.6	+0.1
	Nat. Gas (S04)	-0.3	-7.2	-7.0
	Coal (S02)	+3.4	+3.6	+0.2
	Crude Oil (S02)	-0.7	-0.5	+0.2
	Water, Upstrm (S29)	+1.9	+2.7	+0.2
	Transp. (S35)	+2.0	+2.0	+0.2
	Textile & Clothing (S08)	+2.0	+2.2	+0.2
2050	Majority	-4.7 to +2.7	-4.3 to +3.0	-1.8 to +0.5
	Strong	-33.7 to +9.1	-33.5 to +9.3	-1.8 to +0.5
	Moderate	-0.9 to +2.7	-0.6 to +3.0	+0.3
	Weak	-13.1 to +8.2	-12.8 to +8.4	-11.3 to +0.4
	Elect. T&D (S27)	+5.3	+5.4	+0.2
	All Elect. Prod. (Ex. Elec. Gen by Oil)	+5.3 to +9.1	+5.4 to +9.3	+0.2 to +0.4
	Elect. Gen. Oil (S22)	-33.7	-33.5	+0.2
	Nat. Gas (S04)	-0.3	-11.6	-11.3
	Coal (S02)	-13.1	-12.8	+0.4
	Crude Oil (S02)	-4.7	-4.3	+0.3
	Water, Upstrm (S29)	+2.5	+2.7	+0.2
	Transp. (S35)	+1.5	+2.0	+0.3
	Textile & Clothing (S08)	+2.3	+2.6	+0.3

Source: This author's analysis based on the scenarios model developed in this research.

This analysis assists with examining the extent by which the magnitude of forward linkages could be impacted under one of the scenarios (because of the influence of its governing assumptions). For example, the forward linkage of the Electricity Generation by Coal (S22) in Renewable-Supreme (index=1.53) in 2050, when compared with the Sector's forward linkages in the Base Case scenario (index=2.306) in the same reference year - the (RS-BC) comparison in Table 9.17 - reveals that the Renewable-Supreme scenario negatively impacts the Sector's forward linkages by about -33.7%. However, similar analysis for the same sector under Export-Dominant (index=1.533) and Renewable-Supreme (index=1.530) - the (ED-RS) inter-scenario comparison in the same reference year (2050) - shows that the impact of the Export-Dominant scenario on value of the index is negligible (+0.2%). Therefore, the Renewable-Supreme has more impacts on changing the magnitude of the forward linkages than the Export-Dominant scenario. The latter findings are consistently observed under ED-RS comparison as shown in Table 9.13.

Based on the discussion in this section the key findings are:

- The inter-scenario analysis of forward linkages in 2035 and 2050 (Tables 9.10 and 9.17), reveals that the Export-Dominant scenario under its assumed future parameters (Table 9.1) has more influence on the rate of change in forward linkages than other scenarios;
- The intra-scenario and the inter-scenario analysis of the significant changes in forward linkages with reference the *base year 2015* is attributed to the Exports-Dominant scenario, followed by the Renewable-Supreme (Tables 9.9 and 9.16);
- The NEG Scheme is more effective under a higher set of renewable targets. The outcomes of the Base Case Scenario based on the NEG targets reveal that forward linkages of almost all electricity generator sectors including electricity generation by renewable sources decline. However, the supply improvements are observed in all electricity generation sectors under alternative scenarios assuming a higher set of renewable energy targets. Moreover, the supply of electricity by Electricity Transmission and Distribution (S27) is improved across the economy;
- Regardless of the assumed higher export targets, the decline in forward linkages of the Crude Oil (incl. condensate) Sector (S03), Gas (incl. Nat Gas, LPG and CSG) Sector (S04), Petroleum Products Manufacturing Sector (S12), and the Coal Mining Sector (S02) suggests adaptability of the NEG Scheme to an extended set of future parameters;
- The forward linkage indices of the electricity sector with the Transport and Storage Services (S35) become significantly stronger across all scenarios because of higher supply of electricity to the transport sector influenced by electric vehicle (eVehicle) technologies by 2050;
- The forward linkages of the Textile, Clothing, Footwear and Leather Sector (S08) demonstrate a significant growth of about 97% from 2035 to 2050 in the Base Case Scenario, and 73% in Renewable-Supreme Scenario. These results imply availability of supply for new economic activities elsewhere in the economy based on the scenario assumptions;
- The lower consumption of fossil fuels for electricity generation under the NEG Scheme implies their availability for domestic use or export considering all parameters remain the same;
- Decline in natural gas supply for domestic consumptions has direct relationships with the increase in natural gas export, almost at the same percentages that the gas exports are increasing;
- The impacts of low supply of natural gas for domestic use are much higher at the detailed sectoral level than at the aggregate sectoral or economy-wide levels. For example across all scenarios, the impacts of gas unavailability on aggregate final demand sectors is within the range -2% to 0.0% compared to the Household Sector of final demand which is within the range -28% to -56%.

9.3.3 Key Sectors

The changes in future backward and forward linkages, which were separately covered in sections 9.3.1 and 9.3.2, now are collectively analysed in this section - to describe the full story about the influence of each scenario on future performance of each sector.

The change in linkages potentially could change the economic status of each sector, impacting its level of contribution to the economy. This research has adopted the key sector analysis approach (discussed in Chapter 4) to investigate the "keyness" of each sector - the importance of each sector in the economy influenced by the size of its backward and forward linkages - relative to other sectors to identify possible change in sectoral status. Accordingly, the magnitudinal distributions of both backward and forward linkages based on the estimates by the scenario models are mapped (see Figures 9.4 to 9.10) to trace the change in sectoral status in 2035 and 2050, in comparison to 2015. Each Figure is characterised by four quadrants where a group of sectors are located within each quadrant based on the "keyness" criteria as further described below:

i. Key sectors whose backward and forward linkages are above-average (top right quarter of the graph in green). These sectors because of their strong linkages with rest of the sectors significantly contribute to the economy in response to increased final demand for their products. Also, they play a crucial role in unfolding the future economic objectives of each scenario. These sectors may reveal potential development strategies and future investments options. This research investigates the role of future key sectors in the realisation of the "Reliability of Supply" objective of the NEG Scheme in this section;
ii. Sectors with above average forward linkages are classified as strong Supplier (forward-oriented, top left quarter in dark blue). In the second tier of analysis, these sectors will influence achievement of the "Reliability of Supply" objective of the NEG as discussed earlier.
iii. Sectors with above average backward linkages are classified as strong at demand side (backward-oriented, bottom right quarter in light blue).
iv. Sectors whose both linkages are below average are classified as weak sectors (shown in red).

Sectors which are most exposed to change of status are those which are located close to the borderline of each quadrant. Therefore, possible changes to their backward and forward linkages could relocate them to a new quadrant which consequently impacts on their status. Further discussion on this follows.

In the Base Case in 2015 (Figure 9.4), Crude Oil (S03) is marginally a strong forward-oriented sector, with capacity to supply adequate oil mostly to the Petroleum Products Manufacturing (S12), Wholesale Trade (S34), Transport and Storage Sector (S35), and Construction (S33) sectors. Other forward-oriented sectors are Water Supply Upstream (S29), Petroleum Products Manufacturing (S12), Coal Products Manufacturing (S13), and Water Supply Rural (S31).

Figure 9.4: Sectoral status in Base Case, 2015

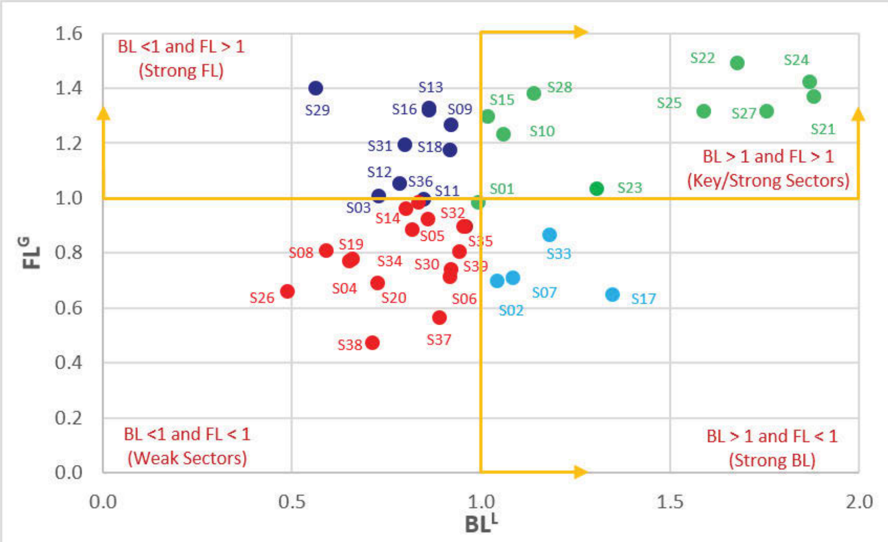


Figure 9.5: Sectoral status in Base Case, 2035

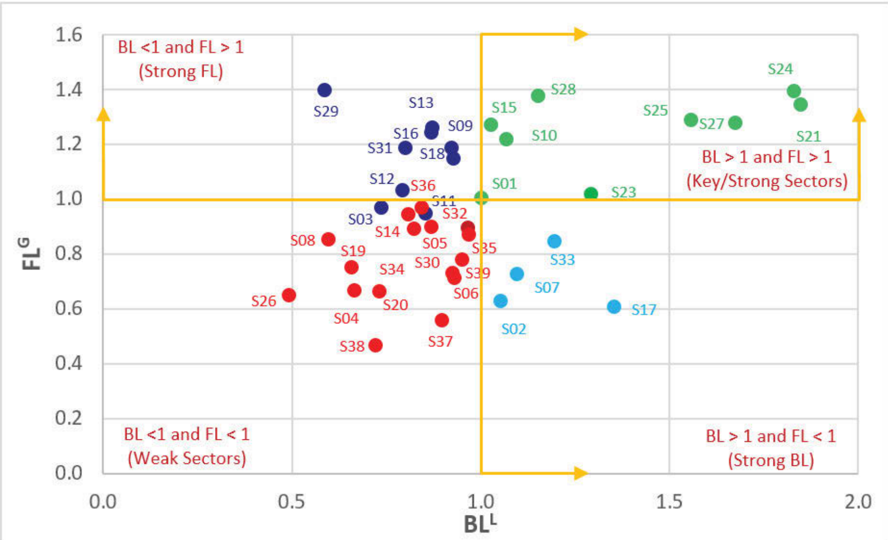
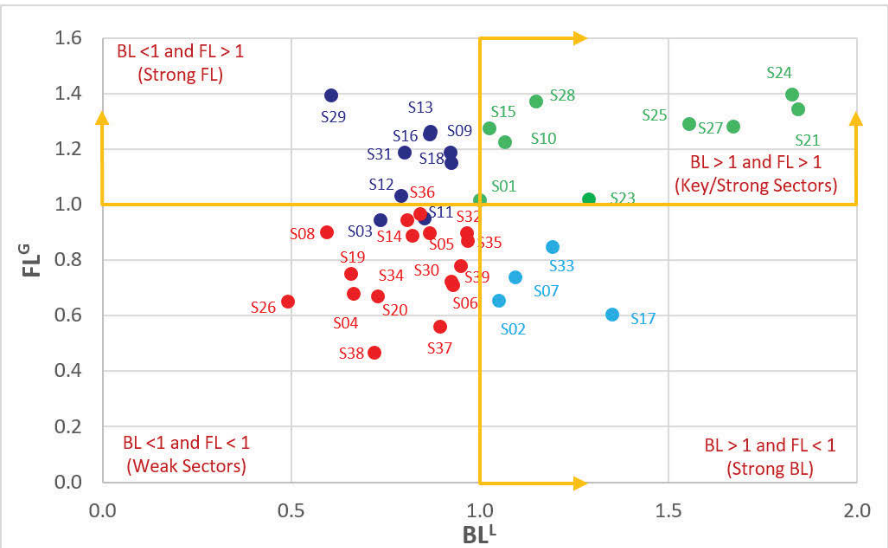


Figure 9.6: Sectoral status in Base Case, 2050



Source: This author's analysis based on the scenarios model developed in this research.

The Transport (S35) is among the weak sectors. Other sectors of the economy such as Printing, publishing other than music and Internet (S11), and Communication, Finance, Property and Business Services (S36) are on the border line of weak and forward-oriented sectors. However, in Base Case in 2035 (Figure 9.5), the economic status of Crude Oil (S03) and the Printing and Publishing Sector (S11) changes to weak. Compared to 2015, the status of Transport and Storage Services Sector (S35) remains weak, unchanged. The same pattern continues in the Base Case 2050. The supply of the Petroleum Products Manufacturing Sector (S12) in 2050 decreases by getting closer to the borderline of the weak sectors.

In Renewable-Supreme Scenario in 2035 (Figure 9.7), Transport and Storage Services (S35) becomes marginally backward-oriented while the linkages of Crude Oil (incl. condensate) (S03) becomes slightly weaker than its 2015 status.

Figure 9.7: Renewable-Supreme sectoral status, 2035

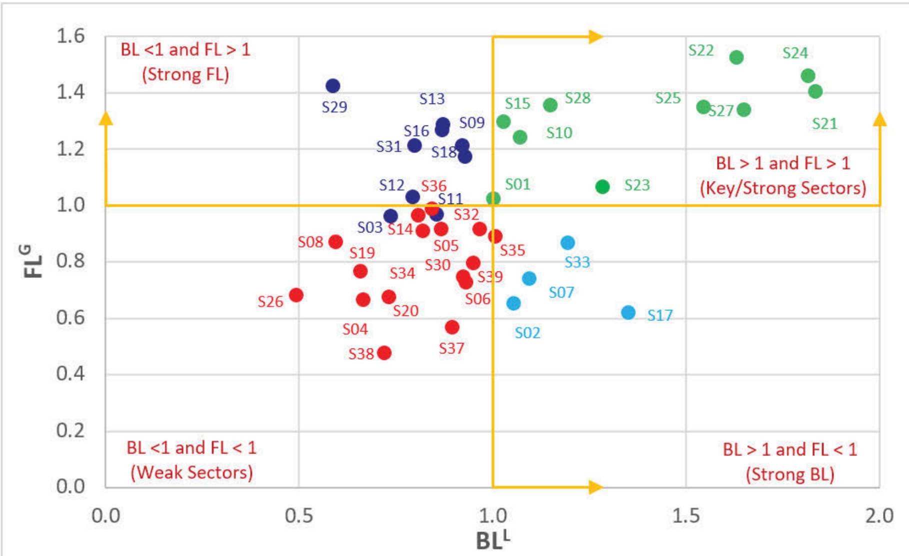
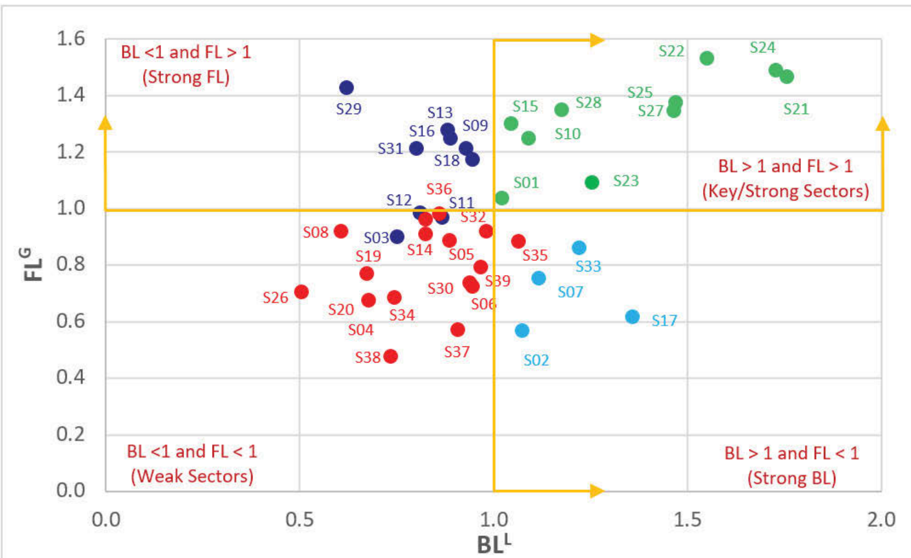


Figure 9.8: Renewable-Supreme sectoral status, 2050



Source: This author's analysis based on the scenarios model developed in this research.

The sectoral status of Printing, publishing other than Music and Internet (S11) changes to weak, while that of Communication, Finance, Property and Business Services (S36) changes slightly towards forward-oriented. In 2050 (Figure 9.8), Petroleum Products Manufacturing (S12) becomes a weak sector in comparison to its 2015 status. The status of Printing, publishing other than Music and Internet (S11) remains mostly unchanged in 2050.

Figure 9.9: Exports-Dominant sectoral status, 2035

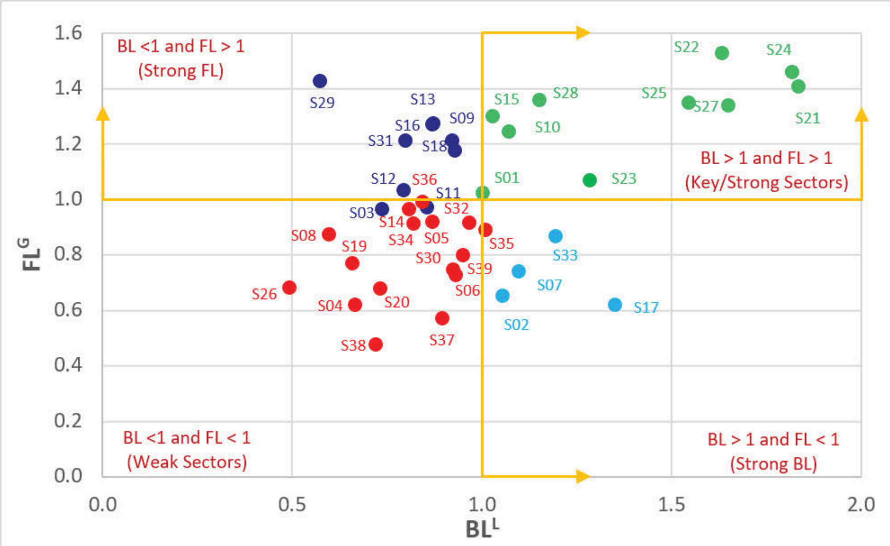
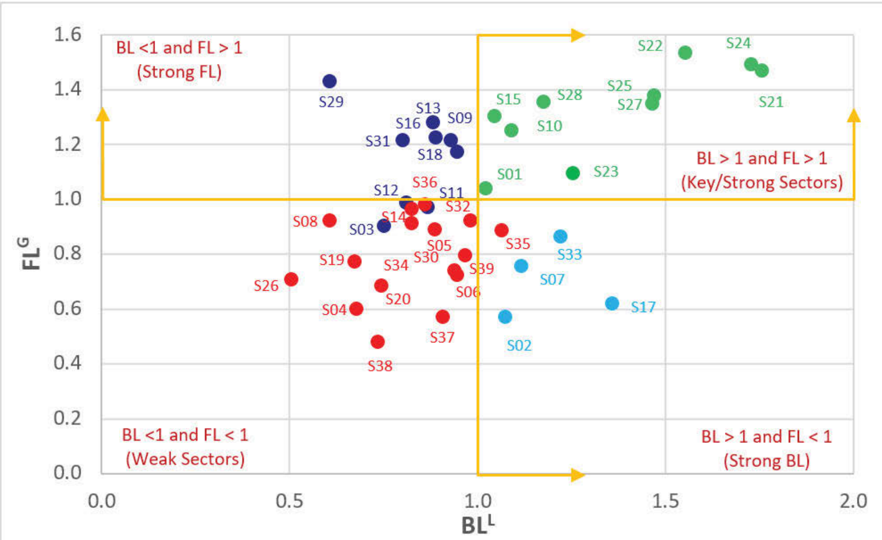


Figure 9.10: Exports-Dominant sectoral status, 2050



Source: This author's analysis based on the scenarios model developed in this research.

Water Services (Sewerage and Drainage) (S32) marginally becomes a backward-oriented sector. Also, in 2050, the status of Transport and Storage Services (S35) remains as backward-oriented, however it develops stronger linkages with its upstream supply sectors particularly Electricity Transmission and Distribution (S27) as discussed in sections 9.3.1.

The status of the sectors in Exports-Dominant and Renewable-Supreme Scenarios is closely similar (Figures 9.7 to 9.10). However, under the Exports-Dominant scenario, the status of the Petroleum Products Manufacturing Sector (S12) slightly improves, because the sector's efficiency improvements were assumed in the scenario (Table 9.1).

The overall weak status of the Crude Oil (incl. condensate) Sector (S03) across scenarios is mainly because to its specialised nature, highly advanced technologies, and the need for skilled labour workforce. These results were previously confirmed by the low backward and forward entropy indices for the Sector (see Chapter 6) describing the specialised nature of its operation.

Also, the overall status of Petroleum Products Manufacturing (S12) suggests policy-focused approaches to improve the efficiency of the sector conducive to higher supply at domestic level.

Apart from the sectors discussed above, the status of other remaining sectors remains almost unchanged. For example, the major energy-focused sectors in NEG Scheme like Electricity Generation by Coal (S21), Electricity Generation by Hydro (S25), Electricity Generation by Renewables (S25), and Electricity Generation by Natural Gas (S23) retained their "keyness" as very strong sectors (key sectors by taking into account its linkages variation indices, C-COV, as discussed in Chapters 5 and 6) in the same ranking order across all scenarios. Also, Electricity Generation by Oil (S22) is a key sector in each scenario, however, because of its very small size and contribution to the overall electricity production (~0.2%), the change in its status will not significantly impact the electricity sector as a whole. Likewise, Electricity Generation by Other Fuels (S26) is a weak sector in all scenarios although its forward linkages show some improvements over the scenario period, but because of its very small size and contribution (~0.1%) its promotion to a higher status will not make a significant difference to overall electricity production. The status of the Electricity T&D (S27) as a key sector remains the same across all scenarios. Other Key sectors which maintained their status are: the Gas Supply (S28), Wood Products (S10), Non-Metallic and Mineral Products (S15), and Agriculture (S01) in the same rank in all scenarios.

The reasons for the consistency of status of the electricity sector, under assumed future parameters, are related to: the stability of generation technology influenced by access to advanced technologies; and high generation capacity (see Chapter 3, the historical analysis). Therefore, based on the scenario results, this research concludes that the "*Reliability of Supply*" objective of the NEC Scheme is achievable under the Base Case and the extended other two scenarios. Further, this conclusion assumes that the technical issues such as electricity interruptions, and voltage fluctuations which led to consequential score of 5.7 (out of maximum 7) for the Australia's *quality of electricity supply* (World Economic Forum 2017) will be improving over the scenario period given the "keyness" of the electricity sectors, and mainly by provisioning support to adopt advanced renewable generation technologies under increased set of renewable targets.

9.3.4 Economy-wide Impacts

In this section, the Australia's net trade, and GDP at aggregated and disaggregated levels over the period 2015-205 are discussed. Table 9.18 presents the general impacts of the Base Case and Alternative Scenarios on the Australia's GDP, the value added components of Labour (L), Capital

(K), Net Taxes (T) as well as Exports (E), Imports (I) and Net Trade (NT).

Comparison of alternative scenarios with the Base Case in 2050 reveals that the highest increase in GDP (3.1%) is achieved under Exports-Dominant scenario. This increase is higher (by 1%) than the Renewable-Supreme and the Exports-Dominant Scenarios.

Table 9.18: Scenarios impacts on the Australian economy, 2015 – 2050

Category	Base Case Scenario (BC)						% Annual Avg Growth Rate 2015 to 2050
	2015	% of GDP	2035	% of GDP	2050	% of GDP	
L	821,077	47.5	1,067,790	47.3	1,300,626	47.3	**1.32**
K	736,763	42.6	969,316	42.9	1,181,929	42.9	**1.36**
T	170,086	9.8	221,813	9.8	270,057	9.8	**1.33**
E	318,681	18.4	449,933	19.9	557,195	20.2	**1.61**
I	350,675	20.3	465,373	20.6	562,441	20.4	**1.36**
GDP	**1,727,926**	100.0	**2,258,919**	100.0	**2,752,611**	100.0	**1.34**
NT	-31,994		-15,439		-5,247		**-5.03**

Category	Renewable-Supreme Scenario (RS)						% Annual Avg Growth Rate 2015 to 2050	% Change RS w/r BC in 2050
	2015	% of GDP	2035	% of GDP	2050	% of GDP		
L	821,077	47.5	1,073,243	47.1	1,316,727	46.8	**1.36**	1.2%
K	736,763	42.6	980,839	43.1	1,218,504	43.3	**1.45**	3.1%
T	170,086	9.8	223,676	9.8	276,175	9.8	**1.39**	2.3%
E	318,681	18.4	449,933	19.8	557,195	19.8	**1.61**	0.0%
I	350,675	20.3	463,132	20.3	555,170	19.7	**1.32**	-1.3%
GDP	**1,727,926**	100.0	**2,277,757**	100.0	**2,811,406**	100.0	**1.40**	**2.1%**
NT	-31,994		-13,198		2,025		**-192.42**	-138.6%

Category	Exports-Dominant Scenario (ED)						% Annual Avg Growth Rate 2015 to 2050	% Change ED w/r BC in 2050
	2015	% of GDP	2035	% of GDP	2050	% of GDP		
L	821,077	47.5	1,075,897	47.0	1,322,741	46.6	**1.37**	1.7%
K	736,763	42.6	990,247	43.2	1,239,720	43.7	**1.50**	4.9%
T	170,086	9.8	223,850	9.8	276,579	9.7	**1.40**	2.4%
E	318,681	18.4	466,385	20.4	594,317	20.9	**1.80**	6.7%
I	350,675	20.3	467,828	20.4	565,827	19.9	**1.38**	0.6%
GDP	**1,727,926**	100.0	**2,289,994**	100.0	**2,839,041**	100.0	**1.43**	**3.1%**
NT	-31,994		-1,443		28,490		**-199.67**	-643.0%

L= Labour, **K** = Capital, **T** = Net Taxes, E = Exports, **I** = Imports, **GDP** = Gross Domestic Product, and **NT**= Net Trade

Source: Results generated by the scenarios model developed in this research.

In Base Case Scenario in 2035, the trade deficit (-\$15.4b) shows improvement over its 2015 level (-\$32b) by ~52%. Also, it declines by further 66%, to -\$5.2b in 2050. The Base Case results over the period 2035-2050 however show that the trade deficit declines at a faster rate (27%).

In Renewable-Supreme and Exports-Dominant scenarios, net trade shows more significant improvements to the extent that in 2050 in both scenarios Australia becomes a net exporter. The country's net export capacity in Exports-Dominant Scenario exceeds that of the Renewable-Supreme by about fourteen times. The reason for such increase is increase in natural gas exports by two times its 2015 level. Also, Labour, Capital, and Net Taxes improve under the alternative Scenarios (Table 9.18).

9.4 Conclusions

This Chapter has analysed the impacts of a major infrastructure policy initiative (NEG Scheme) on the evolution of future linkages, with the view to provide policy makers with insights to design appropriate future infrastructure policies. The key findings include:

- The Exports-Dominant scenario most significantly influences on backward and forward linkages, followed by the Renewable-Supreme and the Base Case scenarios.
- The existing production technologies for majority of the sectors will not significantly change into more input intensive technologies which are characterised by higher sectoral backward linkages. Therefore, it is expected that production technologies will remain almost unchanged over the scenario period considering that Australia, as a developed country, has currently access to the latest production technologies as discussed in Chapter 3.
- The combined analysis of changes in backward and forward linkages reveals that the "keyness" of almost all sectors in terms inducing economic activity in other sectors has remained unaffected within, and across, all scenarios. The reason is that the overall linkage magnitudes, which is a function of production technology, has not changed significantly over the scenario period. As a result, the status of infrastructures of interest (IOI) as "key sectors" including all electricity and Gas Supply (S28) sectors; and other major sectors such as Wood Products (S10), Non-Metallic and Mineral (S15), and Agriculture (S01) have remained unchanged - in the same rank across all scenarios. These key sectors play an important role in achieving the objectives of each scenarios including the NEG Scheme in the Base Case.
- Sectors with relatively strong supply capacities include, in addition to the above noted key sectors, Upstream Water (S29); Rural Water (S31); Coal Products Manufacturing (S13); Other Metal Products (S18); Pulp and Paper Manufacturing (S09); Printing and publishing (S11); and the Petroleum Products (S12). The Exports-Oriented Scenario improves the domestic supply of Petroleum Products Manufacturing (S12) under the assumed efficiency improvements for this sector.
- Doubling the natural gas exports in Exports-Dominant scenario has revealed almost similar percentage decrease in domestic gas supply for final use by the sectors of final demand and the inter-industry sectors. However, analysis at the economy-wide and total final demand levels masks the significant impacts which otherwise prevail at detailed sectoral level.
- The backward linkages of the Transport Sector (S35) and the Electricity T&D (S27) are significantly strengthened in 2035 and 2050, signifying the influence of future electric vehicle technologies as in the Renewable-Supreme and Exports-Dominant scenarios.
- The Base Case scenario shows decline in backward and forward linkages of the Electricity T&D Sector (S27). The decrease in backward linkages are justified by electricity production from renewable sources, which are directly consumable by households or industry considering that the electricity beyond the final use is then exported to the grid and it reduced the share of

fossil fuels in key generation. However, the decline in Electricity T&D forward linkages is mainly related to the low renewable energy targets, in comparison to the Renewable-Supreme and Exports-Dominant Scenarios, where more electricity is produced from renewable sources.

- The Exports-Dominant and Renewable-Supreme scenarios improved the linkages of moderate to weak sectors, suggesting their policy development. In Moderate sectoral category, the highest increases in backward linkages across all three scenarios are attributed to Petroleum Products Manufacturing (S12); Coal Products Manufacturing (S13); Exploration and Mining Services (S05); Communication, Finance and Business Services (S36) and Other Metal Products (S18) respectively. The highest percentage change in linkages for this category is attributed to the Renewable-Supreme and Exports-Dominant Scenarios, ranging from 3.1 to 3.5%.
- Among sectors with weak linkages, the highest change in backward linkages across all scenarios take place in Water Supply Upstream (S29); Electricity Generation by Other Fuel (S26); Machinery and Transport Products (S19); Education, Health and Community Services (S38), and Crude Oil (S03) sectors. The highest increases however occur in Renewable-Supreme Scenario from 3% to 11%, followed by Exports-Dominant Scenario (3% to ~ 8%). The forward linkages of these sectors also improve by similar or slightly lower percentages.
- The Renewable-Supreme scenario support the NEG Scheme's targets beyond the levels specified in the Base Case (Table 9.1), implying that the Emissions Guarantee Objective of the NEG Scheme can be achieved sustainably under the extended assumed targets too.
- A comparison of Exports-Dominant and Renewable supreme Scenarios in 2035 and 2050 show negligible percentage changes in linkages. However, when these scenarios are compared with the Base Case, then significant inter-scenario linkage indices are observed.
- Because the economic status of the sectors are not affected by future scenarios, it means that irrespective of the future, the sectors require policy-focus according to the size of backward and forward linkages. In particular, policies with main objective of increasing supply could provide support for adopting advanced technologies to strengthen their forward linkages.
- The increases in backward linkages of Upstream Water Supply (S29) implies the need for setting higher targets for electricity generation from renewable sources (apart from hydro) to ensure that the hydrologic water cycle system remains unaffected to supply inputs to S29.
- Decreases in forward linkages of the Electricity Generation by Renewables (S25) Sector in Base Case Scenario in 2035 and 2050 suggests increase in renewable energy targets as examined under the Renewable-Supreme and Exports-Dominant Scenarios.
- The positive response of the Petroleum Products Manufacturing (S12) Sector to efficiency improvements (Section 9.3) suggests that this sector can be considered in the design of policies aimed at improving the Sector's domestic supply capacity.

10 Conclusions, Contributions, Recommendations

The main objective of this research is to develop a comprehensive understanding of the nature of infrastructure-economy linkages, with the view to provide insights that would contribute to the formulation of robust infrastructure policies. This objective is achieved in this research through the development of a historical and empirical methodological frameworks, to capture the multi-dimensional aspects of the linkages. The implicit nature of linkages, their evolution and the influencing forces were investigated through the developed historical model. The empirical analysis were carried out through the Infrastructure-embedded Input-Output Model (IeIOM), to fully capture the linkages across all quadrants of the IO tables. In addition, through IeIOM specific dependencies were studied in depth. This research has identified major linkages such as backward and forward input-output linkages, infrastructure linkages with investment and economic growth, the Most Important Coefficients (MIC), the number of inter-industry transactions between one sector and the other, the degree of sectoral specialisation and integration in the economy, the most important sectors, the linkage elasticities, production and job linkages associated with final demand, and multiplier effects. Additionally, this research has investigated the impact, to the year 2050, of alternative scenarios (focus on National Energy Guarantee Scheme) on the evaluation of linkages and hence on economy-wide outcomes.

The major conclusions of this research are presented in Section 10.1. The key contributions of this research are described in Section 10.2. Recommendations for further research are made in Section 10.3.

10.1 Conclusions

The main conclusions of this research are:

Importance of Infrastructure

- Infrastructure is a crucial driver of economy, leading to stronger market integration and competition, international trade, and exchange of ideas and technological innovation. It plays an important role in transforming the lives of citizens and contributes to the prosperity of the nations. In recognition of this importance, governments around the world have placed a high priority on provisioning infrastructure, investing over the past decades, between 2 and 9% of GDP in developing infrastructure. It is estimated that by 2030, US$59 trillion will be needed globally for energy and water infrastructure alone, to respond to the needs of world's growing population, to about 9 billion by 2030.

- In Australia, the governments have spent, over the period 1960-2017, approximately 10% of GDP to develop infrastructure. Also, the Australian Government allocated 2.6% of GDP for the stimulus packages to respond to the 2007-2008 Global Financial Crisis - a substantial proportion of this allocation was allocated to infrastructure development. Further, public spending was supplemented through FDI to facilitate innovation and technological transfer. As a result of this priority, Australia's infrastructure has developed further, and has a major factor behind continuing economic growth of the country.
- Private investments, in electricity, crude oil, natural gas, coal, oil and gas transportation pipelines, and the years of investment, have strong linkages with the Australian economy. For example, for every unit of private investment in natural energy resources and pipeline infrastructure, GDP increased, on average, by 8.75 units; and for every unit of private investments in aforementioned infrastructure and electricity by about A$35.3b every year.
- The strength of investment linkages varies considerably. For example, one unit public investment in Water and in Electricity infrastructure increases private investment in Water by 2.44 units, and private investment in Oil, Coal, Gas, and Pipeline by 4.51 units. Also, investment by the private sector in Oil, Coal, Gas, and Pipeline infrastructure increases by about 5.5 units, in response to one unit increase in private investments in Electricity. There are, however, no appreciable investment linkages between public investment in natural energy-resources and pipeline infrastructure and private investments in Water, Electricity, and natural energy-resource infrastructure. The positive correlations demonstrate the importance of adequately funding infrastructure, and more importantly, from a policy perspective - to identify which infrastructure to invest in to achieve economic policy objectives.
- The highest public investments in Australia have traditionally been in roads and highways, electricity, telecommunication and water infrastructure. Most of private invested have been in coal, crude oil, natural gas, and electricity; the private sector has made almost insignificant investments in building water infrastructures. Also, private sector spending on bridges, harbours, sewerage and drainage, recreation, railways, and pipelines, and other heavy industry has been insignificant.

Historical profile of infrastructure and linkages evolution

- Historically, infrastructures of interest (IOI) in this research and economic sectors strongly interlinked, and practically one infrastructure is required either for development of the other, or for processing requirements of another. In fact, it has been through this complex interaction that linkages have evolved; the evolution of one infrastructure has influenced the evolution of other. These linkages are however implicit, and hence not formally discussed in literature on the topic.
- In the formative years (1788-1900), infrastructure development was influenced by the mid-1800s gold rush and other significant events, e.g., industrial revolution, development of

decentralised small-scale basic technologies, formation of federation, political changes, wars, economic downturns, and growing number of settlers. In this period, water, agriculture, electricity, and coal infrastructures began to shape at an elementary level, while oil and gas infrastructure were in discovery and experimental stages. Also, much of the infrastructure was owned by private interests, or by the colonial governments (public monopolies).

- Historically, Australian infrastructure evolved under the influence of variety of independent and cross-evolutionary forces, which shaped linkages with public and private investments, institutions and governance structures, political ideologies, legislation, public policies, regulation and reforms, technological advancements, social-welfare, environment, and international economic events.
- The inter-infrastructure linkages were initially established in water, environment, and construction domains - to develop the Australian colonies. By the advent of steam energy, the linkages between coal and water, and later with electricity (electricity generation) were established. In addition, electricity required for transporting water, expanding water supply and sewerage and irrigation systems, further strengthening the linkages. Also, as oil and gas infrastructure were established, their linkages with water and electricity developed. Water, gas, oil and coal, not only must be separated in production processes, they are required as fuel sources for generating electricity. Also, water and gas specifically are needed to assist with the extraction of oil. Similarly, the aforementioned infrastructures are linked with other sectors of the economy, to facilitate economic production. Through these developmental processes, infrastructure linkages have evolved - a process that has continued to date.
- The social-welfare dimension of infrastructure in Australia recognised from the early settlement days, and continued its evolutionary path throughout history as is evident from the post WW-II development of Snowy Mountain Hydro-electric Scheme. Government migration and settlement policies resulted in a rapid transformation of water, electricity, petroleum products and gas infrastructure in these years.
- Technological improvements played an important role in the evolution and productivity of infrastructure. For example, the invention of high voltage transmission technology enabled long distance transmission of electricity, thus facilitating the relocation of generators close to fuel sources, such as gas pipelines, coal mines and water reservouirs - reducing pollution and transportation costs; coal-fired and hydroelectric electricity generation technologies enabled effective utilisation of cheap coal in coal-rich regions, and water in Tasmania; availability of electricity in rural areas linked drilling technology to access inland artesian water, and with pumping technology to bring it to the surface linking agriculture with technology for food production; and advancements in production technologies enabled economies-of-scale, thus extending linkages across the economy and assisting with economic growth.

Empirical framework and proposed formulation

- The existing linkage-analysis models offer limited insights into the nature of linkages, as such analysis is predominantly confined to the first quadrant of IO tables only, and normally such analysis focusing on measuring one aspect of the linkages, e.g., technology, input-output, or investment. As such, these models cannot comprehensively capture multiple dimensions of infrastructure linkages concurrently; or enable in-depth investigation of certain links for making informed policy decisions. Clearly a more comprehensive methodological framework is needed to capture the multiple infrastructure linkages, to estimate their magnitudes, to examine their cross-relationships, and to analyse how these linkages and multipliers impacts the economy.
- Some of the models like dynamic IO, CGE, DEA, and Bayesian approach are overly complex and more suitable for analysing 'technological' impacts, or for specialised analysis like IO variable changes, input substitutions, or incorporating resource constraints. For example, the CGE model, when extended, becomes extremely large and mathematically complex, thus limiting its domain of applicability. Also, CGE results are 'ultra-fine-tuned' because of the model's flexibility, which may compromise 'reality', also making it difficult to distinguish direct and indirect linkage effects.
- Alternative models like LCA are inherently restrictive due to the need for specifying rigid boundaries around processes; moreover, they are subject to truncation errors. Econometric models are data intensive, requiring limited assumptions and hence not suitable for economic policy analysis. Integrated models are limited in terms of their ability to capture multiple linkages because of their focus on inter-industry sectors. Commercial models such as IMPLAN are mainly suitable for repetitive analysis, inflexible to local modifications, require specific data in certain pre-defined formats, and have high licence fee.
- In contrast, the IeIOM (developed in this research) is an integrated model that overcomes the above limitations to a significant extent and enables analysis of multiple dimensions of linkages, beyond the traditional inter-industry quadrant; it spans across all four-quadrants of input-output. Additionally, it estimates direct, indirect and induced multipliers for each sector. This model is capable of linkage-specific analysis, capturing the Most Important Coefficients (MIC) and other transactional parameters. IeIOM incorporates several enhancements to capture linkages comprehensively. It is capable of analysing future evolution of linkages, and their impact in the economy, under policy-specific and various assumed future parameters (i.e., alternative scenarios).
- The empirical framework in this research is based on Leontief and Ghosh static IO models, supported by several sub-models justified for reproducibility, applicability, ease of use and debugging, and more importantly in absence of industry-based capital and investment matrices to construct a dynamic input-output framework. The model has satisfactorily produced useful

results of the 25 IO tables, over a 42 year period; and the 'misconception' of fixed production coefficients, as clarified by Rose & Miernyk (2006), is therefore no longer an issue.

Most Important Coefficients (MIC) and Concentration Linkages

- Over the last 42 years, the contribution of IOI to total GVA declined (indexed to 1975). Infrastructures with relatively high shares in total GVA, since 1975, were: Exploration and Mining Services (S05), Crude Oil (S03) and Other Mineral Mining (S06). The Sewerage & Drainage (S32) increased its contribution because of the growth in the Construction (S33) Sector. Sectors with the largest decline of shares were: Coal Products Manufacturing (S13), Natural Gas (S03), Gas Supply (S28), and Petroleum Products Manufacturing (S12), because of high levels of imported refined products. Some possible reasons for such decline are: 'maturisation' & transformation of the economy, and its lower dependence on existing infrastructure; or under-investment in these sectors over the past four decades, thus diminishing their capacity to contribute to GVA.
- 12 out of 19 IOI consistently demonstrated the highest number of the Most Important Coefficients (MIC) - largely dominated by the share of Forward MICs. In this group, only Electricity T&D (S27) sector has high number (7) of Backward MICs. This reflects the ability of the sector to induce economic activities in its immediate upstream sectors and in the economy. More importantly, any change in coefficients of the linked sectors beyond the tolerance limit will impact the production of the Sector significantly.
- Sectors associated with the MICs, with significant linkage influences on Electricity T&D (S27) are: Gas Supply (S28), Electricity T&D (S27) for own use, and the majority of electricity generation sectors. Also, sectors associated with Forward MICs, which were more stable over the period 2009-2015 are: Electricity Generation by Coal (S21), Electricity Generation by Gas (S23), Coal Products Manufacturing (S13), Basic Non-Ferrous Metals (S17), the S27 itself for own use, Construction (S33), and majority of services sectors except Government Administration (S37) which was classified as Important instead of MIC.
- Coal (S02), Crude Oil (S03), Other Mineral Mining (S06) and Upstream Water Supply (S29) have only one backward and 2 Forward MICs. However, their operation is very important in the economy. This finding shows that from a policy point of view operation of these sectors cannot be downgraded on the basis of low number of MICs (linkages) assuming that it would not impact the rest of the sectors. The low number of MICs are expected for the resource-IOI because of their capital intensive, specialised operation, and highly advanced technologies.
- The number of backward MICs, in each sector, increased over the study period, thus engendering economic activity in other sectors, while the overall number of forward MICs slightly declined. The reason for this decline is increased levels of Gas exports, thereby reducing availability of gas for downstream gas consuming supply sectors. Also, possible diversification of product lines may have impacted the dependency on major supply sectors.

- The top 5 sectors with the highest number of inter-industry purchase transactions, as identified by backward concentration indices, are: Rural Water Supply (S31), Electricity Generation by Gas (S23), Basic Non-Ferrous Metal (S17), Food, Beverage and Tobacco (S07), Other Metal Products (S18) - indicating increased outsourcing relative to other sectors. These sectors are strategically important because of their potential to generate economic activity throughout the economy. Also, top 5 sectors with the highest forward concentration indices are: Coal Products Manufacturing (S13), Gas Supply (S28), and Electricity Generation by: Hydro (S24), by Oil Products (S22), and by Natural Gas (S23). These sectors are strategically important because increase in their outputs means the availability of additional inputs to other sectors for production. The fossil-fuel consuming sectors (in the above list) could consider 'related diversification' (Chapter 6), by including renewable energy in their traditional product lines, given that 'oil peak' will come to an end. By doing so, they also contribute to lowering emissions in alignment with the Australian Government's Emission Guarantee Objective of the NEG Scheme.
- The top 5 production sectors, requiring highly specialised inputs from upstream sectors, are: Wholesale and Retail Trades (S34); Communication, Finance and Business Services (S36); Construction (S33); Food, Beverage and Tobacco (S07); Machinery and Transport Products (S19). Also, the top 5 supply sectors providing highly specialised inputs to downstream sectors are: Communication, Finance, and Business Services (S36); Wholesale and Retail Trade (S34); Transport (S35); Agriculture, Forestry and Fishing (S01); and Other Mining (S06). These sectors are highly integrated in the economy for offering specialised products.
- A comparison of two groups of top 10 sectors, one with high un-weighted backward concentration indices, and the other with high weighted backward concentration indices, reveals no common sectors between the two groups because of the influence of the system of weights. However, when their forward concentration indices were compared, three common sectors were found between groups, namely, Electricity T&D (S27), Electricity Generation by Coal (S21), and Iron and Steel Manufacturing (S16). These findings demonstrates the usefulness of different approaches to linkages analysis for policy formulation purposes particularly for situations where more strategic decisions need to be made.

Input-Output Four-Quadrant Linkages

- The importance of majority of the sectors to final demand and to their upstream supply sectors increased over the period 1975-2015, except for Petroleum Products Manufacturing (S12) because of its high use of relatively low-cost imported petroleum products. Also, the importance of natural energy resource-sectors and exploration and mining support services to downstream sectors, and thus to value added, increased except for urban water, sewerage and drainage, gas supply, and electricity T&D. Possible reasons for this decline in importance of electricity T&D are: increased availability of renewable energy for final use; closedown of old coal-powered plants; and insufficient gas supply to gas-powered plants;

- The overall linkage intensities of Electricity T&D (S27), with its upstream electricity generators, increased over the study period, which assisted the Sector to maintain its forward linkages with downstream demand sectors. This is an expected outcome, evidenced by increased backward linkages of electricity generation sectors, particularly coal- and gas-powered plants, suggesting low productivity from outdated production technology. The productivity of Electricity T&D is clearly highly linked to the availability of advanced technologies, and improve in production of its upstream generation sectors while the Sector itself also benefits from accessing more advanced transmission and distribution technologies.
- Electricity generated by renewables (S25) increased over the study period, confirming similar finding through linkage indicators forward MICs and above average forward concentration indices demonstrating large number of sales transactions to its downstream sectors. From a policy perspective, the development of the sector may be conducive of higher electricity production, given the aforementioned issues with other power plants.
- Sectors with small intra-industry share of cumulative backward linkages including non-ferrous metal manufacturing (S15), sewerage & drainage (S32), gas supply (S28), exploration and mining services (S05), and urban water supply (S30) are highly dependent on their upstream supply sectors. On the other hand, sectors including construction (S33), communication and business services (S36), and agriculture (S01) developed less intensive linkages with other sectors, as they are highly reliant on their own production and relatively self-sufficient. Electricity T&D (S27) is also in this category because of high level of own use (electricity losses during transmission and distribution).
- The self-sufficient sectors (as above) are normally classified as weak sectors. The reason is their below average inter-industry linkage indices. However, they are strategic sectors because they produce specialised products, as confirmed by above average backward and forward specialisation (entropy) indices. From a policy point of view, these sectors can be considered for further development. This outcome demonstrates that reliance on just a single dimension of linkages (here production), or classification alone is insufficient, rather multiple linkage dimensions need to be considered (e.g., entropy interconnectedness) for making more informed policy decisions.
- The top ranked communication and business services sector (S36) has the highest share in backward linkages in 25 out of 39 sectors; followed by construction (S33), electricity generation by coal (S21), other mineral mining (06), and crude oil (S03) respectively. Similarly, sectors with the highest shares in cumulative forward linkages (30 to 35 sectors of the economy) are S36, S33, S21, as well as wholesale and retail trades (S34); and chemical production (S14). From a policy perspective, investing and developing these sectors is useful - producing high returns on capital and high economic activity in other sectors.

- The proposed reformulated system of weights (RSOW) classified crude oil (S03), other mineral mining (S06), and electricity generation by coal (S21) as forward-oriented sectors, more aligned with the economic activity of these sectors when compared to the 'weak' sectoral classification under the traditional system of weights (TSOW). Other findings suggest that the quality of underlying data affects the outcomes generated by these two methods.
- IOI with the highest labour requirements, over the study period, are: Exploration and Mining Services (S05), Electricity Generation by Hydro (S24), and Sewerage & Drainage (S31). On the other hand sector with advance technology, namely, coal (S02), Petroleum Products Manufacturing (S12) and Natural Gas (S03) have the lowest labour requirements. All electricity sectors, including Electricity T&D (S27) and Rural Water Supply (S31), are top ranking sectors with total factor inputs in Australia where Electricity Generation by Hydro (S24) is the most primary factor-intensive sector. Also, S24, together with Coal (S02) and Natural Gas (S04), generate the highest gross profits. Moreover, Electricity T&D (S27), Electricity Generation by Hydro (S24), and Coal (S02) Sectors have the highest net tax linkages, thus contributing significantly to government revenue. However, Other Mineral Mining (S05), Rural Water Supply (S31), Coal (S02) and Petroleum Products Manufacturing (S12) have the highest import linkages, implying leakages to overseas markets. The Non-IOI labour-intensive sectors in 1st to 3rd ranks are: Education, Health and Community Services (S38); Public Administration, Defense and Public Safety (S37); and Commercial Services and Waste Management (S39). These sectors also have the highest forward linkages with downstream demand sectors.
- Gas supply forward linkages with households rapidly declined over the period 1975 to 2015 because of expansion of gas export markets, particularly over the period 2005-2015, confirming previous findings through concentration and integration indices (Chapter 6). The findings of this research show direct relationships between the level of increase in gas exports and the level of decline in gas supply for domestic final use. However, the overall declining pattern of gas supply over the period study is alarming, calling for policy intervention which otherwise may impact production by gas consuming sectors, affecting the economic activities.
- Households are direct purchasers of labour for domestic uses, followed by the Private Sector, Exports, and Government Sector. However, the overall purchases of these sectors declined over the study period, due to decreasing consumers' confidence and hence willingness to spend. These linkages however resulted in above average contribution to primary factors of production.

Multipliers, Elasticities and Production Linkages to Final Demand

- Out of 39 sectors, the output multipliers of Electricity T&D (S27) had the highest impacts because, within their ranking position, they consistently translated into new socio-economic multipliers of employment, income and value added - suggesting that reliance on those output multipliers for policy purposes is appropriate. Other sectors, which exhibited similar characteristics to S27, are: Printing, Publishing other than Music and Internet (S11); Other Mineral Mining (S06); Chemical Products (S14); and Upstream Water Supply (S29) Sectors. There are some other sectors whose output multipliers translated into a combination of socio-economic multipliers, or at least one of them. The usefulness of multipliers of these sectors need to be considered in the policy context and its objective priorities. Therefore, the correlations between multipliers are not straightforward to interpret.

- The multipliers in the post-GFC period (2009-2015) were significantly more stable, with a low degree of variability. Also, they were of higher magnitudes in comparison with pre-GFC (1975-2008) multipliers. This is due to the changes in final demand resulting from the introduction of economic stimulus packages over the period 2008-10. For example, over the period 2009-2015 period, the output multipliers of all electricity sectors followed an increasing pattern (ranked 1 to 7) which was significantly higher than pre-GFC, implying access to more advanced technologies as evidenced by the introduction of photovoltaic (PV) solar energy and other renewable technologies; and increased electricity generation capacity, which did not occur in the pre-GFC period.
- The highest employment multipliers in 2014-15 were for Other Manufacturing (S20), followed by Education, Health and Community Services (S38), Other Commercial Services (S39), Pulp and Paper (S09), and Government Administration, Defense and Public Safety (S37), Electricity T&D (S27) and Wood Products (S10). The application of labour intensive technology is the main reason for high employment in these sectors. Also, almost all electricity generation sectors were in the Medium employment band, with Electricity Generation by Hydro (S24) being the highest in the band. Electricity Generation by Gas (S23) was in the Low band and Natural energy resource-sectors in the Very Low band because of their specialised workforce and access to highly advanced technologies. The aforementioned sectors showed the highest indirect and induced employment multiplier effects.
- Five out of Seven Sectors in the High-income multiplier band belonged to electricity sectors and Petroleum Products Manufacturing. Electricity Generation by Coal (S21) generated the highest total direct, indirect and induced income, to meet increased final demand for coal. Also, the indirect income multipliers of Electricity Generation by Renewables (S25) (in 2nd rank) and Generation by Hydro (S24) (in 3rd rank) grew at relatively faster rates over the period 1975-2015, generating higher incomes in other sectors through linkages. Water sectors were in the Low-income band, while Government Administration, Defense and Safety (S37); Education, Health and Community Services; and Electricity Generation by Other Fuels (S26) were in the Very Low-income band, showing the highest direct income multipliers, implying that one unit increase in final demand for their output, the high portion of that one unit goes to wages for employees.

- Value added multipliers of Natural Gas (S04) over the period 1975-2015 were the highest, although they exhibited a slightly declining pattern over the period. The sectors with the lowest value added multipliers were: Exploration and Mining Support Services (S05) and Petroleum products manufacturing (S12). The S12 outcomes are consistent with prior linkage estimates, output multipliers, and the high level of imports.
- Rural Water Supply (S31), Coal Product Manufacturing (S13), and Electricity Generation by Natural Gas (S23) are in a group of 20 sectors with highly inelastic supply and value added linkages, thereby imposing high risks to downstream production sectors because they are linked through the Most Important Forward Coefficients to other sectors. This critical situation calls for policy intervention aimed at sectoral supply improvements so that these sectors can adequately respond to input requirements of other sectors in response to changes in final demand.
- In 2014-15, the Australian economy was heavily dependent on Construction (S33); Households for non-industry based services; Education, Health and Community Services (S38); Government Administration, Defense and public Safety (S37); Communication, Finance, and Business Services (S36); Other Mineral Mining (S06); Wholesale and Retail Trades (S34); Transport and Storage Services (S35); Coal (S02); Machinery and Transport Products (S19); and Basic Non-Ferrous Metal (S17) - as the major (base) sectors for producing the highest inputs for meeting final demand. These sectors can be considered for policy and investment purposes because of their ability to generate economic activity through production requirements to meet final demand and for their contribution to value added, particularly, creation of jobs in the economy.

Impacts of major infrastructure policy initiatives on the evolution of future linkages

- The three scenarios considered in this research show insignificant changes in sectoral linkages and the "keyness" of clusters of sectors, which are capable of inducing high economic activities in other sectors over the period 2015-2050. As a result, the status *key* sectors, including all electricity sectors, Gas Supply (S28) and other major sectors such as Wood Products (S10), Non-Metallic and Mineral (S15), and Agriculture (S01), have remained unchanged across all scenarios. These sectors are however influential in achieving the objectives of each scenario, including the NEG Scheme in the Base Case. The insignificant change in linkages for these sectors is access to advanced technologies, given the developed status of the country. Moreover, the aforementioned key sectors - together with Upstream Water (S29); Rural Water (S31); Coal Products Manufacturing (S13); Other Metal Products (S18); Pulp and Paper Manufacturing (S09); Printing and publishing (S11); and the Petroleum Products manufacturing (S12) Sectors - showed relatively strong supply capabilities. The Exports-Oriented scenario, for example, improved the domestic supply of Petroleum Products

Manufacturing (S12), assuming 4% efficiency increase. Therefore, to achieve the objectives of the NEG Scheme, more influencing policy measures are needed to further evolve the linkages, specifically in electricity and petroleum production manufacturing sectors (as also discussed earlier in this chapter). Further, irrespective of the future performance, these sectors require policy-focus in view of the size of their backward and forward linkages. Particularly, policies which focus on increasing supply, may provide support for adoption of advanced technologies, to strengthen forward linkages.

- The Exports-Dominant scenario, under assumption of doubling natural gas exports, shows almost similar percentage decline in gas supply for domestic final use by sectors of final demand and by the inter-industry gas consuming sectors. However, analysis of gas supply, at the economy-wide and total final demand levels, masks the significant impacts, which otherwise prevailed at disaggregated sectoral level.
- The Exports-Dominant and Renewable-Supreme Scenarios improved the linkages of moderate to weak sectors, suggesting significant potential for developing these sectors in policies aimed at sectoral development. In Moderate sector category, the highest increases in backward linkages, across all three scenarios, are attributed to Petroleum Products Manufacturing (S12); Coal Products Manufacturing (S13); Exploration and Mining Services (S05); Communication, Finance and Business Services (S36) and Other Metal Products (S18). The highest percentage change in this category is attributed to the Renewable-Supreme and Exports-Dominant scenarios, almost similarly ranging from 3.1 to 3.5%. Moreover, the Renewable-Supreme Scenario supports the NEG Scheme's renewable targets, beyond the specified levels in the Base Case, implying that the Emissions Guarantee Objective of the NEG Scheme can be achieved sustainably under the extended assumed targets too. Also, the inter-scenario comparison of Exports-Dominant and Renewable-Supreme Scenarios in 2035 and 2050 show negligible percentage changes in linkages. However, when these scenarios are compared with the Base Case, significant inter-scenario linkage indices are observed.

This research provides practical answers to major policy questions, by evaluating alternative scenario outcomes, for example: What are the multiplicative effects of investment on capital rate of return? Which industries are competitive, and capable of inducing economic activities in other sectors? Which sectors should the government invest in, in order to maximize economic output? What are the impacts of infrastructure investments on employment, household income and value added? How vulnerable is the economy to major financial and economical interruptions? What would be the impact of aggressive pursuit of policies (e.g. promotions of renewable energy) on economy? How will the trade balance of the country be affected by the presence of infrastructure linkages?

10.2 Contributions to Knowledge and Beneficiaries

The evolutionary process of linkages manifest their imperative role in economic development, promoting social-welfare, and advancing the nation's prosperity, therefore it is vitally important to understand the interconnectedness between infrastructure and other sectors of the economy. The existing research shows that linkages are not fully understood, because most of the existing studies were carried out in isolation from other sectors of the economy, or pursued in response to narrowly prescribed objectives, focusing on special infrastructure or selected dimensions. Also, the influence of social, cultural, technological, political, geopolitical, legal, and institutional dimensions were rarely considered. Further, much of existing analysis does not proceed beyond the inter-industry quadrant of the standard IO tables, and generally limited indicators are used to describe linkages. As a result of this limited focus, studies at the global and Australian levels, have limited value for policy purposes. To the best of the knowledge of this author, no in-depth study of linkages and multipliers, has been undertaken for Australia.

This research, through an integrated and holistic approach, has contributed to both practical and theoretical aspects of input-output analysis overcoming (to a significant extent) the present narrow focus on linkage analysis. At the practical level, it has provided an in-depth understanding of the multi-dimensional nature of infrastructure linkages and multipliers in the Australian context, over the period 1975-2050. The research outcomes are envisaged to provide policy-makers with useful insights for developing robust infrastructure policies, and investment decisions. Additionally, the estimates of future backward and forward linkages, over the next three and a half decades, should constitute an invaluable base for the policy makers to analyse the impacts of alternative policy initiatives on the economy and to design appropriate future infrastructure.

Theoretically, this research has progressed the contemporary approach for estimating linkages (and multipliers) confined to the inter-industry quadrant of the IO tables, to an input-output four-quadrant linkage analysis approach. This research has: a) incorporated major linkage descriptors, to enable capturing of multiple dimensions of the linkages, and more importantly, identifying the most important coefficients; b) improved the traditional system of weights by proposing a new formulation, to better identify the relative importance of each sector in the economy for policy purposes; c) suggested a new method of evaluating variability among IO coefficients comprising backward and forward linkages to better identify the sectors exposed to high risks for investment and policy decisions; d) proposed an enhanced method of classifying economic sectors, to more appropriately identifying key sectors of the economy; e) holistically incorporated the aforementioned improvements and methodological approaches into a comprehensive Infrastructure-embedded Input-Output Model (IeIOM) - to effectively capture a vast range of multi-dimensional linkages and to explore their policy implications at sectoral and economy-wide levels.

Overall, the empirical methodological framework, together with the historical analysis, represents a distinct advancement over the existing methodological frameworks. This approach, to the best knowledge of this author, represents the first comprehensive study into the nature of linkages between infrastructure and other sectors of the economy in Australian context.

The outcomes of this research and proposed approaches, although specifically relevant for Australia, should be of value in other country-contexts too. The findings should benefit the governments to make evidence-based policy decisions; researchers who may wish to extend this research (discussed in Section 10.3), public policy analysts and advisors may find it useful for providing policy advice; private sector may find it useful for making informed investment decisions; and others interested may find insights into the nature of relationships between various infrastructures educative.

In summary, this research represents a step beyond contemporary analysis of infrastructure linkages and multipliers; it has appreciably enhanced knowledge of linkages in Australian context; established a robust foundation for similar undertaking research elsewhere; opened opportunities for further enhancements to the proposed methods; and constitutes a find example of enhancing the policy relevance.

10.3 Recommendations for Further Research

While this research has established solid foundations to comprehensively analyse the nature of linkages and multipliers in the Australian context, the author believes that the research could be further deepened to overcome some of its limitations and to enhance its usefulness. Some recommendations are as follows:

- It will be useful to generate a dynamic input-output model, for example, incorporating capital stock matrices into the static input-output model. Comparison of the outcomes of the two models (i.e. static and dynamic) would enable assessments to be made of the changes in technological coefficients and their influence on the estimation of infrastructure linkages.
- It will be useful to identify linkages and multipliers at the state levels in Australia, because the national level linkages and multipliers may not be fully relevant at individual States levels with different regional boundaries, political, production capabilities, supply constraints, inter-state transactions, and final demand characteristics. Also, it will be important to understand the relationships between the state and national linkages and multipliers and their impacts on the economy.
- It will be useful to extend the research to fully analyse the linkages of transport infrastructure at both the state and national level, particularly to examine the impact of adopting electric vehicle and driverless mode of transports on linkages with primary factors of production, institutional arrangements, existing and new infrastructure, social-welfare, and the

environment.

- The proposed Reformulated System of Weights in this research can be further enhanced to account for negative inverse coefficients generated as a result of the quality of underlying data. In this research, minor negative values in order of -0.0001 to -0.0005 were observed which were set to zeros (as proxies for equivalent positive values) for estimating weighted cumulative linkage indices.
- Also, the estimations of linkages and multipliers in real dollar terms can be enhanced by applying sector-specific Producer Price Indices (PPI). This could be achieved by balancing of the IO tables by RAS technique or compatible approaches, because the use of sector-specific PPI affects the row and column totals. The recommendations in this section were deemed outside the scope of the study. This research has applied implicit GDP deflators instead because of the availability of data.
- It will be useful to further investigate the social dimensions of infrastructure spending; and the quality of investment, in addition to the financial aspects of the infrastructure investment - in order to understand how spending translates into productivity and social benefits. Additionally, such analysis could be extended to upstream, transportation (midstream) and downstream levels. This will provide quantitative and qualitative estimation of linkages between infrastructure spending and economic and social-welfare growth. The insights gained can assist policy makers to direct spending to the most relevant infrastructures.
- Lack of standardised methods of measuring the importance of infrastructure, and the assessment of the adequacy of infrastructure provisioning, pose challenges and leads to the adoption of diverse measurement approaches, definitions, data collection methods, use of depreciation rates, and lack of clarity on parameters based on which infrastructure data were reported. This could be a suitable area for future research.
- The results of Final Demand IO Transformation approach can be further enhanced if the actual estimates of households' income by each economic sector were available. This research recommends further investigation into this area, perhaps through value added national accounts. Also, it is recommended that the Australian Bureau of Statistics (ABS) include collection of this data in its IO surveys.
- It will be useful if data agencies such as the ABS incorporates collection of 'displaced jobs' ('real job vacancies'), categorised by economic sectors, in the underlying input-output/employment surveys, so that physical number of jobs which are required for estimating employment multipliers could be estimated correctly. This will be particularly important for evaluating alternative policies focused on the number of *new* jobs generated as a result of these policies. For example in 2016, the ABS reported vacancies at extremely aggregated level (an 18- sector table against disaggregated IO table of 114 sectors) (ABS 2016). For earlier years,

this gets as low as 10 (with different reporting units) as shown in the 1993 data tables (as the final electronic publication). The vacancies data tables are currently at industry division, and group and sub-group levels, which is difficult to disaggregate into sector-based vacancies data. Also, for sectors which are the focus of this research, vacancies are reported at extremely aggregated levels, for example, at the divisional level - for *Mining or Manufacturing*; or at highly aggregated levels for *Electricity, Gas, Water, and Waste Services* Sectors. This recommendation, when incorporated in the analysis of employment multipliers, would reduce overestimation of the employment impact based on IO models.

- Data availability, access, storage, and usability have been the key challenges encountered by this author while undertaking this research. Therefore, efforts need to be initiated so that, in collaboration with data agencies, researchers can obtain required data in usable and useful form. Current data is reported at extremely aggregated levels, requiring a lot of effort to disaggregate while even reliable proxy data for disaggregation is hardly available.

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Appendices

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APPENDIX I

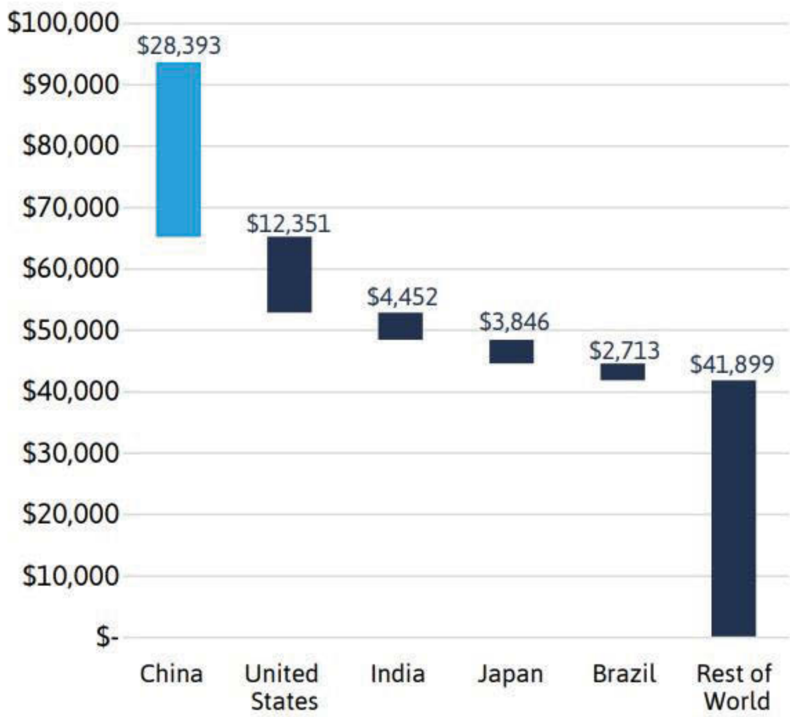
The infrastructure needs and investment gaps by country over the period 2016 to 2040

This Appendix briefly discusses total infrastructure investment needs and total infrastructure spending gaps by major countries and rest of world over the period 2016 to 2040.

I.A Developed countries with the highest infrastructure investment gap

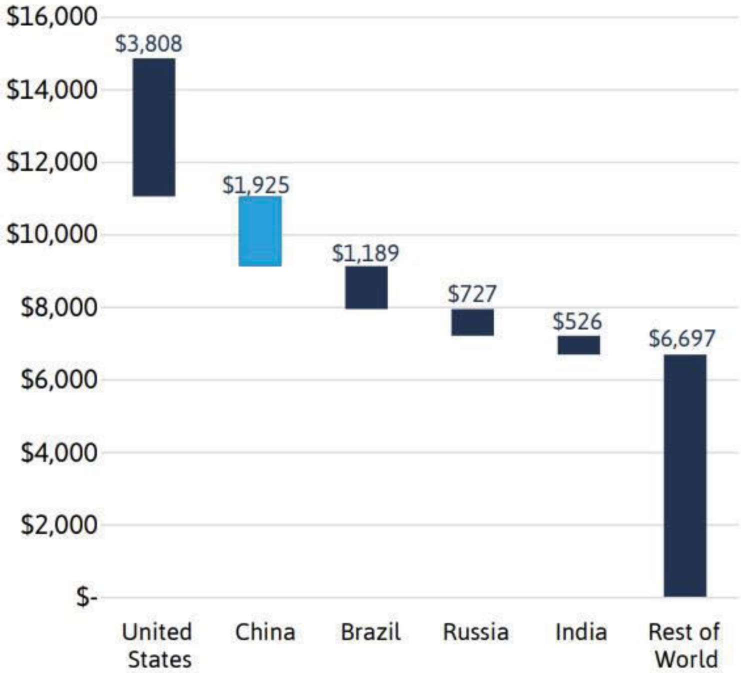
According to GIH (2017) forecast, the United States will have the largest infrastructure investment gap by 2040. Also, United States, China, India, Japan and Brazil are the top five countries with an overall 55% of the world infrastructure gap. Figure I.A.1 shows that although China's investment need is nearly 2.3 times higher than the US, its investment gap (US$1.9 trillion, Figure I.A.2) is only 7% of its investment need (US$28.4 trillion). This is in comparison with the investment gap of the United States (UD$3.8 trillion) at 31% of its investment need (UD$3.8 trillion).

Figure I.A.1 – Infrastructure needs by country, 2016 to 2040 ($b)



Source: GIH (2017)

Figure I.A.2 – Infrastructure spending gap per country, 2016 to 2040 ($b)

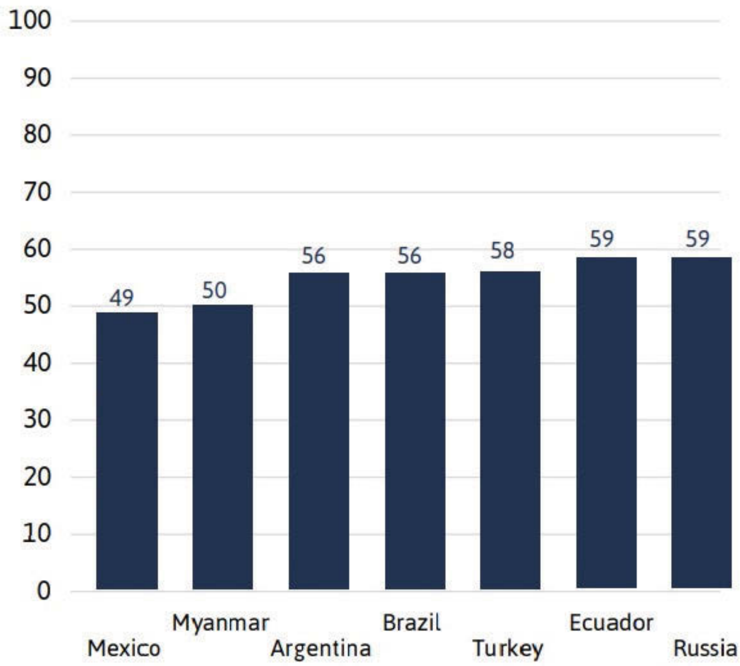


Source: GIH (2017)

I.B Developing and emerging countries with large infrastructure needs and investment gaps

Figure I.B.1 shows that Mexico and Myanmar would need to increase their investment twice as much as the current level in order to meet forecasted infrastructure need. The investment gaps for Argentina, Brazil, Turkey, Ecuador and Russia are also largely below their current level.

Figure I.B.1 – Current trends in investment relative to investment needs (%)



Source: GIH (2017)

APPENDIX II

Philosophy of infrastructure investment in Australia, and global and Australian FDI

This Appendix briefly discusses the philosophy of infrastructure investment in Australia from the establishment of the Australian colony to date.

Also, it defines FDI terms and provides FDI in infrastructure over the period 1990 to 2007. The information and statistics on FDI in infrastructure information is provided based on the broad economic classification of world countries (UN 2015) including Australia. It also covers the statistics at an overall global level.

The FDI on infrastructure was made available in 2008 while the reports in subsequent years were covering general FDI investments not clearly distinguishing between infrastructure and other types of investments, or the focus was on specific type of infrastructure like digital infrastructure (telecommunication).

II.A Philosophy of Infrastructure Investment in Australia

Infrastructure investment in Australia initially was started by government ideologies and political motivation its roots back in 1786 when the British government established a convict settlement in Botany Bay, and start of subsequent European settlement in 1788, supported by public infrastructure investment (Boot 1998). Although the British funding replaced with the colonial funding in 1820 under the jurisdiction of the States and Territories (Butlin 1964, 1982, 1994), it was following a centralised public policy and planning governance model in which infrastructure's organisational structure and operations were within a government department featuring government ownership, statutory monopoly, vertical integration and bureaucratic operation (Albon 2000). Nevertheless, private sector was also funding infrastructure projects to the extent that private monopolies were formed. In 1901 when Australia achieved its political federation, although public infrastructure funding did not step beyond state boundaries, a new infrastructure philosophy by the Australian labour party emerged promoting infrastructure provisioning through public monopolies to oppose private monopolies and achieve social justice (Cranston 1987). This new philosophy was justified on the basis that the markets often fail (a common perception until 1960s) and that such failure would require public ownership and provision of services (King et al. 1996) in order to maintain social welfare of citizens; and that a private monopolist, as the sole producer of the product or service, would be able to use its market power to set prices that exceed costs, to the detriment of economic efficiency and social welfare. The Keynesian theory (Keynes 1936), which was introduced to mitigate the adverse effects of the Great Depression in 1936, further reinforced the role and presence of governments in economic and infrastructure projects. Based on this philosophy certain Commonwealth funded infrastructure was established and by the late 1940s the state governments primarily owned and controlled the electricity infrastructure in Australia because of its political appeal (Sharma & Bartels 1997).

Nevertheless, Australian governments collaboratively joined with the private sector to provide infrastructure such as water and energy and transport infrastructure (rails, roads and ports) for increased prosperity of the nation.

However, government philosophy of maintaining monopolies started to change at the beginning of the 1970s because of concerns about inefficiencies inherent in the Australia's infrastructure which could affect economic growth. Hence, state governments started reforming monopolies under the broad banner of macroeconomic reform (IC 1998) in order to make them more efficient by reduce the cost of inputs, restructuring and to improved governance through regulation. This led the Hawk federal government during the mid-1980's to late 1990's to a philosophical shift in paradigm for infrastructure provisioning from a centralised public infrastructure philosophy to a new liberalised competitive market philosophy under the banner of microeconomic reform. The aim was to achieve productivity and efficiency improvements in infrastructure sector and to compete globally (Everett & Robinson 2006; Tisdell et al. 2002). As a result, the ownership change through privatisation and corporatisation as well as Public-Private-Partnership (PPP) occurred and the industry deregulated (Everett & Robinson 2006; Gretton 2008; Dee et al. 2002). For example in case of the electricity monopoly, the vertical structure was unbundled to enable private investment the industry's management and control improved to remove the inefficiency attributed to factors such as excess generating capacity, overstaffing, inflexible pricing and lack of accountability in the electricity sector (Sharma 2003a, 2003b, 2004). Further details of the reforms and philosophical evolution of the infrastructure sector are described in Chapter 2.

II.B FDI definition of terms and Statistics

The United Nations Conference on Trade and Development (UNCTAD 2008) has defined the FDI terms as following:

- **Foreign direct investment (FDI)** is defined as an investment involving a long-term relationship and reflecting a lasting interest and control by a resident entity in one economy. FDI implies that the investor exerts a significant degree of influence on the management of the enterprise resident in the other economy. FDI has three components: equity capital, reinvested earnings and intra-company loans. Flows of FDI comprise capital provided by a foreign direct investor to an FDI enterprise (either directly or through other related enterprises), or capital received from an FDI enterprise by a foreign direct investor.

- **Flows of FDI** comprise capital provided by a foreign direct investor to an FDI enterprise (either directly or through other related enterprises), or capital received from an FDI enterprise by a foreign direct investor. Flows of FDI comprise capital provided by a foreign direct investor to an FDI enterprise (either directly or through other related enterprises), or capital received from an FDI enterprise by a foreign direct investor.

- **Net decreases in assets (outward FDI) or net increases in liabilities (inward FDI)** are recorded as credits (recorded with a positive sign in the balance of payments), while net increases in assets or net decreases in liabilities are recorded as debits (recorded with an opposite sign in the balance of payments). In the above table the opposite signs are reversed for practical purposes in the case of FDI outflows. Hence, FDI flows with a negative sign indicate that at least one of the three components of FDI (equity capital, reinvested earnings or intra-company loans) is negative and is not offset by positive amounts of the other components. These are instances of reverse investment or disinvestment.

The statistics provided by Tables II.B.1 to II.B.5 are based on the above definition.

II.B FDI in Infrastructure Investment

Table II.B.1: Net inward and outward FDI stock in infrastructure by host region and economy class, 1990-2006

		Net Inward FDI Stock in Infrastructure ($m) & (%)				Net Outward FDI Stock in Infrastructure ($m) & (%)			
Host region/economy class	**Industry**	**1990**	**1995**	**2000**	**2006**	**1990**	**1995**	**2000**	**2006**
Developed countries	Electricity, gas and water	5,119.5	14,590.7	57,832.7	137,995.5	7,301.2	14,458.9	85,365.1	109,526.0
	Transport, storage and communications	13,026.5	30,514.3	253,379.6	439,217.3	31,617.4	58,367.3	418,715.8	440,331.8
	Share of infrastructure in total FDI (%)	1.5	2.5	9.0	8.3	2.9	3.2	11.0	6.1
Developing economies	Electricity, gas and water	2,307.2	7,823.9	33,277.7	47,269.5			899.8	7,519.2
	Transport, storage and communications	4,487.5	20,475.6	78,565.5	151,625.6	356.6	17,116.9	22,556.9	44,620.3
	Share of infrastructure in total FDI (%)	3.8	6.0	8.8	8.9	3.0	6.3	4.4	5.1
South-East Europe and CIS	Electricity, gas and water		128.9	827.7	1,580.5				408.9
	Transport, storage and communications	27.8	3,816.1	5,965.1	7,485.6		0.3	75.9	-86.9
	Share of infrastructure in total FDI (%)	1.4	20.7	17.7	6.5		17.6	9.5	23.6
World	**Electricity, gas and water**	**7,426.7**	**22,543.5**	**91,938.1**	**186,846.5**	**7,301.2**	**14,458.9**	**86,264.9**	**117,454.1**
	Transport, storage and communications	**17,541.8**	**54,806.0**	**337,910.2**	**598,328.4**	**31,974.0**	**75,484.5**	**441,348.7**	**484,865.2**
	Share of infrastructure in total FDI (%)	**1.8**	**3.4**	**9.0**	**8.4**	**2.9**	**3.5**	**10.3**	**6.0**
Australia	Electricity, gas and water	-	-	5 143.3	7 067.1	1 392.4	2 208.2	1 224.3	6 362.1
	Transport, storage and communications	749.9	1 540.7	3 711.3	21 493.3	4.0	4.2	1.5	2.8
	Share of infrastructure in total FDI (%)	1.0	1.5	8.1	11.4				

Table II.B.2: FDI flows by region and economy class, 2005-2007

	FDI inflows ($m)			**FDI outflows** ($m)		
Region/economy class	**2005**	**2006**	**2007**	**2005**	**2006**	**2007**
Developed economies	611,283	940,861	1,247,635	748,885	1,087,186	1,692,141
Developing economies	316,444	412,990	499,747	117,579	212,258	253,145
South-East Europe and CIS	30,971	57,167	85,942	14,345	23,706	51,227
World	**958,697**	**1,411,018**	**1,833,324**	**880,808**	**1,323,150**	**1,996,514**
Australia	-35,295	25,736	22,266	-33,523	22,638	24,209

Source: UNCTAD (2008), FDI/TNC databases (www.unctad/fdistatistics)

Table II.B.3: FDI stock in Infrastructure, by region and economy class, 1990-2007

	FDI inward Stock in Infrastructure ($m)			FDI outward Stock in Infrastructure ($m)		
Region/economy class	**1990**	**2000**	**2007**	**1990**	**2000**	**2007**
Developed economies	1,412,605	3,987,624	10,458,610	1,640,405	5,265,116	13,042,178
Developing economies	528,638	1,738,255	4,246,739	144,862	861,842	2,288,073
South-East Europe and CIS	9	60,821	505,211		21,253	272,088
World	**1,941,252**	**5,786,700**	**15,210,560**	**1,785,267**	**6,148,211**	**15,602,339**
Australia	73,644	111,139	312,275	30,507	85,385	277,917

Table II.B.4: FDI flows and FDI stocks by region and economy class, 1990-2007

		FDI flows (% Gross Fixed Capital			FDI stocks (% GDP)		
Region/Economy Class		**2005**	**2006**	**2007**	**1990**	**2000**	**2007**
Developed economies	Inward	8.9	12.8	15.6	8.1	16.2	27.2
	Outward	10.9	14.8	21.2	9.5	21.3	33.9
Developing economies	Inward	11.4	12.5	12.6	13.6	25.2	29.8
	Outward	4.3	6.5	6.4	4	12.9	16.5
South-East Europe and CIS	Inward	14.3	19.7	20.9	..	15.7	28
	Outward	6.8	8.3	12.7	..	6	15.8
World	**Inward**	**9.7**	**12.9**	**14.8**	**9.1**	**18.1**	**27.9**
	Outward	**9**	**12.2**	**16.2**	**8.5**	**19.4**	**28.9**
Australia	Inward	-18.6	12.7	9	23.2	28.6	34.4
	Outward	-17.7	11.2	9.8	9.6	22	30.6

Table II.B.5: Global infrastructure Spending by investor type, 1996-2006.

	Investors Type			
Infrastructure	**Public**	**Private Dome**	**Foreign**	**Total**
Energy	48.5	21.4	30.0	100.0
Water and Sewage	47.1	27.7	25.2	100.0
Transport	52.9	27.8	19.3	100.0
Telecome	43.6	21.2	35.2	100.0
All	**48.2**	**23.2**	**28.5**	**100.0**

Source: UNCTAD (2008), FDI/TNC database (www.unctad.org/fdistatistics)

Table II.B.6: Global annual spending on infrastructure as percent of GDP by country 2008-2013

(Annual average infrastructure expenditures as percent of GDP worldwide from 2008 to 2013, by country)

Country	Spending as percentage of GDP
China	8.8
Qatar	7.6
India	5.2
South Africa	4.7
Australia	4.7
Saudi Arabia	4.6
Russia	4.5
Japan	4
Turkey	3.6
Canada	3.5
Indonesia	3.1
Mexico	2.7
Brazil	2.5
Italy	2.4
United States	2.4
United Kingdom	2.2
France	2.1
Germany	2
Average	**4**

Source: Statista (2017c)

APPENDIX III

Global and Australian highlights of the early coal infrastructure

Table III.A provides a brief history of formative years of coal infrastructure in Australia and in the world. This table complements discussions in Section 3.4.2 Coal Infrastructure, Early Years (1788 to 1900).

Table III.1: Global and Australian highlights of the early coal infrastructure

Time	Developments
13th Century	Coal used commonly in Europe
1672	Coal mentioned on Cape Breton Island, Canada
1673	Map by explorer Joliet shows coal location in Illinois
End of 17th Century	Long Wall Mining Discovered and Developed in Shiropshire, England
1701	Coal found along James River
1752	Coal found along the Kiskiminetas River by Joe Pattin
1755	Coal was utilized in U.S.
1761	Earliest record of actual coal mining in Pensynvalia USA
1762	First clear record of anthracite coal in USA
1769	First use of anthracite coal by the Gore Brothers in their blacksmith shop at Wilkes-Barre, Pennsylvania
1770	Captain James Cook arrived in Australia in his steam powered ship, HMS, buring coal loaded in England.
1791	Traces of coal was discovered in a creek in Hunter region (Newcastle) in Australia by a convict, William Bryant (ACA, 2008)(Branagan, 1990).
1796	Coal first discovered in the Sydney-Gunnedah Basin in the Port Stephens area near Newcastle (EANSW, 1986).
1797	Presence of Coal was found at the banks of Hunter River (now Newcastle) by Lieutenant John Shortland while searching for convicts escaped from Port Jackson (Knights and Hood, 2009) and soon after coal was confirmed at the mouth of Hunter River (ABS, 2209a)and in south of Botany Bay in Sydney (EANSW, 1986).
1798	Australia exported 45 tons of coal from Hunter River coal open mines (Windsor and Ralston, 1897).
Late 18th Century	Coal Mining appeared in the US.
1801	The first coal mining settlement was established in Newcastle in 1801 (Windsor and Ralston, 1897).
1805	The NSW Government exported 150 tons of coal from Newcastle coal mines to India, Mauritus and South America (Windsor and Ralston, 1897).
1830	Numerous small mining operations in U.S.
1839	Steam Shovel Invented.
1866	Strip Mining Began – horse drawn plows.
1875	Coal replaced charcoal as chief fuel for iron blast furnaces.
1896	General Electric Company build first power plant.

Source: (NSW Government 1986; ACA 2006; Branagan 1991; ABS 2009a; EANSW 1986; Saddler 1981).

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APPENDIX IV

Sectoral naming and IOIG mapping details, and IO table structure

Through Tables IV.1 to IV.4, this Appendix provides structure and mathematical notations of the IO tables; details of the infrastructure and other economic sectors used in this research; and the mapping details of the post-2006 ANZSIC IOIG codes to the pre-2006. The reason for mapping to the pre-2006 is availability of the majority of input-output tables in the pre-2006 data formats. This mapping also assists with aggregating and disaggregating sectors based on a unified IOIG coding structure. Tables IV.5 and IV.6 provide definitions of backward and forward linkages as cited in the literature.

LIST OF THE TABLES

Table IV.1: Structure and mathematical notations of the IO tables used in the research model

Destination →; Origin ↓

Output / Input		Intermediate Demand: Sectors of Production (j) (buying)					*Final Use*: Sectors of Final Demand (f)					Total Outputs (Total Supply, Total Revenue)
		Primary		Secondary	Tertiary	Quaternary?	Households	Government	Investment	⋮	Export	
Production Sectors (i)	Primary	z_{11}	z_{12}	z_{13}	..	z_{1n}	f_{11}	f_{12}	f_{13}	⋯	f_{1k}	$x_1^s = \sum_j \sum_k (z_{1j} + f_{1k})$
		z_{21}	⋱			z_{2n}	f_{21}	⋱			f_{2k}	$x_2^s = \sum_j \sum_k (z_{2j} + f_{2k})$
	Secondary	z_{31}		z_{ij}		z_{3n}	f_{31}		f_{ik}		f_{3k}	$x_3^s = \sum_j \sum_k (z_{3j} + f_{3k})$
	Tertiary	⋮		$[Z]$ (n x n)	⋱		⋮		[F] (n x k)	⋱		⋮ $[X^s]=[X_i]$
	Quaternary	z_{n1}				z_{nn}	f_{n1}				f_{nk}	$x_n^s = \sum_j \sum_k (z_{nj} + f_{nk})$
Total Intermediate Use, $z_{.j}^d$		$\sum_i z_{i1}$				$\sum_i z_{in}$						
Primary Inputs (Factors of Production)	wages	w_{11}	w_{12}	w_{13}	..	w_{1n}	Primary Inputs in Final Demand GDP (Direct purchases of primary factors by sectors of final demand)					$w_{1j}^d = \sum_j w_{1j}$
	Income	c_{21}	c_{22}	c_{23}	..	c_{2n}						$c_{2j}^d = \sum_j c_{2j}$
	Tax products	t_{31}	t_{32}	t_{33}	..	t_{3n}						$t_{3j}^d = \sum_j t_{3j}$
	Tax Production	$\acute{t}_{41}$	$\acute{t}_{42}$	$\acute{t}_{43}$	..	$\acute{t}_{4n}$						$\acute{T}_j^d = \sum_j \acute{t}_j$
	Imports Complement	m_{51}	m_{52}	m_{53}	..	m_{5n}						$m_{5j}^d = \sum_j m_{5j}$
	Imports Competing	$\acute{m}_{61}$	$\acute{m}_{62}$	$\acute{m}_{63}$	..	$\acute{m}_{6n}$						$\acute{m}_{6j}^d = \sum_j \acute{m}_{6j}$
		⋮										⋮
	Other VA	v_{l1}		$[V]$ (Final Payment) (l x n)		v_{ln}						$v_{lj}^d = \sum_j v_{lj}$ $[V]$
Total Inputs (Total Demand, Cost of Production)		x_1^d	x_2^d	x_3^d $[X^d] = [X_j]$	..	x_n^d	g_1	g_2	g_3 g	⋯	g_k	
Total Value Added		(pls see formulas in explanatory notes)										

In this research, economic sectors are defined as:

a) Primary sectors (raw materials and products) Agriculture, Forestry and Fishing, Mining, Crude oil, Gas, and Coal;

b) Secondary sectors (manufacturing industry and all sectors that transform raw materials into products and goods e.g. food manufacturing, textile manufacturing and industries such as energy, electrical, chemical, construction etc;

c) Tertiary sector (Service Sector) including financial resources, health, or a mixture of these services;

d) Quarternary sector (Knowledge Sector) in this thesis education, IT, R&D, and consulting services.

Table IV.2: Notations and key formulas applicable to Table IV.1

Notation	Description
[Z]	The n x n Intermediate Transaction Matrix showing inter-industry flows of input and output. The element of the matrix, z_{ij}, identifies the deliveries from sector *i* to sector *j* in monetary term.
z_{ij}	Elements of Transaction Matrix **Z**, the supply (output) of sector *i* for sector *j*. i.e. amount of product *i* used by industry *j* to produce product *j*.
$z_{i.}^{s}$	Intermediate Output vector. i.e. the total values of output $z_{i1}, z_{i2}, z_{i3}, \cdots, z_{in}$ from sector *i* to the *j* consuming sectors, $z_{i.}^{s} = \sum_j z_{ij}$
$z_{.j}^{d}$	Intermediate Input (Use) Vector. i.e. the total intermediate use for each *j* column sector of production, $z_{.j} = \sum_{i=1}^{n} z_{ij}$
[F]	Final demand of sector *j* output. The n x k Final Use Matrix showing different types of final demand such as Houshold Consumption, Public Expenditure (Government), Investment, Change in Inventory, and Export. The elements f_{ij} identify the deliveries from sector *i* to each sector of final demand, *k*.
f_i	A (n x 1) column vector of Total Final Use by each sector of final demand with elementsf_{ik} . Therefore = $\boldsymbol{f} = \sum_i f_{ik}$
[V]	The flow of factors of production inputs to sector j. The l x n Value Added Matrix showing different type of value added (primary factors of production). Its elements,v_{lj}, identify the dollar value of primary inputs *l* used by *j* sector towards its production.
v_{lj}	Primary input general notation for j^{th} sector, *j*=1 to n
$w_{1j} = v_{1j}$	Compensation to employees (wages) for the j^{th} sector
w_{1j}^{d}	Economy-wide compensation to employees (i.e. the total wages paid by all *j* sectors of production in the economy = $\sum_j w_{1j}$) where *j*=1 to n
$c_{2j} = v_{2j}$	Gross operating surplus & mixed income for the j^{th} sector
c_{2j}^{d}	Economy-wide gross operating surplus & mixed income (i.e. the total income generated by all *j* sectors of production in the economy = $\sum_j c_{2j}$)
$t_{3j} = v_{3j}$	Taxes less subsidies on products for the j^{th} sector
t_{3j}^{d}	Economy-wide taxes less subsidies on products (i.e. the total taxes less subsidies on products payable by all *j* sectors of production = $\sum_j t_{3j}$)
$\acute{t}_{4j} = v_{4j}$	Taxes less subsidies on production for the j^{th} sector
$\acute{t}_{4j}^{d}$	Economy wide taxes less subsidies on production (i.e. the total taxes less subsidies on production by all j sectors of production = $\sum_j \acute{t}_{4j}$)
$m_{5j} = v_{5j}$	Complementary imports for the j^{th} sector
m_{5j}^{d}	Economy-wide complementary imports (i.e. the total complementary imports by all j sectors of production in the economy = $\sum_j m_{5j}$)
$\acute{m}_{6j} = v_{6j}$	Competing imports for the j^{th} sector
$\acute{m}_{6j}^{d}$	Economy-wide competing imports (i.e. the total competing imports by all *j* sectors of production in the economy = $\sum_j \acute{m}_{6j}$)

Notation	Description
$[X^d]$=$[X_j]$	Total Inputs row vector of j elements, $x^d_{.j}$, in monetary term. In Australian IOT, this total is known as "Total Uses".
$x^d_{.j}$	j^{th} sector Total Inputs = $\sum_i \sum_l (z_{ij} + v_{lj})$
$[X^s]$=$[X_i]$	The column vector of Total Output (Supply) in monetary values with elements $x^s_{i.}$ for each production sector i. In Australian IOT, this total is known as "Total Supply".
$x^s_{i.}$	Total outputs of the row sector i. That is, the row sum of intermediate flows (supply) and final demands of sector i which is equal to $\sum_j \sum_k (z_{ij} + f_{jk})$
g	The row vector of final uses with elements g_k
$[\bar{V}]$	The column vector of l primary inputs (primary factors). Primary inputs are called non-produced factors
Total Value Added (TVA)	In Australian IO Tables, total value added for each j sector of production is the sum of compensation to employees (w_{1j}), gross operating surplus & mixed income (c_{2j}), and taxes less subsidies on production ($\acute{t}_{4j}$). That is, $TVA_{.j} = \sum(w_{1j} + c_{2j} + \acute{t}_{4j})$ where $j \in N$ and $N = \{1, 2, 3, \cdots, n\}$. e.g., for j sector 1, $TVA_1 = \sum(w_{11} + c_{21} + \acute{t}_{41})$
Total Australian Production, $p_{.j}$, for each j column sector of production	The sum of Total Intermediate Use ($u_{.j}$), Total Value Added ($TVA_{.j}$), and Complementary Import (m_{5j}). That is, $p_{.j} = \sum(u_{.j} + TVA_{.j} + m_{5j})$ where $j \in N$ and $N = \{1, 2, 3, \cdots, n\}$. e.g. for j=1, $p_{.1} = \sum_{i=1}^{n} z_{ij} + (w_{11} + c_{21} + \acute{t}_{41}) + m_{51}$
Notes on Imports:	
1) Imports if directly allocated towards production are considered as primary input; **2)** In case of indirect allocation of imports, first import assigned to the supply sector and then counted towards the using sector.	

Table IV.3 – Sectors used in this research

No.	Sector Name	Sector Short Name	Abbrev.	Unit
S01	Agriculture, Forestry and Fishing	Ag., Forest & Fish'g	AFF	Monetary
S02	Coal Mining	Coal	CM	Monetary
S03	Crude Oil (incl. condensate)	Crude Oil	CO	Monetary
S04	Gas (incl. Nat Gas, LPG and CSG)	Nat Gas	NGLS	Monetary
S05	Exploration and Mining Support Services	Explor. Mining	EMSS	Monetary
S06	Other Mineral Mining	Oth. Mining	OMM	Monetary
S07	Food, Beverage and Tobacco	Food & Bev	FBT	Monetary
S08	Textile, clothing, footwear and leather	Textile & Clothing	TCFL	Monetary
S09	Pulp, Paper and Paperboard Manufacturing	Pulp & Paper Mfg	PPPM	Monetary
S10	Wood Products	Wood Prod.	WP	Monetary
S11	Printing, Publishing other than Music and Internet	Print & Pub.	PP	Monetary
S12	Petroleum Products Manufacturing	Petro. Prod. Mfg	PPM	Monetary
S13	Coal Products Manufacturing	Coal Prod. Mfg	CPM	Monetary
S14	Chemical Products	Chem. Prod.	CP	Monetary
S15	Non-Metallic and Mineral Products	Non-Metal & Min. Prod.	NMMP	Monetary
S16	Iron and Steel Manufacturing	Iron & Steel Mfg	ISM	Monetary
S17	Basic Non-Ferrous Metal Manufacturing	Non-Ferrous Mfg	BNFMM	Monetary
S18	Metal Products, Other	Oth. Metal Prod.	MPO	Monetary
S19	Machinery, Transport and Machinery Products	Mach. & Transp Prod.	MTMP	Monetary
S20	Other Manufacturing	Mfg Oth.	MO	Monetary
S21	Electricity Generation by Coal	Elec. Gen. Coal	EGC	Monetary
S22	Electricity Generation by Oil Products	Elec. Gen. Oil	EGO	Monetary
S23	Electricity Generation by Natural Gas	Elec. Gen. Nat. Gas	EGG	Monetary
S24	Electricity Generation by Hydro	Elec. Gen. Hydro	EGH	Monetary
S25	Electricity Generation by Renewables	Elec. Gen. Renew.	EGR	Monetary
S26	Electricity Generation by Other Fuel	Elec. Gen Oth. Fuel	EGF	Monetary
S27	Electricity Transmission and Distribution	Elec. T&D	ETD	Monetary
S28	Gas Supply	Gas Supply	GS	Monetary
S29	Upstream Water Supply	Upstrm Water	WSP	Monetary
S30	Urban Water Supply	Urb Water	WSU	Monetary
S31	Rural Water Supply	Rurl Water	WSR	Monetary
S32	Sewerage & Drainage	Sewer & Drain.	SD	Monetary
S33	Construction	Const.	CONST	Monetary
S34	Wholesale and Retail Trade	Wsale & Retail	WRT	Monetary
S35	Transport and Storage Services	Trsprt & Storage Serv.	TSS	Monetary
S36	Communication, Finance, Property and Business Services	Comm, Fin. & Bus. Serv.	CFPBS	Monetary
S37	Government Administration, Defense, Public Order and Safety	Govt Admin	GADPOS	Monetary
S38	Education, Health and Community Services	Edu, Hlth & Cmty Serv.	EHCS	Monetary
S39	Other Commercial Services including Waste Management	Oth. Comml Serv.	OCWM	Monetary

Notes: Gas supply (the 2006 ANZSIC code 2700) includes the distribution of gas, such as natural gas or liquefied petroleum gas, through mains systems.

Table IV.4 – Mapping of the post-2006 IOIG to pre-2006 IOIG

IOIG (2004-05 and 2005-06)	IOIG 2004-06 Descriptor	IOIG post-2006*	IOIG Post-2006 Descriptor
0101	Sheep	0101	Sheep, Grains, Beef and Dairy Cattle
0102	Grains	0101	Sheep, Grains, Beef and Dairy Cattle
		0103	Other Agriculture
0103	Beef cattle	0101	Sheep, Grains, Beef and Dairy Cattle
0104	Dairy cattle	0101	Sheep, Grains, Beef and Dairy Cattle
0105	Pigs	0102	Poultry and Other Livestock
0106	Poultry	0102	Poultry and Other Livestock
0107	Other agriculture	0102	Poultry and Other Livestock
		0103	Other Agriculture
0200	Services to agriculture; hunting and trapping	0101	Sheep, Grains, Beef and Dairy Cattle
		0102	Poultry and Other Livestock
		0201	Aquaculture
		0401	Fishing, hunting and trapping
		0501	Agriculture, Forestry and Fishing Support Services
0300	Forestry and logging	0301	Forestry and Logging
		0501	Agriculture, Forestry and Fishing Support Services
0400	Commercial fishing	0201	Aquaculture
		0401	Fishing, hunting and trapping
		0501	Agriculture, Forestry and Fishing Support Services
0101 to 0400	**Agriculture, forestry and fishing**	**0101 to 0501**	**Agriculture, forestry and fishing**
1101	**Coal**	**0601**	**Coal mining**
1201	Oil and gas	0701	Oil and gas extraction
1201a	**Crude oil (incl. condensate)**	**0701a**	**Crude oil (incl. condensate)**
1201b	**Gas (incl. Nat Gas, LPG and CSG)**	**0701b**	**Gas (incl. Nat Gas, LPG and CSG)**
1500	**Exploration and Mining Support Services (Services to mining)**	**1001**	**Exploration and Mining Support Services**
1301	Iron ores	0801	Iron Ore Mining
1302	Non-ferrous metal ores	0802	Non Ferrous Metal Ore Mining
1400	Other mining	0901	Non Metallic Mineral Mining
1301 to 1400	**Other mining and service to mining**	**0801 to 0901**	**Other mining and service to mining**
2101	Meat and meat products	1101	Meat and Meat product Manufacturing
		1102	Processed Seafood Manufacturing
2102	Dairy products	1103	Dairy Product Manufacturing
		1106	Grain Mill and Cereal Product Manufacturing
2103	Fruit and vegetable products	1104	Fruit and Vegetable Product Manufacturing
2104	Oils and fats	1105	Oils and Fats Manufacturing
2105	Flour mill products and cereal foods	1106	Grain Mill and Cereal Product Manufacturing
		1107	Bakery Product Manufacturing
		1109	Other Food Product Manufacturing
2106	Bakery products	1107	Bakery Product Manufacturing
2107	Confectionery	1108	Sugar and Confectionery Manufacturing
2108	Other food products	1102	Processed Seafood Manufacturing
		1108	Sugar and Confectionery Manufacturing
		1109	Other Food Product Manufacturing
		1201	Soft Drinks, Cordials and Syrup Manufacturing
2109	Soft drinks, cordials and syrups	1201	Soft Drinks, Cordials and Syrup Manufacturing
2110	Beer and malt	1106	Grain Mill and Cereal Product Manufacturing
		1202	Beer Manufacturing
2111	Wine and spirits	1203	Wine, Spirits and Other Alcoholic Beverage Manufacturing
2112	Tobacco products	1204	Cigarette and Tobacco Product Manufacturing
2113	Wine, spirits and tobacco products	1205	Wine, Spirits and Tobacco
2101 to 2113	**Food, beverage and tobacco**	**1101 to 1205**	**Food, beverage and tobacco**
2201	Textile fibres, yarns and woven fabrics	1301	Textile Manufacturing
		1303	Textile Product Manufacturing
2202	Textile products	1303	Textile Product Manufacturing
2203	Knitting mill products	1304	Knitted Product Manufacturing
2204	Clothing	1305	Clothing Manufacturing
2205	Footwear	1306	Footwear Manufacturing
2206	Leather and leather products	1302	Tanned Leather, Dressed Fur and Leather Product Manufacturing
2201 to 2206	**Textile, clothing, footwear and leather**	**1301 to 1306**	**Textile, clothing, footwear and leather**
2303	**Pulp, paper and paperboard**	**1501**	**Pulp, Paper and Paperboard Manufacturing**
2301	Sawmill products	1401	Sawmill Product Manufacturing
2302	Other wood products	1401	Sawmill Product Manufacturing
		1402	Other Wood Product Manufacturing
2301, 2302	**Wood Products**	**1401, 1402**	**Wood Products**
2304	Paper containers and products	1502	Paper Stationery and Other Converted Paper Product Manufacturing
2401	Printing and services to printing	1601	Printing (including the reproduction of recorded media)
		5401	Publishing (except Internet and Music Publishing)
2402	Publishing; recorded media and publishing	1601	Printing (including the reproduction of recorded media)
		5401	Publishing (except Internet and Music Publishing)
2304, 2401, 2402	**Printing, publishing and recorded media**	**1502, 1601, 5401**	**Printing, publishing and recorded media**
2501	Petroleum and coal products	1701	Petroleum and Coal Product Manufacturing

Table IV.4 (Con'd)

IOIG (2004-05 and 2005-06)	IOIG 2004-06 Descriptor	IOIG post-2006*	IOIG Post-2006 Descriptor
2501a	**Petroleum Products**	**1701a**	**Petroleum Products**
2501b	**Coal Products**	**1701b**	**Coal Products**
2502	Basic Chemicals	1803	Basic Chemical Manufacturing
2503	Paints	1901	Polymer Product Manufacturing
2506	Cosmetics and toiletry preparations	1801	Human Pharmaceutical and Medicinal Product Manufacturing
		1802	Veterinary Pharmaceutical and Medicinal Product Manufacturing
		1803	Basic Chemical Manufacturing
2505	Soap and other detergents	1804	Cleaning Compounds and Toiletry Preparation Manufacturing
2508	Rubber products	1901	Polymer Product Manufacturing
		1902	Natural Rubber Product Manufacturing
2509	Plastic products	1901	Polymer Product Manufacturing
2502 to 2509	**Chemicals**	**1801 to 1804, 1901, 1902**	**Chemicals**
2601	Glass and glass products	2001	Glass and Glass Product Manufacturing
2602	Ceramic products	2002	Ceramic Product Manufacturing
2603	Cement, lime and concrete slurry	2003	Cement, Lime and Ready-Mixed Concrete Manufacturing
2604	Plaster and other concrete products	2004	Plaster and Concrete Product Manufacturing
2605	Other non-metallic mineral products	2005	Other Non-Metallic Mineral Product Manufacturing
		2005	Other Non-Metallic Mineral Product Manufacturing
2601 to 2605	**Non-metallic and Mineral Products**	**2001 to 2005**	**Non-metallic and Mineral Products**
2701	Iron and steel	2101	Iron and Steel Manufacturing
		2201	Forged Iron and Steel Product Manufacturing
2701	**Iron and steel**	**2101 and 2201**	**Iron and Steel Manufacturing**
2702	**Basic non-ferrous metal and products**	**2102**	**Basic Non-Ferrous Metal Manufacturing**
2703	Structural metal products	2202	Structural Metal Product Manufacturing
2704	Sheet metal products	2203	Metal Containers and Other Sheet Metal Product manufacturing
2705	Fabricated metal products	2204	Other Fabricated Metal Product manufacturing
2703 to 2705	**Metal Products, Other**	**2202 to 2204**	**Metal Products, Other**
2801	Motor vehicles and parts; other transport	2301	Motor Vehicles and Parts; Other Transport Equipment manufacturing
2802	Ships and boats	2302	Ships and Boat Manufacturing
2803	Railway equipment	2303	Railway Rolling Stock Manufacturing
2804	Aircraft	2304	Aircraft Manufacturing
2806	Electronic equipment	2401	Professional, Scientific, Computer and Electronic Equipment
2807	Household appliances	2404	Domestic Appliance Manufacturing
2808	Other electrical equipment	2403	Electrical Equipment Manufacturing
2809	Agricultural, mining and construction machinery, lifting and material handling	2405	Specialised and other Machinery and Equipment Manufacturing
2810	Other machinery and equipment		
2801 - 2810	**Machinery, Transport and Equipment Prods**	**2301-04 to 2401-05**	**Machinery, Transport and Equipment Products**
2901	Prefabricated buildings		
2902	Furniture	2501	Furniture Manufacturing
2903	Other manufacturing	2502	Other Manufactured Products
2901 to 2903	**Manufacturing, Other**	**2501 and 2502**	**Manufacturing, Other**
3601	Electricity supply	2601	Electricity Generation
3601a	Electricity Generation, Coal-fired	2601a	Electricity Generation, Coal-fired
3601b	Electricity Generation, Gas-turbine	2601b	Electricity Generation, Gas-turbine
3601c	Electricity Generation, Oil Products	2601c	Electricity Generation, Oil
3601d	Electricity Generation, Hydropower	2601d	Electricity Generation, Hydropower
3601e	Electricity Generation, Other Fuel	2601e	Electricity Generation, Other Fuel
3601f	Electricity, Transmission and Distribution	2605	Electricity Transmission, Distribution, On Selling and Electricity Market Operation
3601a to 3601f	**Electricity Supply**	**2601a, 2601e,2605**	**Electricity Supply**
3602	**Gas supply**	**2701**	**Gas Supply**
3701	Water supply; sewerage and drainage services	2801	Water Supply, Sewerage and Drainage Services
3701a	**Water (Urban)**	**2801a**	**Water (Urban)**
3701b	**Water (Rural)**	**2801b**	**Water (Rural)**
3701c	**Water Services (Sewerage and Drainage)**	**2801c**	**Water Services (Sewerage and Drainage)**
4101	Residential building construction	3001	Residential Building Construction
		7201	Building Cleaning, Pest Control, Administrative and Other Support Services
		3002	Non-Residential Building Construction
		3101	Heavy and Civil Engineering Construction
		7201	Building Cleaning, Pest Control, Administrative and Other Support Services
4201	Construction trade services	3201	Construction Services

Table IV.4 (cont'd)

IOIG (2004-05 and 2005-06)	IOIG 2004-06 Descriptor	IOIG post-2006*	IOIG Post-2006 Descriptor
4101 - 4201	**Construction**	**3001 to 3201, 7201**	**Construction**
4501	Wholesale trade	3301	Wholesale Trade
4502	Wholesale mechanical repairs		
4503	Other wholesale repairs		
5101	Retail trade	1107	Bakery Product Manufacturing
		3901	Retail Trade
		4501	Food and Beverage Services
5102	Retail mechanical repairs	9401	Automotive Repair and Maintenance
5103	Other retail repairs	9402	Other Repair and Maintenance
5701	Accommodation, cafes and restaurants	4401	Accommodation
		4501	Food and Beverage Services
4501-4503, 5101-5701	**Wholesale and Retail Trades**	**3301 to 4501, 9401-2**	**Wholesale and Retail Trades**
6101	Road transport	4601	Road Transport
		5201	Transport Support services and storage
6201	Rail, pipeline and other transport	4701	Rail Transport
		5201	Transport Support services and storage
6301	Water transport	4801	Water, Pipeline and Other Transport
6401	Air and space transport	4901	Air and Space Transport
6601	Services to transport; storage	5201	Transport Support services and storage
6101 - 6601	**Transport and Storage Services**	**4601 to 5201**	**Transport and Storage Services**
7101	Communication services	5101	Postal and Courier Pick-up and Delivery Service
		5701	Internet Publishing and Broadcasting and Services Providers, Websearch Portals and Data Processing Services
		5801	Telecommunication Services
7301	Banking	6201	Finance
7302	Non-bank finance	6201	Finance
7401	Insurance	6301	Insurance and Superannuation Funds
7501	Services to finance, invest't & insurance	6401	Auxiliary Finance and Insurance Services
7701	Ownership of dwellings	6701	Ownership of Dwellings
7702	Other property services	6702	Non-Residential Property Operators and Real Estate Services
		7310	Building Cleaning, Pest Control and Other Support Services
7801	Scientific research, technical and computer services	6901	Professional, Scientific and Technical Services
		7001	Computer Systems Design and Related Services
7802	Legal, acctg, mark'tg & business mgmt serv	6901	Professional, Scientific and Technical Services
7803	Other business services	5701	Internet Publishing and Broadcasting and Services Providers, Websearch Portals and Data Processing Services
		7210	Employment, Travel Agency and Other Administrative Services
		6901	Professional, Scientific and Technical Services
7101-7803	**Communication, Finance, Property and Business Services**	**5101, 5701 to 7210**	**Communication, Finance, Property and Business Services**
8101	Government administration	7501	Public Administration and Regulatory Services
		7701	Public Order and Safety
8201	Defence	7601	Defence
8101, 8201	**Government administration, defence, and public order and Safety**	**7501-7701**	**Government administration, defence, and public order and Safety**
8401	Education	8001	Education and Training
		8010	Primary & Secondary Edu Services (incl Pre- and Special Schools)
		8110	Tech, Vocational & Tertiary Edu Services (incl UG & PG)
		8210	Arts, Sports, Adult and Other Edu. Services (incl comm'ty edu.)
8601	Health services	8401	Health Care Services
8701	Community services	8601	Residential Care and Social Assistance Services
8401-8701	**Education, Health and Community Services**	**8001 to 8601**	**Education, Health and Community Services**
9101	Motion picture, radio and television services	5501	Motion Picture and Sound Recording
		5601	Broadcasting (except Internet)
9201	Libraries, museums and the arts	6001	Library and Other Information Services
		8901	Heritage, Creative and Performing Arts
9301	Sport, gambling and recreational services	8901	Heritage, Creative and Performing Arts
		9101	Sports and Recreation
		9201	Gambling
9501	Personal services	6601	Rental and Hiring Services (except Real Estate)
		9501	Personal Services
9601	Other services	2901	Waste Collection, Treatment and Disposal Services
		9502	Other Services
9101-9601	**Other Commercial Services inluding waste management**	**5501-6601, 8901 to 9502**	**Other Commercial Services inluding waste management**

Notes:
The 2008-09 IOIG codes in RED are the right mappings for the 2006 IOIGs.
* Slight changes in IOIG in 2013-14 and 2014-15 were observed which mapped appropriately to the pre-2006 IOIG

Source: Developed by this author based on the ABS IO tables (cat. no. 5209.0.55.001 over the period 1975 to 2015) and the ANZSIC manual (ABS cat. no. 1292.0 for 1993 and 2006)

Table IV.5: Definition of Backward Linkages as cited in the literature

Linkage Type	Definition	Source
Backward Linkages	Total input requirements (uses) for a unit increase in final demand for the j^{th} sector in an economy. It measures the impact on the supplier industries of a unit increase in final demand.	(Hazari 1970; Corugedo & Ruiz 2014; Claus & Li 2003; Lattimore et al. 2009; Tregenna 2008; Kula 2008)
	The demand for additional inputs used by producers to supply additional goods or services. The levels of demand for a sector's inputs	(Hirschman 1956; IFC 2015; Breisinger 2010)
	The change in the output value, when final demand is increased by in one monetary unit (ceteris paribus), holding prices constant (Leontief quantity model). Also known as Backward Multipliers.	(Amores & Rueda-Cantuche 2009)
	Spurring economic activity through demand for inputs from other sectors	(Corugedo & Ruiz 2014)
	if sector ***j*** increases its output, then there is increased demand on the sectors whose products are used as inputs to production in ***j*** (i.e. demand-pull or demand relationship).	(Miller and Blair 1985)
	The relationship of interindustry purchases to total purchases i.e. inputs are economically linked to the firm supplying the product.	(Polenske & Sivitanides 1989)
	The relationship between the activity in a sector and its purchases	(Matallah 2007)
	A pulling effect measure to study the impact generated by a final demand change of sector i^{th} over the total production of the economy.	(Rasmussen 1956; Chenery-Watanabe 1958; Augustinovics 1970)
	Input requirement effect; Input-provision effects (i.e. tells about one sector potential capability to induce the supply of inputs by other sectors)	(Hirschman 1958; Drejer 1999)
	The supply of intermediate inputs to the industry sectors	(NSW Treasury 2009)
	The consumption spending	(NSW Treasury 2009)

Source: This author's compilation based on review of literature for this research.

Table IV.5: Definition of Backward Linkages as cited in the literature

Linkage Type	Definition	Source
Backward Linkages (cont'd)	The input-provision, derived demand, i.e., every non-primary economic activity will induce attempts to supply through domestic production the inputs needed in that activity.	(Jones 1976)
	The quantity of *n* goods contained in the final output ***j***	(Cella 1984)
	Output multipliers illustrating change in total output as a consequence of a change in the final demand within the chosen sector.	(Hirschman 1958; Rasmussen 1956; Jones 1976; Yotopoulos & Nugent 1976; Drejer 1999; Sila & Juvancic 2005)
	Additional demand for the output of upstream sectors	(Tregenna 2008)
	Present the internal transactions, showing that the increase in the total production of sector ***j*** increases the demand of sector ***j*** for inputs from the rest of the economic sectors.	(Surugiu 2009)
	Measures its relative importance of a sector (e.g. Tourism) as demander	(Cai et al. 2006)
	Effects related to derived demand, i.e. the provision of inputs for a given activity	(Laursen & Meliciani 2000)
	An indicator showing to what extent the economic branches have been specialising as yet: A tight network of intermediate flows is transmitting production stimuli to other sectors.	Shultz (1974)
	Describe the process of how a sector buys its inputs (goods, products, or supplies) from a other sectors	(Hirschman 1958)
	The growth of a sector leads to the growth of the sectors that supply inputs to it.	(Reis & Rua 2006)
	The demands of a sector leads to the establishment of other sectors to produce for the needs of this sector. Or, simply, demand of a sector for other sectors	(Marconi et al. 2016)

Source: This author's compilation based on review of literature for this research.

Table IV.6: Definition of Forward Linkages as cited in the literature

Linkage Type	Definition	Source
Forward Linkages	Total increase in output (supplies/sales) of sector i to meet one unit increase in final demand of all sectors.	(Hazari 1970; Chatterjee 1989; Corugedo & Ruiz 2014; Tregenna 2008; Kula 2008)
	Input (Supply) Multipliers; Input multipliers revealing the situation if the whole IO System is transposed. Input multipliers depicting changes in output of the whole economy as a consequence of a change in value added within the chosen sector.	(Hirschman 1958; Rasmussen 1956; Jones 1976; Drejer 1999; Dietzenbacher1997, 2001; Miller & Blair 2009; Lahr & Dietzenbacher 2001; Guerra & Sancho 2010)
	Diffusion effect that values the joint impact over all sectors of changing inputs in supply and production of a particular sector	(Rasmussen 1956; Chenery-Watanabe 1958; Augustinovics 1970)
	A measure of total effects on outputs as a result of unitary changes in value added	(Dietzenbacher 1997)
	Supply of a sector's output as inputs to other sectors. The increased supply of inputs to upstream industries as a result of expansion of an ***i***-sector.	(Hirschman 1958; IFC 2015; Breisinger 2010)
	The capacity of each sector to induce the use of its output as input by other producers	(Bulmer-Thomas 1982)
	Increased output in sector ***j*** means that additional amounts of product ***j*** are available to be used as inputs to production in the other sectors (supply relationship). This is also known as Higher FL.	(Miller & Blair 1985; Bekhet 2010)
	The relationship of interindustry sales to total output (supplies)	(Polenske & Sivitanides 1989)
	Output utilisation effects - a measure of the potential effect of one sector over other sectors' demand	(Hirschman 1958; Drejer 1999)
	The output utilisation, i.e. every activity that does not by its nature cater exclusively to final demands, will induce attempts to utilize its outputs as inputs in some new activities.	(Jones 1976)

Source: This author's compilation based on review of literature for this research.

Table IV.6: Definition of Forward Linkages as cited in the literature

Linkage Type	Definition	Source
Forward Linkages (cont'd)	The quantity of the good ***j*** contained in the final production of the n commodities	(Cella 1984)
	The relationship between each sector and its downstream (user) industries	(Tregenna 2008)
	The relationship between the activity in a sector and its sales	(Matallah 2007)
	Presents the intersectoral transactions, showing that an increase in total production of sector ***j*** increases its total supply to the rest of the economic sectors that are using the product of sector ***j*** as an input in their production process.	(Bonfiglio et al. 2006; Surugiu 2009)
	Depict changes in output, employment and income of the whole economy as a consequence of a change in added value within the chosen sector.	(Golemanova & Kuhar 2007)
	An industries' relative importance in terms of their primary inputs requirements	(Claus & Li 2003)
	The increase in the output of sector *i* needed to supply the inputs required to produce an additional unit of final demand output given each industry's share in total final demand.	(Chatterjee 1989
	Measures the relative importance of a sector (e.g. Tourism) as supplier to the other (non-tourism) industries in the economy	(Cai et al. 2006)
	Effects are related to the use of output, i.e. the outputs from a given activity will induce attempts to use this output as inputs.	(Laursen et al. 2000)
	Effects generally weaker than backward linkages because the output produced is not necessarily met by adequate demand - give an indication of the direction of supply	(Schultz 1974)
	The potential change in the output value when the value added is increased by one monetary unit (ceteris paribus), holding the use of factor inputs constant (Ghosh price model)	(Amores & Rueda-Cantuche 2009)
	Describe the process of how a sector sells its outputs (goods, products, or supplies) to a different sector	(Hirschman 1958)

Source: This author's compilation based on review of literature for this research.

APPENDIX V

Derivation of Weighted Comparable Coefficient of Variation and Justification of Leontief-Ghosh Framework

This Appendix derives the mathematical formulation of the proposed Weighted Comparable Coefficient of Variance (WC-COV). Also, provides the justification for the combined Leontief-Ghosh Framework implemented in this research and describe the backward and forward behavior of linkages in this Framework. Different parts of this Appendix is organised as following:

V.1 - Justification for application of Leontief-Ghosh Combination Model

Because of the following reason, the use of a combine Leontief-Ghosh model for IO analysis is preferred:

- *More effective measurements of total linkages* - measurements of backward and forward linkages which are related to a unitary change in exogenous variables of final demand and value-added respectively, would effectively represent the combined effect of total sectoral linkages in an economy. For example, Khayum (1995) who applied this method to study the total intersectoral linkages in USA justified that the combination of these exogenous variables provided reliable information on total linkages effect, and also assisted to better understand the changing nature of economic interdependence over time;
- *Input usage based on sector size*: a small production sector (j) which relies heavily on its upstream supplier sectors (i) for inputs, will lead to a biased index of backward linkages for the production sector. Therefore, the weighted matrix based on the chosen construction method, would proportionally adjust each sector's input usage according to its size to avoid production of misleading linkages. Likewise, expansion of outputs in a supply sector not proportional to its importance (size) in total value added would lead to misleading large forward linkages (see section 6.3.1.2 for further discussion);
- *Plausibility of forward linkages measurements*: measuring forward linkages based on Leontief total matrix is misleading because first, it assumes that *all* sectors' final demand increases by unity based on yet another assumption that all sectors are of equal importance. This is contrary to the real-world situations; weighted matrix constructed based on Ghosh framework brings forward linkages closer to their original purpose. For example, Bulmer-Thomas (1982) pointed out that while the Leontief backward linkages would capably measure the traces of output, the Leontief measure of forward linkages has failed the original purpose behind forward linkages "*to trace the output increases which occur or might occur in using industries when there is a change in the sector supplying inputs, just as with backward linkages we trace the output increases which occur in supplying sectors when there is a change in the sector using their outputs as inputs*". Ghosh measure of forward linkages excels Leontief approach by measuring increase in output of all using industries *as a result on one unit increase in value added*. This aligns more with the Rasmussen's (1958) original conception of forward linkages and their cumulative ripple effects which is shown by: $I + B + B^2 + B^3 + \cdots + B^n$. The initial effect of change in output of the supply sector i expands in itself as a result of unitary increase in value added for sector i. This output is then distributed to using sectors following the row sum $\sum_{j=1}^{n} g_{ij}$. Then the increases in user sector's output is made available to other sectors shown by second round effect, B^2, and so on. This process conveys the original purpose of forward linkages when compared to the Leontief approach;

- *Provides useful information for more informed policy decisions* – as describe above, the weighted matrices incorporate the sector size (importance) into account to better explain the large magnitude of linkages. Therefore, more informed policy decisions can be made, which otherwise could focus on expanding capacity in a sector whose 'inducements' effects on other sectors could adversely impact the economic growth in the economy.

V.2 - Backward and forward linkages behaviour: Leontief-Ghosh Model

Jones (1976) interpreted sales of sector A to sector B as industry A's forward linkages and industry B's backward linkages. Then, he concluded that each sector's backward linkage is equivalent to a weighted sum of the forward linkages of its supplier industries, while each forward linkage is a weighted sum of the user's backward linkages. This equal relationship no longer is valid under combined Ghosh-Leontief model. Also, the Hirschman (1958) theory that one of the linkages in causal sense is important for economic development is no longer valid (mainly backward linkages because of their inducing economic activities in other sectors). The reason is that, by application of both Leontief and Ghosh inverse matrices the backward and forward linkages are calculated differently. Therefore, both contribute to economic development.

The reason for difference between backward and forward linkages are:

- The backward and forward linkages are measured for inter-industry quadrant one of the IO Table;
- Normally the inter-industry sales (by i row sectors) are not the same as the inter-industry purchases (by j column sectors) which can be confirmed by examining the elements of the transaction matrix and the coefficients of the inverse matrix; backward linkages represent the input requirements of the j^{th} column production sector while the row elements of the i^{th} sector represents the input requirements of all are production sectors in an economy. Therefore the inverse elements in a column sector and its corresponding row sector are different;
- The magnitude of the backward linkage, which is the summation of weighted or unweighted inverse coefficients, would not be the same as the summation of the row coefficients for forward linkages. Although by definition each single coefficients of the inverse matrix represent the sales of sector i to sector j, which is also equal to the purchases of sector j from sector i but at the combined upstream and downstream sectoral level this relationship does not remain valid. In conclusion, it is natural to expect that for an industry where upstream and downstream linkages are different, then the total linkages represent the maximum potential causal linkages for economic development.

V.3 - Estimation of National Average Backward and Forward Linkages

Leontief Model

When calculations of both backward and forward linkages are based on the same Leontief total coefficient matrix, the average estimates of the national economy's backward and forward linkages are equal to each other as shown below:

$$\frac{1}{n^2}\sum_{j=1}^{n}\sum_{i=1}^{n} l_{ij}^{w} = \frac{1}{n^2}\sum_{j=1}^{n} BL_{j.}^{w} = \frac{1}{n^2}\sum_{j=1}^{n} FL_{i.}^{w} \qquad \text{Eq. V.3.1}$$

For example for 2008-09 Australian economy, the estimate of the national weighted average total backward and forward linkages is 0.024 (against the unweighted national average of 0.052). It means that at national level, a unit increase in final demand only stimulated the whole economy by 0.024 of a unit, given each sector's share in final demand. This result shows the stability of the economy which does not require a high level of induced production activities through changes in final demand. Likewise, it is the case with the very low unweighted measurements. For policy decisions, it is recommended perhaps to consider the average of the weighted and unweighted linkages measurements (0.038). In other words, it represents the average inducement for the whole economy when all sectors' final demands increases by one unit, given the share of each sector in final demand.

The reason for the equality of national average linkages, in the above context, is that according to the Leontief IO model the supplies of sector A to sector B are recorded as sector A's forward linkages and sector B's backward linkages. This equality led to the Hirschman (1958) causality theory stating that only one of the linkages type is important for economic development purposes (mainly backward linkages because of their ability to stimulate production activities in the whole economy). Therefore backward linkage of a sector is equal to a weighted sum of the forward linkages of its supplier sectors, while each forward linkage is a weighted sum of the user's backward linkages. For example see Jones (1976) or Drejer (1999).

Ghosh-Leontief Model

The equality of national average backward and forward linkages; however, is not the case when the estimates of national average backward total linkages and the estimate of national average forward total linkages are based on Leontief and Ghosh total coefficient matrices respectively. In this case, it is natural to expect different linkages measurements. Therefore, the Hirschman's theory of causality should be extended beyond giving importance only to one of the linkages types because now both types of linkages play role in economic development. For example in case of 2008-09 Australian input-output table shows the national average of 0.024 for backward weighted linkages, while for the forward weighted linkages the national average was 0.031.

As discussed earlier, the latter results represent the economy based on changes in exogenous variables final demand and value added, which is preferred method of assigning weights rather than being solely based on the changes in final demand.

V.4 Derivation of Reformulated Weighted Comparable Coefficient of Variance (WC-COV), Leontief-Ghosh Framework

Section V.4 corresponds to the Section 5.3.3 Coefficient of Variation: Existing and Proposed Formulations - item 2, *WC-COV: Existing System of Weights and Directional Weighting Model Number Four*. This method also, applies to item 3.

Let, matrix ***A*** represents an (n x n) unweighted matrix with elements a_{ij} where i represents each of its rows and j each its columns:

$$\boldsymbol{A} = \begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \ddots & \vdots \\ a_{n1} & \cdots & a_{nn} \end{bmatrix} \quad i = 1,2,\cdots,n \;\; ; \;\; j = 1,2,\cdots,n) \text{ and } a_{ij} \geq 0$$

Let x_j represents the vertical vector of j^{th} column of the total matrix ***A***, and w_j the weight associated with each of the columns. The system of weights assigns a different weight to each column of the ***A*** matrix. However, within each column, the same weight equally applies to each of the column's elements, a_{ij}. For example weight w_1 equally applies to each of the elements of the column vector x_1.

The x_j and its weighted vector $w_j x_j$ are shown below:

$$x_j = \begin{vmatrix} a_{1j} \\ a_{2j} \\ a_{3j} \\ \vdots \\ a_{nj} \end{vmatrix} \qquad b_j = w_j x_j \begin{vmatrix} w_j a_{1j} \\ w_j a_{2j} \\ w_j a_{3j} \\ \vdots \\ w_j a_{nj} \end{vmatrix}$$

Let, ***B*** the weighted matrix of ***A*** whose weighted columns are shown by b_j (where $j = 1, 2, 3, \ldots,$ n). The elements of each b_j are represented by $b_{ij} = (b_{1j}, b_{2j}, \cdots, b_{nj})$ where *i*=1, 2, …, n.

$$\boldsymbol{B} = \begin{vmatrix} w_1 a_{11} & w_2 a_{12} & w_3 a_{13} & & w_n a_{1n} \\ w_1 a_{21} & w_2 a_{22} & w_3 a_{23} & & w_n a_{2j} \\ w_1 a_{31} & w_2 a_{32} & w_3 a_{33} & & w_n a_{3j} \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ w_1 a_{n1} & w_2 a_{n2} & w_3 a_{n3} & & w_n a_{nn} \end{vmatrix}$$
$$\quad b_1 \qquad b_2 \qquad \ldots \qquad b_n$$

1) Let $\mu_j = \frac{1}{n}\sum_{i=1}^{n} a_{ij}$, which is the average of each unweighted j^{th} column, and let $\widehat{\mu_j}$ the weighted average of the j^{th} column vector $w_j x_j$ (or b_j). The $\widehat{\mu_j}$ is derived as follows:

$$\widehat{\mu_j} = E\left(w_j x_j\right) = \frac{w_j a_{1j} + w_j a_{2j} + w_j a_{3j} + \cdots + w_j a_{nj}}{n}$$

$$= \frac{1}{n}\sum_{i=1}^{n} w_j a_{ij}$$

$$\boldsymbol{\widehat{\mu_j} = \frac{w_j}{n}\sum_{i=1}^{n} a_{ij}}$$ **Eq. V.4.1**

$$\boldsymbol{\widehat{\mu_j} = E\left(w_j x_j\right) = w_j \mu_j}$$ **Eq. V.4.2**

2) Let vertical matrix $\boldsymbol{Y} = (y_1, y_2, y_3, \cdots, y_n)$.
The general variance formula for ***Y*** is given by:

$$\boldsymbol{= \frac{1}{n-1}\left[\sum_{j=1}^{n}(y_j - \bar{y})^2\right]}$$ **Eq. V.4.3**

Expanding Eq. V.4.3 produces an alternative variance formula as shown by Eq. V.4.4 below:

$$= \frac{1}{n-1}\left[\sum_{j=1}^{n}\left(y_j^2 - 2\bar{y}y_i + \bar{y}^2\right)\right]$$

$$= \frac{1}{n-1}\left[\sum_{j=1}^{n} y_j^2 - 2\bar{y}\sum_{i=1}^{n} y_i + n\bar{y}^2\right]$$

$$= \frac{1}{n-1}\left[\sum_{j=1}^{n} y_j^2 - 2\bar{y}.n\bar{y} + n\bar{y}^2\right]$$

$$\frac{1}{n-1}\left[\sum_{j=1}^{n} y_j^2 - 2n\bar{y}^2 + n\bar{y}^2\right]$$

$$\boldsymbol{= \frac{1}{n-1}\left[\sum_{j=1}^{n} y_j^2 - n\bar{y}^2\right]}$$ **Eq. V.4.4**

3) Based on Eq. V.4.3, the weighted variance of the j^{th} column vector $w_j x_j$ is derived as follows:

$$var\ (w_j x_j) = \frac{(w_j a_{1j} - \widehat{\mu_j})^2 + \left(w_j a_{2j} - \widehat{\mu_j}\right)^2 + \left(w_j a_{3j} - \widehat{\mu_j}\right)^2 + \cdots + (w_j a_{nj} - \widehat{\mu_j})^2}{n-1}$$

Or

$$var\left(w_j x_j\right) = \frac{\sum_{i=1}^{n}\left(w_j a_{ij} - \widehat{\mu_j}\right)^2}{n-1}$$

$$var\left(w_j x_j\right) = \frac{1}{n-1}\sum_{i=1}^{n}(w_j a_{ij} - \widehat{\mu_j})^2 \qquad j=1,2,\ldots,n$$ Eq. V.4.5

Using Eq. V.4.2, substituting for $\widehat{\mu_j}$:

$$= \frac{1}{n-1}\sum_{i=1}^{n}\left(w_j a_{ij} - w_j \mu_j\right)^2$$ Eq. V.4.6

$$= \frac{w_j^2}{n-1}\sum_{i=1}^{n}\left(a_{ij} - \mu_j\right)^2$$

Or, simply

$$\boldsymbol{var\left(b_j\right) = var\left(w_j x_j\right) = w_j^2 var(x_j)}$$ **Eq. V.4.7**

4) Let's expand Eq. V.4.6 to develop $var\left(w_j x_j\right)$ in terms of a_{ij} and w_j:

Eq. V.4.5 can be extended as follows:

$$= \frac{1}{n-1}\sum_{i=1}^{n}\left(w_j^2 a_{ij}^2 - 2w_j a_{ij} w_j \mu_j + {w_j}^2{\mu_j}^2\right) \qquad i = 1, 2, 3, \cdots, n$$

$$= \frac{1}{n-1}\sum_{i=1}^{n}\left(w_j^2 a_{ij}^2 - 2w_j^2 a_{ij}\mu_j + {w_j}^2{\mu_j}^2\right)$$

$$= \frac{w_j^2}{n-1}\left[\sum_{i=1}^{n} a_{ij}^2 - 2\mu_j \sum_{i=1}^{n} a_{ij} + n{\mu_j}^2\right]$$

$$= \frac{w_j^2}{n-1}\left[\sum_{i=1}^{n} a_{ij}^2 - 2n\mu_j \frac{\sum_{i=1}^{n} a_{ij}}{n} + n{\mu_j}^2\right]$$

$$= \frac{w_j^2}{n-1}\left[\sum_{i=1}^{n} a_{ij}^2 - 2n{\mu_j}^2 + n{\mu_j}^2\right]$$

$$= \frac{w_j^2}{n-1}\left[\sum_{i=1}^{n} a_{ij}^2 - n{\mu_j}^2\right]$$

$$= \frac{w_j^2}{n-1}\left[\sum_{i=1}^{n} a_{ij}^2 - n\left[\frac{1}{n}\sum_{i=1}^{n} a_{ij}\right]^2\right]$$

$$\boldsymbol{var\ (w_j x_j) = \frac{w_j^2}{n-1}\left[\sum_{i=1}^{n} a_{ij}^2 - \frac{1}{n}\left(\sum_{i=1}^{n} a_{ij}\right)^2\right]} \qquad \textbf{Eq. V.4.8}$$

Therefore, Eq. V.4.7 and Eq. V.4.8 are the simplified formula for the weighted variance of *column vector* $w_j x_j$

5) Let $\hat{\mu}$ the total mean of the weighted matrix ***B*** which is derived as follows:

$$\hat{\mu} = E(B) = \frac{E(w_1x_1) + E(w_2x_2) + E(w_3x_3) + \cdots + E(w_nx_n)}{n}$$

$$= \frac{\frac{1}{n}\sum_{i=1}^{n} w_1 a_{i1} + \frac{1}{n}\sum_{i=1}^{n} w_2 a_{i2} + \frac{1}{n}\sum_{i=1}^{n} w_1 a_{i3} + \cdots + \frac{1}{n}\sum_{i=1}^{n} w_1 a_{in}}{n}$$

$$\hat{\mu} = E(B) = \frac{1}{n^2}\left[w_1 \sum_{i=1}^{n} a_{i1} + w_2 \sum_{i=1}^{n} a_{i2} + w_3 \sum_{i=1}^{n} a_{i3} + \cdots + w_n \sum_{i=1}^{n} a_{in}\right]$$

$$= \frac{1}{n^2}\left[\sum_{j=1}^{n} w_j \sum_{i=1}^{n} a_{ij}\right] \qquad \text{Eq. V.4.9}$$

$$\hat{\mu} = \frac{1}{n}\sum_{j=1}^{n}\frac{w_j}{n}\sum_{i=1}^{n} a_{ij}$$

$$\boldsymbol{\hat{\mu} = \frac{1}{n}\sum_{j=1}^{n} w_j\, \mu_j} \qquad \textbf{Eq. V.4.10}$$

With reference to Eq.V.4.1, $\hat{\mu}$ can be simplified as:

$$\boldsymbol{\hat{\mu} = \frac{1}{n}\sum_{j=1}^{n}\widehat{\mu_j}} \qquad \textbf{Eq. V.4.11}$$

6) With reference to Eq. V.4.3 and Eq. V.4.4, the general variance formula, the weighted variance of the population matrix ***B***, which has *n* column vectors, is derived as follows:

$$Var\ (B) = \frac{1}{n^2-1}\sum_{i,j=1}^{n}\left(b_{ij} - \hat{\mu}\right)^2$$ Eq. V.4.12

Or, in simplified form (Eq. V.4.4):

$$Var\ (B) = \frac{1}{n^2-1}\left[\sum_{i,j=1}^{n} b_{ij}^2 - n^2\hat{\mu}^2\right]$$ Eq. V.4.13

where: $b_{ij} = w_j a_{ij}$ the elements of B matrix, and $\hat{\mu}$ the total mean of ***B***.

Note: Eq. V.4.12 and Eq. V.4.13 are the same as proved earlier by Eq.V.4.3 and Eq. V.4.4.

Therefore, using Eq. V.4.13 gives the following formula for weighted matrix ***B***:

$$= \frac{1}{n^2-1}\left[\sum_{j=1}^{n}\sum_{i=1}^{n}(w_j a_{ij})^2 - n^2\left(\frac{1}{n^2}\sum_{j=1}^{n} w_j \sum_{i=1}^{n} a_{ij}\right)^2\right]$$

$$= \frac{1}{n^2-1}\left[\sum_{j=1}^{n} w_j{}^2 \sum_{i=1}^{n}(a_{ij})^2 - n^2 . \frac{1}{n^4}\left(\sum_{j=1}^{n} w_j \sum_{i=1}^{n} a_{ij}\right)^2\right]$$

$$= \frac{1}{n^2-1}\left[\sum_{j=1}^{n} w_j{}^2 \sum_{i=1}^{n}(a_{ij})^2 - \frac{1}{n^2}\left(\sum_{j=1}^{n} w_j \sum_{i=1}^{n} a_{ij}\right)^2\right]$$ **Eq. V.4.14**

Or, the final equation, Weighted Coefficient of variation (WC-COV) based on the existing method of weights for backward linkages is obtained by Eq. V.4.15

$$WC - COV,\ \ \gamma = \frac{(n+1)w_j^2\left[\sum_{i=1}^{n} a_{ij}^2 - \frac{1}{n}\left(\sum_{i=1}^{n} a_{ij}\right)^2\right]}{\left[\sum_{j=1}^{n} w_j^2 \sum_{i=1}^{n} a_{ij}^2 - \frac{1}{n^2}\left(\sum_{j=1}^{n} w_j \sum_{i=1}^{n} a_{ij}\right)^2\right]}$$ Eq. V.4.15

Likewise, the Weighted Coefficient of Variation (WC-COV) for calculating the variance among coefficients which comprise forward linkages follow similar approach to Eq. V.4.15 using the Ghosh model. In this case the WC-COV for forward linkages is calculated using Eq. V.4.16:

$$\textbf{WC-COV}_{(w, X_{i.}\ , Model\ 4)} = \gamma_{i.}^{w} = \sqrt{\frac{(n+1)\left[\sum_{j=1}^{n} w_j^2 l_{ij}^2 - \frac{1}{n}\left(\sum_{j=1}^{n} w_j l_{ij}\right)^2\right]}{\left[\sum_{i=1}^{n}\sum_{j=1}^{n} w_j^2 l_{ij}^2 - \frac{1}{n^2}\left(\sum_{i-1}^{n}\sum_{j=1}^{n} w_j l_{ij}\right)^2\right]}}$$ **(Eq. V.4.16)**

APPENDIX VI

Full set of Imports and Associated Ranks; and MIC, Concentration, Entropy Indices, 1975 2015

This Appendix provides Imports and associated ranks and the complete set of linkage indices of the dimensions discussed in Chapter 6 over the period 197-2015 in tables listed below:

Sources of all Tables in this appendix

This author’s analysis based on the models developed in chapter 4 and the results generated by these models.

Table VI.1- Imports and associated ranks[1] of Australian sectors, 1975-2015
($m, real price term - base year 2014-15 = 100)

Sect Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
S01	1107 (11)	1265 (11)	1068 (15)	986 (17)	1224 (16)	1335 (14)	858 (19)	1496 (13)	1539 (16)	1287 (21)	1330 (122)	1330 (19)	2452 (12)	2463 (14)	2790 (15)	2512 (19)	1243 (22)	1346 (22)	1605 (22)	1365 (22)	1513 (22)	1546 (22)	1226 (23)	1574 (22)	1704 (21)
S02	172 (22)	641 (17)	98 (27)	1241 (14)	1579 (12)	304 (24)	152 (26)	310 (22)	241 (25)	219 (25)	163 (200)	163 (23)	925 (20)	530 (23)	343 (24)	517 (25)	31 (25)	32 (25)	73 (26)	23 (26)	34 (26)	32 (26)	23 (26)	28 (26)	48 (26)
S03	686 (15)	678 (16)	1689 (10)	1423 (12)	1351 (14)	2456 (9)	2386 (10)	1696 (12)	1167 (20)	1928 (12)	2343 (73)	2343 (12)	850 (22)	2014 (16)	1383 (19)	2747 (17)	10256 (7)	12340 (4)	12880 (5)	16042 (3)	10118 (9)	8846 (8)	9153 (9)	10820 (8)	6629 (15)
S04	333 (19)	637 (19)	130 (25)	208 (25)	767 (22)	505 (23)	488 (21)	633 (18)	361 (24)	382 (23)	826 (154)	826 (22)	736 (23)	1069 (21)	919 (22)	2106 (20)	2938 (16)	3636 (15)	4735 (16)	4971 (15)	5962 (15)	5429 (15)	9144 (10)	8279 (12)	7135 (13)
S05	3 (25)	-72 (39)	-87 (39)	-164 (39)	-222 (39)	-213 (39)	-232 (39)	61 (27)	33 (29)	-40 (39)	115 (206)	115 (24)	101 (28)	120 (28)	327 (25)	339 (26)	172 (23)	172 (24)	203 (25)	298 (25)	367 (24)	301 (24)	208 (25)	164 (25)	399 (25)
S06	258 (20)	539 (21)	476 (22)	478 (22)	764 (23)	647 (20)	347 (24)	188 (25)	871 (21)	1728 (15)	1531 (104)	1531 (14)	2224 (14)	2209 (15)	1092 (20)	3417 (15)	4006 (14)	6927 (10)	7620 (11)	9830 (9)	13715 (6)	8404 (9)	5973 (17)	4849 (17)	4617 (16)
S07	2137 (6)	2042 (6)	2268 (7)	2204 (9)	2522 (8)	2683 (7)	2663 (5)	3781 (5)	3421 (7)	4249 (6)	5099 (30)	5099 (5)	7793 (5)	8326 (4)	8225 (5)	9545 (6)	11354 (6)	11374 (8)	12664 (6)	13615 (6)	14747 (4)	14476 (4)	16884 (5)	19313 (4)	20849 (5)
S08	4030 (3)	5396 (2)	6181 (2)	6039 (3)	5830 (4)	6408 (4)	4978 (4)	6574 (2)	6253 (3)	7034 (3)	9115 (11)	9115 (3)	5865 (6)	5473 (6)	6585 (9)	6624 (7)	12275 (4)	12181 (5)	10804 (7)	12327 (7)	13591 (7)	12615 (6)	16996 (4)	18565 (5)	21013 (4)
S09	702 (14)	169 (24)	816 (17)	678 (20)	1037 (18)	1089 (17)	766 (20)	0 (34)	1564 (15)	1372 (19)	1403 (116)	1403 (17)	1369 (18)	1403 (20)	1431 (18)	1529 (23)	3219 (15)	3100 (16)	1405 (23)	2853 (17)	2624 (19)	2337 (20)	2052 (20)	2073 (21)	1972 (20)
S10	1439 (9)	891 (15)	1813 (9)	2274 (8)	2034 (9)	2162 (11)	1484 (12)	1771 (10)	2175 (10)	1868 (14)	1387 (117)	1387 (18)	564 (24)	529 (24)	787 (23)	1830 (22)	2181 (20)	1930 (20)	2854 (18)	1807 (21)	1803 (21)	1744 (21)	1853 (21)	2090 (20)	2445 (19)
S11	1253 (10)	1011 (13)	1555 (12)	1540 (11)	1455 (13)	1156 (16)	1347 (14)	783 (17)	1694 (13)	2467 (10)	2423 (69)	2423 (11)	4048 (10)	4362 (9)	4944 (10)	5403 (8)	4166 (13)	4075 (14)	5965 (13)	4378 (16)	4660 (16)	4521 (16)	6033 (15)	6409 (15)	6848 (14)
S12	2219 (5)	2545 (5)	4034 (4)	5154 (4)	6373 (2)	9010 (2)	8432 (2)	4128 (4)	3809 (6)	3063 (8)	2712 (55)	2712 (9)	5487 (8)	5270 (8)	7822 (6)	4727 (9)	7729 (8)	12072 (6)	9844 (8)	15325 (4)	17621 (3)	16305 (3)	22747 (3)	25122 (3)	23633 (3)
S13	183 (21)	91 (25)	125 (26)	146 (27)	256 (26)	288 (25)	283 (25)	234 (23)	68 (28)	68 (26)	73 (215)	73 (27)	96 (29)	92 (30)	52 (31)	76 (31)	139 (24)	246 (23)	238 (24)	336 (24)	293 (25)	393 (23)	820 (24)	574 (24)	414 (24)
S14	5154 (2)	4164 (3)	5475 (3)	7150 (2)	6000 (3)	6804 (3)	5137 (3)	4623 (3)	8135 (2)	9974 (2)	10500 (9)	10500 (2)	12876 (2)	12227 (2)	17778 (2)	13979 (4)	30115 (2)	30007 (2)	26703 (3)	32258 (2)	33123 (2)	31845 (2)	34322 (2)	35300 (2)	36646 (2)
S15	878 (12)	971 (14)	1094 (14)	1196 (15)	1300 (15)	1313 (15)	1081 (16)	1162 (14)	1407 (17)	1529 (17)	1424 (113)	1424 (16)	2057 (15)	1593 (19)	2253 (16)	2088 (21)	2619 (17)	2455 (17)	3025 (17)	2658 (19)	2758 (18)	2782 (18)	2428 (19)	2973 (19)	3358 (18)
S16	1698 (8)	1243 (12)	1532 (13)	1624 (10)	2011 (10)	2405 (10)	2152 (11)	1825 (9)	1933 (11)	2407 (11)	2106 (81)	2106 (13)	879 (21)	298 (26)	147 (29)	2695 (18)	5817 (10)	5946 (11)	6080 (12)	5856 (13)	8480 (10)	5500 (14)	5982 (16)	6182 (16)	7324 (11)
S17	341 (18)	343 (23)	400 (23)	705 (19)	541 (25)	575 (21)	350 (23)	503 (21)	382 (23)	313 (24)	77 (211)	77 (26)	2386 (13)	2941 (12)	3412 (12)	2800 (16)	1703 (21)	1596 (21)	2797 (19)	2463 (20)	2357 (20)	2614 (19)	2984 (18)	3393 (18)	3411 (17)
S18	1877 (7)	1974 (8)	2181 (8)	2461 (7)	2528 (7)	2919 (6)	2600 (6)	2229 (7)	2723 (9)	3010 (9)	2853 (52)	2853 (7)	1069 (19)	1771 (17)	1571 (17)	3929 (10)	5730 (11)	5891 (12)	8204 (10)	5838 (14)	6672 (14)	5841 (13)	7981 (11)	8382 (11)	9143 (10)
S19	14667 (1)	15939 (1)	17140 (1)	16517 (1)	19038 (1)	19653 (1)	17071 (1)	18939 (1)	22199 (1)	25373 (1)	25967 (1)	25967 (1)	27521 (1)	28197 (1)	38019 (1)	36285 (1)	97314 (1)	99788 (1)	86515 (1)	106420 (1)	104612 (1)	107845 (1)	108837 (1)	108531 (1)	114862 (1)
S20	754 (13)	1279 (10)	915 (16)	1104 (16)	1102 (17)	1432 (13)	1438 (13)	1159 (15)	1879 (12)	1877 (13)	2435 (67)	2435 (10)	1813 (16)	2828 (13)	3251 (14)	3495 (13)	7157 (9)	7442 (9)	5562 (14)	8269 (10)	8290 (11)	7863 (10)	7751 (12)	8631 (10)	9625 (9)
S21	0 (31)	28 (28)	93 (28)	157 (26)	160 (28)	53 (28)	75 (28)	150 (26)	74 (27)	17 (29)	62 (218)	62 (28)	210 (27)	290 (27)	243 (27)	255 (28)	11 (29)	11 (29)	16 (29)	9 (30)	9 (30)	9 (29)	13 (29)	13 (29)	15 (29)
S22	0 (36)	2 (33)	6 (34)	9 (31)	7 (32)	3 (35)	5 (35)	8 (31)	2 (36)	0 (35)	2 (267)	2 (32)	3 (35)	4 (36)	2 (37)	4 (37)	0 (36)	0 (34)	1 (36)	0 (37)	0 (36)	0 (37)	1 (36)	1 (37)	1 (37)
S23	0 (35)	3 (32)	11 (32)	11 (30)	15 (30)	6 (32)	6 (34)	2 (32)	3 (35)	1 (33)	5 (254)	5 (30)	13 (33)	12 (34)	17 (33)	29 (34)	0 (34)	0 (36)	2 (32)	2 (32)	1 (35)	1 (34)	3 (33)	4 (33)	4 (33)
S24	0 (33)	5 (30)	20 (29)	25 (28)	25 (29)	10 (31)	12 (31)	21 (28)	11 (31)	2 (32)	8 (244)	8 (29)	27 (32)	36 (32)	33 (32)	31 (33)	1 (31)	1 (31)	2 (34)	1 (35)	1 (34)	1 (33)	2 (34)	2 (34)	2 (34)
S25	0 (34)	3 (31)	12 (31)	13 (29)	13 (31)	5 (33)	6 (33)	10 (30)	4 (32)	1 (34)	4 (256)	4 (31)	13 (34)	13 (33)	10 (35)	14 (35)	1 (32)	1 (32)	2 (33)	1 (33)	1 (32)	1 (32)	3 (32)	4 (32)	4 (32)
S26	0 (38)	0 (34)	0 (37)	0 (33)	0 (34)	0 (37)	0 (37)	0 (33)	0 (38)	0 (37)	0 (283)	0 (34)	1 (37)	1 (37)	1 (38)	2 (38)	0 (35)	0 (35)	1 (37)	0 (36)	0 (37)	0 (36)	1 (35)	1 (35)	1 (36)
S27	0 (29)	35 (27)	140 (24)	214 (24)	205 (27)	77 (27)	104 (27)	192 (24)	95 (26)	20 (27)	81 (209)	81 (25)	266 (26)	355 (25)	306 (26)	336 (27)	14 (27)	14 (27)	23 (28)	13 (27)	12 (27)	13 (27)	23 (27)	26 (27)	28 (27)
S28	0 (26)	7 (29)	5 (35)	5 (32)	5 (33)	4 (34)	12 (30)	19 (29)	20 (30)	19 (28)	1 (272)	1 (33)	-1 (39)	-3 (39)	9 (36)	46 (32)	0 (39)	0 (39)	0 (38)	0 (38)	0 (38)	0 (39)	0 (38)	0 (39)	0 (38)
S29	0 (39)	0 (35)	0 (38)	0 (34)	0 (35)	0 (38)	0 (38)	0 (35)	0 (39)	0 (38)	0 (285)	0 (35)	0 (38)	0 (38)	0 (39)	0 (39)	0 (38)	0 (38)	0 (39)	0 (39)	0 (39)	0 (38)	0 (39)	0 (38)	0 (39)
S30	0 (30)	-10 (38)	16 (30)	-6 (37)	-6 (38)	18 (29)	14 (29)	-8 (38)	3 (34)	2 (31)	-4 (298)	-4 (37)	42 (31)	46 (31)	82 (30)	132 (29)	10 (30)	9 (30)	11 (31)	11 (28)	9 (29)	8 (30)	11 (30)	11 (30)	12 (30)
S31	0 (37)	0 (36)	1 (36)	0 (35)	0 (36)	1 (36)	1 (36)	-1 (36)	0 (37)	0 (36)	0 (295)	0 (36)	2 (36)	5 (35)	11 (34)	9 (36)	1 (33)	1 (33)	1 (35)	1 (34)	1 (33)	1 (35)	0 (37)	1 (36)	1 (35)
S32	0 (32)	-5 (37)	9 (33)	-4 (36)	-5 (37)	13 (30)	11 (32)	-7 (37)	4 (33)	4 (30)	-6 (301)	-6 (38)	83 (30)	119 (29)	159 (28)	119 (30)	11 (28)	13 (28)	11 (30)	10 (29)	11 (28)	13 (28)	14 (28)	16 (28)	17 (28)
S33	0 (28)	1379 (9)	2456 (6)	3312 (5)	3266 (5)	3302 (5)	2431 (9)	1758 (11)	4155 (5)	4878 (5)	2770 (53)	2770 (8)	5118 (9)	4314 (10)	7642 (7)	3659 (12)	23 (26)	22 (26)	1878 (21)	1064 (23)	1252 (23)	60 (25)	7351 (13)	6529 (14)	1232 (23)
S34	90 (23)	638 (18)	665 (18)	454 (23)	783 (21)	569 (22)	488 (22)	-46 (39)	1582 (14)	1430 (18)	-142 (308)	-142 (39)	5520 (7)	5427 (7)	7414 (8)	17500 (2)	5379 (12)	5314 (13)	27521 (2)	6762 (12)	7263 (12)	7500 (11)	9744 (8)	10209 (9)	10333 (8)
S35	2487 (4)	3092 (4)	3123 (5)	3053 (6)	3101 (6)	2583 (8)	2532 (7)	3412 (6)	3365 (8)	3808 (7)	5909 (24)	5909 (4)	7930 (4)	7247 (5)	10418 (4)	11579 (5)	12597 (3)	12853 (3)	13813 (4)	15306 (5)	14290 (5)	13552 (5)	11437 (7)	11483 (7)	10984 (7)
S36	618 (16)	1978 (7)	1562 (11)	1317 (13)	1671 (11)	1848 (12)	2460 (8)	2124 (8)	5662 (4)	5550 (4)	4879 (32)	4879 (6)	9900 (3)	11687 (3)	11523 (3)	16174 (3)	12194 (5)	12006 (7)	8302 (9)	10547 (8)	10778 (8)	10216 (7)	15303 (6)	16963 (6)	17819 (6)
S37	0 (27)	82 (26)	557 (21)	-30 (38)	585 (24)	80 (26)	1152 (15)	552 (20)	626 (22)	715 (22)	1109 (139)	1109 (21)	544 (25)	574 (22)	1087 (21)	1333 (24)	0 (37)	0 (37)	32 (27)	2 (31)	2 (31)	2 (31)	7 (31)	7 (31)	8 (31)
S38	13 (24)	525 (22)	660 (19)	984 (18)	825 (19)	826 (19)	902 (18)	950 (16)	1238 (19)	1593 (16)	1500 (106)	1500 (15)	1562 (17)	1689 (18)	3543 (11)	3778 (11)	2481 (19)	2451 (18)	2312 (20)	2670 (18)	2785 (17)	2793 (17)	1380 (22)	1435 (23)	1485 (22)
S39	364 (17)	629 (20)	632 (20)	662 (21)	785 (20)	884 (18)	968 (17)	590 (19)	1245 (18)	1291 (20)	1124 (138)	1124 (20)	3570 (11)	3099 (11)	3327 (13)	3427 (14)	2500 (18)	2401 (19)	5067 (15)	7237 (11)	6959 (13)	6627 (12)	7226 (14)	7116 (13)	7202 (12)

[1] The numbers in parenthesis show the import ranks of each sector within each input-output reference year

Source: Results obtained from the model developed in this research.

Table VI.2 - The number of Most Important Coefficients (MIC) by sectors, 1975-2015

Sect Code	1974-75			1977-78			1978-79			1979-80			1980-81			1981-82		
	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC
S01	2	1	3	2	2	4	1	1	2	1	1	2	1	1	2	2	2	4
S02	1	3	4	1	3	4	2	5	7	2	3	5	1	3	4	1	4	5
S03	2	2	4	2	2	4	2	1	3	2	1	3	2	2	4	3	1	4
S04	0	16	16	0	6	6	0	20	20	0	21	21	0	16	16	0	19	19
S05	1	6	7	1	5	6	1	5	6	1	5	6	1	5	6	1	3	4
S06	1	3	4	1	2	3	0	2	2	0	2	2	0	2	2	0	2	2
S07	2	1	3	2	1	3	2	1	3	3	1	4	2	1	3	2	1	3
S08	1	1	2	1	1	2	1	1	2	1	1	2	1	1	2	1	1	2
S09	1	5	6	1	4	5	1	10	11	1	8	9	1	9	10	1	10	11
S10	2	5	7	1	6	7	1	7	8	1	6	7	1	7	8	1	6	7
S11	1	6	7	0	7	7	1	7	8	1	7	8	1	7	8	1	6	7
S12	3	9	12	3	8	11	1	5	6	3	5	8	2	5	7	2	5	7
S13	0	14	14	0	18	18	0	16	16	0	16	16	0	16	16	0	16	16
S14	2	5	7	2	6	8	3	6	9	2	7	9	2	7	9	1	7	8
S15	1	5	6	1	6	7	1	6	7	1	6	7	1	6	7	1	6	7
S16	3	4	7	2	5	7	3	5	8	2	5	7	2	5	7	3	5	8
S17	2	4	6	2	4	6	3	4	7	3	4	7	3	4	7	3	4	7
S18	1	4	5	1	5	6	2	5	7	3	5	8	3	5	8	3	5	8
S19	4	2	6	4	1	5	5	1	6	5	1	6	4	1	5	4	2	6
S20	1	4	5	0	6	6	0	6	6	0	5	5	0	5	5	0	6	6
S21	2	11	13	2	9	11	3	10	13	2	10	12	2	9	11	3	9	12
S22	0	19	19	0	17	17	0	20	20	0	19	19	0	20	20	0	18	18
S23	2	22	24	2	19	21	2	21	23	2	21	23	2	19	21	2	20	22
S24	1	18	19	1	16	17	1	17	18	1	19	20	1	19	20	1	18	19
S25	0	11	11	0	13	13	0	13	13	0	17	17	0	15	15	0	17	17
S26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S27	5	7	12	6	8	14	6	8	14	5	7	12	5	6	11	6	6	12
S28	1	13	14	1	12	13	1	16	17	1	16	17	1	16	17	1	12	13
S29	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S30	1	10	11	1	9	10	1	8	9	1	9	10	1	7	8	1	9	10
S31	0	11	11	0	17	17	0	17	17	0	18	18	0	16	16	0	18	18
S32	0	11	11	0	9	9	0	9	9	0	9	9	0	8	8	0	8	8
S33	4	0	4	4	0	4	6	0	6	6	0	6	6	0	6	6	0	6
S34	4	1	5	3	0	3	2	0	2	1	0	1	2	0	2	2	0	2
S35	1	2	3	1	2	3	1	2	3	1	1	2	1	2	3	1	3	4
S36	3	1	4	4	2	6	4	1	5	6	1	7	6	1	7	6	1	7
S37	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S38	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S39	0	0	0	0	2	2	0	2	2	0	1	1	0	1	1	0	2	2
Total	58	240	298	53	235	288	58	260	318	59	260	319	56	249	305	60	254	314

Sect Code	1982-83			1983-84			1986-87			1989-90			1992-93			1993-94		
	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC
S01	3	2	5	2	1	3	2	1	3	1	1	2	2	1	3	2	1	3
S02	1	3	4	1	3	4	0	2	2	0	2	2	0	2	2	1	2	3
S03	2	1	3	2	2	4	2	2	4	2	1	3	2	1	3	1	2	3
S04	0	19	19	0	10	10	1	17	18	2	13	15	2	8	10	0	13	13
S05	1	3	4	1	4	5	1	5	6	1	5	6	1	4	5	0	3	3
S06	0	2	2	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S07	2	1	3	3	1	4	2	2	4	2	2	4	2	1	3	2	1	3
S08	1	3	4	1	2	3	1	2	3	1	3	4	1	1	2	1	3	4
S09	1	10	11	1	3	4	1	7	8	1	8	9	0	7	7	0	8	8
S10	1	6	7	1	5	6	1	5	6	1	7	8	1	9	10	1	10	11
S11	1	7	8	0	6	6	1	5	6	1	6	7	1	7	8	1	5	6
S12	2	5	7	4	6	10	4	6	10	1	5	6	2	5	7	2	5	7
S13	0	17	17	0	18	18	0	18	18	0	18	18	0	18	18	0	18	18
S14	3	8	11	2	7	9	1	8	9	2	7	9	2	5	7	2	6	8
S15	1	6	7	1	6	7	1	6	7	1	6	7	1	6	7	3	7	10
S16	2	5	7	2	5	7	1	5	6	3	5	8	2	5	7	2	5	7
S17	3	4	7	3	4	7	4	4	8	4	4	8	2	1	3	4	2	6
S18	2	5	7	1	5	6	1	5	6	1	5	6	2	6	8	2	7	9
S19	4	2	6	3	1	4	3	3	6	4	2	6	4	1	5	3	3	6
S20	0	5	5	0	4	4	0	5	5	1	5	6	1	3	4	1	3	4
S21	3	8	11	2	7	9	3	7	10	3	8	11	3	8	11	0	7	7
S22	0	17	17	0	18	18	1	22	23	1	22	23	1	19	20	0	21	21
S23	3	17	20	2	17	19	3	17	20	3	15	18	2	16	18	1	17	18
S24	1	16	17	1	16	17	1	16	17	1	15	16	1	15	16	0	16	16
S25	0	16	16	0	16	16	0	17	17	1	17	18	1	16	17	0	15	15
S26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S27	7	5	12	5	5	10	8	6	14	9	7	16	8	7	15	1	7	8
S28	1	13	14	1	13	14	1	12	13	1	12	13	1	12	13	0	14	14
S29	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S30	1	9	10	1	8	9	1	8	9	1	9	10	1	12	13	1	7	8
S31	0	18	18	0	16	16	0	17	17	1	16	17	1	16	17	0	16	16
S32	0	8	8	0	8	8	0	9	9	0	8	8	0	9	9	0	6	6
S33	6	0	6	4	0	4	6	0	6	4	0	4	4	0	4	3	0	3
S34	2	0	2	3	0	3	2	0	2	2	0	2	1	0	1	2	0	2
S35	1	3	4	1	2	3	1	2	3	1	3	4	1	1	2	1	2	3
S36	6	1	7	5	1	6	9	2	11	8	2	10	5	1	6	9	1	10
S37	0	0	0	0	0	0	0	0	0	5	1	6	5	1	6	5	1	6
S38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S39	0	1	1	0	1	1	0	2	2	0	2	2	0	1	1	0	2	2
Total	62	248	310	55	225	280	65	249	314	72	246	318	65	229	294	53	240	293

Source: Results obtained from the model developed in Chapter 4.

Table VI.2 (cont'd)

	1994-95			1996-97			1998-99			2001-02			2004-05			2005-06			2006-07			2007-08			2008-09			2009-10			2012-13			2013-14			2014-15		
Sect Code	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC	MIC (BL)	MIC (FL)	Total MIC
S01	3	2	5	2	2	4	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	3	5	2	4	6	2	4	6	2	3	5	2	4	6
S02	1	3	4	1	2	3	1	2	3	1	2	3	1	2	3	1	1	2	1	2	3	1	2	3	1	0	1	1	0	1	1	2	3	1	2	3	1	1	2
S03	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	0	2	2	1	2	3	1	2	3	1	2	3
S04	1	11	12	0	10	10	1	12	13	1	6	7	1	8	9	1	7	8	1	6	7	1	7	8	2	7	9	2	8	10	1	7	8	1	5	6	1	5	6
S05	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2	0	5	5	0	5	5	0	5	5
S06	1	2	3	1	2	3	1	2	3	1	1	2	1	1	2	1	1	2	1	1	2	1	1	2	1	1	2	1	1	2	2	0	2	3	0	3	1	2	3
S07	2	2	4	2	2	4	3	2	5	2	2	4	2	2	4	2	2	4	2	2	4	2	2	4	2	2	4	3	2	5	2	2	4	3	2	5	2	2	4
S08	1	4	5	1	3	4	1	5	6	1	5	6	1	5	6	0	5	5	1	5	6	1	7	8	0	7	7	0	8	8	0	7	7	0	7	7	0	7	7
S09	0	7	7	0	10	10	0	10	10	0	9	9	0	11	11	0	10	10	0	11	11	0	11	11	0	13	13	0	7	7	0	12	12	0	11	11	0	12	12
S10	1	7	8	1	7	8	1	6	7	1	8	9	1	8	9	1	8	9	0	6	6	1	7	8	1	8	9	0	6	6	0	5	5	0	5	5	0	5	5
S11	1	5	6	1	5	6	2	8	10	2	7	9	1	6	7	1	7	8	1	6	7	1	7	8	1	7	8	1	7	8	2	7	9	1	8	9	1	8	9
S12	2	6	8	1	5	6	2	5	7	1	5	6	1	4	5	1	4	5	1	5	6	1	5	6	1	5	6	1	4	5	1	5	6	2	5	7	2	6	8
S13	0	18	18	0	17	17	0	20	20	0	19	19	0	18	18	0	17	17	0	18	18	0	18	18	0	17	17	0	17	17	0	14	14	0	16	16	0	17	17
S14	2	5	7	1	5	6	1	4	5	2	4	6	2	4	6	2	5	7	2	5	7	2	5	7	3	4	7	3	4	7	2	4	6	3	5	8	2	5	7
S15	2	6	8	2	6	8	3	6	9	2	7	9	2	6	8	2	6	8	2	6	8	1	6	7	1	7	8	1	6	7	1	6	7	0	5	5	0	4	4
S16	1	6	7	1	5	6	1	7	8	1	6	7	2	6	8	2	6	8	1	6	7	1	6	7	1	6	7	2	6	8	0	6	6	1	7	8	0	6	6
S17	3	2	5	2	2	4	2	4	6	2	3	5	2	2	4	1	1	2	2	3	5	1	2	3	2	3	5	2	4	6	1	4	5	2	4	6	1	4	5
S18	1	6	7	1	7	8	1	7	8	1	6	7	1	6	7	1	6	7	1	4	5	2	5	7	1	7	8	1	6	7	1	6	7	1	6	7	1	6	7
S19	2	3	5	1	2	3	2	3	5	2	3	5	2	3	5	1	2	3	1	3	4	1	2	3	2	2	4	1	2	3	1	3	4	1	3	4	1	3	4
S20	1	6	7	1	5	6	1	6	7	1	6	7	1	5	6	1	5	6	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6	0	6	6
S21	0	6	6	1	9	10	3	8	11	3	8	11	2	8	10	3	8	11	3	9	12	3	9	12	2	10	12	2	9	11	2	9	11	2	11	13	2	11	13
S22	0	21	21	0	22	22	0	22	22	0	23	23	1	23	24	1	21	22	1	21	22	1	21	22	1	21	22	1	22	23	1	19	20	1	19	20	1	19	20
S23	1	14	15	2	18	20	1	18	19	1	15	16	2	15	17	3	18	21	2	17	19	1	15	16	2	17	19	2	15	17	1	16	17	1	15	16	2	16	18
S24	0	14	14	1	17	18	1	18	19	1	17	18	1	17	18	1	18	19	1	18	19	1	18	19	1	18	19	1	16	17	2	15	17	2	15	17	2	15	17
S25	0	12	12	0	17	17	0	6	6	0	17	17	1	17	18	1	16	17	1	18	19	1	17	18	1	16	17	1	15	16	2	15	17	2	15	17	2	15	17
S26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0	1	1	0	0	0
S27	1	3	4	5	7	12	5	6	11	5	6	11	7	6	13	9	7	16	8	8	16	7	7	14	7	8	15	7	6	13	6	7	13	6	7	13	7	6	13
S28	0	8	8	0	11	11	0	16	16	0	16	16	0	15	15	0	16	16	0	21	21	0	19	19	0	18	18	1	17	18	1	16	17	1	15	16	1	16	17
S29	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
S30	1	10	11	1	7	8	1	8	9	1	9	10	1	10	11	1	9	10	1	11	12	1	11	12	1	10	11	1	10	11	1	10	11	1	9	10	1	9	10
S31	1	17	18	1	16	17	1	15	16	0	17	17	0	19	19	0	16	16	1	14	15	0	16	16	0	14	14	0	16	16	0	18	18	1	13	14	1	13	14
S32	0	10	10	0	7	7	0	8	8	0	11	11	0	11	11	0	10	10	0	12	12	0	12	12	0	11	11	0	12	12	0	12	12	0	10	10	0	11	11
S33	5	1	6	5	1	6	8	2	10	6	2	8	5	2	7	6	2	8	7	2	9	7	2	9	9	2	11	8	2	10	8	2	10	8	2	10	7	2	9
S34	7	1	8	6	1	7	8	1	9	6	1	7	9	1	10	7	1	8	6	0	6	6	0	6	8	1	9	9	1	10	11	1	12	10	1	11	9	1	10
S35	2	3	5	2	3	5	2	3	5	1	2	3	1	2	3	1	2	3	1	3	4	1	3	4	1	3	4	1	3	4	2	4	6	2	4	6	2	4	6
S36	9	1	10	8	1	9	4	1	5	8	1	9	6	1	7	6	1	7	5	1	6	5	1	6	6	1	7	6	1	7	7	1	8	7	1	8	7	1	8
S37	0	1	1	1	1	2	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	0	1	1	3	1	4	2	1	3	2	1	3
S38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S39	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2	0	2	2	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3	0	3	3
Total	54	231	285	54	243	297	61	253	314	57	256	313	61	256	317	61	250	311	58	263	321	55	263	318	62	267	329	62	253	315	66	258	324	69	251	320	63	255	318

Source: Results obtained from the model developed in Chapter 4.

Table VI.3 – Backward MIC by sector, 1974-75

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	I	NI	NI	NI	NI	NI	MIC	I	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S02	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	LI	MIC	LI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S04	I	I	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	LI	LI	LI	NI	LI	LI	NI	NI	NI	MIC	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S05	NI	MIC	MIC	I	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S06	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	LI	I	I	MIC	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI
S07	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI
S08	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	LI	NI	NI	NI	NI	NI
S09	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	LI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI
S10	NI	NI	NI	NI	NI	NI	NI	LI	LI	MIC	MIC	NI	NI	LI	NI	NI	NI	LI	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	NI	NI	NI	LI
S11	I	NI	NI	NI	NI	NI	I	I	NI	NI	I	NI	NI	I	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	I	I	MIC	I
S12	I	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	MIC	NI	I	LI	I	I	NI	LI	NI	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	I	MIC	LI	NI	NI	LI
S13	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	MIC	I	MIC	I	I	LI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI
S14	MIC	NI	NI	NI	NI	LI	LI	I	NI	NI	I	LI	NI	MIC	LI	NI	LI	LI	I	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	NI	LI	I	LI
S15	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	MIC	LI	LI	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	NI	NI	LI	NI
S16	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	LI	MIC	LI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI
S17	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	I	MIC	I	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI
S18	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	I	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	NI	NI	LI	LI
S19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	NI	LI	NI	LI
S20	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	NI	NI	NI	I	NI
S21	I	LI	NI	NI	NI	I	I	LI	NI	LI	NI	NI	NI	I	LI	I	I	LI	I	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	LI	NI	NI	LI	MIC	LI	I	I	I	I
S22	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI
S23	I	NI	NI	NI	NI	I	I	LI	NI	LI	NI	LI	NI	I	LI	I	I	LI	I	NI	NI	NI	MIC	NI	NI	NI	MIC	I	NI	LI	NI	NI	LI	MIC	LI	I	I	I	I
S24	LI	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	I	LI	I	I	NI	I	NI	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	LI	LI	I	I	I
S25	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	I	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	I	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	I	LI	I	I	NI	I	NI	MIC	NI	I	I	NI	NI	MIC	NI	NI	NI	NI	NI	LI	I	LI	LI	I	I	I
S28	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	LI	NI	I	I	NI	NI	I	I	NI	NI	NI	I	NI	NI	NI	I	NI	NI	NI	NI	NI	LI	I	LI	NI	NI	I	NI
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	LI	MIC	NI	I	LI
S31	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI
S32	I	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	LI	MIC	NI	I	LI
S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	LI	LI	NI
S34	I	NI	NI	NI	NI	NI	I	I	NI	NI	LI	NI	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	I	LI	NI	LI	LI
S35	I	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	I	I	I	LI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	I	I	LI
S36	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	NI	MIC	MIC	NI	NI
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S39	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	I	NI	NI	I

MIC = Most Important Coefficient (Sector) I = Important Coefficient LI = Less Important Coefficient NI = Not Important Coefficient

Source: Results obtained from the model developed in Chapter 4.

Table VI.4– Forward MIC by sectors, 1974-75

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20
S01	I	NI	NI	NI	NI	NI	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S02	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	MIC	NI	LI	LI	MIC	I	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI
S04	MIC	MIC	LI	NI	NI	NI	MIC	I	NI	I	NI	I	NI	MIC	I	MIC	I	MIC	MIC	NI
S05	NI	MIC	MIC	I	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S06	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	I	I	MIC	MIC	NI	LI	NI
S07	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S08	LI	NI	NI	NI	NI	NI	LI	MIC	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	I	NI
S09	NI	NI	NI	NI	NI	NI	NI	LI	MIC	MIC	NI	I	NI	I	NI	LI	NI	I	MIC	MIC
S10	LI	NI	NI	NI	NI	NI	I	I	NI	MIC	MIC	NI	NI	I	NI	NI	NI	I	MIC	I
S11	I	NI	NI	NI	NI	NI	MIC	I	NI	NI	I	NI	NI	I	NI	NI	NI	LI	MIC	NI
S12	MIC	NI	NI	NI	NI	LI	MIC	LI	NI	NI	LI	MIC	NI	MIC	LI	I	I	NI	MIC	NI
S13	MIC	I	NI	I	NI	MIC	NI	NI	NI	MIC	MIC	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	NI
S14	MIC	NI	NI	NI	NI	NI	I	I	NI	NI	LI	NI	NI	MIC	NI	NI	NI	LI	MIC	NI
S15	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	MIC	I	LI	I	MIC	NI
S16	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	MIC	NI	MIC	MIC	LI
S17	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	I	MIC	MIC	MIC	LI
S18	NI	NI	NI	NI	NI	NI	MIC	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	I	MIC	NI
S19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI
S20	NI	NI	NI	NI	NI	NI	I	LI	NI	NI	NI	NI	NI	LI	NI	NI	NI	LI	MIC	I
S21	MIC	NI	NI	NI	NI	I	MIC	I	NI	LI	LI	NI	NI	MIC	I	I	I	I	MIC	NI
S22	MIC	NI	MIC	NI	NI	MIC	MIC	MIC	NI	I	I	MIC	NI	MIC	I	MIC	MIC	MIC	MIC	LI
S23	MIC	NI	NI	LI	NI	MIC	MIC	MIC	I	MIC	MIC	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	I
S24	MIC	NI	NI	NI	NI	MIC	MIC	MIC	NI	I	I	NI	NI	MIC	I	MIC	MIC	MIC	MIC	LI
S25	MIC	NI	NI	NI	NI	I	MIC	I	NI	LI	LI	I	NI	MIC	I	MIC	I	I	MIC	NI
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI
S27	I	NI	NI	NI	NI	I	MIC	I	NI	NI	NI	NI	NI	I	LI	I	I	LI	MIC	NI
S28	NI	NI	NI	NI	NI	NI	MIC	I	NI	NI	I	I	NI	MIC	MIC	MIC	I	MIC	MIC	LI
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	NI	NI	NI	NI	I	MIC	I	NI	NI	NI	I	NI	MIC	I	I	NI	I	MIC	NI
S31	MIC	NI	NI	NI	NI	I	MIC	I	NI	NI	NI	I	NI	MIC	I	I	NI	I	MIC	NI
S32	MIC	NI	NI	NI	NI	I	MIC	I	NI	NI	NI	I	NI	MIC	I	I	NI	I	MIC	NI
S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S34	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI
S35	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	I	NI	LI	NI	NI	I	NI
S36	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S39	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI

	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S02	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	I	NI	NI	LI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI
S04	NI	NI	MIC	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	I
S05	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	I	LI	I	NI
S06	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	LI	NI	NI	NI
S07	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI
S08	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	NI	NI	LI	LI	NI
S09	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	LI	NI	NI	LI	NI	NI
S10	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	I	I	I	I
S11	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	MIC	MIC	MIC	I
S12	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	LI	I
S13	MIC	NI	LI	LI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	I	I	NI	NI
S14	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	LI	I	I	LI
S15	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	I	NI	I	NI
S16	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	LI	NI	NI	NI	NI	NI
S17	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI
S18	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	LI	I	LI	I	LI
S19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	I	NI	NI	NI	NI
S20	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	LI	I	I	MIC	NI
S21	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	MIC	MIC	I
S22	NI	I	NI	NI	NI	NI	MIC	NI	NI	LI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S23	NI	NI	MIC	NI	NI	NI	MIC	I	NI	I	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S24	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	LI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S25	NI	NI	NI	NI	I	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	MIC	MIC	I
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	I	MIC	I	MIC	I
S28	NI	NI	I	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	I
S29	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI
S30	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S31	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S32	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI
S34	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	LI	NI	NI	NI	NI
S35	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	I	I	I	NI
S36	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	NI	MIC	I	NI	NI
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S39	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	I	LI	NI	I

MIC = Most Important Coefficient (Sector) I = Important Coefficient LI = Less Important Coefficient NI = Not Important Coefficient

Source: Results obtained from the model developed in Chapter 4.

Table VI.5– Backward MIC by sectors, 1979-80

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	I	NI	NI	NI	NI	NI	MIC	I	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S02	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	I	LI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S04	I	MIC	LI	NI	NI	NI	LI	NI	NI	LI	NI	LI	NI	I	I	LI	I	NI	LI	NI	NI	NI	MIC	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	LI	NI	I	NI	NI	LI	NI
S05	NI	MIC	MIC	I	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S06	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	LI	I	I	MIC	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI
S07	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S08	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	LI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	LI	NI	NI	LI	NI
S09	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	NI	NI	LI	NI	NI	NI	LI	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	NI
S10	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	I	LI	LI	NI
S11	LI	NI	NI	NI	NI	NI	MIC	LI	NI	NI	I	NI	NI	I	LI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	MIC	I	I	I
S12	I	NI	NI	NI	NI	LI	LI	NI	NI	NI	NI	I	NI	LI	LI	LI	I	NI	NI	NI	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	I	MIC	I	NI	NI	I
S13	NI	NI	NI	I	NI	LI	NI	NI	NI	LI	LI	LI	NI	MIC	I	MIC	MIC	MIC	LI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI
S14	I	NI	NI	NI	NI	LI	I	I	NI	NI	I	LI	NI	MIC	LI	NI	NI	LI	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	I	I	LI	I	I
S15	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	MIC	I	NI	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	I	NI	LI	NI
S16	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	LI	MIC	NI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	LI	NI	NI	NI
S17	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	I	MIC	MIC	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI
S18	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	NI	LI	NI	I	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	I	LI	LI	LI
S19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	LI	I	LI	LI
S20	NI	NI	NI	NI	NI	NI	LI	LI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	NI	NI	LI	I	NI
S21	I	LI	NI	NI	NI	I	I	LI	NI	LI	NI	NI	NI	I	I	I	I	LI	I	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	LI	NI	NI	NI	I	I	I	I	I	LI
S22	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	NI	LI	NI	NI	NI
S23	I	NI	NI	LI	NI	I	I	LI	NI	LI	NI	I	NI	I	I	I	I	LI	I	NI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	LI	NI	NI	NI	I	I	I	I	I	LI
S24	LI	NI	NI	NI	NI	I	I	LI	NI	LI	NI	NI	NI	I	LI	I	I	LI	I	NI	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	LI	I	I	I	LI
S25	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	I	NI	NI	NI	NI	NI	NI	LI	NI	LI	LI	LI	NI
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	LI	NI	NI	NI	NI	I	I	LI	NI	LI	NI	LI	NI	I	LI	I	I	LI	I	NI	MIC	NI	I	I	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	LI	I	I	I	LI
S28	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	LI	NI	I	I	LI	LI	LI	I	NI	NI	NI	I	NI	NI	NI	I	NI	NI	NI	NI	NI	LI	I	LI	I	NI	I	NI
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	LI	MIC	LI	I	LI
S31	MIC	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	MIC	NI	I	NI
S32	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	LI	MIC	LI	I	LI
S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI
S34	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	LI	NI	NI	NI	NI
S35	I	NI	NI	NI	LI	LI	I	NI	NI	NI	LI	NI	NI	I	I	I	LI	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	I	I	LI
S36	LI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	I	I	I	MIC	I	I	LI
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S39	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	I	NI	NI	I

MIC = Most Important Coefficient (Sector) I = Important Coefficient LI = Less Important Coefficient NI = Not Important Coefficient

Source: Results obtained from the model developed in Chapter 4.

Table VI.6– Forward MIC by sectors, 1979-80

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	I	NI	NI	NI	NI	NI	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S02	NI	I	NI	NI	NI	NI	LI	NI	NI	NI	NI	MIC	NI	NI	LI	MIC	LI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	I	NI	NI	LI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI
S04	MIC	MIC	I	NI	NI	I	MIC	I	NI	MIC	I	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	LI	NI	NI	MIC	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S05	NI	MIC	MIC	I	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	MIC	NI	LI	NI
S06	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	I	I	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI
S07	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI
S08	LI	NI	NI	NI	NI	NI	LI	MIC	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	NI	I	NI
S09	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	LI	NI	MIC	NI	LI	NI	MIC	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	MIC	LI	NI	NI
S10	LI	NI	NI	NI	NI	NI	I	LI	NI	MIC	MIC	NI	NI	LI	NI	NI	NI	LI	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	I	LI
S11	I	NI	NI	NI	NI	NI	MIC	LI	NI	NI	I	NI	NI	I	NI	NI	NI	LI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	MIC	MIC	MIC	MIC	I
S12	MIC	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	I	NI	I	NI	LI	I	NI	I	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	LI	I	I
S13	MIC	I	NI	MIC	NI	MIC	NI	NI	NI	MIC	MIC	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	NI	MIC	NI	LI	I	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	MIC	I	NI	NI
S14	MIC	NI	NI	NI	NI	NI	MIC	I	NI	NI	LI	NI	NI	MIC	NI	NI	NI	LI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	I	LI	MIC	I
S15	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	MIC	I	NI	LI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	MIC	NI	I	NI
S16	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	I	NI	MIC	NI	MIC	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	LI	NI	MIC	LI	NI	NI
S17	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	I	MIC	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	I	NI	NI	NI
S18	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	NI	LI	NI	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	LI	MIC	I	I	LI
S19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	LI	LI	NI
S20	LI	NI	NI	NI	NI	NI	I	I	NI	NI	I	NI	NI	I	NI	NI	NI	LI	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	MIC	I
S21	I	LI	NI	NI	NI	I	MIC	I	NI	LI	LI	LI	NI	MIC	I	I	I	I	MIC	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	MIC	MIC	MIC	MIC	I
S22	MIC	NI	MIC	NI	NI	MIC	MIC	MIC	NI	I	I	MIC	NI	MIC	I	MIC	MIC	MIC	MIC	LI	NI	I	NI	NI	NI	NI	MIC	NI	NI	LI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S23	MIC	NI	NI	NI	NI	MIC	MIC	MIC	LI	I	MIC	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	I	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	I	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S24	MIC	NI	NI	NI	NI	MIC	MIC	MIC	NI	I	I	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	I	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	LI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S25	MIC	NI	NI	NI	NI	MIC	MIC	MIC	NI	I	I	MIC	NI	MIC	I	MIC	MIC	I	MIC	LI	NI	NI	NI	NI	I	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	I	NI	NI	NI	NI	I	MIC	I	NI	NI	NI	I	NI	I	LI	I	I	LI	MIC	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	I	MIC	I	MIC	I
S28	I	NI	NI	NI	NI	LI	MIC	MIC	LI	I	I	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	NI	NI	NI	I	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	I
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	NI	NI	NI	NI	I	MIC	LI	NI	LI	NI	I	NI	MIC	I	I	NI	I	MIC	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	I
S31	MIC	I	NI	NI	NI	MIC	MIC	MIC	LI	I	I	MIC	NI	MIC	MIC	MIC	I	MIC	MIC	NI	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S32	MIC	NI	NI	NI	NI	LI	MIC	LI	NI	NI	NI	LI	NI	MIC	I	I	NI	LI	I	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	I
S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI
S34	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	LI	NI	NI	NI
S35	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	NI	LI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	I	I	LI	I	NI
S36	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	NI	MIC	NI	I	NI
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	LI	NI	I	NI	LI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S39	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	LI	MIC	LI	I	I

MIC = Most Important Coefficient (Sector)   I = Important Coefficient   LI = Less Important Coefficient   NI = Not Important Coefficient

Source: Results obtained from the model developed in Chapter 4.

Table VI.7– Backward MIC by sectors, 1986-87

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	I	NI	NI	NI	NI	NI	MIC	I	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI
S02	NI	I	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	LI	LI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S04	LI	I	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	I	I	I	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	NI	NI	LI	I	I	I	NI
S05	NI	I	MIC	I	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S06	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	NI	LI	I	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI
S07	I	NI	NI	NI	NI	NI	MIC	LI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI
S08	LI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	I	NI	I	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	LI	LI	I	LI
S09	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	MIC	NI	I	NI	I	NI	I	I	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	I	NI	NI	NI
S10	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	NI	I	LI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	LI	LI	NI	NI	NI
S11	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	I	NI	NI	I	LI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	MIC	LI	MIC	I	I	I
S12	MIC	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	I	NI	NI	NI	LI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	I	I	MIC	I	LI	NI	I
S13	NI	NI	NI	MIC	NI	LI	NI	NI	NI	LI	LI	I	NI	I	I	I	MIC	I	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI
S14	I	LI	NI	NI	NI	LI	I	NI	NI	NI	I	LI	NI	MIC	NI	NI	NI	NI	I	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	LI	I	I	I	I
S15	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	MIC	LI	NI	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	LI	NI	LI	NI
S16	NI	LI	LI	NI	NI	LI	NI	NI	NI	NI	NI	LI	NI	NI	I	MIC	NI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	LI	NI	NI	NI
S17	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	LI	NI	I	MIC	I	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI
S18	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	NI	LI	NI	I	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	LI	I	LI	LI	LI
S19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	I	LI	LI
S20	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	NI	LI	LI	I	NI
S21	I	LI	NI	NI	NI	I	I	NI	LI	NI	NI	NI	NI	I	LI	I	I	NI	I	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	LI	I	I	MIC	I	I	I
S22	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	LI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	NI	I	I	LI	NI
S23	I	NI	NI	I	NI	I	I	NI	NI	NI	NI	LI	NI	I	LI	LI	I	NI	I	NI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	NI	NI	NI	LI	I	I	MIC	I	I	I
S24	I	NI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	I	LI	I	I	NI	I	NI	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	NI	NI	NI	LI	I	I	MIC	I	I	I
S25	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	I	NI	I	NI	NI	NI	NI	NI	NI	I	NI	I	I	LI	NI
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	I	LI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	I	LI	LI	I	NI	LI	NI	MIC	NI	I	I	NI	NI	MIC	NI	NI	NI	NI	NI	LI	I	I	MIC	I	I	I
S28	NI	NI	NI	NI	NI	NI	I	LI	LI	NI	NI	I	NI	I	I	I	MIC	NI	LI	NI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	NI	I	NI	I	NI
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	NI	MIC	LI	I	LI
S31	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	LI	NI	MIC	LI	I	LI
S32	I	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	NI	MIC	LI	I	LI
S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI
S34	LI	NI	NI	NI	NI	NI	I	LI	NI	NI	NI	LI	NI	LI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	LI	I	LI
S35	LI	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	I	NI	LI	LI	LI	LI	NI	LI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	I	I	I	I	I	LI	LI
S36	LI	NI	NI	NI	NI	NI	LI	NI	NI	NI	LI	LI	NI	LI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	I	MIC	I	I	I
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	LI	NI	NI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S39	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	I	LI	NI	I

MIC = Most Important Coefficient (Sector) I = Important Coefficient LI = Less Important Coefficient NI = Not Important Coefficient

Source: Results obtained from the model developed in Chapter 4.

Table VI.8– Forward MIC by sectors, 1986-87

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	I	NI	NI	NI	NI	NI	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI
S02	NI	I	NI	NI	NI	NI	I	NI	NI	LI	NI	LI	NI	LI	NI	LI	I	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI
S04	MIC	MIC	NI	NI	NI	I	MIC	NI	NI	I	NI	I	NI	MIC	MIC	MIC	I	I	MIC	NI	NI	NI	MIC	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S05	NI	MIC	MIC	MIC	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	I	NI	NI	NI
S06	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	NI	I	I	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	LI	NI	LI	NI	NI	NI
S07	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	I	NI	NI	NI
S08	I	NI	NI	NI	NI	NI	I	MIC	NI	NI	NI	I	NI	I	NI	NI	NI	NI	I	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	I	I	I	I	LI
S09	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	MIC	NI	MIC	NI	I	NI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	MIC	I	NI	NI
S10	NI	LI	NI	NI	NI	NI	I	LI	NI	MIC	MIC	NI	NI	I	LI	NI	NI	LI	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	LI	LI
S11	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	I	NI	NI	I	LI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	I	MIC	MIC	MIC	I
S12	MIC	NI	NI	NI	NI	LI	LI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	I	NI	LI	NI	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	I	I
S13	MIC	MIC	I	MIC	NI	MIC	NI	NI	NI	MIC	MIC	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	NI	MIC	NI	I	I	LI	NI	MIC	NI	NI	NI	NI	I	MIC	NI	NI	MIC	MIC	NI	NI
S14	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	I	NI	NI	MIC	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	MIC	I
S15	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	MIC	LI	NI	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	MIC	LI	I	LI
S16	NI	LI	NI	NI	NI	LI	LI	NI	NI	NI	NI	I	NI	LI	I	MIC	NI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	MIC	LI	NI	NI
S17	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	I	NI	I	MIC	MIC	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	LI	NI	I	NI	NI	NI
S18	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	NI	LI	NI	I	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	I	I
S19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	I	I	LI	NI
S20	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	LI	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	LI	MIC	I	MIC	I
S21	I	LI	NI	NI	NI	I	I	LI	NI	NI	NI	NI	NI	I	LI	LI	I	NI	I	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	MIC	MIC	MIC	MIC	I
S22	MIC	NI	MIC	NI	NI	MIC	MIC	MIC	I	I	MIC	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	I	NI	MIC	NI	NI	NI	NI	MIC	NI	NI	LI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S23	MIC	NI	NI	I	NI	MIC	MIC	I	LI	I	I	MIC	NI	MIC	I	MIC	MIC	I	MIC	LI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S24	MIC	NI	NI	NI	NI	MIC	MIC	I	I	I	I	NI	NI	MIC	I	MIC	MIC	I	MIC	LI	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S25	MIC	NI	NI	NI	NI	MIC	MIC	MIC	LI	I	I	MIC	NI	MIC	I	MIC	MIC	I	MIC	LI	NI	NI	NI	NI	I	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	I	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	I	NI	LI	I	NI	I	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	I	MIC	MIC	MIC	I
S28	I	NI	NI	NI	NI	LI	MIC	I	I	NI	I	MIC	NI	MIC	MIC	MIC	MIC	I	MIC	NI	NI	NI	I	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	MIC	I
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	LI	NI	NI	NI	I	MIC	NI	NI	NI	I	MIC	NI	I	NI	LI	NI	NI	I	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	MIC	MIC	MIC
S31	MIC	I	NI	NI	NI	MIC	MIC	I	I	NI	MIC	MIC	NI	MIC	I	MIC	I	I	MIC	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S32	MIC	NI	NI	NI	NI	I	MIC	NI	NI	NI	LI	MIC	NI	I	NI	LI	NI	NI	I	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	MIC	MIC	MIC
S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	I	NI	NI	NI
S34	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	NI	I	NI	LI	NI
S35	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	I	MIC	I	I	NI
S36	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	MIC	NI	MIC	NI	LI	NI
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	NI	I	NI	LI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S39	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	MIC	LI	LI	I

MIC = Most Important Coefficient (Sector) I = Important Coefficient LI = Less Important Coefficient NI = Not Important Coefficient

Source: Results obtained from the model developed in Chapter 4.

Table VI.9 – Backward MIC by sectors, 1992-93

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	I	NI	NI	NI	NI	NI	MIC	I	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	LI
S02	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S04	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	I	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI
S05	NI	LI	MIC	MIC	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S06	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	I	I	MIC	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI
S07	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI
S08	NI	NI	NI	NI	NI	NI	LI	MIC	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	LI	NI
S09	NI	NI	NI	NI	NI	NI	NI	NI	I	LI	MIC	MIC	NI	NI	I	NI	NI	I	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	I	NI	NI	NI
S10	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	LI	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	I	LI	LI	I
S11	LI	NI	NI	NI	NI	NI	I	I	NI	NI	I	NI	NI	I	LI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	LI	MIC	MIC	I	I
S12	MIC	NI	NI	NI	NI	I	I	NI	NI	NI	NI	I	NI	LI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	I	I	MIC	I	LI	NI	I
S13	NI	NI	NI	MIC	NI	I	NI	NI	NI	NI	LI	I	NI	MIC	I	MIC	MIC	I	LI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI
S14	I	NI	NI	NI	NI	I	I	LI	NI	NI	I	NI	NI	MIC	LI	NI	LI	LI	I	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	LI	I	I	I	I
S15	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	I	NI	LI	LI
S16	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	LI	MIC	NI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	LI	NI	NI	NI
S17	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	I	I	I	I	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI
S18	NI	NI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	I	LI	NI	NI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	LI	I	I	I	LI	LI
S19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	I	LI	LI
S20	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	LI	NI	LI	NI	LI	NI
S21	I	I	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	LI	LI	NI	I	NI	LI	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	LI	NI	NI	NI	I	I	I	MIC	I	I
S22	NI	NI	MIC	NI	NI	LI	LI	NI	NI	NI	NI	I	NI	NI	NI	NI	LI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	LI	LI	I	I	LI	LI
S23	I	NI	NI	I	NI	I	I	NI	NI	NI	NI	LI	NI	LI	LI	NI	I	NI	LI	NI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	LI	NI	NI	NI	I	I	I	MIC	I	I
S24	I	NI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	LI	LI	NI	I	NI	LI	NI	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	LI	NI	NI	NI	I	I	I	MIC	I	I
S25	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	MIC	NI	NI	NI	NI	NI	NI	LI	LI	I	I	LI	NI
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	I	LI	LI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	LI	LI	NI	I	NI	LI	NI	MIC	NI	I	I	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	I	I	I	I	I
S28	NI	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	I	I	LI	I	NI	LI	NI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	NI	NI	NI	LI	I	NI	I	LI	I	NI
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	I	NI	MIC	I	I	I
S31	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	LI	NI	MIC	LI	I	LI
S32	I	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	I	NI	MIC	I	I	I
S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	LI	NI	NI
S34	LI	NI	NI	NI	NI	NI	I	NI	NI	LI	I	NI	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	LI	LI	I
S35	I	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	LI	NI	NI	LI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	I	LI	I
S36	LI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	MIC	I	I	I
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S39	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	I	LI	NI	I

MIC = Most Important Coefficient (Sector) I = Important Coefficient LI = Less Important Coefficient NI = Not Important Coefficient

Source: Results obtained from the model developed in Chapter 4.

Table VI.10 – Forward MIC by sectors, 1992-93

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	I	NI	NI	NI	NI	NI	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	LI
S02	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	I	NI	I	I	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI
S04	I	I	NI	NI	NI	I	MIC	NI	NI	NI	LI	I	NI	MIC	I	I	MIC	NI	I	NI	NI	NI	LI	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	I	I	I	MIC	MIC	MIC	I
S05	NI	I	MIC	MIC	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S06	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	LI	I	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	I	NI	NI	LI
S07	LI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	I	NI	NI	NI
S08	NI	NI	NI	NI	NI	NI	I	MIC	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	LI	I	I	I	LI
S09	NI	NI	NI	NI	NI	NI	NI	I	I	I	MIC	MIC	NI	I	MIC	NI	NI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	MIC	I	NI	NI
S10	I	NI	NI	NI	NI	NI	I	NI	NI	MIC	LI	NI	NI	I	NI	NI	NI	I	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	MIC	MIC	MIC
S11	LI	NI	NI	NI	NI	NI	MIC	I	NI	NI	I	NI	NI	I	NI	NI	NI	LI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	I	MIC	MIC	MIC	MIC
S12	MIC	NI	NI	NI	NI	I	I	NI	NI	NI	NI	I	NI	I	NI	NI	I	NI	I	NI	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	I	I
S13	MIC	MIC	I	MIC	NI	MIC	NI	NI	NI	MIC	MIC	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	NI	MIC	NI	I	I	LI	NI	MIC	NI	NI	NI	NI	I	MIC	NI	NI	MIC	MIC	NI	NI
S14	I	NI	NI	NI	NI	LI	MIC	LI	NI	NI	LI	NI	NI	MIC	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	MIC	I	MIC	I
S15	I	NI	NI	NI	NI	LI	MIC	NI	NI	NI	NI	NI	NI	I	MIC	I	NI	I	MIC	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	MIC	MIC	NI	MIC	I	I	I
S16	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	I	LI	MIC	NI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	MIC	I	NI	NI
S17	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	I	NI	I	I	I	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	I	NI	NI	NI
S18	NI	NI	NI	NI	NI	I	MIC	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	MIC	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	I	I
S19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	I	LI	NI
S20	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	LI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	I	MIC	I	I	I
S21	I	LI	NI	NI	NI	I	MIC	NI	NI	NI	NI	NI	NI	I	NI	NI	I	NI	I	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	MIC	MIC	MIC	MIC	I
S22	MIC	NI	MIC	NI	NI	MIC	MIC	MIC	LI	I	I	MIC	NI	MIC	MIC	I	MIC	I	MIC	LI	NI	MIC	NI	NI	NI	NI	MIC	NI	NI	LI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S23	MIC	NI	NI	MIC	NI	MIC	MIC	I	LI	LI	I	I	NI	MIC	I	I	MIC	I	MIC	LI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	LI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S24	MIC	NI	NI	NI	NI	MIC	MIC	I	NI	LI	I	NI	NI	MIC	I	I	MIC	I	MIC	LI	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	LI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S25	MIC	NI	NI	NI	NI	MIC	MIC	I	NI	LI	I	MIC	NI	MIC	I	I	MIC	I	MIC	NI	NI	NI	NI	NI	MIC	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	I	NI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	I	NI	NI	I	NI	I	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	MIC	MIC	MIC	MIC	I
S28	LI	NI	NI	NI	NI	I	MIC	I	NI	NI	I	I	NI	MIC	MIC	I	MIC	I	MIC	NI	NI	NI	I	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	MIC	MIC	MIC
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	LI	NI	NI	NI	MIC	MIC	LI	NI	NI	I	NI	NI	I	NI	I	LI	NI	MIC	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S31	MIC	I	NI	NI	NI	MIC	MIC	I	LI	NI	MIC	NI	NI	MIC	LI	MIC	I	I	MIC	NI	MIC	NI	NI	NI	NI	NI	MIC	LI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S32	MIC	NI	NI	NI	NI	I	MIC	NI	NI	NI	I	NI	NI	I	NI	LI	NI	NI	MIC	NI	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	I	MIC	MIC	MIC	MIC
S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	LI	NI	NI
S34	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	NI	LI	NI
S35	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	MIC	I	I	LI
S36	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	LI	MIC	LI	LI	NI
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	NI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI
S39	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	MIC	I	LI	I

MIC = Most Important Coefficient (Sector)   I = Important Coefficient   LI = Less Important Coefficient   NI = Not Important Coefficient

Source: Results obtained from the model developed in Chapter 4.

Table VI.11 – Backward MIC by sectors, 1998-99

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	MIC	NI	NI	NI	NI	NI	MIC	I	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	LI
S02	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	LI	NI	I	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI
S04	NI	LI	NI	NI	NI	NI	I	LI	NI	NI	I	NI	NI	I	MIC	I	I	NI	LI	NI	NI	NI	I	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	I	NI	I	NI	I	NI
S05	NI	MIC	I	I	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S06	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	MIC	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI
S07	LI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	LI	NI	NI	LI
S08	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	NI	LI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	NI	LI	NI	LI	LI
S09	NI	NI	NI	NI	NI	NI	LI	NI	I	NI	MIC	LI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	LI	I	I	NI	I
S10	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	LI	NI	I	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	I	LI	NI	LI
S11	NI	NI	NI	NI	NI	NI	I	NI	LI	NI	MIC	NI	NI	I	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	LI	MIC	I	I	I
S12	I	LI	NI	NI	I	I	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	I	I	MIC	I	NI	NI	LI
S13	NI	I	NI	MIC	NI	I	NI	NI	NI	NI	LI	NI	NI	I	I	LI	I	I	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI
S14	I	NI	NI	NI	NI	NI	I	LI	NI	NI	I	NI	NI	MIC	NI	NI	NI	LI	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	I	I	LI	I	I
S15	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	MIC	NI	NI	LI	I	LI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	MIC	I	NI	I	NI	LI	I
S16	NI	NI	NI	NI	I	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	LI	NI	NI	NI
S17	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	LI	NI	I	MIC	I	I	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	LI	NI	NI	NI
S18	NI	NI	NI	NI	NI	LI	I	NI	NI	NI	LI	NI	NI	I	LI	LI	NI	I	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	I	I	NI	LI	I
S19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	I	LI	LI
S20	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	I	I	I	LI
S21	NI	LI	NI	NI	NI	LI	I	NI	NI	NI	LI	NI	NI	I	LI	I	I	LI	LI	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	I	I	I	LI	I	I
S22	NI	NI	MIC	NI	NI	NI	LI	NI	NI	NI	NI	MIC	NI	LI	NI	NI	LI	NI	NI	NI	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	LI	I	LI	I	NI	I	NI
S23	NI	NI	NI	LI	NI	LI	I	NI	NI	NI	LI	NI	NI	I	LI	I	I	LI	I	NI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	I	I	LI	I	I
S24	NI	NI	NI	NI	NI	LI	I	NI	NI	NI	LI	NI	NI	I	LI	I	I	LI	I	NI	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	I	I	LI	I	I
S25	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	NI	LI	NI	NI	NI	LI	I	NI	NI	NI	LI	NI	NI	I	NI	LI	I	LI	LI	NI	MIC	NI	LI	LI	NI	NI	MIC	NI	NI	NI	NI	NI	I	I	I	I	LI	I	I
S28	NI	NI	NI	NI	NI	LI	I	I	LI	NI	I	LI	NI	I	MIC	I	I	NI	LI	LI	NI	NI	I	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	MIC	LI	I	NI	I	NI
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	LI	I	I	NI	MIC	NI	NI	LI
S31	MIC	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	LI	I	I	NI	I	NI	NI	NI
S32	I	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	NI	MIC	NI	NI	LI
S33	I	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	I	I	I	NI	NI
S34	NI	NI	NI	NI	NI	NI	LI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	NI	NI	LI
S35	LI	LI	NI	NI	NI	NI	I	LI	NI	NI	NI	LI	NI	LI	LI	NI	NI	LI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	MIC	I	I	LI	LI
S36	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	LI	NI	NI	LI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	I	MIC	I	I	I
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	LI	I	I	NI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI
S39	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	I	NI	I	I

MIC = Most Important Coefficient (Sector) I = Important Coefficient LI = Less Important Coefficient NI = Not Important Coefficient

Source: Results obtained from the model developed in Chapter 4.

Table VI.12 – Forward MIC by sectors, 1998-99

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	MIC	NI	NI	NI	NI	NI	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	NI	I	NI	NI	LI
S02	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	I	NI	I	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI
S04	I	I	NI	NI	NI	I	MIC	I	NI	NI	MIC	LI	NI	MIC	MIC	MIC	MIC	LI	MIC	I	NI	NI	I	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	MIC	MIC	I	MIC	I
S05	NI	MIC	I	I	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S06	NI	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	LI	I	I	MIC	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	LI	NI	NI	NI
S07	LI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	MIC	NI	I	NI	LI	LI
S08	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	NI	I	NI	NI	NI	LI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	I	I
S09	NI	LI	NI	NI	I	I	MIC	NI	I	LI	MIC	I	NI	MIC	I	LI	NI	LI	I	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S10	LI	NI	NI	NI	NI	LI	I	NI	NI	MIC	NI	NI	NI	I	NI	LI	NI	I	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	I	I
S11	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	MIC	MIC	MIC
S12	MIC	LI	NI	NI	LI	I	I	NI	NI	NI	NI	LI	NI	LI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	I	I
S13	MIC	MIC	I	MIC	MIC	MIC	NI	NI	NI	MIC	MIC	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	NI	MIC	NI	I	MIC	I	NI	MIC	NI	NI	NI	NI	I	MIC	NI	NI	MIC	MIC	NI	NI
S14	I	NI	NI	NI	NI	NI	I	NI	NI	NI	I	NI	NI	MIC	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	I	I
S15	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	MIC	NI	LI	LI	MIC	LI	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	NI	MIC	NI	I	I
S16	NI	NI	NI	NI	LI	LI	MIC	NI	NI	NI	NI	NI	NI	I	NI	MIC	I	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	NI	LI
S17	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	I	NI	I	MIC	LI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	MIC	NI	NI	NI
S18	I	NI	NI	NI	NI	LI	I	NI	NI	NI	LI	NI	NI	MIC	LI	LI	LI	I	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	I	MIC
S19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	I	MIC	I	I	LI
S20	NI	NI	NI	NI	NI	LI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	MIC	MIC	I
S21	LI	LI	NI	NI	NI	I	MIC	NI	NI	NI	LI	NI	NI	I	NI	LI	I	LI	I	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	MIC	I
S22	MIC	NI	MIC	NI	NI	MIC	MIC	MIC	LI	I	MIC	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC	NI	I	NI	NI	NI	NI	MIC	NI	NI	I	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S23	MIC	NI	NI	I	NI	MIC	MIC	I	NI	I	MIC	I	NI	MIC	I	MIC	MIC	MIC	MIC	I	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S24	MIC	NI	NI	NI	NI	MIC	MIC	I	NI	I	MIC	NI	NI	MIC	I	MIC	MIC	MIC	MIC	I	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	LI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S25	NI	NI	NI	NI	NI	NI	I	MIC	NI	NI	I	MIC	NI	I	NI	LI	LI	NI	I	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	MIC	MIC	LI	I	I
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	LI	NI	NI	NI	NI	LI	I	NI	NI	NI	LI	NI	NI	I	NI	LI	I	LI	I	NI	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	MIC	I
S28	I	NI	NI	NI	NI	MIC	MIC	MIC	I	NI	MIC	I	NI	MIC	MIC	MIC	MIC	I	MIC	I	NI	NI	I	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	MIC	MIC	MIC	MIC	MIC
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	NI	NI	NI	NI	I	MIC	I	NI	NI	I	I	NI	I	NI	LI	I	NI	MIC	NI	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	I	MIC	MIC	NI	MIC	MIC	MIC	MIC
S31	MIC	LI	NI	NI	NI	MIC	MIC	MIC	NI	LI	MIC	MIC	NI	MIC	I	I	I	I	MIC	LI	I	NI	NI	NI	NI	NI	MIC	NI	NI	I	NI	I	MIC	MIC	I	MIC	MIC	MIC	MIC
S32	MIC	NI	NI	NI	NI	I	MIC	LI	NI	NI	LI	I	NI	I	NI	LI	LI	NI	I	NI	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	NI	MIC	MIC	MIC	MIC
S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	I	MIC	I	NI	NI
S34	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	LI	MIC	NI	NI	NI
S35	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	MIC	MIC	LI	LI	NI
S36	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	LI	MIC	NI	NI	NI
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	MIC	I	NI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI
S39	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	MIC	NI	MIC	NI	I	I

MIC = Most Important Coefficient (Sector) I = Important Coefficient LI = Less Important Coefficient NI = Not Important Coefficient

Source: Results obtained from the model developed in Chapter 4.

Table VI.13 – Backward MIC by sectors, 2004-05

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	MIC	NI	NI	NI	NI	NI	MIC	LI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	LI
S02	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI
S04	NI	LI	I	I	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	I	LI	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	NI	I	NI	LI	NI
S05	NI	MIC	I	I	LI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S06	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	LI	I	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI
S07	LI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	LI	NI	NI	LI
S08	NI	NI	NI	NI	NI	NI	LI	MIC	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	LI	I	LI	I	LI
S09	NI	NI	NI	NI	NI	NI	I	NI	I	I	MIC	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	LI	I	I	NI	LI
S10	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	LI	NI	LI	NI	LI	I	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	I	I	LI	LI	LI
S11	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	I	NI	NI	LI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	LI	MIC	I	I	I
S12	I	I	NI	NI	LI	I	NI	NI	NI	NI	NI	I	NI	I	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	I	I	MIC	I	LI	NI	LI
S13	NI	I	NI	MIC	NI	I	NI	NI	NI	NI	NI	NI	NI	MIC	I	MIC	NI	I	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI
S14	I	NI	NI	NI	NI	LI	I	NI	NI	NI	I	NI	NI	MIC	LI	NI	NI	LI	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	I	I	I
S15	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	MIC	LI	NI	LI	I	LI	LI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	MIC	I	NI	I	NI	LI	LI
S16	NI	NI	NI	NI	LI	LI	NI	NI	NI	NI	NI	NI	NI	NI	LI	MIC	NI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	LI	NI	NI	NI
S17	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	I	MIC	I	I	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI
S18	NI	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	I	NI	LI	NI	I	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	I	I	I	LI	I
S19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	I	I	LI
S20	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	NI	I	I	I	LI
S21	NI	LI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	I	LI	LI	LI	NI	LI	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	I	I	I	I	I
S22	NI	NI	MIC	NI	NI	LI	I	NI	NI	NI	NI	I	NI	I	NI	LI	LI	NI	LI	NI	NI	MIC	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	I	I	I	LI	I	LI
S23	NI	NI	NI	LI	NI	LI	I	NI	NI	NI	NI	NI	NI	I	NI	LI	LI	NI	LI	NI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	I	I	I	LI	I	LI
S24	NI	NI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	I	LI	I	LI	NI	I	NI	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	I	I	I	I	I
S25	NI	NI	NI	NI	NI	LI	LI	NI	NI	NI	NI	NI	NI	I	NI	LI	NI	NI	LI	NI	NI	NI	NI	NI	MIC	NI	MIC	NI	NI	NI	NI	NI	LI	I	I	I	LI	I	LI
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	NI	LI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	I	LI	LI	LI	NI	LI	NI	MIC	NI	LI	LI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	I	I	I	I	LI
S28	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	LI	NI	NI	I	MIC	I	I	NI	LI	NI	NI	NI	I	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	MIC	LI	I	NI	I	NI
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	I	MIC	I	LI	LI
S31	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	LI	LI	I	I	MIC	I	NI	LI
S32	I	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	MIC	I	LI	LI
S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	LI	I	I	NI	NI
S34	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	I	LI	LI	LI
S35	LI	LI	NI	NI	NI	NI	I	NI	NI	NI	LI	NI	NI	LI	LI	LI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	I	I	I	LI	LI
S36	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	LI	NI	NI	LI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	I	MIC	I	I	I
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	LI	I	I	NI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	LI	NI
S39	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	MIC	NI	I	I

MIC = Most Important Coefficient (Sector)   I = Important Coefficient   LI = Less Important Coefficient   NI = Not Important Coefficient

Source: Results obtained from the model developed in Chapter 4.

Table VI.14 – Forward MIC by sectors, 2004-05

	S01	S02	S03	S04	S05	S06	S07	S08	S09	S10	S11	S12	S13	S14	S15	S16	S17	S18	S19	S20	S21	S22	S23	S24	S25	S26	S27	S28	S29	S30	S31	S32	S33	S34	S35	S36	S37	S38	S39
S01	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	MIC	NI	I	NI	NI	LI
S02	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	LI	NI	I	LI	NI	NI
S03	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI
S04	I	I	I	I	NI	LI	MIC	NI	NI	NI	I	LI	NI	MIC	MIC	I	I	LI	MIC	NI	NI	NI	I	NI	NI	NI	MIC	NI	NI	NI	NI	NI	I	MIC	I	MIC	I	MIC	I
S05	NI	MIC	I	I	LI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S06	NI	NI	NI	NI	NI	I	LI	NI	NI	NI	NI	NI	NI	I	LI	I	MIC	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	LI	NI	I	NI	NI	NI
S07	LI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	I	NI	LI	LI
S08	LI	NI	NI	NI	NI	NI	I	MIC	NI	NI	LI	NI	NI	I	NI	NI	NI	LI	I	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	MIC	I
S09	LI	LI	NI	NI	LI	I	MIC	NI	I	I	MIC	NI	NI	MIC	I	I	NI	LI	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S10	I	NI	NI	NI	NI	LI	I	NI	NI	MIC	LI	NI	NI	I	NI	LI	NI	I	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	MIC	I
S11	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	I	NI	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	MIC	MIC	I
S12	I	I	NI	NI	NI	I	I	NI	NI	NI	NI	I	NI	I	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	I	I
S13	MIC	MIC	MIC	MIC	I	MIC	NI	NI	NI	I	MIC	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	NI	MIC	NI	I	I	I	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	MIC	MIC	NI	NI
S14	I	NI	NI	NI	NI	NI	I	NI	NI	NI	I	NI	NI	MIC	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	I	I
S15	LI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	I	MIC	LI	NI	I	MIC	LI	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	I	I
S16	NI	NI	NI	NI	NI	LI	LI	NI	NI	NI	NI	NI	NI	LI	NI	MIC	LI	MIC	MIC	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	LI	I	LI
S17	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	I	MIC	I	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	NI	I	NI	NI	NI
S18	LI	NI	NI	NI	NI	LI	MIC	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	I	MIC	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	I	I
S19	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	I	MIC	LI	I	NI
S20	NI	NI	NI	NI	NI	LI	I	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	I	MIC	I	MIC	I
S21	LI	LI	NI	NI	NI	I	I	NI	NI	NI	LI	NI	NI	I	NI	LI	LI	NI	MIC	NI	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	MIC	I
S22	MIC	NI	MIC	NI	NI	MIC	MIC	MIC	I	I	MIC	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC	NI	MIC	NI	NI	NI	NI	MIC	NI	NI	I	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S23	I	NI	NI	I	NI	MIC	MIC	I	NI	LI	I	I	NI	MIC	I	MIC	MIC	I	MIC	LI	NI	NI	MIC	NI	NI	NI	MIC	NI	NI	LI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S24	MIC	NI	NI	NI	NI	MIC	MIC	I	NI	I	MIC	NI	NI	MIC	I	MIC	MIC	I	MIC	I	NI	NI	NI	MIC	NI	NI	MIC	NI	NI	I	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S25	MIC	NI	NI	NI	NI	MIC	MIC	I	NI	LI	MIC	I	NI	MIC	I	MIC	MIC	I	MIC	I	NI	NI	NI	NI	MIC	NI	MIC	NI	NI	LI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S26	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
S27	NI	NI	NI	NI	NI	I	I	NI	NI	NI	NI	NI	NI	I	NI	LI	LI	NI	I	NI	I	NI	NI	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	I	MIC	I
S28	I	NI	NI	NI	NI	I	MIC	I	LI	NI	MIC	I	NI	MIC	MIC	MIC	MIC	I	MIC	I	NI	NI	I	NI	NI	NI	MIC	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S29	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	MIC	NI	NI	NI	NI	NI	NI	NI	NI	NI
S30	NI	NI	NI	NI	NI	I	MIC	LI	NI	NI	LI	NI	NI	MIC	NI	I	NI	NI	MIC	NI	LI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	I	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S31	MIC	I	NI	NI	NI	MIC	MIC	MIC	NI	LI	MIC	I	NI	MIC	I	MIC	I	I	MIC	I	MIC	NI	NI	NI	NI	NI	MIC	NI	NI	MIC	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S32	MIC	NI	NI	NI	NI	I	MIC	LI	NI	NI	I	NI	NI	MIC	NI	I	NI	NI	MIC	NI	I	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	MIC	MIC	MIC	MIC	MIC	MIC	MIC
S33	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	MIC	I	NI	MIC	NI	NI	NI
S34	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	I	LI	MIC	NI	NI	NI
S35	NI	NI	NI	NI	NI	NI	I	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	LI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	I	MIC	LI	LI	NI
S36	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	LI	MIC	NI	NI	NI
S37	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	I	I	MIC	I	LI	NI
S38	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	NI	LI	NI
S39	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	I	MIC	NI	MIC	NI	I	I

MIC = Most Important Coefficient (Sector) I = Important Coefficient LI = Less Important Coefficient NI = Not Important Coefficient

Source: Results obtained from the model developed in Chapter 4.

Table VI.15: Backward Concentration Indices (BL-CI), 1975-2015

Sec	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
S01	1.0673 (20)	1.0341 (25)	0.9594 (29)	0.958 (32)	0.9874 (26)	1.0041 (27)	1.066 (19)	1.0098 (25)	1.0538 (20)	0.9797 (30)	1.0467 (22)	1.0582 (20)	1.0346 (28)	1.0387 (26)	1.0018 (30)	0.9685 (33)	1.0096 (28)	1.0156 (28)	1.0611 (23)	1.058 (25)	1.0603 (24)	1.0308 (28)	1.0366 (25)	1.0444 (23)	1.0516 (22)
S02	0.9982 (27)	0.984 (29)	1.0127 (23)	0.9712 (29)	0.9742 (28)	1.0723 (17)	1.0863 (15)	1.0657 (19)	0.956 (33)	0.9495 (32)	0.9812 (29)	0.9911 (25)	1.1008 (11)	1.1001 (11)	1.1118 (7)	1.089 (14)	1.0922 (19)	1.0629 (26)	1.1221 (6)	1.116 (14)	1.0124 (28)	1.1078 (12)	1.1202 (9)	1.1213 (8)	1.1262 (9)
S03	1.0356 (23)	1.0948 (15)	0.9214 (34)	1.0051 (26)	1.0765 (15)	1.008 (26)	1.0157 (26)	1.0076 (27)	1.0003 (30)	0.9045 (35)	0.9384 (34)	0.9882 (26)	0.8104 (36)	0.7501 (36)	0.9029 (34)	0.815 (35)	0.6927 (37)	0.7587 (37)	0.7888 (37)	0.7197 (37)	0.7613 (36)	0.886 (34)	0.9734 (31)	0.955 (33)	0.9767 (31)
S04	0.7761 (35)	0.7487 (36)	1.1478 (7)	1.1138 (11)	0.9068 (34)	1.0357 (19)	1.072 (17)	0.9632 (32)	1.0032 (26)	1.0266 (24)	0.9681 (30)	0.9474 (30)	0.607 (37)	0.6831 (37)	0.8271 (36)	0.6963 (37)	0.7964 (35)	0.8847 (34)	0.8908 (35)	0.8649 (35)	0.7364 (37)	0.8812 (35)	0.9241 (34)	0.9963 (30)	0.9163 (34)
S05	1.1628 (9)	1.0301 (26)	1.1457 (8)	1.2038 (2)	1.1829 (4)	1.1711 (4)	1.1375 (7)	1.071 (17)	1.0751 (15)	1.075 (18)	1.0754 (18)	1.1752 (4)	1.0889 (14)	1.1152 (8)	1.111 (8)	1.0798 (19)	1.1027 (16)	1.1229 (6)	1.0945 (17)	1.0845 (19)	1.117 (11)	1.0575 (20)	1.0248 (26)	1.0321 (25)	1.0359 (26)
S06	1.0204 (25)	1.0502 (23)	1.0367 (20)	1.0114 (24)	1.0668 (18)	1.0852 (15)	1.0478 (21)	1.0921 (12)	1.0734 (17)	1.0785 (16)	1.1201 (7)	1.1739 (6)	1.0692 (21)	1.0942 (13)	1.0947 (15)	1.0923 (11)	1.0846 (20)	1.0768 (23)	1.0516 (27)	1.0593 (24)	1.0776 (17)	1.0441 (25)	1.1053 (15)	1.0949 (16)	1.1073 (13)
S07	1.1924 (7)	1.172 (4)	1.1595 (6)	1.1485 (7)	1.1593 (7)	1.1511 (8)	1.1425 (6)	1.1397 (6)	1.1361 (6)	1.1152 (10)	1.1297 (6)	1.1739 (5)	1.1196 (6)	1.1196 (7)	1.1019 (12)	1.1181 (4)	1.1275 (5)	1.1167 (7)	1.1225 (5)	1.1183 (12)	1.1115 (13)	1.0951 (13)	1.096 (17)	1.0917 (18)	1.0985 (16)
S08	0.999 (26)	0.9458 (31)	0.9436 (31)	0.9085 (34)	0.9608 (30)	0.9584 (32)	0.9642 (33)	0.9515 (33)	0.9721 (32)	0.9664 (31)	0.9523 (32)	0.9719 (28)	1.0749 (18)	1.0804 (17)	1.0617 (21)	1.0367 (29)	0.9406 (32)	0.8847 (35)	0.9423 (32)	0.906 (33)	0.8682 (34)	0.8514 (36)	0.7699 (36)	0.7599 (37)	0.7451 (37)
S09	1.0576 (22)	1.1041 (13)	0.9956 (27)	0.9885 (28)	0.9753 (27)	1.0236 (24)	1.0701 (18)	1.1628 (3)	1.0006 (29)	1.0572 (19)	1.0522 (20)	1.0505 (21)	1.082 (16)	1.1349 (4)	1.1142 (6)	1.115 (5)	0.9745 (31)	1.0034 (29)	1.115 (8)	1.0219 (27)	1.0374 (26)	1.0591 (19)	1.1156 (11)	1.1172 (9)	1.128 (8)
S10	1.1349 (14)	1.0965 (14)	1.0291 (21)	1.0278 (22)	1.0322 (22)	1.0301 (21)	1.054 (20)	1.045 (24)	1.0612 (18)	1.0366 (22)	1.0494 (21)	1.0931 (17)	1.078 (17)	1.0689 (21)	1.1144 (5)	1.0681 (23)	1.0772 (23)	1.0841 (20)	1.102 (12)	1.1237 (8)	1.114 (12)	1.1236 (9)	1.108 (14)	1.1122 (10)	1.1258 (10)
S11	1.1578 (10)	1.0761 (19)	1.12 (11)	1.0985 (14)	1.1308 (10)	1.1172 (9)	1.0958 (13)	1.0976 (11)	1.1072 (11)	1.1 (14)	1.0869 (15)	1.0989 (15)	1.0556 (24)	1.0461 (25)	1.0374 (26)	1.0569 (28)	1.0741 (26)	1.0729 (24)	1.0764 (20)	1.0895 (18)	1.0734 (21)	1.0346 (27)	1.0223 (27)	1.0551 (22)	1.0477 (24)
S12	1.2109 (5)	1.1829 (2)	1.0897 (16)	1.1379 (9)	1.1462 (9)	1.0751 (16)	1.0834 (16)	1.1564 (4)	1.1747 (3)	1.1203 (8)	1.1035 (11)	1.1456 (9)	1.0647 (22)	1.0808 (16)	1.0598 (22)	1.106 (9)	1.0454 (27)	1.0614 (27)	1.0232 (28)	1.0178 (28)	1.0052 (29)	0.9877 (30)	0.9996 (29)	1.009 (29)	0.9849 (30)
S13	0.9853 (28)	1.1182 (10)	0.9993 (25)	1.0656 (16)	0.9996 (25)	0.9477 (33)	0.9781 (31)	1.0735 (15)	1.1885 (2)	1.1038 (11)	1.0812 (16)	1.0893 (18)	1.0095 (31)	1.0771 (18)	1.1043 (9)	1.1088 (7)	0.9997 (29)	0.9748 (30)	0.9267 (34)	0.8893 (34)	0.9773 (32)	0.9954 (29)	1.0064 (28)	1.0099 (28)	1.0498 (23)
S14	1.1149 (15)	1.0427 (24)	0.9992 (26)	1.0102 (25)	1.0071 (23)	0.9652 (30)	1.0194 (24)	1.0672 (18)	0.9754 (31)	0.9876 (29)	1.0394 (24)	1.0124 (24)	1.0292 (29)	1.0309 (30)	0.9812 (32)	1.0357 (30)	0.9799 (30)	0.9574 (31)	0.9988 (29)	0.978 (30)	0.9851 (31)	0.9827 (31)	0.9967 (30)	0.9834 (31)	0.9698 (32)
S15	1.1575 (11)	1.1301 (9)	1.1363 (9)	1.1242 (10)	1.1306 (11)	1.1161 (10)	1.1147 (9)	1.1106 (10)	1.1101 (10)	1.0987 (15)	1.1113 (8)	1.1474 (8)	1.0588 (23)	1.0716 (20)	1.0431 (25)	1.0821 (18)	1.1029 (15)	1.105 (12)	1.0962 (16)	1.1089 (15)	1.0945 (16)	1.1082 (11)	1.1029 (16)	1.1073 (12)	1.1114 (12)
S16	1.1127 (16)	1.1135 (11)	1.0948 (15)	1.0988 (13)	1.1021 (13)	1.1028 (14)	1.1065 (11)	1.0614 (20)	1.0735 (16)	1.1198 (9)	1.1014 (12)	1.1369 (13)	1.0744 (19)	1.1317 (5)	1.1204 (4)	1.1229 (3)	1.0976 (18)	1.1247 (4)	1.1076 (11)	1.1031 (16)	1.0773 (18)	1.0894 (16)	1.1123 (12)	1.0956 (14)	1.0681 (19)
S17	1.2184 (4)	1.171 (5)	1.174 (4)	1.1414 (8)	1.1527 (8)	1.1787 (2)	1.1569 (4)	1.1696 (2)	1.1585 (4)	1.1548 (3)	1.1743 (2)	1.1728 (7)	1.0965 (13)	1.0633 (23)	1.0703 (19)	1.1255 (2)	1.1382 (2)	1.1417 (2)	1.0988 (13)	1.1359 (6)	1.1511 (3)	1.1346 (7)	1.1663 (3)	1.1639 (1)	1.1744 (4)
S18	1.2077 (6)	1.1645 (7)	1.1652 (5)	1.1638 (6)	1.1643 (5)	1.152 (7)	1.1368 (8)	1.1353 (8)	1.136 (7)	1.138 (6)	1.0983 (14)	1.1425 (11)	1.106 (9)	1.0906 (14)	1.1418 (1)	1.1137 (6)	1.1145 (9)	1.1233 (5)	1.0968 (14)	1.1187 (11)	1.111 (14)	1.0934 (15)	1.0929 (18)	1.0929 (17)	1.0773 (18)
S19	1.078 (18)	1.0568 (20)	1.0418 (19)	1.0485 (20)	1.0414 (21)	1.0261 (22)	0.9937 (29)	0.9977 (29)	1.002 (27)	1.0289 (23)	1.0376 (25)	1.048 (23)	1.0195 (30)	1.0229 (31)	0.9445 (33)	1.0202 (32)	0.9339 (33)	0.9473 (32)	0.9497 (31)	0.9423 (31)	0.9433 (33)	0.9101 (33)	0.8594 (35)	0.8565 (35)	0.8069 (35)

Source: Results obtained from the model developed in Chapter 4.

Table VI.15 (cont'd)

Sec	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
S20	1.2369 (2)	1.1653 (6)	1.1869 (2)	1.1755 (5)	1.1858 (3)	1.165 (6)	1.1441 (5)	1.149 (5)	1.1406 (5)	1.1454 (5)	1.1462 (4)	1.1941 (2)	1.1462 (3)	1.1258 (6)	1.104 (10)	1.1459 (1)	1.1275 (4)	1.103 (14)	1.0882 (18)	1.056 (26)	1.0197 (27)	1.0456 (24)	1.0435 (23)	1.0169 (27)	0.9941 (28)
S21	1.0336 (24)	1.0567 (21)	1.1181 (12)	1.0652 (17)	1.0503 (20)	1.1141 (11)	1.0995 (12)	1.0725 (16)	1.0787 (14)	1.044 (20)	1.0448 (23)	0.9647 (29)	1.1062 (8)	1.0643 (22)	1.0893 (17)	1.0955 (10)	1.1234 (7)	1.1262 (3)	1.1456 (2)	1.162 (2)	1.1216 (9)	1.1385 (6)	1.1403 (7)	1.1405 (7)	1.1522 (7)
S22	0.7215 (37)	0.7945 (35)	0.84 (36)	0.8044 (36)	0.8159 (36)	0.8178 (36)	0.8222 (36)	0.84 (35)	0.9415 (34)	0.942 (34)	0.929 (35)	0.8051 (35)	1.1352 (4)	1.1031 (10)	1.1015 (13)	1.0913 (13)	1.1285 (3)	1.0972 (15)	1.0871 (19)	1.1219 (9)	1.1499 (4)	1.1743 (2)	1.1687 (1)	1.1629 (2)	1.1789 (1)
S23	1.1712 (8)	1.1427 (8)	1.1322 (10)	1.1896 (3)	1.1596 (6)	1.1664 (5)	1.1814 (2)	1.1985 (1)	1.1952 (1)	1.1756 (2)	1.1575 (3)	1.1386 (12)	1.1471 (2)	1.1429 (3)	1.1248 (3)	1.1075 (8)	1.1855 (1)	1.1955 (1)	1.1217 (7)	1.1207 (10)	1.1767 (1)	1.1842 (1)	1.1648 (4)	1.1617 (4)	1.1763 (3)
S24	0.9441 (29)	0.9997 (28)	1.0118 (24)	1.013 (23)	1.0003 (24)	1.0353 (20)	1.0458 (22)	1.0536 (23)	1.0486 (21)	1.0266 (25)	1.066 (19)	0.8387 (34)	1.0856 (15)	1.0344 (29)	1.032 (27)	1.0616 (25)	1.1211 (8)	1.1119 (8)	1.1351 (4)	1.1612 (3)	1.1613 (2)	1.1741 (3)	1.1674 (2)	1.1626 (3)	1.178 (2)
S25	0.7708 (36)	0.9371 (32)	0.9285 (33)	0.9669 (30)	0.938 (33)	0.9779 (29)	0.9968 (28)	1.0079 (26)	1.026 (23)	1.018 (26)	0.9676 (31)	0.8988 (33)	1.1209 (5)	1.0999 (12)	1.0726 (18)	1.0877 (15)	1.1079 (12)	1.0872 (18)	1.111 (10)	1.13 (7)	1.1493 (5)	1.1661 (4)	1.1621 (5)	1.1578 (5)	1.1725 (5)
S26	0.1506 (38)	0.2339 (38)	0.2358 (38)	0.254 (38)	0.235 (38)	0.2238 (38)	0.2427 (38)	0.2453 (38)	0.2675 (38)	0.2181 (38)	0.1694 (38)	0.2052 (38)	0.3393 (38)	0.3055 (38)	0.2362 (38)	0.2002 (38)	0.1389 (38)	0.1238 (38)	0.1225 (38)	0.1156 (38)	0.0824 (38)	0.093 (38)	0.0936 (38)	0.0862 (38)	0.0885 (38)
S27	0.7775 (34)	0.8437 (34)	0.8929 (35)	0.8799 (35)	0.8984 (35)	0.9621 (31)	0.9874 (30)	0.9881 (30)	1.008 (24)	1.0009 (28)	1.006 (27)	0.7785 (36)	1.0504 (26)	0.9694 (32)	1.022 (29)	1.0285 (31)	1.099 (17)	1.1033 (13)	1.1137 (9)	1.1378 (5)	1.1193 (10)	1.1415 (5)	1.1428 (6)	1.1415 (6)	1.1538 (6)
S28	1.069 (19)	1.0831 (18)	1.0784 (18)	1.0329 (21)	1.0716 (16)	1.1114 (12)	1.1108 (10)	1.0912 (13)	1.0821 (13)	1.1222 (7)	1.1 (13)	0.9168 (32)	0.9184 (33)	0.9518 (33)	0.9885 (31)	1.0785 (20)	1.1058 (13)	1.1074 (10)	0.9762 (30)	0.9996 (29)	1.1364 (8)	1.0685 (17)	0.9314 (33)	0.9681 (32)	0.9879 (29)
S29	0.003 (39)	0.0026 (39)	0.0026 (39)	0.0025 (39)	0.0024 (39)	0.0026 (39)	0.0025 (39)	0.0024 (39)	0.0024 (39)	0.0025 (39)	0.0024 (39)	0.0022 (39)	0.0024 (39)	0.002 (39)	0.0021 (39)	0.0018 (39)	0.0016 (39)	0.0016 (39)	0.0016 (39)	0.0015 (39)	0.0017 (39)	0.0017 (39)	0.0017 (39)	0.0017 (39)	0.0016 (39)
S30	1.1425 (13)	1.1114 (12)	1.1159 (13)	1.1015 (12)	1.1086 (12)	1.1086 (13)	1.0936 (14)	1.055 (22)	1.0483 (22)	1.1018 (12)	1.1072 (9)	1.1282 (14)	1.102 (10)	1.1494 (2)	1.1026 (11)	1.0838 (17)	1.1109 (10)	1.1076 (9)	1.1363 (3)	1.1475 (4)	1.1425 (7)	1.1254 (8)	1.1093 (13)	1.1093 (11)	1.1162 (11)
S31	1.2968 (1)	1.2607 (1)	1.2592 (1)	1.2454 (1)	1.2626 (1)	1.2295 (1)	1.1956 (1)	1.137 (7)	1.1301 (8)	1.2001 (1)	1.1835 (1)	1.3004 (1)	1.1856 (1)	1.1558 (1)	1.1311 (2)	1.0738 (21)	1.1103 (11)	1.0728 (25)	1.0967 (15)	1.1167 (13)	1.1103 (15)	1.0938 (14)	1.1306 (8)	1.1001 (13)	1.103 (14)
S32	0.844 (32)	1.0166 (27)	0.9835 (28)	0.962 (31)	0.955 (32)	0.9131 (34)	0.8885 (34)	0.8217 (36)	0.7688 (37)	0.8822 (36)	1.0023 (28)	0.9724 (27)	0.9766 (32)	1.0359 (28)	1.0275 (28)	1.0918 (12)	1.1258 (6)	1.1069 (11)	1.1517 (1)	1.1646 (1)	1.1482 (6)	1.1137 (10)	1.1161 (10)	1.0953 (15)	1.1004 (15)
S33	1.2307 (3)	1.1735 (3)	1.1843 (3)	1.1774 (4)	1.1887 (2)	1.1753 (3)	1.158 (3)	1.134 (9)	1.1259 (9)	1.1515 (4)	1.1334 (5)	1.1848 (3)	1.1157 (7)	1.1088 (9)	1.096 (14)	1.0684 (22)	1.077 (24)	1.0926 (17)	1.0539 (26)	1.063 (23)	1.0559 (25)	1.0509 (21)	1.0375 (24)	1.0307 (26)	1.0336 (27)
S34	0.8723 (31)	0.9518 (30)	0.9587 (30)	0.9967 (27)	0.966 (29)	0.9826 (28)	0.9693 (32)	0.9756 (31)	1.0012 (28)	1.038 (21)	0.9419 (33)	1.0504 (22)	1.0526 (25)	1.037 (27)	1.0473 (23)	1.0596 (27)	1.0793 (22)	1.0846 (19)	1.0706 (21)	1.09 (17)	1.0756 (20)	1.06 (18)	1.0605 (21)	1.0609 (21)	1.0664 (20)
S35	1.0887 (17)	1.0927 (16)	1.082 (17)	1.0621 (19)	1.07 (17)	1.0247 (23)	1.0082 (27)	1.0001 (28)	1.0072 (25)	1.0155 (27)	1.0252 (26)	1.0748 (19)	1.0479 (27)	1.0584 (24)	1.046 (24)	1.0655 (24)	1.0793 (21)	1.0832 (21)	1.0698 (22)	1.0755 (20)	1.0703 (22)	1.0503 (22)	1.044 (22)	1.0409 (24)	1.0431 (25)
S36	0.836 (33)	0.7453 (37)	0.7461 (37)	0.7639 (37)	0.7969 (37)	0.8111 (37)	0.7874 (37)	0.7898 (37)	0.8258 (36)	0.7531 (37)	0.763 (37)	0.7601 (37)	0.8194 (35)	0.8165 (35)	0.7902 (37)	0.7694 (36)	0.7845 (36)	0.7886 (36)	0.8124 (36)	0.8023 (36)	0.8221 (35)	0.784 (37)	0.7606 (37)	0.7748 (36)	0.7612 (36)
S37	1.1492 (12)	1.0854 (17)	1.1024 (14)	1.077 (15)	1.0788 (14)	1.0215 (25)	1.0164 (25)	1.0608 (21)	1.0848 (12)	1.1017 (13)	1.107 (10)	1.1432 (10)	1.0996 (12)	1.0876 (15)	1.0921 (16)	1.0872 (16)	1.1053 (14)	1.0941 (16)	1.0549 (25)	1.0714 (21)	1.0697 (23)	1.0479 (23)	1.0923 (19)	1.0794 (19)	1.0827 (17)
S38	0.9101 (30)	0.9315 (33)	0.9421 (32)	0.9394 (33)	0.9564 (31)	0.8927 (35)	0.8823 (35)	0.9119 (34)	0.9001 (35)	0.9422 (33)	0.9221 (36)	0.9304 (31)	0.8971 (34)	0.8768 (34)	0.8874 (35)	0.8907 (34)	0.929 (34)	0.9117 (33)	0.9275 (33)	0.9386 (32)	0.9964 (30)	0.9737 (32)	0.9361 (32)	0.9488 (34)	0.9477 (33)
S39	1.0637 (21)	1.0559 (22)	1.0269 (22)	1.0651 (18)	1.0628 (19)	1.044 (18)	1.0262 (23)	1.0878 (14)	1.0596 (19)	1.0775 (17)	1.078 (17)	1.0954 (16)	1.0721 (20)	1.0745 (19)	1.0626 (20)	1.061 (26)	1.0753 (25)	1.0815 (22)	1.0587 (24)	1.0683 (22)	1.0767 (19)	1.0403 (26)	1.0641 (20)	1.0613 (20)	1.0601 (21)

Source: Results obtained from the model developed in Chapter 4.

Table VI.16: Forward Concentration Indices (FL-CI), 1975-2015

Sec	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
S01	0.9898 (28)	1.0064 (28)	0.9872 (28)	0.9907 (28)	0.979 (28)	0.9674 (29)	0.9691 (29)	0.9534 (29)	0.9843 (29)	0.9706 (29)	1.0037 (28)	1.0204 (27)	0.9962 (29)	0.972 (28)	1.006 (25)	0.9933 (27)	1.0017 (26)	1.0059 (26)	1.0186 (26)	1.0246 (26)	1.0117 (25)	1.0122 (25)	0.9786 (28)	0.9895 (28)	1.0065 (26)
S02	1.1975 (6)	1.2259 (4)	1.1984 (5)	1.2175 (4)	1.2062 (3)	1.1981 (5)	1.169 (8)	1.2034 (8)	1.1462 (11)	1.13 (16)	1.1356 (18)	1.1435 (17)	0.9999 (28)	0.9953 (26)	1.0887 (20)	1.0402 (25)	0.9379 (31)	0.9793 (28)	1.0418 (24)	1.0444 (24)	0.9586 (29)	0.9953 (27)	0.9714 (29)	0.9511 (30)	0.9651 (29)
S03	1.2005 (5)	1.2198 (6)	1.1928 (7)	1.1793 (10)	1.1858 (9)	1.1849 (8)	1.1698 (7)	1.1956 (10)	1.138 (12)	1.1418 (13)	1.1599 (14)	1.1772 (8)	1.1392 (6)	1.131 (11)	1.1352 (10)	1.1352 (6)	1.133 (7)	1.1335 (5)	1.1254 (6)	1.1225 (7)	1.1145 (10)	1.1102 (13)	1.1148 (14)	1.1137 (13)	1.0979 (15)
S04	1.2794 (1)	1.2864 (1)	1.2631 (1)	1.2698 (1)	1.2513 (1)	1.2244 (2)	1.2234 (2)	1.2712 (1)	1.2368 (1)	1.2413 (1)	1.1943 (6)	1.2063 (4)	1.1534 (2)	1.1584 (5)	1.1686 (3)	1.0788 (20)	1.1394 (5)	1.1259 (7)	0.9939 (28)	1.0319 (25)	1.0928 (16)	1.1106 (12)	1.0518 (22)	1.0135 (25)	1.0155 (25)
S05	1.1793 (9)	1.2078 (9)	1.2257 (3)	1.2081 (5)	1.1637 (11)	1.1332 (16)	1.165 (10)	1.2301 (3)	1.1765 (7)	1.1999 (4)	1.1748 (12)	1.1881 (7)	1.1056 (15)	1.1167 (16)	1.1486 (6)	1.1284 (8)	1.1239 (9)	1.1165 (11)	1.0971 (14)	1.0831 (18)	1.057 (20)	1.0766 (18)	1.0457 (23)	1.0591 (19)	1.0768 (18)
S06	1.1507 (14)	1.1409 (16)	1.1382 (17)	1.1477 (16)	1.1358 (18)	1.1107 (19)	1.0855 (23)	1.1187 (19)	1.0839 (21)	1.0673 (24)	1.0415 (27)	1.059 (24)	1.0665 (22)	1.0591 (21)	1.0782 (21)	1.0542 (23)	1.0512 (25)	1.0257 (25)	1.0237 (25)	1.0224 (27)	1.0009 (26)	1.0034 (26)	1.003 (25)	0.92 (32)	0.9481 (31)
S07	0.5757 (36)	0.5656 (34)	0.5644 (35)	0.5967 (34)	0.5685 (35)	0.5581 (37)	0.5748 (37)	0.5134 (36)	0.6833 (35)	0.6846 (35)	0.6293 (35)	0.6102 (35)	0.8556 (33)	0.835 (33)	0.8737 (34)	0.8649 (34)	0.8474 (35)	0.8685 (34)	0.8437 (36)	0.888 (35)	0.8967 (35)	0.8885 (34)	0.8395 (35)	0.8561 (35)	0.8527 (35)
S08	0.7822 (33)	0.6901 (33)	0.7762 (34)	0.8159 (32)	0.7739 (34)	0.7601 (34)	0.7703 (34)	0.7763 (33)	0.8614 (32)	0.8475 (32)	0.6558 (34)	0.7996 (33)	0.7541 (36)	0.7147 (36)	0.9505 (31)	0.9185 (32)	0.8923 (33)	0.8814 (33)	0.8846 (34)	0.9306 (32)	0.9302 (32)	0.9468 (31)	0.9799 (27)	1.0175 (24)	1.0217 (24)
S09	1.1498 (15)	0.5249 (36)	1.1622 (11)	1.0904 (23)	1.1539 (12)	1.1559 (12)	1.1608 (11)	0.4307 (37)	1.1676 (9)	1.1761 (8)	1.1874 (8)	1.1891 (6)	1.1204 (11)	1.1735 (1)	1.1596 (4)	1.1515 (3)	1.1547 (3)	1.1504 (4)	1.143 (4)	1.1448 (3)	1.1292 (6)	1.1242 (7)	1.1461 (4)	1.139 (7)	1.1455 (5)
S10	1.1541 (13)	1.0346 (26)	1.1514 (13)	1.1507 (15)	1.139 (17)	1.128 (18)	1.1228 (18)	1.0708 (24)	1.1198 (18)	1.0862 (21)	1.0678 (25)	1.0943 (23)	1.1273 (9)	1.1204 (13)	1.1178 (16)	1.104 (15)	1.0967 (17)	1.0947 (18)	1.0794 (21)	1.0858 (16)	1.0852 (17)	1.0735 (20)	1.0564 (20)	1.0542 (21)	1.0493 (22)
S11	1.1609 (11)	1.1923 (11)	1.1473 (15)	1.1399 (17)	1.1448 (16)	1.1425 (13)	1.1322 (17)	1.1781 (13)	1.1289 (15)	1.1237 (18)	1.1412 (17)	1.1466 (15)	1.1148 (12)	1.1176 (15)	1.1126 (17)	1.0929 (17)	1.0963 (18)	1.0957 (17)	1.0905 (17)	1.1007 (12)	1.0983 (15)	1.0838 (17)	1.0732 (17)	1.0922 (16)	1.0837 (16)
S12	1.1858 (8)	1.1929 (10)	1.1685 (10)	1.1579 (12)	1.1678 (10)	1.1678 (10)	1.1515 (12)	1.1648 (15)	1.121 (16)	1.1248 (17)	1.1434 (16)	1.1565 (12)	1.1487 (3)	1.1166 (17)	1.1208 (15)	1.1282 (9)	1.1311 (8)	1.1259 (8)	1.121 (7)	1.1228 (6)	1.1111 (11)	1.112 (11)	1.1237 (10)	1.1222 (9)	1.1214 (10)
S13	1.2416 (2)	1.2857 (2)	1.2506 (2)	1.2487 (2)	1.2376 (2)	1.2364 (1)	1.2266 (1)	1.2561 (2)	1.2221 (2)	1.2294 (2)	1.2269 (1)	1.2331 (1)	1.2062 (1)	1.1724 (2)	1.2 (1)	1.1789 (1)	1.1982 (1)	1.1796 (1)	1.1603 (3)	1.1657 (1)	1.1612 (3)	1.1878 (1)	1.1278 (9)	1.1647 (3)	1.1829 (1)
S14	1.1094 (22)	1.0686 (24)	1.1056 (21)	1.117 (19)	1.1006 (21)	1.0909 (23)	1.088 (22)	1.07 (25)	1.0837 (22)	1.0969 (20)	1.0845 (22)	1.1154 (19)	1.121 (10)	1.1184 (14)	1.1241 (14)	1.0908 (19)	1.0899 (19)	1.081 (21)	1.0575 (22)	1.0717 (21)	1.0525 (21)	1.0478 (23)	1.0557 (21)	1.0537 (22)	1.0533 (21)
S15	1.0895 (25)	1.0979 (22)	1.0711 (26)	1.0747 (26)	1.0612 (26)	1.0551 (26)	1.0509 (25)	1.084 (23)	1.0449 (25)	1.0526 (26)	1.0934 (20)	1.1056 (20)	1.1294 (8)	1.1131 (18)	1.1084 (18)	1.0913 (18)	1.0822 (21)	1.0743 (22)	1.0823 (20)	1.0837 (17)	1.0812 (19)	1.0765 (19)	1.0629 (19)	1.0572 (20)	1.0577 (20)
S16	1.1389 (16)	1.1624 (15)	1.1378 (18)	1.1325 (18)	1.1322 (19)	1.129 (17)	1.1353 (14)	1.1595 (16)	1.1205 (17)	1.1158 (19)	1.1305 (19)	1.1471 (14)	1.1336 (7)	1.1272 (12)	1.1314 (11)	1.1298 (7)	1.1177 (12)	1.1185 (10)	1.1123 (11)	1.1137 (10)	1.1068 (12)	1.1184 (10)	1.1315 (8)	1.1203 (10)	1.1128 (12)
S17	1.0711 (26)	1.0393 (25)	1.0732 (25)	1.0752 (25)	1.0729 (25)	1.057 (25)	1.0329 (26)	1.0332 (26)	1.0281 (27)	1.0334 (27)	0.989 (30)	1.0044 (28)	0.7681 (35)	0.7249 (35)	0.9363 (33)	0.8649 (33)	0.9109 (32)	0.8661 (35)	0.8455 (35)	0.8482 (36)	0.9033 (34)	0.8546 (36)	0.8845 (34)	0.896 (34)	0.856 (34)
S18	1.1092 (23)	1.1126 (21)	1.0981 (23)	1.0962 (22)	1.0847 (24)	1.0784 (24)	1.0716 (24)	1.105 (22)	1.0816 (23)	1.073 (23)	1.0893 (21)	1.1451 (16)	1.1407 (5)	1.1568 (7)	1.1431 (9)	1.1224 (10)	1.1141 (15)	1.1141 (13)	1.0989 (13)	1.0975 (14)	1.1016 (13)	1.1036 (15)	1.1099 (15)	1.1048 (15)	1.1025 (14)
S19	0.9171 (29)	0.8834 (31)	0.8718 (32)	0.8571 (31)	0.8814 (31)	0.8466 (32)	0.8762 (31)	0.9014 (30)	0.9218 (31)	0.8902 (31)	0.893 (31)	0.9321 (30)	0.9756 (31)	0.9695 (29)	0.958 (29)	0.9662 (29)	0.9702 (28)	0.9567 (30)	0.9649 (29)	0.9214 (33)	0.9319 (31)	0.9471 (30)	0.9709 (30)	1.006 (26)	0.9869 (28)

Source: Results obtained from the model developed in Chapter 4.

Table VI.16 (con'd)

Sec	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
S20	0.8219 (31)	0.8847 (30)	0.8772 (31)	0.8605 (30)	0.8185 (32)	0.8671 (31)	0.8632 (32)	0.7878 (32)	0.8063 (33)	0.7744 (34)	0.732 (33)	0.655 (34)	1.0244 (25)	0.9535 (30)	0.9959 (27)	0.9655 (30)	0.949 (29)	0.9842 (27)	0.9437 (31)	0.9415 (30)	0.9096 (33)	0.9133 (33)	0.9215 (33)	0.9057 (33)	0.9377 (33)
S21	1.2079 (4)	1.2224 (5)	1.197 (6)	1.1995 (6)	1.1937 (5)	1.189 (7)	1.1726 (6)	1.2076 (7)	1.1697 (8)	1.1718 (9)	1.1775 (10)	1.177 (9)	1.0945 (19)	1.153 (8)	1.1295 (12)	1.1223 (11)	1.1182 (11)	1.1111 (14)	1.1146 (10)	1.1026 (11)	1.1169 (8)	1.122 (8)	1.1436 (5)	1.143 (5)	1.1388 (6)
S22	1.1224 (19)	1.1864 (12)	1.1398 (16)	1.1645 (11)	1.1492 (13)	1.159 (11)	1.148 (13)	1.1834 (11)	1.1813 (6)	1.1786 (7)	1.214 (2)	1.2083 (3)	1.0869 (21)	1.1673 (4)	1.1503 (5)	1.1491 (4)	1.1496 (4)	1.1512 (3)	1.1606 (2)	1.1383 (4)	1.1617 (2)	1.1662 (2)	1.1845 (1)	1.1807 (1)	1.1789 (2)
S23	1.2401 (3)	1.2461 (3)	1.221 (4)	1.2202 (3)	1.205 (4)	1.204 (3)	1.1899 (4)	1.2207 (4)	1.184 (4)	1.1876 (5)	1.2108 (4)	1.1899 (5)	1.1018 (16)	1.1701 (3)	1.1466 (7)	1.0959 (16)	1.1105 (16)	1.1073 (16)	1.0923 (16)	1.0659 (22)	1.1271 (7)	1.1341 (6)	1.138 (7)	1.1405 (6)	1.1328 (7)
S24	1.1751 (10)	1.2091 (8)	1.1865 (9)	1.1981 (7)	1.1903 (7)	1.1923 (6)	1.1826 (5)	1.2185 (5)	1.1825 (5)	1.1856 (6)	1.203 (5)	1.1754 (10)	1.0978 (17)	1.1583 (6)	1.1457 (8)	1.1364 (5)	1.1358 (6)	1.1269 (6)	1.1345 (5)	1.1342 (5)	1.1539 (4)	1.158 (3)	1.1702 (2)	1.1683 (2)	1.1665 (3)
S25	0.8465 (30)	0.9226 (29)	0.9157 (30)	0.989 (29)	0.9597 (29)	0.9929 (27)	1.0027 (27)	1.0263 (28)	1.0306 (26)	1.0536 (25)	1.0791 (24)	0.9188 (31)	0.7686 (34)	1.0134 (24)	0.4306 (38)	0.9991 (26)	1.0632 (23)	1.0631 (23)	1.0927 (15)	1.0973 (15)	1.1457 (5)	1.1512 (4)	1.1656 (3)	1.1624 (4)	1.16 (4)
S26	0.0447 (39)	0.0386 (39)	0.0175 (39)	0.0183 (39)	0.0174 (39)	0.0157 (39)	0.016 (39)	0.0156 (39)	0.0173 (39)	0.0152 (39)	0.0161 (39)	0.0154 (39)	0.0082 (39)	0.0112 (39)	0.0089 (39)	0.0073 (39)	0.0043 (39)	0.0039 (39)	0.004 (39)	0.0033 (39)	0.075 (39)	0.0041 (39)	0.0032 (39)	0.0526 (39)	0.0311 (39)
S27	1.1972 (7)	1.2143 (7)	1.1889 (8)	1.1941 (8)	1.187 (8)	1.1835 (9)	1.168 (9)	1.2023 (9)	1.1667 (10)	1.1697 (10)	1.176 (11)	1.1753 (11)	1.0872 (20)	1.1512 (10)	1.1275 (13)	1.1173 (12)	1.1144 (14)	1.1077 (15)	1.1112 (12)	1.0983 (13)	1.1147 (9)	1.119 (9)	1.1386 (6)	1.1375 (8)	1.1328 (8)
S28	1.1325 (17)	1.1393 (18)	1.1196 (19)	1.1937 (9)	1.191 (6)	1.2011 (4)	1.2009 (3)	1.2183 (6)	1.2111 (3)	1.2174 (3)	1.2134 (3)	1.2232 (2)	1.147 (4)	1.1529 (9)	1.1946 (2)	1.1692 (2)	1.1645 (2)	1.1696 (2)	1.1779 (1)	1.1541 (2)	1.1788 (1)	1.1491 (5)	1.1183 (12)	1.1197 (11)	1.1218 (9)
S29	1.1609 (12)	1.1802 (13)	1.1521 (12)	1.1521 (14)	1.1454 (15)	1.1404 (14)	1.1335 (16)	1.1789 (12)	1.1295 (14)	1.1658 (11)	1.1874 (7)	1.1505 (13)	1.1101 (13)	1.0692 (20)	1.0943 (19)	1.1097 (14)	1.1158 (13)	1.1152 (12)	1.118 (8)	1.1138 (9)	1.0831 (18)	1.0978 (16)	1.12 (11)	1.1168 (12)	1.1208 (11)
S30	1.1105 (21)	1.1297 (19)	1.0999 (22)	1.1024 (21)	1.0956 (22)	1.0917 (22)	1.0895 (21)	1.1378 (18)	1.0857 (20)	1.1334 (15)	1.1599 (15)	1.0945 (22)	1.0484 (24)	0.9322 (32)	1.0039 (26)	1.0733 (21)	1.0859 (20)	1.0817 (20)	1.0889 (18)	1.0828 (19)	1.038 (22)	1.0585 (21)	1.088 (16)	1.0759 (18)	1.076 (19)
S31	1.1203 (20)	1.1728 (14)	1.1504 (14)	1.1526 (13)	1.1458 (14)	1.1385 (15)	1.1345 (15)	1.1668 (14)	1.1298 (13)	1.156 (12)	1.1795 (9)	1.1361 (18)	1.1084 (14)	1.0425 (22)	1.0774 (22)	1.1131 (13)	1.1232 (10)	1.12 (9)	1.1166 (9)	1.119 (8)	1.0984 (14)	1.1058 (14)	1.115 (13)	1.1089 (14)	1.1123 (13)
S32	1.1234 (18)	1.1407 (17)	1.1102 (20)	1.1112 (20)	1.1031 (20)	1.0992 (21)	1.0978 (19)	1.1452 (17)	1.0937 (19)	1.1415 (14)	1.1668 (13)	1.0991 (21)	1.0605 (23)	0.9363 (31)	1.0075 (24)	1.0722 (22)	1.0799 (22)	1.083 (19)	1.0886 (19)	1.0805 (20)	1.0348 (23)	1.058 (22)	1.0655 (18)	1.0776 (17)	1.0791 (17)
S33	0.6747 (34)	0.5513 (35)	0.561 (36)	0.5635 (36)	0.5369 (36)	0.5699 (36)	0.5891 (36)	0.5483 (35)	0.5424 (37)	0.4748 (37)	0.5247 (36)	0.5129 (36)	1.0025 (27)	0.9813 (27)	0.9547 (30)	0.75 (36)	0.6922 (36)	0.7388 (36)	0.8952 (33)	0.8897 (34)	0.892 (36)	0.8553 (35)	0.817 (36)	0.8306 (36)	0.8399 (36)
S34	1.0142 (27)	1.0862 (23)	0.9194 (29)	0.5946 (35)	0.9205 (30)	0.8873 (30)	0.9116 (30)	1.1148 (20)	0.9301 (30)	0.9002 (30)	1.0803 (23)	0.9514 (29)	1.0042 (26)	1.0414 (23)	0.9428 (32)	0.9385 (31)	0.9393 (30)	0.9339 (31)	0.939 (32)	0.9356 (31)	0.9393 (30)	0.9451 (32)	0.9484 (32)	0.9509 (31)	0.9479 (32)
S35	1.1061 (24)	1.115 (20)	1.0763 (24)	1.0843 (24)	1.0879 (23)	1.1036 (20)	1.0913 (20)	1.1122 (21)	1.0703 (24)	1.0822 (22)	1.0435 (26)	1.0476 (25)	1.0974 (18)	1.0939 (19)	1.0544 (23)	1.0509 (24)	1.0548 (24)	1.0562 (24)	1.0515 (23)	1.0558 (23)	1.0335 (24)	1.0435 (24)	1.0374 (24)	1.032 (23)	1.0244 (23)
S36	0.8139 (32)	1.0163 (27)	0.9922 (27)	0.9946 (27)	0.9843 (27)	0.9788 (28)	0.9781 (28)	1.0293 (27)	0.9925 (28)	0.989 (28)	0.9977 (29)	1.0218 (26)	0.9932 (30)	1.0099 (25)	0.9868 (28)	0.9665 (28)	0.9748 (27)	0.972 (29)	0.9509 (30)	0.9576 (29)	0.9592 (28)	0.9677 (29)	0.9708 (31)	0.9693 (29)	0.9635 (30)
S37	0.5506 (37)	0.5125 (37)	0.4317 (37)	0.5124 (37)	0.5028 (37)	0.5791 (35)	0.6587 (35)	0.6711 (34)	0.649 (36)	0.6112 (36)	0.4586 (37)	0.4984 (37)	0.6669 (37)	0.7015 (37)	0.666 (36)	0.6438 (37)	0.6547 (37)	0.6571 (37)	0.7018 (37)	0.6843 (37)	0.6821 (37)	0.6892 (37)	0.7184 (37)	0.7071 (37)	0.7251 (37)
S38	0.2715 (38)	0.2676 (38)	0.2635 (38)	0.3302 (38)	0.3149 (38)	0.3678 (38)	0.3752 (38)	0.2886 (38)	0.2823 (38)	0.2626 (38)	0.3863 (38)	0.4555 (38)	0.576 (38)	0.5508 (38)	0.5009 (37)	0.5302 (38)	0.5099 (38)	0.5267 (38)	0.4364 (38)	0.4411 (38)	0.4343 (38)	0.3988 (38)	0.4054 (38)	0.3937 (38)	0.3867 (38)
S39	0.5831 (35)	0.8268 (32)	0.7965 (33)	0.7983 (33)	0.8109 (33)	0.8147 (33)	0.8212 (33)	0.8106 (31)	0.7947 (34)	0.8448 (33)	0.7524 (32)	0.8204 (32)	0.8597 (32)	0.8172 (34)	0.82 (35)	0.8552 (35)	0.8714 (34)	0.8964 (32)	0.9972 (27)	1.0009 (28)	0.997 (27)	0.9906 (28)	1.003 (26)	0.9959 (27)	0.9879 (27)

Source: Results obtained from the model developed in Chapter 4.

Table VI.17: Backward Entropy Indices (BL-EI), 1975-2015

Sectors / Year	Sec	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
Ag., Forest & Fish'g	S01	1.4716 (8)	1.7554 (9)	1.8977 (10)	1.912 (10)	1.6733 (10)	0.0794 (25)	0.087 (37)	1.4306 (3)	0.109 (38)	0.9729 (11)	1.1828 (10)	0.4925 (14)	1.6951 (9)	1.9887 (7)	1.5963 (10)	1.4084 (14)	1.5347 (11)	1.3315 (14)	1.1841 (14)	1.1604 (16)	1.4165 (10)	1.2101 (14)	1.3246 (12)	1.3448 (12)	1.3955 (12)
Coal	S02	1.2042 (21)	0.8182 (22)	1.0289 (17)	0.633 (22)	0.972 (20)	0.3929 (11)	0.7244 (10)	1.305 (19)	0.2547 (20)	0.2675 (20)	0.3193 (21)	0.4592 (17)	1.3849 (12)	1.3752 (11)	1.7148 (8)	1.9779 (6)	1.5664 (10)	1.3765 (11)	1.9457 (9)	1.8097 (10)	2.0037 (9)	1.9832 (2)	2.2024 (8)	2.2006 (8)	2.1375 (8)
Crude Oil	S03	0.559 (31)	0.0347 (36)	0.0206 (36)	0.1793 (32)	0.1318 (34)	0.0628 (37)	0.1214 (23)	0.4348 (33)	0.2627 (19)	0.2088 (21)	0.2249 (27)	0.1773 (25)	0.1576 (30)	0.1512 (30)	0.1737 (28)	0.2407 (29)	0.2232 (27)	0.207 (29)	0.2447 (29)	0.1859 (32)	0.2081 (27)	1.461 (10)	0.3054 (26)	0.3081 (26)	0.2801 (26)
Nat Gas	S04	0.1714 (34)	0.1389 (32)	0.0951 (34)	0.0786 (35)	0.2638 (31)	0.1305 (17)	0.2046 (14)	0.4174 (34)	0.1389 (27)	0.0845 (36)	0.3132 (22)	0.2113 (24)	0.1115 (34)	0.1456 (31)	0.1989 (27)	0.4627 (24)	0.2295 (26)	0.293 (25)	0.6663 (20)	0.6666 (19)	0.3264 (25)	1.6548 (8)	0.3072 (25)	0.4795 (22)	0.2886 (25)
Explor. Mining	S05	0.7008 (28)	0.1752 (31)	0.2372 (30)	0.5467 (24)	1.4055 (17)	0.0659 (36)	0.0944 (32)	0.9434 (24)	0.1182 (33)	0.1001 (30)	0.1055 (33)	0.0998 (33)	0.1392 (32)	0.1957 (27)	0.1716 (29)	0.1983 (31)	0.1991 (28)	0.2679 (26)	0.3582 (25)	0.6286 (21)	0.4529 (22)	1.0548 (17)	0.5669 (22)	0.6154 (21)	0.5426 (21)
Oth. Mining	S06	1.4591 (12)	1.4254 (15)	1.3732 (15)	1.3213 (13)	1.5509 (13)	0.0963 (21)	0.1598 (19)	1.3908 (13)	0.4565 (14)	0.4285 (16)	1.1371 (12)	0.8837 (10)	1.1125 (15)	1.2338 (12)	1.2738 (13)	1.1676 (16)	1.1956 (15)	1.6282 (10)	2.3214 (7)	2.4411 (3)	2.6538 (4)	1.9023 (4)	1.9564 (10)	2.1449 (9)	1.7856 (10)
Food & Bev	S07	1.4782 (5)	1.9 (2)	2.1032 (4)	2.1916 (5)	1.7536 (2)	0.72 (8)	1.763 (4)	1.4458 (1)	2.1591 (3)	1.8279 (4)	2.3824 (3)	1.8878 (4)	2.3829 (4)	2.7541 (2)	2.6405 (3)	2.407 (4)	2.9653 (2)	2.7354 (3)	2.4306 (4)	2.0031 (8)	2.4824 (7)	1.4477 (11)	2.7842 (3)	2.695 (3)	2.7764 (3)
Textile & Clothing	S08	1.4831 (3)	1.7463 (10)	1.8858 (11)	1.6373 (11)	1.7025 (8)	0.0602 (38)	0.0828 (38)	1.4295 (4)	0.4339 (15)	0.3157 (19)	1.1532 (11)	0.5749 (12)	1.6009 (11)	1.6364 (10)	1.2955 (12)	1.0188 (17)	0.9852 (17)	0.9261 (18)	0.8593 (19)	0.6537 (20)	0.8072 (18)	0.9883 (20)	0.5846 (21)	0.4438 (23)	0.4647 (22)
Pulp & Paper Mfg	S09	0.6642 (29)	1 (20)	0.1628 (32)	0.0565 (36)	0.1518 (33)	0.0681 (33)	0.0914 (36)	1.2761 (20)	0.1198 (30)	0.0902 (34)	0.1555 (30)	0.1061 (30)	0.3458 (27)	0.0186 (38)	0.0475 (36)	0.0158 (38)	0.0605 (35)	0.0755 (34)	0.08 (33)	0.0672 (36)	0.1072 (33)	0.1513 (34)	0.0615 (33)	0.0956 (32)	0.0713 (34)
Wood Prod.	S10	1.278 (19)	1.3898 (17)	0.5305 (24)	0.3678 (27)	0.8283 (24)	0.0688 (31)	0.096 (31)	1.1837 (23)	0.1449 (25)	0.128 (26)	0.2324 (26)	0.175 (26)	0.2759 (28)	0.2703 (25)	0.5239 (22)	0.2482 (28)	0.2995 (25)	0.208 (27)	0.5574 (22)	0.3818 (25)	0.2903 (26)	0.3882 (31)	0.0747 (31)	0.0753 (34)	0.1158 (31)
Print & Pub.	S11	1.3863 (17)	1.2901 (18)	1.0142 (18)	0.9472 (18)	1.2578 (18)	0.0816 (24)	0.135 (21)	1.3424 (16)	0.3245 (17)	0.4455 (15)	0.6027 (17)	0.4851 (16)	0.5571 (22)	0.5257 (21)	0.4443 (24)	0.5674 (21)	0.8739 (18)	0.9054 (19)	1.1948 (13)	1.3105 (15)	0.6089 (20)	1.0324 (18)	0.7101 (19)	0.7589 (17)	0.7972 (16)
Petro. Prod. Mfg	S12	1.2522 (20)	1.1659 (19)	0.9429 (20)	1.0817 (17)	1.1527 (19)	0.7924 (7)	1.141 (5)	1.3322 (17)	1.4942 (4)	1.2155 (7)	1.4568 (7)	1.3422 (8)	0.6724 (19)	1.0442 (16)	0.8146 (18)	1.7206 (11)	0.8448 (20)	0.8651 (20)	1.1268 (16)	1.4409 (14)	1.1917 (14)	0.973 (22)	0.7768 (15)	0.7866 (15)	0.8335 (14)
Coal Prod. Mfg	S13	0.0527 (36)	0.0114 (37)	0.0061 (37)	0.0055 (37)	0.012 (37)	0.07 (28)	0.0987 (28)	0.055 (37)	0.1194 (31)	0.089 (35)	0.1015 (34)	0.1058 (31)	0.0319 (37)	0.0756 (34)	0.0319 (38)	0.0557 (36)	0.0365 (37)	0.0257 (37)	0.0255 (38)	0.017 (38)	0.0465 (38)	0.0247 (37)	0.0278 (37)	0.0308 (37)	0.0122 (38)
Chem. Prod.	S14	1.4654 (9)	1.7214 (12)	1.4568 (13)	1.3078 (14)	1.4595 (15)	0.0776 (26)	0.1033 (27)	1.4072 (10)	0.1099 (37)	0.1475 (25)	1.0431 (13)	0.3737 (20)	1.0628 (16)	1.0499 (15)	0.654 (21)	1.0059 (18)	1.2621 (13)	1.2284 (15)	1.7116 (10)	1.5985 (12)	1.4042 (11)	1.3088 (12)	1.6393 (11)	1.5539 (11)	1.6445 (11)
Non-Metal & Min. Prod.	S15	1.0027 (23)	0.5618 (26)	0.4929 (26)	0.4296 (26)	0.6834 (26)	0.0819 (23)	0.1563 (20)	0.7304 (28)	0.1812 (23)	0.204 (22)	0.2725 (24)	0.2748 (22)	0.1811 (29)	0.2364 (26)	0.1476 (30)	0.1633 (32)	0.198 (29)	0.0975 (33)	0.3488 (27)	0.2755 (31)	0.1686 (30)	0.0557 (36)	0.0033 (38)	0.005 (38)	0.0601 (37)
Iron & Steel Mfg	S16	1.3302 (18)	0.9051 (21)	0.772 (21)	0.7096 (21)	0.9244 (22)	0.116 (19)	0.1065 (26)	0.8192 (26)	0.2901 (18)	0.4837 (14)	0.3947 (19)	0.4239 (18)	0.5833 (21)	0.5757 (20)	0.6554 (20)	0.385 (25)	0.5784 (23)	0.494 (23)	0.6474 (21)	0.5999 (22)	0.4695 (21)	0.2463 (32)	0.0605 (36)	0.1326 (30)	0.2481 (28)
Non-Ferrous Mfg	S17	1.4473 (15)	1.4367 (14)	1.386 (14)	1.2718 (15)	1.4636 (14)	0.6003 (9)	0.9814 (6)	1.3707 (15)	1.4562 (5)	1.7666 (5)	2.3492 (4)	1.8022 (5)	1.7519 (7)	1.7723 (8)	1.678 (9)	1.8878 (9)	1.9196 (8)	1.8308 (7)	2.4048 (5)	2.5306 (1)	2.893 (2)	2.0943 (1)	2.2804 (7)	2.2788 (6)	2.2876 (6)
Other Metal Prod.	S18	1.4183 (16)	1.39 (16)	1.2696 (16)	1.2322 (16)	1.4157 (16)	0.0841 (22)	0.5205 (11)	1.3179 (18)	0.8369 (9)	1.0049 (10)	0.8825 (16)	0.5096 (13)	0.4101 (25)	0.3841 (23)	0.4981 (23)	0.5431 (23)	0.7012 (22)	0.6629 (22)	0.9942 (17)	0.9066 (17)	0.751 (19)	0.7779 (27)	0.6306 (20)	0.7653 (16)	0.7023 (19)
Mach. & Transp Prod.	S19	1.4577 (13)	1.8313 (5)	2.0353 (7)	2.1196 (8)	1.7106 (6)	6.4624 (1)	0.1836 (17)	1.4078 (9)	0.5252 (13)	1.5233 (6)	2.2552 (5)	1.504 (6)	2.0377 (6)	2.3679 (5)	1.7462 (7)	2.0158 (5)	2.7553 (4)	2.6554 (4)	2.3824 (6)	2.1385 (7)	2.5572 (6)	1.1344 (15)	2.3657 (6)	2.2107 (7)	2.1653 (7)

Source: Results obtained from the model developed in Chapter 4.

Table VI.17 (cont'd)

Sector	Sec	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
Mfg Oth.	S20	1.4817 (4)	1.553 (13)	1.5513 (12)	1.4021 (12)	1.607 (12)	0.0693 (30)	0.0962 (30)	1.4107 (8)	0.6705 (10)	1.1279 (8)	1.8926 (6)	1.4851 (7)	1.3483 (13)	1.6773 (9)	1.201 (14)	1.516 (13)	1.8059 (9)	1.3628 (12)	0.9898 (18)	0.8473 (18)	0.9468 (17)	0.9878 (21)	0.7476 (16)	0.63 (20)	0.6236 (20)
Elec. Gen. Coal	S21	1.0919 (22)	0.79 (23)	0.9512 (19)	0.9197 (19)	0.9641 (21)	0.2982 (12)	0.9305 (7)	1.2258 (21)	1.0828 (7)	0.8339 (12)	1.2235 (9)	0.4881 (15)	1.6919 (10)	0.7437 (18)	1.0297 (15)	1.9301 (8)	0.8508 (19)	1.1483 (17)	1.4436 (12)	1.7322 (11)	0.962 (16)	1.7941 (7)	0.725 (18)	0.6994 (19)	0.7675 (17)
Elec. Gen. Oil	S22	0.1803 (33)	0.0779 (34)	0.0955 (33)	0.0808 (34)	0.117 (36)	0.0663 (34)	0.0917 (35)	0.2397 (35)	0.1164 (34)	0.0996 (31)	0.0926 (36)	0.0836 (38)	0.1219 (33)	0.0495 (36)	0.0522 (35)	0.1245 (33)	0.044 (36)	0.0553 (36)	0.0541 (36)	0.1027 (34)	0.0689 (36)	0.171 (33)	0.0726 (32)	0.0849 (33)	0.0811 (33)
Elec. Gen. Nat. Gas	S23	0.1391 (35)	0.1163 (33)	0.1662 (31)	0.1881 (31)	0.2106 (32)	0.1544 (15)	0.3545 (12)	0.5432 (30)	0.5392 (12)	0.364 (17)	0.3609 (20)	0.2165 (23)	0.4387 (23)	0.1751 (28)	0.226 (26)	0.5915 (20)	0.3066 (24)	0.3625 (24)	0.3544 (26)	0.4841 (24)	0.396 (24)	0.9059 (26)	0.36 (23)	0.3559 (24)	0.3958 (23)
Elec. Gen. Hydro	S24	0.4797 (32)	0.229 (30)	0.2706 (29)	0.2336 (30)	0.2893 (30)	0.077 (27)	0.2029 (15)	0.5163 (31)	0.2398 (21)	0.1884 (24)	0.2864 (23)	0.1099 (29)	0.3505 (26)	0.1206 (33)	0.1341 (32)	0.3715 (26)	0.1146 (32)	0.1713 (30)	0.2084 (30)	0.2796 (29)	0.1359 (31)	0.519 (30)	0.1822 (29)	0.1885 (29)	0.1972 (30)
Elec. Gen. Renew.	S25	0.5609 (30)	0.2977 (29)	0.3439 (28)	0.3277 (29)	0.4126 (29)	0.0662 (35)	0.093 (34)	0.7247 (29)	0.1138 (36)	0.1174 (27)	0.1837 (28)	0.0989 (35)	0.4316 (24)	0.1359 (32)	0.1326 (33)	0.5584 (22)	0.1286 (31)	0.2074 (28)	0.2592 (28)	0.3604 (26)	0.1717 (29)	0.6491 (29)	0.2512 (27)	0.2713 (27)	0.2697 (27)
Elec. Gen Oth. Fuel	S26	0.0022 (38)	0.0009 (38)	0.0011 (38)	0.0011 (38)	0.0015 (38)	0.0682 (32)	0.094 (33)	0.0038 (38)	0.1156 (35)	0.0977 (33)	0.0949 (35)	0.0895 (37)	0.0279 (38)	0.0392 (37)	0.0388 (37)	0.0321 (37)	0.0363 (38)	0.0201 (38)	0.0313 (37)	0.0276 (37)	0.0621 (37)	0.0233 (38)	0.061 (34)	0.0611 (35)	0.0659 (35)
Elec. T&D	S27	0.8643 (25)	0.5876 (25)	0.7137 (22)	0.7214 (20)	0.8355 (23)	0.2162 (13)	0.8508 (8)	1.1997 (22)	1.1704 (6)	1.008 (9)	1.3802 (8)	0.4067 (19)	1.7341 (8)	0.686 (19)	1.0154 (16)	1.9623 (7)	1.0299 (16)	1.3351 (13)	1.606 (11)	1.9293 (9)	1.2941 (13)	1.9524 (3)	1.2981 (13)	1.3091 (13)	1.3695 (13)
Gas Supply	S28	0.8337 (26)	0.4716 (28)	0.4309 (27)	0.3674 (28)	0.5383 (28)	0.1663 (14)	0.2879 (13)	0.9424 (25)	0.3552 (16)	0.3584 (18)	0.4931 (18)	0.1245 (28)	0.053 (36)	0.0634 (35)	0.0593 (34)	0.3431 (27)	0.0615 (34)	0.1515 (31)	0.0599 (35)	0.149 (33)	0.0931 (35)	0.9232 (25)	0.0609 (35)	0.0605 (36)	0.0612 (36)
Water, Upstrm	S29	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0.0557 (39)	0.0661 (39)	0 (39)	0.0626 (39)	0.0397 (39)	0.0252 (39)	0.0316 (39)	0.0014 (39)	0.0017 (39)	0.0017 (39)	0.0032 (39)	0.0033 (39)	0.0045 (39)	0.0015 (39)	0.0014 (39)	0.0037 (39)	0.0041 (39)	0.0033 (39)	0.0033 (39)	0.0036 (39)
Water, Urb	S30	0.9751 (24)	0.5474 (27)	0.5129 (25)	0.4989 (25)	0.5886 (27)	0.5267 (10)	0.8182 (9)	0.453 (32)	1.005 (8)	0.1986 (23)	0.2355 (25)	0.9901 (9)	0.6326 (20)	1.2217 (13)	0.8395 (17)	1.3928 (15)	0.7306 (21)	0.8565 (21)	1.1328 (15)	1.4685 (13)	1.4013 (12)	1.8545 (5)	0.7368 (17)	0.722 (18)	0.7449 (18)
Water, Rurl	S31	0.0312 (37)	0.0677 (35)	0.0735 (35)	0.0818 (33)	0.1278 (35)	0.1199 (18)	0.1768 (18)	0.0743 (36)	0.1929 (22)	0.066 (38)	0.0756 (38)	0.2922 (21)	0.1531 (31)	0.2704 (24)	0.2368 (25)	0.0806 (35)	0.0883 (33)	0.0689 (35)	0.0737 (34)	0.0675 (35)	0.1038 (34)	0.0649 (35)	0.1407 (30)	0.1032 (31)	0.1031 (32)
Water, Sev.	S32	0.7594 (27)	0.7098 (24)	0.6134 (23)	0.5883 (23)	0.7979 (25)	0.0696 (29)	0.0973 (29)	0.7495 (27)	0.119 (32)	0.0983 (32)	0.1106 (31)	0.0977 (36)	0.0781 (35)	0.173 (29)	0.1369 (31)	0.1004 (34)	0.1466 (30)	0.1367 (32)	0.1247 (32)	0.3154 (28)	0.1837 (28)	0.9407 (24)	0.3161 (24)	0.3243 (25)	0.3171 (24)
Const.	S33	1.4719 (7)	1.9125 (1)	2.1917 (1)	2.3764 (1)	1.7563 (1)	6.4624 (2)	9.1434 (1)	1.4311 (2)	0.6229 (11)	3.3133 (3)	3.5902 (2)	2.6383 (3)	2.6045 (2)	2.2586 (6)	2.4803 (5)	2.4995 (3)	1.9504 (7)	1.6549 (9)	2.2445 (8)	2.1684 (5)	2.6081 (5)	1.6069 (9)	0.2023 (28)	0.2585 (28)	0.2258 (29)
Wsale&Retail	S34	1.4539 (14)	1.7882 (8)	2.0618 (5)	2.2666 (3)	1.6869 (9)	6.4624 (3)	9.1434 (2)	1.3942 (12)	11.2466 (1)	9.5082 (1)	1.0114 (14)	9.4688 (1)	2.2122 (5)	2.5192 (3)	2.6882 (2)	2.5443 (2)	3.5205 (1)	3.4281 (1)	2.7584 (1)	2.3902 (4)	3.1184 (1)	1.06 (16)	3.7888 (1)	3.7262 (1)	3.9178 (1)
Trsprt & Storage Serv.	S35	1.4627 (11)	1.8204 (6)	2.0437 (6)	2.1407 (6)	1.7047 (7)	6.4624 (4)	0.1891 (16)	1.4038 (11)	0.1691 (24)	0.4908 (13)	0.973 (15)	0.6761 (11)	1.3414 (14)	0.9754 (17)	1.7709 (6)	1.8068 (10)	2.2838 (5)	2.3327 (5)	2.6572 (2)	2.5072 (2)	2.0797 (8)	1.2519 (13)	2.0375 (9)	2.1073 (10)	1.8564 (9)
Comm, Fin. & Bus. Serv.	S36	1.465 (10)	1.7394 (11)	1.9615 (9)	2.0825 (9)	1.6516 (11)	6.4624 (5)	9.1434 (3)	1.3815 (14)	11.2466 (2)	9.5082 (2)	10.039 (1)	9.4688 (2)	5.0421 (1)	6.0868 (1)	6.0286 (1)	0.2084 (30)	1.3595 (12)	1.7294 (8)	0.1576 (31)	0.3549 (27)	0.1105 (32)	0.6505 (28)	2.4264 (5)	2.3546 (5)	2.3098 (5)
Govt Admin	S37	1.473 (6)	1.8873 (4)	2.1399 (3)	2.2666 (4)	1.746 (3)	0.0999 (20)	0.1176 (25)	1.4261 (5)	0.1306 (28)	0.0744 (37)	0.0833 (37)	0.1428 (27)	2.5314 (3)	2.4126 (4)	2.5217 (4)	2.8335 (1)	1.2015 (14)	1.1565 (16)	0.4034 (24)	0.2757 (30)	0.4223 (23)	1.7992 (6)	1.0091 (14)	0.8155 (14)	0.8068 (15)
Edu, Hlth & Cmty Serv.	S38	1.4981 (1)	1.8939 (3)	2.1488 (2)	2.3038 (2)	1.7352 (4)	0.1414 (16)	0.12 (24)	1.4244 (6)	0.1243 (29)	0.1002 (29)	0.1776 (29)	0.0993 (34)	1.0133 (17)	1.1561 (14)	1.311 (11)	1.6591 (12)	2.8032 (3)	2.75 (2)	2.4557 (3)	2.147 (6)	2.8621 (3)	0.9943 (19)	3.4782 (2)	3.5544 (2)	3.7648 (2)
Oth. Comml Serv.	S39	1.4938 (2)	1.8119 (7)	2.0176 (8)	2.1233 (7)	1.7161 (5)	0.8438 (6)	0.1322 (22)	1.416 (7)	0.1416 (26)	0.1031 (28)	0.1062 (32)	0.1024 (32)	0.6974 (18)	0.4325 (22)	0.7886 (19)	0.9522 (19)	2.1054 (6)	2.2534 (6)	0.4998 (23)	0.5756 (23)	1.1368 (15)	0.958 (23)	2.44 (4)	2.4447 (4)	2.5097 (4)

Source: Results obtained from the model developed in Chapter 4.

Table VI.18: Forward Entropy Indices (FL-EI), 1975-2015

Sectors / Year	Sec	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
Ag., Forest & Fish'g	S01	1.9387 (4)	2.1844 (5)	2.2801 (4)	2.4174 (4)	1.926 (6)	1.9765 (5)	1.913 (6)	2.0746 (4)	2.3232 (2)	2.0316 (4)	2.1771 (5)	2.2469 (3)	2.0228 (5)	2.0572 (4)	1.9125 (4)	2.1758 (4)	2.0111 (4)	1.9246 (5)	1.9222 (4)	1.9402 (4)	2.1192 (3)	1.9556 (4)	1.6125 (5)	1.8748 (4)	1.3817 (4)
Coal	S02	1.8371 (5)	2.2791 (4)	1.9553 (6)	2.8922 (3)	2.375 (3)	2.1413 (4)	2.0385 (4)	2.1793 (3)	2.1927 (4)	1.5791 (9)	1.7686 (7)	2.1492 (4)	0.5168 (23)	0.7703 (19)	1.2272 (14)	1.0978 (17)	0.8112 (19)	1.2009 (14)	1.12 (20)	1.1199 (18)	1.5673 (11)	1.0397 (20)	0.7661 (23)	0.7132 (24)	1.0135 (26)
Crude Oil	S03	0.855 (19)	0.8854 (12)	1.4892 (7)	1.2885 (10)	0.9897 (16)	1.2613 (11)	1.2499 (11)	1.3262 (11)	1.2462 (12)	1.1638 (15)	1.292 (10)	1.2819 (10)	1.0844 (16)	1.2768 (12)	0.9613 (19)	1.2995 (12)	1.5866 (10)	1.933 (4)	1.7706 (8)	1.782 (8)	1.692 (9)	1.3598 (11)	1.4402 (12)	1.5142 (12)	1.4071 (3)
Nat Gas	S04	1.322 (11)	1.5537 (6)	0.3982 (13)	0.7413 (15)	1.2544 (13)	0.6348 (17)	0.6964 (18)	1.4996 (10)	1.3667 (10)	1.2542 (13)	1.029 (14)	0.9653 (16)	1.1708 (15)	1.0465 (17)	0.9798 (17)	1.1786 (15)	0.94 (18)	0.9381 (20)	0.8663 (21)	0.9611 (21)	1.415 (13)	1.2914 (12)	1.2409 (15)	1.1398 (16)	1.3439 (5)
Explor. Mining	S05	0.3225 (27)	0.4258 (15)	0.5749 (12)	0.1974 (25)	0.5057 (21)	0.5078 (22)	0.7568 (17)	1.0818 (14)	0.5803 (22)	0.5387 (21)	0.4356 (26)	0.7622 (19)	0.8242 (19)	0.9594 (18)	0.9725 (18)	1.0253 (19)	1.0421 (17)	1.128 (17)	1.1243 (19)	1.1034 (20)	1.0041 (20)	1.1134 (16)	0.9006 (22)	1.1179 (17)	1.3287 (6)
Oth. Mining	S06	2.5452 (2)	2.3378 (3)	2.1844 (5)	3.2225 (2)	2.4027 (2)	1.9666 (6)	2.0078 (5)	2.0605 (5)	2.3067 (3)	1.9464 (5)	1.5828 (8)	1.7638 (6)	1.6294 (9)	1.5469 (10)	1.6182 (8)	1.3472 (11)	1.4563 (12)	1.5978 (9)	1.7242 (10)	1.6985 (10)	1.5577 (12)	1.6322 (8)	1.5505 (7)	1.6886 (6)	1.2385 (11)
Food & Bev	S07	0.3791 (25)	0.4103 (16)	0.1833 (19)	0.6599 (16)	0.5472 (20)	0.5575 (21)	0.6073 (20)	0.4619 (22)	0.694 (20)	0.7012 (19)	0.9138 (16)	0.6478 (22)	1.8704 (6)	1.5989 (9)	1.3312 (13)	1.6696 (8)	1.5177 (11)	1.5015 (10)	1.5599 (12)	1.7429 (9)	1.846 (6)	1.6832 (6)	1.4779 (11)	1.7161 (5)	1.3043 (8)
Textile & Clothing	S08	0.4209 (23)	0.1808 (23)	0.1164 (25)	0.6455 (17)	0.551 (19)	0.6172 (18)	0.4463 (23)	0.592 (19)	0.5979 (21)	0.6495 (20)	0.4575 (25)	0.5029 (24)	0.5059 (24)	0.3366 (26)	0.6739 (24)	0.4892 (25)	0.3658 (25)	0.313 (26)	0.3831 (26)	0.4621 (25)	0.5084 (23)	0.4557 (23)	0.5109 (27)	0.539 (27)	1.1217 (18)
Pulp & Paper Mfg	S09	0.5367 (22)	0.1128 (29)	0.1045 (34)	0.386 (21)	0.3743 (24)	0.4744 (24)	0.4422 (24)	0.0825 (37)	0.7544 (19)	0.4454 (24)	0.5156 (22)	0.6768 (20)	0.2507 (27)	0.0516 (37)	0.0997 (32)	0.2592 (28)	0.2805 (28)	0.24 (28)	0.204 (30)	0.2476 (30)	0.2083 (30)	0.2196 (33)	0.2776 (32)	0.3385 (32)	0.7771 (31)
Wood Prod.	S10	0.5965 (20)	0.5829 (13)	0.3895 (14)	1.1673 (12)	1.0746 (15)	1.0524 (15)	0.9682 (16)	0.8529 (17)	0.9919 (16)	0.834 (18)	0.63 (21)	0.6596 (21)	1.2654 (13)	1.1256 (15)	1.1373 (16)	1.0918 (18)	1.1829 (15)	1.1748 (16)	1.5228 (13)	1.6881 (11)	1.3747 (15)	1.1556 (15)	1.229 (16)	1.3794 (14)	1.1096 (20)
Print & Pub.	S11	0.0857 (34)	0.1039 (30)	0.1161 (26)	0.1011 (38)	0.079 (36)	0.0785 (36)	0.0759 (38)	0.0864 (33)	0.0881 (35)	0.0644 (37)	0.1864 (30)	0.2805 (25)	1.0278 (18)	1.3851 (11)	0.8751 (21)	1.1855 (14)	1.1175 (16)	1.0241 (18)	1.1371 (18)	1.1176 (19)	1.1121 (19)	1.0521 (19)	1.0435 (18)	0.9142 (21)	1.3069 (7)
Petro. Prod. Mfg	S12	0.1656 (31)	0.3062 (21)	0.104 (35)	0.4443 (19)	0.6139 (18)	0.6039 (19)	0.5705 (21)	0.3263 (23)	0.3135 (24)	0.5338 (22)	0.7329 (19)	1.1316 (13)	0.5523 (22)	0.5884 (22)	0.4379 (25)	0.4959 (24)	0.743 (20)	0.9279 (21)	1.2562 (17)	1.3814 (16)	1.1625 (18)	0.8353 (21)	0.9421 (21)	1.1002 (18)	1.301 (9)
Coal Prod. Mfg	S13	0.1494 (32)	0.1176 (28)	0.1214 (24)	0.1201 (31)	0.1122 (29)	0.0919 (32)	0.0832 (33)	0.1014 (29)	0.0499 (39)	0.0506 (38)	0.0688 (33)	0.119 (32)	0.0217 (38)	0.0223 (38)	0.0122 (38)	0.0217 (38)	0.0358 (38)	0.0482 (37)	0.076 (36)	0.0852 (35)	0.0464 (38)	0.0533 (37)	0.1571 (35)	0.1101 (36)	0.3821 (37)
Chem. Prod.	S14	1.4091 (10)	0.3891 (17)	0.0977 (38)	1.675 (8)	1.7276 (8)	1.8274 (7)	1.7871 (8)	1.2695 (12)	1.4892 (9)	1.9206 (6)	1.5436 (9)	1.4645 (7)	1.7789 (7)	1.8436 (6)	1.8541 (5)	1.6903 (7)	1.7689 (6)	1.6478 (7)	1.798 (6)	1.899 (5)	1.7178 (7)	1.4761 (10)	1.4974 (10)	1.6805 (7)	1.1643 (16)
Non-Metal & Min. Prod.	S15	1.4145 (9)	0.9608 (10)	0.1067 (31)	1.2127 (11)	1.0763 (14)	1.0553 (14)	0.9686 (15)	0.9879 (16)	0.9816 (17)	0.9504 (16)	0.9629 (15)	0.9793 (15)	1.459 (11)	1.2252 (14)	1.4895 (11)	1.2701 (13)	1.337 (13)	1.3832 (13)	1.7864 (7)	1.8385 (6)	1.6432 (10)	1.284 (14)	1.3613 (14)	1.5025 (13)	1.073 (24)
Iron & Steel Mfg	S16	1.8151 (6)	1.3942 (8)	0.8902 (10)	2.1121 (5)	1.7916 (7)	1.7449 (9)	1.4048 (10)	1.7995 (7)	1.5759 (7)	1.4372 (10)	1.2282 (12)	1.2441 (11)	1.4001 (12)	0.5082 (23)	1.3593 (12)	1.1689 (16)	1.3186 (14)	1.1861 (15)	1.4111 (15)	1.5493 (13)	1.2976 (16)	1.0878 (17)	1.0588 (17)	1.1639 (15)	1.2243 (12)
Non-Ferrous Mfg	S17	0.9972 (16)	0.9204 (11)	0.8322 (11)	1.7659 (7)	1.4757 (11)	1.2162 (13)	1.0972 (14)	1.0515 (15)	1.3049 (11)	1.2797 (11)	0.8904 (17)	0.9549 (17)	0.6829 (20)	0.6264 (20)	0.9412 (20)	0.5955 (22)	0.5579 (23)	0.4502 (24)	0.8478 (22)	0.8552 (22)	0.5961 (22)	0.5006 (22)	0.2552 (34)	0.2647 (34)	0.797 (29)
Other Metal Prod.	S18	0.9704 (18)	0.561 (14)	0.1335 (22)	1.1468 (13)	1.2588 (12)	1.2549 (12)	1.2068 (12)	1.0919 (13)	1.1329 (13)	1.2672 (12)	1.264 (11)	1.3829 (9)	1.7256 (8)	1.6943 (7)	1.2127 (15)	1.6574 (9)	1.7052 (7)	1.6466 (8)	1.9304 (3)	1.9739 (3)	1.8808 (5)	1.6396 (7)	1.5281 (8)	1.6597 (8)	1.0962 (21)
Mach. & Transp Prod.	S19	0.0633 (38)	0.0808 (38)	0.1086 (28)	0.2482 (24)	0.9052 (17)	0.957 (16)	1.1786 (13)	0.5385 (21)	0.8384 (18)	1.2507 (14)	1.1268 (13)	0.8906 (18)	2.1345 (4)	1.8622 (5)	1.4963 (10)	1.74 (6)	1.6405 (8)	1.4868 (11)	1.6422 (11)	1.4336 (15)	1.2886 (17)	1.2887 (13)	1.4171 (13)	1.5977 (10)	1.245 (10)

Source: Results obtained from the model developed in Chapter 4.

Table VI.18 (cont'd)

Sector	Sec	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
Mfg Oth.	S20	0.082 (36)	0.0954 (34)	0.1029 (37)	0.1377 (28)	0.1823 (27)	0.3286 (26)	0.2289 (27)	0.16 (27)	0.2567 (26)	0.2611 (26)	0.1945 (29)	0.2244 (27)	0.6303 (21)	0.6095 (21)	0.7032 (23)	0.584 (23)	0.6234 (22)	0.6306 (22)	0.5116 (24)	0.5348 (24)	0.3913 (26)	0.2918 (27)	0.4217 (29)	0.3426 (31)	1.09 (22)
Elec. Gen. Coal	S21	1.2135 (13)	1.185 (9)	0.9068 (9)	1.4327 (9)	1.4781 (10)	1.4415 (10)	1.5487 (9)	1.6531 (9)	1.5026 (8)	1.5902 (8)	1.9553 (6)	1.2031 (12)	1.0475 (17)	1.0919 (16)	1.5988 (9)	1.4981 (10)	1.5967 (9)	1.4534 (12)	1.4432 (14)	1.2876 (17)	1.7145 (8)	1.5261 (9)	1.5918 (6)	1.6154 (9)	1.4654 (2)
Elec. Gen. Oil	S22	0.1847 (30)	0.2377 (22)	0.2209 (18)	0.2823 (22)	0.1955 (26)	0.2445 (27)	0.2714 (26)	0.2933 (24)	0.2601 (25)	0.1736 (29)	0.2741 (27)	0.1609 (31)	0.0447 (37)	0.0623 (35)	0.0494 (36)	0.0669 (36)	0.0854 (36)	0.111 (35)	0.1544 (32)	0.121 (32)	0.1786 (32)	0.144 (35)	0.2599 (33)	0.32 (33)	0.4498 (36)
Elec. Gen. Nat. Gas	S23	0.3669 (26)	0.3244 (19)	0.2622 (16)	0.2775 (23)	0.3572 (25)	0.3636 (25)	0.329 (25)	0.1313 (28)	0.2041 (27)	0.37 (25)	0.4865 (24)	0.1989 (29)	0.1259 (30)	0.1106 (30)	0.2334 (29)	0.2537 (29)	0.097 (33)	0.0301 (38)	0.3094 (27)	0.3083 (27)	0.2561 (29)	0.2518 (31)	0.5623 (26)	0.6258 (25)	0.8365 (28)
Elec. Gen. Hydro	S24	0.3912 (24)	0.3762 (18)	0.313 (15)	0.4191 (20)	0.4567 (23)	0.4807 (23)	0.5318 (22)	0.5424 (20)	0.5116 (23)	0.4906 (23)	0.6959 (20)	0.2777 (26)	0.2108 (28)	0.2275 (27)	0.3965 (26)	0.3259 (27)	0.3126 (27)	0.2893 (27)	0.2969 (28)	0.2623 (29)	0.4049 (25)	0.3507 (26)	0.5079 (28)	0.5145 (28)	0.7824 (30)
Elec. Gen. Renew.	S25	0.1328 (33)	0.1424 (25)	0.1433 (20)	0.1599 (26)	0.1359 (28)	0.1508 (28)	0.1645 (28)	0.1728 (26)	0.1555 (30)	0.1269 (31)	0.2119 (28)	0.0831 (34)	0.0502 (35)	0.0656 (34)	0.0183 (37)	0.0898 (35)	0.1808 (30)	0.201 (29)	0.2448 (29)	0.2705 (28)	0.4446 (24)	0.4401 (25)	0.7463 (24)	0.8516 (23)	1.045 (25)
Elec. Gen Oth. Fuel	S26	0.0556 (39)	0.0653 (39)	0.0837 (39)	0.0614 (39)	0.0447 (39)	0.0381 (39)	0.0382 (39)	0.0527 (39)	0.0568 (38)	0.0321 (39)	0.0247 (39)	0.0387 (39)	0.008 (39)	0.0136 (39)	0.0043 (39)	0.0042 (39)	0.0042 (39)	0.0041 (39)	0.0025 (39)	0.0012 (39)	0.0394 (39)	0.0027 (39)	0.0022 (39)	0.0036 (39)	0.0095 (39)
Elec. T&D	S27	1.4576 (7)	1.41 (7)	1.2418 (8)	1.7918 (6)	1.7191 (9)	1.7668 (8)	1.8441 (7)	1.9169 (6)	1.7695 (6)	1.7861 (7)	2.2185 (4)	1.4293 (8)	1.2145 (14)	1.2633 (13)	1.8358 (6)	1.7505 (5)	1.8176 (5)	1.6832 (6)	1.756 (9)	1.6008 (12)	2.0013 (4)	1.8139 (5)	1.9439 (4)	2.1224 (3)	1.5543 (1)
Gas Supply	S28	0.2634 (28)	0.122 (27)	0.1432 (21)	0.4877 (18)	0.4612 (22)	0.6011 (20)	0.6958 (19)	0.6151 (18)	1.0136 (15)	0.9005 (17)	0.8326 (18)	1.0247 (14)	0.4188 (25)	0.4198 (24)	0.7705 (22)	0.5995 (21)	0.5221 (24)	0.5478 (23)	0.7089 (23)	0.5383 (23)	0.3806 (27)	0.2576 (29)	0.3005 (31)	0.3631 (30)	0.6499 (32)
Water, Upstrm	S29	0.0844 (35)	0.0954 (35)	0.1059 (33)	0.1014 (37)	0.0807 (33)	0.0803 (34)	0.0805 (34)	0.0869 (32)	0.0898 (33)	0.0676 (33)	0.0668 (34)	0.0772 (35)	0.0503 (34)	0.0574 (36)	0.0543 (35)	0.053 (37)	0.0533 (37)	0.0517 (36)	0.0465 (38)	0.0443 (38)	0.0515 (37)	0.0505 (38)	0.0409 (37)	0.047 (38)	0.0359 (38)
Water, Urb	S30	1.2108 (14)	0.0956 (33)	0.1066 (32)	0.1016 (35)	0.0787 (37)	0.0782 (38)	0.0784 (37)	0.0846 (36)	0.0875 (37)	0.0658 (36)	0.0651 (36)	0.0752 (37)	0.0488 (36)	0.0791 (33)	0.0841 (34)	0.1096 (33)	0.1411 (32)	0.1132 (34)	0.1301 (34)	0.1191 (33)	0.1383 (33)	0.2572 (30)	0.5725 (25)	0.5697 (26)	1.2075 (13)
Water, Rurl	S31	0.2398 (29)	0.1477 (24)	0.1031 (36)	0.1371 (29)	0.0966 (31)	0.123 (29)	0.1359 (29)	0.2084 (25)	0.1574 (29)	0.1468 (30)	0.1341 (31)	0.0839 (33)	0.0647 (33)	0.0902 (31)	0.096 (33)	0.1569 (31)	0.0939 (35)	0.1507 (32)	0.164 (31)	0.1342 (31)	0.1319 (34)	0.1493 (34)	0.0327 (38)	0.234 (35)	0.6175 (33)
Water, Sev.	S32	1.1162 (15)	0.0961 (32)	0.1081 (30)	0.1025 (33)	0.081 (32)	0.0783 (37)	0.0786 (36)	0.0848 (35)	0.0876 (36)	0.066 (35)	0.0654 (35)	0.0754 (36)	0.0859 (32)	0.0892 (32)	0.117 (31)	0.1024 (34)	0.0962 (34)	0.1206 (33)	0.112 (35)	0.0898 (34)	0.1185 (35)	0.2298 (32)	0.3364 (30)	0.4075 (29)	1.1247 (17)
Const.	S33	2.0645 (3)	0.1356 (26)	2.3196 (3)	0.1257 (30)	0.1108 (30)	0.0989 (31)	0.0982 (31)	0.1002 (30)	0.1031 (32)	0.0663 (34)	0.0604 (38)	0.2014 (28)	1.6109 (10)	1.6227 (8)	1.8223 (7)	0.7496 (20)	0.6536 (21)	0.9922 (19)	1.8616 (5)	1.8084 (7)	1.4136 (14)	1.0788 (18)	1.0205 (19)	1.0693 (19)	0.9449 (27)
Wsale&Retail	S34	8.0027 (1)	9.0379 (1)	10.0365 (1)	0.1428 (27)	2.3046 (4)	2.7552 (2)	3.0131 (2)	3.2547 (2)	1.0687 (14)	3.3137 (2)	3.5792 (2)	3.6057 (2)	3.1072 (2)	3.4095 (2)	2.2594 (3)	2.9201 (2)	2.8578 (2)	2.7176 (2)	2.6958 (1)	2.5283 (1)	2.9097 (1)	2.8584 (2)	2.0269 (2)	2.2289 (1)	1.0786 (23)
Trsprt & Storage Serv.	S35	0.5632 (21)	0.3215 (20)	0.2388 (17)	0.8832 (14)	2.2904 (5)	2.479 (3)	2.4401 (3)	1.682 (8)	1.9322 (5)	2.7877 (3)	2.3221 (3)	1.9802 (5)	2.9499 (3)	3.1282 (3)	2.497 (2)	2.5792 (3)	2.6744 (3)	2.5387 (3)	2.5874 (2)	2.4527 (2)	2.8005 (2)	2.6254 (3)	1.9687 (3)	2.1762 (2)	1.1207 (19)
Comm, Fin. & Bus. Serv.	S36	1.4441 (8)	9.0379 (2)	10.0365 (2)	9.6047 (1)	7.6487 (1)	7.6071 (1)	7.6248 (1)	8.2322 (1)	8.5076 (1)	6.4017 (1)	6.3286 (1)	7.3188 (1)	4.764 (1)	5.4393 (1)	5.147 (1)	5.027 (1)	5.0523 (1)	4.8972 (1)	0.1496 (33)	0.0838 (36)	0.2068 (31)	4.7884 (1)	3.8749 (1)	0.8863 (22)	0.4848 (35)
Govt Admin	S37	1.2489 (12)	0.095 (37)	0.1081 (29)	0.1015 (36)	0.0798 (34)	0.0811 (33)	0.0866 (32)	0.0792 (38)	0.197 (28)	0.1801 (28)	0.121 (32)	0.1655 (30)	0.3809 (26)	0.3962 (25)	0.2916 (27)	0.3274 (26)	0.3348 (26)	0.3759 (25)	0.3862 (25)	0.3497 (26)	0.3687 (28)	0.4415 (24)	0.9694 (20)	0.9713 (20)	1.1706 (14)
Edu, Hlth & Cmty Serv.	S38	0.9779 (17)	0.0951 (36)	0.1094 (27)	0.1028 (32)	0.0793 (35)	0.0787 (35)	0.079 (35)	0.1 (31)	0.1224 (31)	0.1862 (27)	0.4952 (23)	0.5993 (23)	0.1187 (31)	0.1226 (29)	0.2462 (28)	0.154 (32)	0.1743 (31)	0.1522 (31)	0.0606 (37)	0.0482 (37)	0.1105 (36)	0.0569 (36)	0.056 (36)	0.0634 (37)	0.5492 (34)
Oth. Comml Serv.	S39	0.0759 (37)	0.0969 (31)	0.1232 (23)	0.1023 (34)	0.0779 (38)	0.1043 (30)	0.1332 (30)	0.0853 (34)	0.0881 (34)	0.0888 (32)	0.062 (37)	0.0728 (38)	0.1443 (29)	0.1761 (28)	0.1834 (30)	0.189 (30)	0.2097 (29)	0.1868 (30)	1.2957 (16)	1.5371 (14)	0.9005 (21)	0.2616 (28)	1.498 (9)	1.5723 (11)	1.167 (15)

Source: Results obtained from the model developed in Chapter 4.

APPENDIX VII

Full set of IO linkages in each quadrant, and results of the proposed key sector identification systems

Sources of all Tables in this appendix

This author's analysis based on the models developed in chapter 4 and the results generated by these models.

Table VII-1: Comparison of major key sector analysis approaches, 2014-15

2014-15		Original Chenery-Watanabe (CW_o)	Modified Chenery-Watanabe (CW_m)	Original Rasmussen Method (R_o)	Modified Rasmussen Method (R_m)	Original Hirschman-Rasmussen (H-R)	Original Hirschman-Rasmussen (H-R)	Original Cuello (C_o)	Modified Cuello (C_m)	Evaluation of Common Results		
Sector Name	Sec Code	Direct Linkages	Direct Linkages	Total Linkages	Total Linkages	Direct Linkages	Total Linkages	Total Linkages	Total Linkages	Max. No. out of 8	No. Direct Out of 3	No. of Total out of 5
Ag., Forest & Fish'g	S01	K	K	K	B	K	K	W	W	5	3	2, 2
Coal	S02	B	B	B	B	B	B	W	W	6	3	3
Crude Oil	S03	F	W	W	W	F	W	W	W	6	2	5
Nat Gas	S04	W	W	W	W	W	W	W	W	8	3	5
Explor. Mining	S05	W	F	W	W	W	W	W	W	7	2	5
Oth. Mining	S06	K	K	F	W	K	F	F	W	3, 3	3	3
Food & Bev	S07	K	B	K	B	K	K	F	W	4	2	2
Textile & Clothing	S08	W	W	W	W	W	W	W	W	8	3	5
Pulp & Paper Mfg	S09	W	F	W	F	W	W	W	K	3, 3	2	3
Wood Prod.	S10	B	K	W	K	B	W	W	K	3, 3	2	3
Print & Pub.	S11	W	F	W	W	W	W	W	K	6	2	4
Petro. Prod. Mfg	S12	W	F	F	F	W	F	W	W	4, 4	2	3
Coal Prod. Mfg	S13	B	K	W	F	W	W	W	K	3	0	3
Chem. Prod.	S14	K	F	K	K	K	K	W	W	5	2	3
Non-Metal & Min. Prod	S15	B	K	W	K	B	W	W	K	3, 3	2	3
Iron & Steel Mfg	S16	W	F	W	F	W	W	W	K	5	2	3
Non-Ferrous Mfg	S17	B	B	B	B	B	B	B	B	8	3	5
Other Metal Prod.	S18	B	K	W	K	W	W	W	K	4	0	3
Mach. & Transp Prod.	S19	K	W	K	B	K	K	K	W	4	2	3
Mfg Oth.	S20	W	W	W	W	W	W	W	W	8	3	5
Elec. Gen. Coal	S21	K	K	K	K	K	K	K	K	8	3	5
Elec. Gen. Oil	S22	B	K	B	K	B	B	B	K	5	2	3
Elec. Gen. Nat. Gas	S23	B	B	B	K	B	B	B	B	7	3	4
Elec. Gen. Hydro	S24	B	K	B	K	B	B	B	K	5	2	3
Elec. Gen. Renew.	S25	B	K	B	K	B	B	B	K	5	2	3
Elec. Gen Oth. Fuel	S26	W	W	W	W	W	W	W	W	8	3	5
Elec. T&D	S27	K	K	K	K	K	K	K	K	8	3	5
Gas Supply	S28	B	K	W	F	B	W	W	W	4	2	4
Upstrm Water	S29	F	F	F	F	F	F	W	W	6	3	3
Urb Water	S30	W	W	B	W	B	B	W	W	5	2	3
Rurl Water	S31	W	F	B	F	B	B	W	W	3	0	2, 2
Water Sev.	S32	B	B	W	W	W	W	W	W	6	2	5
Const.	S33	K	K	K	K	K	K	K	K	8	3	5
Wsale&Retail	S34	K	K	K	K	K	K	K	K	8	3	5
Trsprt & Storage Serv.	S35	K	K	K	K	K	K	K	K	8	3	5
Comm, Fin. & Bus. Serv	S36	K	K	K	W	K	K	K	K	7	3	4
Govt Admin	S37	B	B	W	W	B	W	K	B	4	3	3
Edu, Hlth & Cmty Serv.	S38	B	B	B	B	B	B	K	K	6	3	3
Oth. Comml Serv.	S39	K	K	B	K	K	B	K	B	5	3	3

Source: Results obtained from the model developed in Chapter 4.

Table VII-2: Inter-industry direct backward linkages and ranks, 1975-2015
($m, real price term - base year 2014-15 = 100)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S01	0.8852 (22)	0.9237 (22)	0.7228 (27)	0.7212 (27)	0.8137 (24)	0.8947 (23)	1.1216 (19)	0.8208 (26)	0.9877 (19)	0.7996 (27)	0.9388 (24)	0.9727 (23)	1.0618 (21)	1.0165 (22)	1.0142 (24)	0.8741 (30)	0.9415 (28)	0.9917 (21)	1.2364 (9)	1.236 (11)	1.2413 (8)	1.1704 (14)	1.1351 (15)	1.2055 (10)	1.2125 (12)	0.9976 (20)
S02	0.5617 (29)	0.6009 (30)	0.7136 (28)	0.5259 (34)	0.6217 (30)	0.8123 (25)	0.9172 (21)	0.8685 (23)	0.5787 (33)	0.5485 (33)	0.5771 (31)	0.5729 (27)	1.0464 (24)	1.0154 (23)	1.0998 (17)	0.942 (28)	1.0282 (24)	0.8011 (29)	1.1558 (14)	1.106 (17)	0.6723 (31)	1.0496 (21)	1.2909 (9)	1.3549 (7)	1.3555 (7)	0.8727 (29)
S03	0.5215 (31)	0.7729 (25)	0.429 (36)	0.5157 (35)	0.7306 (27)	0.5839 (33)	0.6281 (33)	0.6356 (32)	0.6194 (31)	0.4319 (36)	0.5115 (34)	0.566 (28)	0.3049 (37)	0.2315 (37)	0.416 (37)	0.3132 (37)	0.2037 (38)	0.2573 (38)	0.2916 (38)	0.2307 (38)	0.2691 (38)	0.409 (37)	0.5881 (32)	0.5474 (35)	0.585 (33)	0.4637 (38)
S04	0.2392 (38)	0.2393 (38)	0.9824 (20)	0.7839 (24)	0.4066 (36)	0.7618 (26)	0.807 (26)	0.5276 (33)	0.5836 (32)	0.6489 (30)	0.4802 (36)	0.452 (35)	0.1408 (38)	0.1729 (38)	0.3007 (38)	0.1965 (38)	0.3691 (37)	0.4533 (37)	0.4278 (37)	0.3808 (37)	0.3531 (37)	0.5202 (36)	0.4251 (36)	0.5533 (34)	0.3929 (36)	0.464 (37)
S05	2.2827 (1)	1.7853 (3)	1.9814 (1)	2.447 (1)	2.0658 (1)	2.1578 (1)	1.9514 (1)	1.6112 (5)	1.5792 (6)	1.6008 (3)	1.692 (2)	2.0084 (2)	1.1223 (17)	1.3333 (8)	1.3476 (7)	1.0453 (21)	1.172 (9)	1.3567 (6)	1.1915 (12)	1.0438 (21)	1.3247 (7)	1.1037 (16)	0.896 (25)	0.9936 (21)	0.9753 (22)	1.5227 (4)
S06	0.6051 (27)	0.7679 (26)	0.765 (26)	0.6928 (28)	0.8227 (23)	0.9415 (20)	0.8473 (25)	0.9433 (20)	0.912 (22)	0.9196 (24)	1.0197 (21)	1.1626 (15)	0.8924 (29)	0.9702 (27)	1.0102 (25)	0.9662 (26)	0.9792 (25)	0.8585 (27)	0.8408 (29)	0.8409 (28)	0.8603 (29)	0.7457 (31)	0.9326 (22)	0.8292 (28)	0.9863 (21)	0.8845 (27)
S07	1.8424 (4)	1.7414 (4)	1.8867 (2)	1.8794 (2)	1.833 (3)	1.8171 (2)	1.7376 (2)	1.6483 (4)	1.6547 (4)	1.581 (4)	1.5309 (4)	1.643 (3)	1.4444 (3)	1.3996 (3)	1.4124 (5)	1.4847 (4)	1.4209 (5)	1.4525 (4)	1.4638 (3)	1.4463 (4)	1.3836 (5)	1.3181 (7)	1.3012 (7)	1.3087 (8)	1.3511 (8)	1.5593 (3)
S08	1.2864 (15)	1.1983 (13)	1.235 (14)	1.1122 (18)	1.1605 (14)	1.142 (15)	1.1511 (18)	1.064 (18)	1.1646 (14)	1.0661 (19)	0.982 (22)	1.1452 (16)	1.1965 (10)	1.1695 (15)	1.093 (18)	1.0619 (20)	0.6959 (31)	0.5944 (34)	0.703 (33)	0.6799 (31)	0.5632 (35)	0.5255 (35)	0.353 (37)	0.2711 (38)	0.2546 (38)	0.9148 (25)
S09	1.4464 (8)	1.5374 (7)	1.1158 (19)	1.2421 (11)	1.082 (17)	1.0819 (18)	1.2037 (14)	1.4885 (6)	0.9179 (21)	1.0473 (20)	0.8622 (26)	0.8764 (24)	1.0386 (25)	1.3296 (9)	1.279 (9)	1.0623 (19)	0.5793 (34)	0.6596 (31)	1.0355 (22)	0.6972 (30)	0.695 (30)	0.7615 (30)	0.708 (30)	0.8445 (27)	0.9244 (23)	1.0207 (19)
S10	1.3878 (10)	1.3006 (9)	1.1719 (16)	1.1199 (17)	1.1536 (15)	1.1393 (16)	1.1682 (16)	1.1557 (13)	1.1601 (15)	1.1514 (16)	1.3086 (8)	1.3701 (8)	1.2057 (9)	1.0959 (17)	1.4357 (3)	1.1138 (15)	1.0928 (15)	1.1665 (15)	1.187 (13)	1.2929 (10)	1.2202 (13)	1.2323 (10)	1.1654 (12)	1.1545 (13)	1.2791 (9)	1.2092 (10)
S11	1.2599 (16)	1.1844 (15)	1.1953 (15)	1.1376 (15)	1.2162 (13)	1.2257 (14)	1.1966 (15)	1.3789 (7)	1.1952 (12)	1.1067 (18)	1.2238 (15)	1.0489 (19)	1.0497 (23)	0.9849 (26)	1.0261 (23)	1.0942 (16)	1.0916 (16)	1.1174 (16)	1.047 (20)	1.0654 (20)	0.9658 (25)	0.9721 (24)	0.9184 (23)	0.9659 (22)	0.8739 (26)	1.1017 (14)
S12	1.8975 (2)	1.8176 (2)	1.5277 (5)	1.5829 (6)	1.5718 (6)	1.3216 (7)	1.3999 (6)	1.8906 (2)	1.9562 (2)	1.7386 (1)	1.7396 (1)	1.604 (4)	1.1413 (14)	1.3701 (4)	1.1617 (11)	1.607 (1)	1.4729 (4)	1.4079 (5)	1.4027 (5)	1.3234 (7)	1.1895 (14)	1.0669 (18)	0.8931 (27)	0.9459 (23)	0.8654 (28)	1.4358 (5)
S13	0.5946 (28)	1.0614 (19)	0.8222 (24)	0.9325 (20)	0.7393 (26)	0.6457 (31)	0.6961 (29)	0.9268 (21)	1.7029 (3)	1.3096 (9)	1.2303 (13)	1.0185 (22)	0.8436 (30)	1.246 (10)	1.4461 (2)	1.5222 (3)	1.0445 (22)	0.8299 (28)	0.794 (31)	0.6607 (32)	0.9414 (26)	0.9783 (23)	0.8942 (26)	0.9317 (24)	1.0892 (18)	0.9961 (21)
S14	1.4153 (9)	1.2927 (10)	1.2837 (12)	1.2273 (12)	1.326 (9)	1.3184 (8)	1.3384 (7)	1.3641 (8)	1.2655 (10)	1.1583 (15)	1.3015 (9)	1.1787 (14)	1.1015 (19)	1.0764 (20)	0.8893 (27)	1.1286 (11)	0.9301 (29)	0.8752 (26)	0.9896 (23)	0.937 (26)	0.901 (27)	0.8629 (28)	0.8248 (29)	0.769 (29)	0.7955 (29)	1.102 (13)
S15	1.2893 (14)	1.2579 (12)	1.2881 (11)	1.252 (10)	1.2645 (12)	1.269 (13)	1.3077 (8)	1.3019 (10)	1.3244 (8)	1.2476 (12)	1.2945 (10)	1.357 (10)	1.17 (12)	1.1934 (13)	1.1174 (15)	1.202 (9)	1.2192 (6)	1.2861 (8)	1.2838 (8)	1.3034 (9)	1.1804 (15)	1.2588 (9)	1.2097 (11)	1.2351 (9)	1.2647 (10)	1.2551 (9)
S16	1.501 (7)	1.4909 (8)	1.4415 (6)	1.478 (7)	1.4552 (7)	1.4903 (5)	1.5308 (5)	1.3301 (9)	1.4389 (7)	1.4014 (6)	1.3829 (6)	1.5149 (6)	1.2615 (8)	1.5257 (2)	1.3339 (8)	1.3959 (6)	1.2045 (7)	1.3481 (7)	1.3066 (7)	1.3215 (8)	1.2225 (12)	1.2319 (11)	1.2335 (10)	1.1981 (11)	0.8657 (27)	1.3562 (7)
S17	1.8792 (3)	1.6593 (6)	1.7218 (3)	1.6611 (4)	1.6719 (5)	1.7322 (3)	1.6647 (4)	1.6748 (3)	1.6191 (5)	1.5705 (5)	1.5591 (3)	1.5447 (5)	1.42 (4)	1.3425 (7)	1.2362 (10)	1.5966 (2)	1.6999 (2)	1.8088 (2)	1.6875 (1)	1.6712 (1)	1.8062 (1)	1.6883 (1)	1.9108 (3)	1.8786 (2)	1.8654 (2)	1.6628 (1)
S18	1.3486 (12)	1.2706 (11)	1.3113 (9)	1.3024 (9)	1.3122 (11)	1.2985 (11)	1.2465 (11)	1.2701 (11)	1.274 (9)	1.2991 (11)	1.2384 (12)	1.2699 (12)	1.1674 (13)	1.0022 (24)	1.4289 (4)	1.1835 (10)	1.1499 (12)	1.2078 (10)	1.1284 (15)	1.2296 (12)	1.1347 (16)	1.0846 (17)	0.9764 (21)	1.0605 (19)	1.0268 (20)	1.2089 (11)
S19	1.205 (17)	1.124 (17)	1.1475 (17)	1.1645 (14)	1.1151 (16)	1.1382 (17)	1.0385 (20)	1.039 (19)	1.0442 (18)	0.9911 (22)	1.0268 (20)	1.0346 (20)	0.9503 (26)	0.8699 (29)	0.8335 (29)	0.9609 (27)	0.6743 (32)	0.6886 (30)	0.7077 (32)	0.6466 (33)	0.6178 (34)	0.5573 (34)	0.4834 (35)	0.4874 (36)	0.4457 (35)	0.8797 (28)

Source: Results obtained from the model developed in Chapter 4

Table VII-2 (cont'd)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S20	1.3386 (13)	1.1786 (16)	1.3361 (8)	1.3081 (8)	1.3669 (8)	1.2834 (12)	1.2304 (12)	1.2546 (12)	1.2025 (11)	1.1733 (14)	1.2262 (14)	1.2311 (13)	1.2908 (7)	1.174 (14)	1.0587 (21)	1.2559 (7)	1.0797 (20)	0.9626 (22)	0.9247 (25)	0.7688 (29)	0.6456 (32)	0.73 (32)	0.6797 (31)	0.5821 (32)	0.5469 (34)	1.0732 (15)
S21	0.9301 (20)	1.017 (20)	1.3444 (7)	1.1209 (16)	1.0169 (19)	1.3148 (9)	1.2578 (10)	1.0998 (17)	1.172 (13)	0.9894 (23)	1.0472 (19)	0.6377 (25)	1.0563 (22)	0.906 (28)	1.0464 (22)	1.039 (22)	1.0873 (17)	1.1671 (14)	1.3412 (6)	1.4192 (5)	1.2328 (9)	1.2726 (8)	1.3896 (5)	1.5562 (3)	1.5303 (4)	1.1597 (12)
S22	0.2679 (37)	0.3374 (37)	0.4289 (37)	0.3808 (37)	0.3691 (38)	0.3775 (37)	0.3749 (37)	0.3888 (36)	0.5505 (34)	0.5567 (32)	0.4548 (38)	0.3398 (37)	1.2941 (6)	1.0944 (18)	1.138 (12)	0.9882 (24)	1.0801 (19)	0.9365 (24)	0.9132 (27)	1.0394 (22)	1.0049 (22)	1.2123 (12)	1.1556 (13)	1.137 (15)	1.2378 (11)	0.7623 (32)
S23	1.7542 (5)	1.8208 (1)	1.2897 (10)	1.6938 (3)	1.7199 (4)	1.4953 (4)	1.684 (3)	2.2777 (1)	2.0627 (1)	1.6827 (2)	1.4668 (5)	1.3688 (9)	1.5541 (2)	1.6301 (1)	1.447 (1)	1.2076 (8)	1.9248 (1)	2.2041 (1)	1.2128 (10)	1.1328 (15)	1.6247 (2)	1.5546 (2)	1.0799 (19)	1.1314 (16)	1.1942 (13)	1.5686 (2)
S24	0.6333 (26)	0.7618 (27)	0.8267 (23)	0.848 (23)	0.7706 (25)	0.8745 (24)	0.9067 (22)	0.9092 (22)	0.8805 (24)	0.8003 (26)	0.8914 (25)	0.3945 (36)	0.9351 (27)	0.7801 (31)	0.7889 (30)	0.8552 (31)	1.0361 (23)	1.0133 (20)	1.1985 (11)	1.3372 (6)	1.2242 (11)	1.3213 (6)	1.2992 (8)	1.4299 (5)	1.4199 (6)	0.9654 (23)
S25	0.3012 (36)	0.5307 (31)	0.5794 (31)	0.6705 (29)	0.5514 (32)	0.664 (30)	0.7161 (28)	0.7291 (28)	0.7751 (27)	0.7616 (28)	0.543 (32)	0.4621 (34)	1.1763 (11)	1.076 (21)	0.9866 (26)	0.9762 (25)	0.9697 (26)	0.8938 (25)	1.0439 (21)	1.0966 (18)	1.0434 (20)	1.1151 (15)	1.0908 (18)	1.1493 (14)	1.1522 (16)	0.8422 (30)
S26	0.0082 (39)	0.0207 (39)	0.0244 (39)	0.028 (39)	0.0216 (39)	0.021 (39)	0.0247 (39)	0.0245 (39)	0.0287 (39)	0.0194 (39)	0.011 (39)	0.016 (39)	0.0367 (39)	0.0306 (39)	0.0188 (39)	0.0131 (39)	0.0061 (39)	0.0049 (39)	0.005 (39)	0.0044 (39)	0.0022 (39)	0.0027 (39)	0.003 (39)	0.0026 (39)	0.0027 (39)	0.0152 (39)
S27	0.3219 (33)	0.3985 (35)	0.459 (35)	0.4601 (36)	0.4924 (35)	0.5874 (32)	0.6511 (31)	0.6679 (30)	0.7463 (28)	0.7381 (29)	0.7587 (27)	0.3282 (38)	0.789 (31)	0.576 (34)	0.7321 (34)	0.7361 (33)	0.9493 (27)	1.0162 (19)	1.0824 (19)	1.1922 (13)	1.2324 (10)	1.4514 (4)	1.9121 (2)	2.1163 (1)	1.9833 (1)	0.8951 (26)
S28	0.8139 (23)	0.9473 (21)	0.8656 (22)	0.7613 (25)	0.9535 (20)	1.0577 (19)	1.1635 (17)	1.1488 (14)	1.1599 (16)	1.3987 (7)	1.3469 (7)	0.5167 (31)	0.5294 (34)	0.6081 (33)	0.7483 (32)	1.117 (14)	1.1922 (8)	1.1754 (12)	0.5989 (34)	0.6336 (34)	1.3323 (6)	1.5176 (3)	1.3135 (6)	1.3965 (6)	1.4486 (5)	1.0298 (18)
S29	0.5591 (30)	0.5171 (33)	0.5339 (33)	0.5294 (33)	0.5182 (33)	0.5247 (34)	0.5071 (34)	0.4993 (34)	0.4972 (35)	0.4906 (35)	0.4745 (37)	0.509 (32)	0.4554 (35)	0.4392 (35)	0.4472 (35)	0.4562 (35)	0.454 (36)	0.4669 (36)	0.4672 (36)	0.4666 (36)	0.4679 (36)	0.3974 (38)	0.3044 (38)	0.3275 (37)	0.3088 (37)	0.4648 (36)
S30	0.3182 (34)	0.3392 (36)	0.3588 (38)	0.3396 (38)	0.3708 (37)	0.3689 (38)	0.3545 (38)	0.2405 (38)	0.224 (38)	0.3977 (37)	0.5397 (33)	0.4717 (33)	0.6985 (32)	1.2063 (11)	0.7419 (33)	0.548 (34)	0.6367 (33)	0.6517 (32)	0.9489 (24)	0.9951 (24)	1.0305 (21)	0.9203 (26)	0.5501 (33)	0.6424 (31)	0.6526 (31)	0.5819 (34)
S31	1.6083 (6)	1.6712 (5)	1.7039 (4)	1.6109 (5)	1.9486 (2)	1.4806 (6)	1.2267 (13)	0.7252 (29)	0.7098 (29)	1.3004 (10)	1.2233 (16)	2.8132 (1)	1.7771 (1)	1.3463 (5)	1.1222 (14)	0.8179 (32)	1.0472 (21)	0.6303 (33)	0.8316 (30)	1.0037 (23)	1.0013 (23)	0.864 (27)	1.9629 (1)	0.6885 (30)	0.6765 (30)	1.2717 (8)
S32	0.3127 (35)	0.6665 (29)	0.6028 (30)	0.5719 (31)	0.5122 (34)	0.4517 (36)	0.4146 (36)	0.332 (37)	0.2605 (37)	0.3947 (38)	0.7182 (28)	0.5486 (29)	0.6136 (33)	0.757 (32)	0.7716 (31)	1.0123 (23)	1.132 (13)	1.038 (18)	1.4579 (4)	1.5309 (2)	1.4041 (4)	1.1864 (13)	1.1034 (17)	1.1307 (17)	1.1651 (15)	0.8036 (31)
S33	1.3661 (11)	1.1886 (14)	1.2684 (13)	1.2225 (13)	1.3245 (10)	1.3022 (10)	1.2723 (9)	1.1267 (15)	1.0911 (17)	1.2193 (13)	1.2192 (17)	1.283 (11)	1.3983 (5)	1.3461 (6)	1.3591 (6)	1.4799 (5)	1.5309 (3)	1.5931 (3)	1.4764 (2)	1.5011 (3)	1.4571 (3)	1.4508 (5)	1.48 (4)	1.5199 (4)	1.5564 (3)	1.3613 (6)
S34	0.763 (24)	0.7251 (28)	0.6976 (29)	0.7227 (26)	0.6901 (28)	0.7376 (27)	0.727 (27)	0.7479 (27)	0.8523 (25)	0.9941 (21)	0.6792 (29)	1.023 (21)	1.1329 (16)	1.0858 (19)	1.0929 (19)	1.1211 (13)	1.1608 (10)	1.2123 (9)	1.1159 (16)	1.1804 (14)	1.0514 (19)	0.9897 (22)	1.0132 (20)	1.0425 (20)	1.0386 (19)	0.9439 (24)
S35	1.0153 (19)	1.1071 (18)	1.1171 (18)	1.0338 (19)	1.0412 (18)	0.9386 (21)	0.8876 (23)	0.8211 (25)	0.8094 (26)	0.8739 (25)	0.9707 (23)	1.0846 (18)	1.1144 (18)	1.203 (12)	1.0827 (20)	1.1271 (12)	1.1529 (11)	1.1877 (11)	1.0945 (17)	1.1311 (16)	1.0843 (18)	1.0584 (19)	1.1352 (14)	1.1555 (12)	1.1658 (14)	1.0557 (16)
S36	0.7195 (25)	0.5243 (32)	0.529 (34)	0.5963 (30)	0.6558 (29)	0.6994 (28)	0.6425 (32)	0.6395 (31)	0.6682 (30)	0.5972 (31)	0.6258 (30)	0.6252 (26)	0.9195 (28)	0.8583 (30)	0.8737 (28)	0.9045 (29)	0.9004 (30)	0.9537 (23)	0.9 (28)	0.8738 (27)	0.873 (28)	0.8301 (29)	0.8535 (28)	0.8802 (26)	0.8912 (25)	0.7614 (33)
S37	1.201 (18)	0.8549 (24)	0.9334 (21)	0.8659 (22)	0.8403 (22)	0.6908 (29)	0.6926 (30)	0.8252 (24)	0.9036 (23)	1.3306 (8)	1.2782 (11)	1.3946 (7)	1.0782 (20)	0.997 (25)	1.1051 (16)	1.0655 (18)	1.0805 (18)	1.087 (17)	0.9239 (26)	0.976 (25)	0.9872 (24)	0.9409 (25)	0.9104 (24)	0.8845 (25)	0.9059 (24)	0.9901 (22)
S38	0.4054 (32)	0.5115 (34)	0.5408 (32)	0.5401 (32)	0.5682 (31)	0.4633 (35)	0.4473 (35)	0.4914 (35)	0.4525 (36)	0.536 (34)	0.4876 (35)	0.5235 (30)	0.4517 (36)	0.4115 (36)	0.434 (36)	0.4391 (36)	0.4897 (35)	0.4738 (35)	0.4949 (35)	0.5084 (35)	0.6445 (33)	0.5977 (33)	0.5192 (34)	0.5719 (33)	0.5883 (32)	0.5037 (35)
S39	0.9133 (21)	0.8553 (23)	0.8176 (25)	0.9172 (21)	0.9049 (21)	0.8948 (22)	0.8657 (24)	1.1107 (16)	0.9748 (20)	1.1274 (17)	1.1376 (18)	1.0881 (17)	1.1397 (15)	1.1289 (16)	1.1229 (13)	1.0893 (17)	1.1197 (14)	1.17 (13)	1.088 (18)	1.0957 (19)	1.1144 (17)	1.0496 (20)	1.1044 (16)	1.1199 (18)	1.1258 (17)	1.043 (17)

Source: Results obtained from the model developed in Chapter 4.

Table VII-3: Inter-industry direct forward linkages, and ranks 1975-2015
($m, real price term - base year 2014-15 = 100)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S01	0.9856 (22)	1.1304 (17)	1.0505 (19)	1.0258 (21)	1.1003 (19)	1.0597 (18)	1.1592 (19)	0.964 (22)	1.019 (21)	0.9027 (23)	1.0578 (22)	1.1251 (19)	1.1336 (16)	0.9699 (22)	1.0992 (20)	1.0625 (20)	1.1044 (18)	1.1048 (18)	1.2295 (13)	1.2452 (12)	1.2155 (15)	1.2088 (14)	1.041 (20)	1.0872 (18)	1.1717 (16)	1.0901 (21)
S02	0.9752 (23)	1.1988 (14)	0.6967 (29)	1.2164 (17)	1.2828 (13)	0.7254 (28)	0.5919 (30)	0.8577 (28)	0.4684 (32)	0.3797 (34)	0.3391 (33)	0.6543 (30)	0.4159 (35)	0.306 (36)	0.4381 (35)	0.353 (36)	0.3119 (36)	0.2643 (36)	0.3925 (36)	0.4008 (36)	0.226 (37)	0.2759 (36)	0.3261 (36)	0.285 (36)	0.2988 (36)	0.5472 (32)
S03	1.4646 (11)	1.8426 (2)	1.7658 (2)	1.527 (7)	1.7192 (2)	1.7974 (2)	1.7226 (4)	1.7327 (3)	1.3313 (12)	1.3169 (12)	1.4246 (11)	1.461 (8)	1.301 (10)	1.3857 (9)	1.445 (8)	1.3999 (8)	1.3134 (9)	1.3875 (9)	1.3563 (9)	1.2927 (10)	1.3255 (12)	1.1697 (17)	1.1225 (17)	1.1414 (17)	0.9805 (21)	1.4291 (7)
S04	1.5803 (6)	1.3294 (11)	1.7246 (3)	1.657 (4)	1.3283 (10)	1.2803 (13)	1.3486 (10)	1.3682 (10)	1.689 (2)	1.9653 (1)	1.0089 (23)	1.1118 (20)	1.2062 (14)	1.0829 (19)	1.1244 (17)	0.7033 (27)	0.9266 (25)	0.8527 (26)	0.5335 (34)	0.6042 (32)	0.7489 (29)	0.832 (24)	0.6112 (32)	0.4967 (33)	0.4958 (34)	1.1044 (20)
S05	1.5811 (5)	1.6215 (6)	1.619 (7)	1.4281 (9)	1.0693 (20)	0.999 (23)	1.1967 (17)	1.6315 (5)	1.4905 (7)	1.4529 (9)	1.4567 (10)	1.6707 (2)	1.257 (11)	1.3464 (11)	1.4416 (9)	1.3664 (10)	1.3553 (8)	1.3883 (8)	1.1853 (16)	1.0815 (17)	1.0855 (20)	1.1131 (19)	0.8633 (23)	1.025 (21)	1.1349 (17)	1.3144 (11)
S06	1.0055 (19)	1.0363 (21)	1.081 (18)	1.1216 (20)	1.0679 (21)	0.9885 (25)	0.8947 (25)	0.9599 (23)	0.8469 (26)	0.7649 (27)	0.7285 (27)	0.6896 (29)	1.0801 (18)	1.0209 (21)	0.9755 (22)	1.0469 (21)	1.0691 (21)	0.9745 (23)	0.986 (22)	0.935 (23)	0.7723 (26)	0.7144 (29)	0.6841 (29)	0.5018 (32)	0.5996 (31)	0.9018 (26)
S07	0.4253 (32)	0.4092 (32)	0.4016 (33)	0.4384 (32)	0.3985 (32)	0.4047 (33)	0.412 (34)	0.3318 (33)	0.4173 (33)	0.4021 (33)	0.3322 (34)	0.3456 (34)	0.6037 (31)	0.5258 (31)	0.6661 (30)	0.6084 (31)	0.589 (32)	0.665 (30)	0.613 (31)	0.7325 (29)	0.7272 (30)	0.6882 (30)	0.6079 (33)	0.6411 (30)	0.6311 (30)	0.5207 (33)
S08	0.6942 (29)	0.6668 (30)	0.7121 (27)	0.694 (29)	0.6675 (30)	0.6227 (30)	0.6727 (29)	0.6078 (30)	0.7372 (29)	0.6541 (28)	0.4778 (31)	0.6993 (28)	0.4862 (34)	0.411 (35)	0.6765 (28)	0.6813 (29)	0.5844 (33)	0.5524 (33)	0.5706 (32)	0.6981 (30)	0.6641 (32)	0.6776 (31)	0.7061 (28)	0.7735 (26)	0.8032 (27)	0.6476 (29)
S09	1.6013 (4)	0.6167 (31)	1.6354 (6)	1.6776 (2)	1.6891 (3)	1.6713 (3)	1.7677 (1)	0.2599 (35)	1.6085 (4)	1.5575 (4)	1.5506 (6)	1.6646 (3)	1.2377 (13)	1.9497 (1)	1.7471 (2)	1.7848 (1)	1.6645 (3)	1.623 (3)	1.6044 (2)	1.5995 (4)	1.4827 (6)	1.5015 (6)	1.5806 (6)	1.5032 (6)	1.6014 (5)	1.5272 (5)
S10	1.4832 (9)	1.133 (16)	1.5733 (8)	1.5809 (6)	1.5345 (7)	1.5519 (7)	1.5053 (7)	1.4002 (9)	1.4586 (8)	1.3936 (11)	1.4779 (9)	1.5465 (5)	1.6632 (4)	1.6132 (4)	1.565 (5)	1.5143 (5)	1.5341 (5)	1.5944 (4)	1.3078 (11)	1.5117 (6)	1.5361 (4)	1.5767 (4)	1.7014 (4)	1.702 (3)	1.6958 (4)	1.5262 (6)
S11	1.4354 (12)	1.5383 (7)	1.4233 (10)	1.3732 (11)	1.4002 (9)	1.4583 (8)	1.4244 (8)	1.4641 (7)	1.397 (9)	1.2574 (17)	1.3299 (14)	1.3365 (13)	1.402 (8)	1.3555 (10)	1.3857 (12)	1.3057 (12)	1.2822 (10)	1.2803 (12)	1.2627 (12)	1.3106 (9)	1.3402 (11)	1.2444 (12)	1.1931 (16)	1.2183 (16)	1.1318 (18)	1.342 (9)
S12	1.3534 (13)	1.1984 (15)	1.1777 (17)	1.1447 (18)	1.1546 (17)	1.1899 (16)	1.1673 (18)	1.2776 (14)	1.1641 (20)	1.0664 (22)	1.1882 (19)	1.2514 (18)	1.3171 (9)	1.0291 (20)	1.0584 (21)	1.2098 (15)	1.2017 (15)	1.2142 (14)	1.2003 (15)	1.2298 (14)	1.2238 (14)	1.2095 (13)	1.2307 (15)	1.2478 (15)	1.2395 (13)	1.1978 (15)
S13	1.4697 (10)	1.7105 (4)	1.6729 (4)	1.6656 (3)	1.6271 (5)	1.6711 (4)	1.6196 (6)	1.5876 (6)	1.4942 (6)	1.4669 (8)	1.4857 (8)	1.459 (9)	1.7976 (3)	1.1471 (18)	1.5589 (6)	1.5099 (6)	1.5649 (4)	1.5313 (5)	1.5752 (3)	1.7543 (2)	1.3684 (9)	1.6506 (3)	1.6063 (5)	1.6385 (5)	1.7185 (3)	1.5741 (3)
S14	1.2611 (15)	1.1302 (18)	1.3873 (11)	1.4134 (10)	1.4327 (8)	1.4517 (9)	1.4039 (9)	1.1437 (18)	1.3921 (10)	1.2787 (15)	1.1555 (20)	1.3151 (14)	1.4259 (7)	1.3894 (8)	1.3947 (11)	1.2836 (13)	1.261 (11)	1.1953 (15)	1.1259 (17)	1.2023 (15)	1.1017 (19)	1.0421 (21)	1.0673 (18)	1.0301 (20)	1.0337 (20)	1.2527 (12)
S15	1.6864 (3)	1.7167 (3)	1.6374 (5)	1.6017 (5)	1.6338 (4)	1.6476 (6)	1.642 (5)	1.7521 (2)	1.6107 (3)	1.4978 (7)	1.5998 (5)	1.6358 (4)	1.8316 (2)	1.7541 (3)	1.7226 (3)	1.6642 (3)	1.6889 (2)	1.7488 (2)	1.5426 (4)	1.6175 (3)	1.6535 (2)	1.7229 (2)	1.8366 (1)	1.8098 (1)	1.7543 (2)	1.6804 (2)
S16	1.504 (8)	1.6216 (5)	1.544 (9)	1.5107 (8)	1.5699 (6)	1.6569 (5)	1.7485 (3)	1.6804 (4)	1.5851 (5)	1.4197 (10)	1.5023 (7)	1.501 (7)	1.6288 (5)	1.5383 (6)	1.4155 (10)	1.5637 (4)	1.4605 (7)	1.503 (7)	1.4898 (6)	1.5385 (5)	1.5655 (3)	1.562 (5)	1.7451 (3)	1.6823 (4)	1.5162 (6)	1.5621 (4)
S17	0.9875 (21)	0.9008 (24)	0.9395 (23)	0.9653 (24)	1.0325 (22)	1.0018 (22)	0.9344 (24)	0.9386 (25)	0.8847 (24)	0.8091 (26)	0.6305 (28)	0.7431 (26)	0.5325 (32)	0.6497 (28)	0.6738 (29)	0.6043 (32)	0.6295 (30)	0.4555 (35)	0.5676 (33)	0.4807 (35)	0.6769 (31)	0.6664 (32)	0.5053 (35)	0.4775 (34)	0.4247 (35)	0.7245 (27)
S18	1.2361 (16)	1.2842 (12)	1.3093 (15)	1.2604 (15)	1.29 (12)	1.3406 (11)	1.3071 (12)	1.3232 (12)	1.307 (13)	1.1605 (20)	1.2813 (16)	1.5194 (6)	1.6107 (6)	1.5512 (5)	1.5352 (7)	1.4821 (7)	1.4795 (6)	1.5037 (6)	1.33 (10)	1.4021 (8)	1.4846 (5)	1.4875 (7)	1.4774 (8)	1.4263 (8)	1.4607 (8)	1.394 (8)
S19	0.7627 (27)	0.6744 (29)	0.7017 (28)	0.6898 (30)	0.7072 (29)	0.7023 (29)	0.7158 (28)	0.7029 (29)	0.7587 (28)	0.6122 (29)	0.6014 (29)	0.7046 (27)	0.7936 (28)	0.7039 (27)	0.7973 (25)	0.7817 (26)	0.7312 (28)	0.6835 (28)	0.6971 (29)	0.5843 (33)	0.603 (34)	0.5961 (34)	0.6381 (30)	0.7206 (29)	0.6808 (29)	0.6938 (28)

Source: Results obtained from the model developed in Chapter 4

Table VII-3 (cont'd)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S20	0.334 (33)	0.4077 (33)	0.4515 (32)	0.4514 (31)	0.3917 (33)	0.4437 (31)	0.4422 (32)	0.3162 (34)	0.3632 (35)	0.2852 (36)	0.2338 (36)	0.1715 (36)	0.804 (27)	0.6038 (29)	0.721 (26)	0.5879 (33)	0.5477 (34)	0.6372 (31)	0.5246 (35)	0.553 (34)	0.4848 (35)	0.4806 (35)	0.5065 (34)	0.4663 (35)	0.5436 (33)	0.4701 (35)
S21	1.3047 (14)	1.3667 (10)	1.3147 (14)	1.2942 (14)	1.3222 (11)	1.3533 (10)	1.3089 (11)	1.3667 (11)	1.3344 (11)	1.2828 (14)	1.2948 (15)	1.3072 (15)	0.9707 (22)	1.309 (14)	1.1371 (16)	1.1364 (17)	1.099 (19)	1.071 (19)	1.122 (18)	1.0654 (18)	1.1849 (17)	1.1785 (15)	1.3008 (11)	1.3304 (12)	1.306 (11)	1.2425 (13)
S22	0.5978 (31)	0.7544 (28)	0.6539 (30)	0.8337 (27)	0.7213 (28)	0.8091 (27)	0.8057 (27)	0.8699 (27)	1.2252 (19)	1.0853 (21)	1.3639 (12)	1.3409 (12)	0.8145 (25)	1.3188 (13)	1.1561 (15)	1.1924 (16)	1.214 (14)	1.2496 (13)	1.3959 (8)	1.1905 (16)	1.3579 (10)	1.384 (9)	1.5246 (7)	1.4754 (7)	1.4715 (7)	1.1122 (19)
S23	1.5174 (7)	1.443 (9)	1.3607 (13)	1.3385 (12)	1.2711 (14)	1.2974 (12)	1.2641 (14)	1.2732 (15)	1.2694 (16)	1.2696 (16)	1.3596 (13)	1.387 (11)	0.9854 (19)	1.4495 (7)	1.2205 (14)	0.9182 (23)	0.9854 (22)	0.9868 (21)	0.9149 (25)	0.7937 (28)	0.9312 (22)	0.9086 (22)	0.901 (22)	0.9413 (22)	0.8738 (24)	1.1545 (18)
S24	0.9187 (25)	1.0819 (19)	1.0246 (20)	1.122 (19)	1.1333 (18)	1.1844 (17)	1.1989 (16)	1.2718 (16)	1.2872 (15)	1.2842 (13)	1.2654 (18)	1.2937 (16)	0.972 (21)	1.3234 (12)	1.2276 (13)	1.2198 (14)	1.1872 (16)	1.1439 (16)	1.2196 (14)	1.256 (11)	1.3913 (8)	1.3458 (10)	1.3497 (9)	1.3685 (9)	1.3403 (10)	1.2165 (14)
S25	0.2281 (35)	0.2964 (35)	0.2855 (35)	0.3775 (33)	0.3521 (34)	0.3923 (34)	0.4148 (33)	0.4425 (31)	0.4936 (31)	0.5411 (30)	0.5014 (30)	0.4073 (32)	0.2426 (36)	0.582 (30)	0.0546 (38)	0.5557 (34)	0.7545 (27)	0.77 (27)	0.9008 (26)	0.9611 (22)	1.1944 (16)	1.1779 (16)	1.2761 (12)	1.2686 (13)	1.2242 (15)	0.6278 (31)
S26	0.0004 (39)	0.0003 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0.0017 (39)	0 (39)	0 (39)	0.0008 (39)	0.0003 (39)	0.0002 (39)
S27	1.1767 (17)	1.264 (13)	1.2099 (16)	1.2243 (16)	1.2376 (16)	1.2728 (14)	1.2429 (15)	1.2973 (13)	1.2923 (14)	1.2553 (18)	1.2688 (17)	1.2814 (17)	0.93 (23)	1.2893 (15)	1.1161 (19)	1.0942 (19)	1.0693 (20)	1.0433 (20)	1.0892 (19)	1.0317 (19)	1.1663 (18)	1.1549 (18)	1.2444 (13)	1.26 (14)	1.2309 (14)	1.1897 (16)
S28	0.7372 (28)	0.8597 (26)	0.8288 (25)	0.9144 (25)	0.9736 (25)	1.0067 (21)	1.0264 (21)	1.1807 (17)	1.243 (18)	1.2349 (19)	1.1117 (21)	1.4488 (10)	0.9795 (20)	0.8969 (24)	1.5963 (4)	1.3882 (9)	1.2356 (13)	1.2841 (11)	1.5357 (5)	1.23 (13)	1.4188 (7)	1.4248 (8)	1.3209 (10)	1.3418 (10)	1.2879 (12)	1.1803 (17)
S29	1.8221 (1)	1.8685 (1)	1.7822 (1)	1.7407 (1)	1.771 (1)	1.7974 (1)	1.7657 (2)	1.8763 (1)	1.7329 (1)	1.6267 (2)	1.7359 (1)	1.7826 (1)	1.938 (1)	1.9123 (2)	1.8122 (1)	1.769 (2)	1.796 (1)	1.7917 (1)	1.7752 (1)	1.8011 (1)	1.7556 (1)	1.7326 (1)	1.7625 (2)	1.7585 (2)	1.7818 (1)	1.7875 (1)
S30	0.9902 (20)	1.0352 (22)	0.9745 (22)	0.981 (23)	1.0082 (24)	0.9892 (24)	1.0044 (22)	1.0718 (20)	0.9687 (23)	1.5451 (6)	1.6392 (4)	0.9336 (24)	0.7709 (30)	0.4442 (33)	0.5992 (33)	0.8694 (25)	0.9332 (24)	0.9279 (25)	0.9741 (23)	0.9234 (25)	0.7559 (28)	0.7977 (26)	0.8395 (24)	0.8345 (25)	0.8483 (25)	0.9464 (25)
S31	1.7777 (2)	1.5373 (8)	1.3728 (12)	1.2952 (13)	1.2628 (15)	1.2577 (15)	1.2838 (13)	1.4149 (8)	1.2474 (17)	1.5853 (3)	1.6836 (2)	1.0709 (21)	1.1272 (17)	0.784 (25)	0.8663 (24)	1.3121 (11)	1.2604 (12)	1.3538 (10)	1.4435 (7)	1.429 (7)	1.2807 (13)	1.3145 (11)	1.2348 (14)	1.3376 (11)	1.3959 (9)	1.3172 (10)
S32	1.029 (18)	1.0684 (20)	1.0043 (21)	1.0058 (22)	1.0281 (23)	1.0118 (20)	1.0284 (20)	1.1042 (19)	0.9937 (22)	1.5499 (5)	1.6449 (3)	0.9455 (22)	0.812 (26)	0.4488 (32)	0.603 (32)	0.876 (24)	0.9223 (26)	0.9417 (24)	0.9895 (21)	0.9298 (24)	0.7566 (27)	0.8068 (25)	0.7857 (25)	0.8591 (24)	0.8777 (23)	0.9609 (22)
S33	0.1918 (36)	0.1114 (36)	0.1173 (36)	0.1108 (36)	0.1003 (36)	0.1186 (37)	0.1272 (37)	0.1019 (37)	0.1012 (37)	0.0736 (37)	0.0922 (37)	0.0974 (37)	0.7764 (29)	0.758 (26)	0.7047 (27)	0.6855 (28)	0.6855 (29)	0.6696 (29)	0.8582 (27)	0.8684 (26)	0.8716 (24)	0.769 (27)	0.7534 (27)	0.7706 (27)	0.8403 (26)	0.4542 (36)
S34	0.8479 (26)	0.8757 (25)	0.4952 (31)	0.1574 (35)	0.4848 (31)	0.44 (32)	0.4742 (31)	1.001 (21)	0.5475 (30)	0.4671 (31)	0.8639 (25)	0.5926 (31)	0.84 (24)	0.9658 (23)	0.632 (31)	0.6143 (30)	0.6263 (31)	0.6148 (32)	0.6192 (30)	0.6132 (31)	0.6177 (33)	0.6063 (33)	0.6134 (31)	0.6064 (31)	0.5986 (32)	0.6326 (30)
S35	0.952 (24)	1.0091 (23)	0.9005 (24)	0.9018 (26)	0.9184 (26)	1.0194 (19)	0.969 (23)	0.9585 (24)	0.8538 (25)	0.8966 (24)	0.8004 (26)	0.8212 (25)	1.2518 (12)	1.2209 (16)	0.9595 (23)	0.9541 (22)	0.9688 (23)	0.9858 (22)	0.9659 (24)	1.005 (21)	0.9038 (23)	0.8896 (23)	0.9272 (21)	0.9132 (23)	0.913 (22)	0.9544 (24)
S36	0.6414 (30)	0.7914 (27)	0.7487 (26)	0.796 (28)	0.8441 (27)	0.8397 (26)	0.817 (26)	0.8759 (26)	0.841 (27)	0.8197 (25)	0.8825 (24)	0.9434 (23)	1.1889 (15)	1.1708 (17)	1.1202 (18)	1.1022 (18)	1.1233 (17)	1.1361 (17)	1.0062 (20)	1.0252 (20)	1.0346 (21)	1.0458 (20)	1.042 (19)	1.0321 (19)	1.0448 (19)	0.9565 (23)
S37	0.1394 (37)	0.0917 (37)	0.0649 (37)	0.0926 (37)	0.0904 (37)	0.124 (36)	0.1635 (36)	0.1647 (36)	0.1488 (36)	0.375 (35)	0.2368 (35)	0.2687 (35)	0.2162 (37)	0.2311 (37)	0.2165 (36)	0.2026 (37)	0.2029 (37)	0.2164 (37)	0.2314 (37)	0.2229 (37)	0.2304 (36)	0.2248 (37)	0.2438 (37)	0.2236 (37)	0.2543 (37)	0.1951 (37)
S38	0.0277 (38)	0.0261 (38)	0.0259 (38)	0.043 (38)	0.0398 (38)	0.052 (38)	0.0521 (38)	0.0314 (38)	0.0276 (38)	0.0278 (38)	0.0532 (38)	0.0799 (38)	0.1347 (38)	0.1201 (38)	0.093 (37)	0.1084 (38)	0.1 (38)	0.1056 (38)	0.0728 (38)	0.0778 (38)	0.0762 (38)	0.0629 (38)	0.0593 (38)	0.0556 (38)	0.0558 (38)	0.0643 (38)
S39	0.2732 (34)	0.351 (34)	0.3312 (34)	0.3279 (34)	0.3436 (35)	0.3695 (35)	0.3764 (35)	0.3973 (32)	0.3686 (34)	0.4362 (32)	0.3394 (32)	0.392 (33)	0.5206 (33)	0.4413 (34)	0.4435 (34)	0.4875 (35)	0.5363 (35)	0.5482 (34)	0.7914 (28)	0.8015 (27)	0.7842 (25)	0.7554 (28)	0.7702 (26)	0.7475 (28)	0.7379 (28)	0.5069 (34)

Source: Results obtained from the model developed in Chapter 4.

Table VII-4: Inter-industry unweighted total backward linkages, and ranks, 1975-2015
($m, real price term - base year 2014-15 = 100)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S01	0.9602 (28)	0.974 (21)	0.8849 (27)	0.8825 (25)	0.9242 (25)	0.9452 (24)	1.0513 (17)	0.9243 (24)	1.003 (19)	0.9098 (28)	0.9618 (24)	0.995 (21)	1.0372 (21)	1.0207 (22)	1.0049 (23)	0.9366 (31)	0.9646 (27)	0.987 (24)	1.1057 (11)	1.1015 (14)	1.0407 (15)	0.941 (15)	0.841 (17)	0.8246 (15)	0.8633 (14)	0.9634 (23)
S02	0.8453 (14)	0.8462 (30)	0.9063 (24)	0.8387 (30)	0.8621 (27)	0.9595 (22)	0.9938 (22)	0.9604 (22)	0.809 (33)	0.8035 (32)	0.8023 (32)	0.8363 (25)	1.0162 (23)	1.0168 (23)	1.0692 (14)	0.9816 (29)	1.0172 (22)	0.9188 (28)	1.0663 (15)	1.0264 (19)	0.7859 (31)	0.9128 (17)	0.9108 (12)	0.8967 (10)	0.9125 (12)	0.9198 (28)
S03	0.8517 (6)	0.9245 (23)	0.7895 (34)	0.8479 (29)	0.9257 (23)	0.8545 (30)	0.8618 (28)	0.8536 (31)	0.8367 (31)	0.7653 (36)	0.7728 (36)	0.83 (27)	0.6762 (36)	0.6382 (37)	0.7376 (35)	0.6855 (36)	0.6305 (38)	0.6613 (38)	0.6673 (38)	0.6359 (38)	0.5993 (38)	0.614 (37)	0.6265 (33)	0.5793 (34)	0.6304 (33)	0.7398 (36)
S04	0.7191 (1)	0.7011 (38)	1.0396 (18)	0.9869 (20)	0.7798 (35)	0.9406 (25)	0.9583 (23)	0.8185 (32)	0.8415 (30)	0.8791 (30)	0.787 (34)	0.7969 (30)	0.5987 (38)	0.6121 (38)	0.6849 (37)	0.6321 (38)	0.6993 (36)	0.7504 (36)	0.7285 (36)	0.7007 (36)	0.6279 (36)	0.6582 (35)	0.5805 (35)	0.6098 (33)	0.5753 (35)	0.7483 (35)
S05	1.7945 (2)	1.5284 (1)	1.4485 (1)	1.708 (1)	1.4809 (1)	1.486 (1)	1.3751 (2)	1.25 (5)	1.2429 (5)	1.222 (4)	1.2492 (3)	1.3694 (2)	1.0402 (20)	1.1516 (8)	1.1491 (7)	1.0195 (23)	1.0632 (13)	1.1504 (6)	1.049 (16)	0.9845 (23)	1.048 (13)	0.8718 (19)	0.7181 (28)	0.7101 (27)	0.7373 (28)	1.1939 (7)
S06	0.8445 (19)	0.9048 (27)	0.8995 (26)	0.8701 (27)	0.927 (22)	0.9629 (21)	0.9162 (25)	0.9846 (21)	0.9581 (22)	0.97 (24)	1.0225 (19)	1.1131 (13)	0.9479 (28)	1.0094 (25)	1.0257 (22)	0.9931 (27)	0.998 (25)	0.9589 (26)	0.9229 (30)	0.9137 (27)	0.8772 (25)	0.7727 (29)	0.8165 (22)	0.7605 (24)	0.8205 (19)	0.9276 (27)
S07	1.3275 (32)	1.3221 (3)	1.3368 (3)	1.3436 (3)	1.3434 (3)	1.329 (2)	1.335 (3)	1.2545 (4)	1.2802 (4)	1.2317 (3)	1.2165 (4)	1.2809 (3)	1.2217 (2)	1.2069 (4)	1.2068 (3)	1.2208 (4)	1.1995 (4)	1.2158 (4)	1.2411 (4)	1.2339 (5)	1.1339 (9)	1.0267 (10)	0.939 (10)	0.9057 (9)	0.9503 (10)	1.2121 (6)
S08	1.1102 (30)	1.0735 (15)	1.0823 (14)	1.0297 (17)	1.0571 (15)	1.0336 (16)	1.043 (18)	0.995 (19)	1.0589 (14)	1.0119 (21)	0.9601 (25)	1.0671 (16)	1.0918 (12)	1.0816 (13)	1.0329 (20)	1.017 (24)	0.8395 (33)	0.7941 (34)	0.8447 (32)	0.8241 (31)	0.7184 (35)	0.6459 (36)	0.5275 (37)	0.4815 (37)	0.5088 (37)	0.9172 (29)
S09	1.197 (8)	1.2753 (4)	1.0312 (19)	1.1029 (11)	1.0184 (18)	1.0175 (18)	1.09 (14)	1.2049 (6)	0.9462 (23)	1.0255 (20)	0.9348 (27)	0.9409 (24)	1.0062 (25)	1.1495 (9)	1.1283 (9)	1.0305 (21)	0.8018 (34)	0.8409 (31)	1.0264 (19)	0.8572 (30)	0.809 (29)	0.7885 (27)	0.8175 (21)	0.824 (16)	0.8616 (15)	0.989 (20)
S10	1.1573 (13)	1.0964 (11)	1.0522 (17)	1.0294 (18)	1.0511 (16)	1.0335 (17)	1.0538 (16)	1.0313 (16)	1.0443 (15)	1.0599 (16)	1.1155 (12)	1.1873 (6)	1.105 (10)	1.0513 (17)	1.2785 (1)	1.056 (14)	1.0414 (19)	1.0757 (14)	1.0938 (13)	1.1478 (9)	1.051 (12)	1.0011 (11)	0.8798 (15)	0.87 (13)	0.9404 (11)	1.0602 (15)
S11	1.101 (18)	1.0216 (19)	1.0772 (15)	1.0395 (16)	1.0916 (13)	1.08 (13)	1.0639 (15)	1.0911 (13)	1.0649 (13)	1.0326 (18)	1.0342 (18)	1.0032 (20)	1.012 (24)	0.993 (26)	1.0048 (24)	1.0407 (17)	1.0158 (23)	1.0247 (19)	1.012 (22)	1.0063 (22)	0.9031 (24)	0.8336 (24)	0.7637 (25)	0.7542 (25)	0.7534 (26)	0.9927 (19)
S12	1.2804 (12)	1.2697 (5)	1.1001 (12)	1.1476 (8)	1.1532 (10)	1.0462 (15)	1.0904 (13)	1.3319 (3)	1.3381 (2)	1.2007 (6)	1.1922 (6)	1.1693 (8)	0.9617 (27)	1.0357 (19)	0.9764 (26)	1.127 (7)	1.0065 (24)	1.0174 (20)	0.9757 (25)	0.9427 (26)	0.852 (28)	0.7766 (28)	0.6799 (32)	0.6627 (30)	0.6738 (31)	1.0403 (16)
S13	0.8206 (7)	0.9896 (20)	0.8701 (28)	0.9203 (23)	0.8551 (28)	0.8112 (33)	0.8298 (32)	0.9462 (23)	1.2383 (6)	1.0458 (17)	1.006 (22)	0.9593 (23)	0.8498 (32)	0.9893 (27)	1.0855 (11)	1.096 (8)	0.8705 (30)	0.8228 (32)	0.7849 (34)	0.7376 (35)	0.7763 (32)	0.7491 (32)	0.6802 (31)	0.6584 (31)	0.7425 (27)	0.8854 (31)
S14	1.1769 (16)	1.1148 (10)	1.1288 (10)	1.1053 (10)	1.1631 (9)	1.1424 (9)	1.15 (7)	1.1442 (9)	1.1195 (11)	1.0721 (14)	1.0921 (15)	1.081 (14)	1.0476 (18)	1.0366 (18)	0.941 (27)	1.0716 (11)	0.9624 (28)	0.9263 (27)	0.9814 (24)	0.9473 (25)	0.8693 (26)	0.8007 (26)	0.7265 (27)	0.6676 (29)	0.6968 (30)	1.0066 (18)
S15	1.0855 (17)	1.09 (12)	1.0997 (13)	1.0788 (14)	1.0958 (12)	1.0874 (12)	1.1014 (11)	1.1126 (11)	1.1233 (10)	1.1069 (10)	1.1248 (10)	1.1563 (9)	1.0602 (14)	1.0898 (12)	1.0414 (17)	1.0918 (9)	1.1092 (9)	1.134 (9)	1.1356 (9)	1.1368 (11)	1.0164 (17)	0.9993 (12)	0.8998 (14)	0.8728 (12)	0.9048 (13)	1.0702 (14)
S16	1.2058 (11)	1.2339 (7)	1.2173 (5)	1.2269 (6)	1.231 (6)	1.2492 (6)	1.2726 (5)	1.1741 (7)	1.2349 (7)	1.2198 (5)	1.1788 (7)	1.2703 (4)	1.1342 (8)	1.3061 (1)	1.1828 (5)	1.2233 (3)	1.1341 (5)	1.193 (5)	1.1722 (7)	1.1447 (10)	1.0453 (14)	0.9812 (13)	0.9134 (11)	0.8579 (14)	0.7766 (23)	1.1512 (8)
S17	1.3023 (21)	1.2667 (6)	1.2663 (4)	1.2292 (5)	1.281 (4)	1.3159 (3)	1.2814 (4)	1.3521 (2)	1.3043 (3)	1.277 (2)	1.2707 (2)	1.2577 (5)	1.1911 (6)	1.2042 (5)	1.1289 (8)	1.3185 (1)	1.3659 (2)	1.3475 (2)	1.2846 (2)	1.275 (3)	1.3391 (7)	1.2539 (7)	1.3022 (7)	1.2566 (7)	1.2644 (7)	1.2775 (3)
S18	1.1806 (20)	1.1607 (9)	1.1734 (8)	1.1737 (7)	1.1864 (7)	1.1712 (8)	1.1463 (9)	1.1456 (8)	1.1545 (9)	1.1761 (8)	1.1321 (9)	1.1703 (7)	1.0932 (11)	1.0144 (24)	1.2401 (2)	1.1324 (6)	1.1044 (10)	1.1348 (8)	1.0842 (14)	1.1338 (12)	1.0365 (16)	0.941 (14)	0.8269 (19)	0.8101 (18)	0.8013 (22)	1.093 (13)
S19	1.1011 (29)	1.0633 (16)	1.0732 (16)	1.0866 (13)	1.0653 (14)	1.0641 (14)	1.0074 (21)	1.0142 (18)	1.013 (18)	1.0055 (22)	0.9985 (23)	1.0349 (17)	0.9755 (26)	0.9431 (29)	0.9099 (30)	0.9938 (26)	0.8412 (32)	0.8504 (30)	0.8518 (31)	0.8208 (33)	0.7605 (34)	0.6733 (34)	0.5801 (36)	0.55 (36)	0.5572 (36)	0.9134 (30)

Source: Results obtained from the model developed in Chapter 4

Table VII-4 (cont'd)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S20	1.1579 (33)	1.0804 (14)	1.1488 (9)	1.1325 (9)	1.1645 (8)	1.1208 (10)	1.0965 (12)	1.1046 (12)	1.0914 (12)	1.0902 (13)	1.1025 (13)	1.14 (11)	1.1462 (7)	1.0999 (10)	1.0538 (16)	1.1413 (5)	1.0398 (20)	0.9924 (23)	0.9655 (26)	0.8946 (29)	0.7868 (30)	0.7665 (31)	0.6968 (30)	0.6255 (32)	0.636 (32)	1.011 (17)
S21	0.9773 (5)	1.0496 (17)	1.2055 (6)	1.075 (15)	1.0498 (17)	1.2198 (7)	1.2189 (6)	1.1418 (10)	1.1596 (8)	1.0616 (15)	1.1986 (5)	0.8321 (26)	1.0814 (13)	0.9857 (28)	1.0806 (12)	1.0669 (12)	1.1278 (6)	1.1453 (7)	1.2898 (1)	1.3382 (2)	1.5272 (2)	1.8007 (4)	2.2307 (3)	2.5441 (3)	2.3832 (3)	1.3117 (2)
S22	0.7018 (24)	0.7234 (37)	0.7538 (38)	0.7286 (38)	0.7314 (38)	0.729 (38)	0.7197 (37)	0.7334 (35)	0.8058 (34)	0.8137 (31)	0.7791 (35)	0.7255 (37)	1.2016 (4)	1.0767 (14)	1.0892 (10)	1.036 (18)	1.1203 (7)	1.0355 (17)	1.0285 (18)	1.1203 (13)	1.4013 (6)	1.9033 (3)	2.1444 (4)	2.1458 (5)	2.1946 (4)	1.0977 (12)
S23	1.1774 (3)	1.2192 (8)	1.1973 (7)	1.3644 (2)	1.2495 (5)	1.2965 (4)	1.4387 (1)	1.6482 (1)	1.5903 (1)	1.3716 (1)	1.4754 (1)	1.0749 (15)	1.2141 (3)	1.2437 (2)	1.1914 (4)	1.074 (10)	1.4204 (1)	1.5412 (1)	1.1164 (10)	1.0844 (15)	1.4795 (4)	1.6379 (6)	1.4473 (6)	1.5427 (6)	1.5087 (6)	1.3442 (1)
S24	0.838 (15)	0.9147 (26)	0.9414 (22)	0.9445 (21)	0.9242 (24)	0.9855 (20)	1.0199 (19)	1.0342 (15)	1.0263 (17)	0.9821 (23)	1.1221 (11)	0.7455 (36)	1.0226 (22)	0.9198 (30)	0.9399 (28)	0.9823 (28)	1.1135 (8)	1.0934 (10)	1.2293 (5)	1.3401 (1)	1.7319 (1)	2.0899 (1)	2.3156 (2)	2.6291 (2)	2.4386 (2)	1.253 (4)
S25	0.7178 (34)	0.8037 (31)	0.8078 (31)	0.8364 (31)	0.8069 (31)	0.8416 (31)	0.8587 (29)	0.8767 (29)	0.8995 (29)	0.8968 (29)	0.8159 (31)	0.7748 (34)	1.1336 (9)	1.0574 (15)	0.9933 (25)	1.0205 (22)	1.0461 (16)	1.0058 (22)	1.1036 (12)	1.1543 (8)	1.4542 (5)	1.739 (5)	2.0647 (5)	2.2635 (4)	2.0789 (5)	1.1221 (10)
S26	0.6139 (39)	0.6046 (39)	0.6103 (39)	0.6041 (39)	0.5988 (39)	0.5942 (39)	0.5811 (39)	0.5847 (39)	0.5786 (39)	0.5803 (39)	0.5603 (39)	0.6003 (39)	0.5514 (39)	0.5386 (39)	0.5394 (39)	0.5452 (39)	0.542 (39)	0.5457 (39)	0.5384 (39)	0.5351 (39)	0.4899 (39)	0.4461 (39)	0.4041 (39)	0.3798 (39)	0.4093 (39)	0.543 (39)
S27	0.7311 (9)	0.7626 (34)	0.8056 (32)	0.7914 (35)	0.8042 (33)	0.8661 (27)	0.9035 (27)	0.9112 (26)	0.9425 (24)	0.934 (26)	1.0214 (20)	0.7156 (38)	0.9349 (30)	0.8118 (33)	0.9078 (32)	0.9073 (32)	1.0415 (18)	1.0596 (16)	1.1359 (8)	1.2038 (7)	1.5123 (3)	1.9735 (2)	2.9276 (1)	3.3491 (1)	2.9564 (1)	1.2364 (5)
S28	0.8833 (26)	0.9304 (22)	0.9295 (23)	0.8787 (26)	0.9305 (21)	0.9868 (19)	1.0169 (20)	0.9891 (20)	0.9839 (20)	1.0913 (12)	1.0384 (17)	0.789 (32)	0.7648 (34)	0.7934 (34)	0.8574 (34)	1.047 (16)	1.0878 (11)	1.0897 (11)	0.8082 (33)	0.8226 (32)	1.0705 (11)	1.1883 (8)	0.9076 (13)	0.8873 (11)	0.9708 (9)	0.9497 (25)
S29	0.7678 (4)	0.7497 (35)	0.7566 (37)	0.7471 (36)	0.7421 (37)	0.7373 (37)	0.719 (38)	0.7233 (36)	0.7132 (36)	0.7202 (38)	0.6988 (38)	0.7467 (35)	0.6698 (37)	0.6585 (36)	0.6669 (38)	0.6775 (37)	0.6777 (37)	0.683 (37)	0.6739 (37)	0.6701 (37)	0.621 (37)	0.5472 (38)	0.4675 (38)	0.4434 (38)	0.4725 (38)	0.67 (38)
S30	0.7414 (25)	0.744 (36)	0.7618 (36)	0.7416 (37)	0.7589 (36)	0.7645 (34)	0.7549 (34)	0.698 (38)	0.6887 (37)	0.7795 (35)	0.8192 (30)	0.7854 (33)	0.8958 (31)	1.1624 (7)	0.9084 (31)	0.818 (34)	0.8625 (31)	0.8705 (29)	1.0117 (23)	1.0323 (18)	0.9957 (18)	0.9019 (18)	0.7472 (26)	0.753 (26)	0.7642 (24)	0.8305 (34)
S31	1.2859 (10)	1.3296 (2)	1.3446 (2)	1.288 (4)	1.4665 (2)	1.2562 (5)	1.1464 (8)	0.9167 (25)	0.908 (26)	1.1911 (7)	1.1599 (8)	1.8388 (1)	1.4096 (1)	1.2256 (3)	1.0716 (13)	0.8714 (33)	0.9863 (26)	0.8142 (33)	0.934 (28)	1.0162 (21)	0.9709 (19)	0.8548 (23)	1.2121 (8)	0.7626 (23)	0.7589 (25)	1.1208 (11)
S32	0.7329 (23)	0.8474 (29)	0.8261 (30)	0.8073 (32)	0.7952 (34)	0.7637 (35)	0.7383 (36)	0.7127 (37)	0.6805 (38)	0.7393 (37)	0.84 (28)	0.8121 (29)	0.8126 (33)	0.8808 (32)	0.8783 (33)	0.9976 (25)	1.0484 (15)	1.0103 (21)	1.1831 (6)	1.2099 (6)	1.0929 (10)	0.9384 (16)	0.85 (16)	0.8121 (17)	0.8495 (16)	0.8744 (32)
S33	1.1353 (36)	1.0827 (13)	1.1139 (11)	1.0995 (12)	1.1421 (11)	1.1205 (11)	1.1031 (10)	1.0514 (14)	1.0373 (16)	1.1008 (11)	1.0759 (16)	1.1285 (12)	1.1949 (5)	1.1681 (6)	1.1781 (6)	1.2938 (2)	1.324 (3)	1.3408 (3)	1.2427 (3)	1.2558 (4)	1.1625 (8)	1.0903 (9)	0.9839 (9)	0.9406 (8)	1.0137 (8)	1.1352 (9)
S34	0.8828 (27)	0.8606 (28)	0.8535 (29)	0.8576 (28)	0.8481 (29)	0.8595 (28)	0.8433 (31)	0.872 (30)	0.9042 (28)	0.9563 (25)	0.8276 (29)	0.9777 (22)	1.0569 (16)	1.0327 (20)	1.0364 (19)	1.0546 (15)	1.067 (12)	1.0867 (12)	1.0386 (17)	1.0655 (16)	0.9564 (21)	0.8685 (20)	0.8045 (24)	0.7783 (21)	0.8126 (20)	0.9281 (26)
S35	0.9992 (22)	1.034 (18)	1.0274 (20)	1.0006 (19)	1.0014 (19)	0.9453 (23)	0.9192 (24)	0.9077 (27)	0.9066 (27)	0.9294 (27)	0.952 (26)	1.0232 (18)	1.0463 (19)	1.0946 (11)	1.0308 (21)	1.0592 (13)	1.0605 (14)	1.0758 (13)	1.023 (20)	1.0328 (17)	0.9543 (22)	0.8657 (21)	0.8155 (23)	0.78 (20)	0.8269 (17)	0.9725 (21)
S36	0.856 (31)	0.779 (33)	0.7843 (35)	0.802 (33)	0.8276 (30)	0.8398 (32)	0.8065 (33)	0.8133 (33)	0.8219 (32)	0.7947 (33)	0.7942 (33)	0.822 (28)	0.9442 (29)	0.9128 (31)	0.9178 (29)	0.9374 (30)	0.9357 (29)	0.9608 (25)	0.9244 (29)	0.9067 (28)	0.8544 (27)	0.7718 (30)	0.7029 (29)	0.6726 (28)	0.7159 (29)	0.836 (33)
S37	1.0223 (37)	0.9215 (24)	0.9519 (21)	0.919 (24)	0.9215 (26)	0.8566 (29)	0.8462 (30)	0.9059 (28)	0.9385 (25)	1.139 (9)	1.0951 (14)	1.1452 (10)	1.0562 (17)	1.0225 (21)	1.0612 (15)	1.0326 (19)	1.0336 (21)	1.0301 (18)	0.9453 (27)	0.9651 (24)	0.914 (23)	0.8259 (25)	0.822 (20)	0.767 (22)	0.8023 (21)	0.9576 (24)
S38	0.7666 (38)	0.7856 (32)	0.7992 (33)	0.7934 (34)	0.805 (32)	0.7607 (36)	0.7431 (35)	0.7667 (34)	0.749 (35)	0.7871 (34)	0.7558 (37)	0.7917 (31)	0.7387 (35)	0.7129 (35)	0.7283 (36)	0.7378 (35)	0.7584 (35)	0.7521 (35)	0.7576 (35)	0.7601 (34)	0.7644 (33)	0.6868 (33)	0.5947 (34)	0.5769 (35)	0.6113 (34)	0.7394 (37)
S39	0.9497 (35)	0.9205 (25)	0.9039 (25)	0.9407 (22)	0.9393 (20)	0.9255 (26)	0.9046 (26)	1.0192 (17)	0.9626 (21)	1.0255 (19)	1.0154 (21)	1.0118 (19)	1.058 (15)	1.0519 (16)	1.0408 (18)	1.0318 (20)	1.0415 (17)	1.0629 (15)	1.0219 (21)	1.0212 (20)	0.9703 (20)	0.8624 (22)	0.8309 (18)	0.794 (19)	0.8246 (18)	0.9652 (22)

Source: Results obtained from the model developed in Chapter 4.

Table VII-5: Inter-industry unweighted total forward linkages and ranks, 1975-2015

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S01	0.8235 (9)	0.8749 (23)	0.8501 (27)	0.8478 (27)	0.8673 (27)	0.848 (27)	0.8885 (26)	0.7934 (28)	0.8321 (27)	0.7784 (28)	0.8211 (25)	0.9398 (24)	0.9748 (22)	0.8903 (24)	0.9744 (21)	0.9441 (22)	0.9557 (23)	0.9763 (22)	1.0338 (18)	1.0766 (17)	0.9606 (19)	0.9442 (18)	0.8707 (21)	0.8909 (21)	0.924 (19)	0.9033 (22)
S02	1.0993 (21)	1.2246 (10)	1.09 (14)	1.2834 (9)	1.307 (8)	1.1619 (12)	1.0451 (18)	1.0894 (13)	0.9289 (20)	0.835 (25)	0.8272 (24)	0.9475 (22)	0.7522 (31)	0.7264 (31)	0.8436 (25)	0.7644 (32)	0.6868 (36)	0.6892 (36)	0.778 (30)	0.782 (31)	0.6137 (36)	0.6386 (35)	0.6528 (34)	0.6249 (35)	0.6359 (35)	0.8811 (28)
S03	1.3848 (31)	1.5377 (4)	1.513 (5)	1.3608 (8)	1.4673 (4)	1.5345 (2)	1.493 (2)	1.4864 (5)	1.2166 (13)	1.1984 (11)	1.2642 (9)	1.3981 (5)	1.2548 (7)	1.2258 (12)	1.2585 (6)	1.3094 (5)	1.2318 (6)	1.2473 (8)	1.2383 (10)	1.2195 (10)	1.1407 (14)	1.0395 (16)	1.0163 (16)	1.0389 (16)	0.9491 (17)	1.281 (7)
S04	2.0071 (34)	1.8441 (1)	1.5565 (2)	1.8032 (1)	1.6922 (1)	1.3582 (8)	1.4279 (7)	1.687 (1)	1.8441 (1)	2.2528 (1)	1.0806 (16)	1.163 (10)	1.131 (12)	1.1106 (17)	1.1611 (15)	0.8709 (26)	1.0593 (19)	1.0166 (21)	0.7473 (32)	0.7959 (29)	0.8823 (22)	0.9109 (20)	0.7587 (28)	0.6921 (31)	0.6806 (31)	1.2614 (9)
S05	1.7293 (28)	1.8288 (2)	1.7144 (1)	1.6179 (2)	1.2519 (12)	1.1385 (14)	1.2805 (11)	1.5981 (2)	1.4651 (2)	1.516 (3)	1.311 (8)	1.4028 (4)	1.1027 (14)	1.1366 (16)	1.2359 (9)	1.1798 (12)	1.1669 (12)	1.1482 (13)	1.039 (17)	0.9796 (20)	0.8613 (23)	0.861 (23)	0.7787 (25)	0.8098 (25)	0.8561 (22)	1.2404 (12)
S06	0.9798 (14)	0.9622 (17)	1.0207 (19)	1.0512 (15)	1.0293 (18)	0.9632 (21)	0.906 (22)	0.9333 (23)	0.8822 (23)	0.8244 (26)	0.7753 (29)	0.8517 (28)	0.9677 (23)	0.9504 (23)	0.9561 (22)	0.9637 (21)	0.9816 (22)	0.8923 (27)	0.9053 (26)	0.8813 (27)	0.7623 (29)	0.7338 (29)	0.735 (29)	0.6322 (34)	0.6642 (33)	0.8882 (27)
S07	0.6175 (1)	0.6157 (34)	0.6109 (34)	0.6222 (32)	0.6049 (33)	0.6047 (35)	0.6034 (34)	0.5845 (34)	0.6033 (33)	0.5831 (34)	0.5643 (34)	0.6259 (34)	0.7518 (32)	0.7167 (32)	0.7532 (34)	0.728 (35)	0.7187 (33)	0.7587 (31)	0.7222 (34)	0.787 (30)	0.7038 (31)	0.6781 (31)	0.6647 (33)	0.6734 (32)	0.6677 (32)	0.6626 (34)
S08	0.7553 (10)	0.7241 (30)	0.7608 (29)	0.7635 (29)	0.735 (30)	0.7131 (30)	0.7172 (30)	0.7132 (31)	0.7638 (29)	0.698 (30)	0.6152 (32)	0.7964 (29)	0.6868 (35)	0.6467 (36)	0.7744 (31)	0.7737 (29)	0.7229 (32)	0.71 (34)	0.7081 (35)	0.7764 (32)	0.6867 (33)	0.6775 (32)	0.7152 (30)	0.7407 (29)	0.7502 (28)	0.725 (32)
S09	1.3405 (29)	0.6994 (31)	1.2621 (9)	1.1915 (12)	1.2791 (9)	1.2621 (10)	1.3403 (10)	0.5553 (35)	1.3424 (9)	1.3433 (8)	1.2565 (10)	1.4259 (2)	1.1851 (9)	1.5831 (1)	1.508 (1)	1.4886 (2)	1.3873 (3)	1.3718 (2)	1.3081 (4)	1.338 (3)	1.1598 (12)	1.1769 (12)	1.1858 (12)	1.15 (13)	1.1814 (12)	1.2529 (11)
S10	1.1477 (19)	0.8627 (24)	1.1972 (12)	1.1789 (13)	1.1764 (13)	1.1506 (13)	1.1325 (14)	0.9637 (18)	1.0934 (15)	1.0064 (18)	1.0008 (19)	1.1482 (13)	1.3026 (5)	1.2358 (9)	1.2492 (7)	1.1994 (9)	1.1926 (9)	1.2336 (9)	1.1196 (14)	1.2312 (8)	1.1533 (13)	1.1155 (13)	1.1875 (11)	1.2003 (11)	1.2195 (10)	1.1479 (15)
S11	1.0421 (17)	1.1128 (13)	1.0373 (17)	0.9933 (21)	1.028 (19)	1.0523 (17)	1.0492 (17)	1.0796 (15)	1.0251 (16)	0.9589 (20)	0.9837 (20)	1.0717 (19)	1.1671 (11)	1.1526 (15)	1.1437 (16)	1.1002 (18)	1.0709 (18)	1.0758 (18)	1.0422 (16)	1.0675 (18)	0.9847 (18)	0.9411 (19)	0.9595 (18)	0.9699 (18)	0.9259 (18)	1.0414 (20)
S12	1.153 (20)	1.0827 (14)	1.0606 (16)	1.0355 (17)	1.0433 (15)	1.0778 (16)	1.0714 (15)	1.1002 (11)	1.0114 (18)	0.9525 (21)	1.0048 (18)	1.1171 (18)	1.1744 (10)	1.031 (21)	1.0179 (20)	1.105 (17)	1.0964 (17)	1.1013 (15)	1.0829 (15)	1.1031 (14)	0.9969 (17)	0.9691 (17)	0.9992 (17)	0.9919 (17)	1.0027 (16)	1.0553 (19)
S13	1.3443 (36)	1.5747 (3)	1.5419 (3)	1.541 (3)	1.5194 (2)	1.5614 (1)	1.543 (1)	1.4166 (7)	1.4572 (3)	1.4952 (4)	1.3115 (7)	1.4104 (3)	1.5671 (1)	1.1846 (14)	1.4332 (2)	1.3416 (3)	1.4707 (2)	1.3717 (3)	1.2974 (5)	1.3853 (2)	1.2268 (10)	1.4404 (6)	1.2013 (10)	1.281 (8)	1.3863 (6)	1.4122 (2)
S14	1.0525 (12)	0.962 (18)	1.1356 (13)	1.1269 (14)	1.1668 (14)	1.1831 (11)	1.1348 (13)	0.962 (19)	1.1351 (14)	1.0542 (17)	0.9538 (21)	1.1557 (11)	1.2407 (8)	1.1946 (13)	1.1887 (13)	1.1413 (14)	1.12 (15)	1.0797 (17)	1.0332 (19)	1.0864 (16)	0.9339 (20)	0.8875 (22)	0.9179 (20)	0.8933 (20)	0.9004 (21)	1.0656 (17)
S15	1.0523 (23)	1.0442 (15)	1.026 (18)	1.0137 (19)	1.016 (20)	1.0223 (20)	1.0227 (20)	1.0664 (17)	1.0061 (19)	0.9727 (19)	1.0288 (17)	1.1395 (14)	1.3963 (3)	1.3308 (3)	1.3259 (5)	1.2982 (6)	1.3021 (4)	1.3323 (4)	1.2942 (6)	1.334 (4)	1.2342 (9)	1.2265 (10)	1.2965 (8)	1.2722 (10)	1.268 (9)	1.1729 (14)
S16	1.234 (18)	1.2701 (9)	1.262 (10)	1.2404 (11)	1.263 (11)	1.3054 (9)	1.3585 (9)	1.3124 (10)	1.2819 (12)	1.1005 (16)	1.1321 (15)	1.3035 (7)	1.3392 (4)	1.2585 (7)	1.1981 (12)	1.3264 (4)	1.259 (5)	1.2743 (5)	1.2891 (7)	1.3053 (5)	1.2371 (8)	1.1978 (11)	1.2797 (9)	1.2753 (9)	1.1848 (11)	1.2595 (10)
S17	0.9177 (16)	0.8609 (25)	0.9103 (22)	0.9241 (22)	0.9672 (22)	0.933 (23)	0.8871 (27)	0.9027 (25)	0.8783 (24)	0.8429 (23)	0.7385 (30)	0.8901 (26)	0.7218 (34)	0.7616 (29)	0.8094 (27)	0.764 (33)	0.7864 (29)	0.6952 (35)	0.7269 (33)	0.6888 (36)	0.7239 (30)	0.698 (30)	0.6481 (35)	0.6421 (33)	0.6157 (36)	0.7974 (29)
S18	0.923 (15)	0.9231 (19)	0.9363 (20)	0.9168 (23)	0.9222 (23)	0.9366 (22)	0.9231 (21)	0.9424 (22)	0.9261 (21)	0.8778 (22)	0.9436 (22)	1.151 (12)	1.2787 (6)	1.234 (11)	1.2399 (8)	1.1966 (11)	1.1805 (11)	1.1954 (10)	1.1365 (13)	1.1803 (11)	1.1093 (15)	1.0913 (14)	1.0982 (14)	1.0783 (15)	1.1046 (15)	1.0578 (18)
S19	0.776 (6)	0.7321 (29)	0.7382 (30)	0.7226 (30)	0.7375 (29)	0.7307 (29)	0.7325 (29)	0.7616 (29)	0.7532 (30)	0.6708 (31)	0.6749 (31)	0.7958 (30)	0.8599 (29)	0.818 (27)	0.8339 (26)	0.8311 (27)	0.8047 (28)	0.7846 (28)	0.7882 (29)	0.736 (34)	0.6753 (34)	0.6633 (34)	0.7101 (31)	0.7496 (28)	0.7219 (29)	0.7521 (30)

Source: Results obtained from the model developed in Chapter 4.

Table VII-5 (cont'd)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S20	0.592 (13)	0.6274 (33)	0.6335 (32)	0.6192 (33)	0.6019 (34)	0.6279 (33)	0.6194 (33)	0.5915 (33)	0.576 (35)	0.5347 (36)	0.531 (35)	0.5628 (36)	0.8431 (30)	0.7457 (30)	0.7849 (29)	0.7299 (34)	0.7127 (34)	0.7563 (32)	0.7023 (36)	0.7082 (35)	0.6143 (35)	0.5975 (36)	0.6345 (36)	0.6107 (36)	0.643 (34)	0.648 (36)
S21	1.4004 (22)	1.4499 (7)	1.4852 (6)	1.4329 (6)	1.4471 (5)	1.5264 (3)	1.4919 (3)	1.4896 (4)	1.4424 (4)	1.3509 (7)	1.616 (3)	1.1259 (15)	0.9997 (20)	1.2451 (8)	1.1357 (17)	1.1343 (15)	1.1231 (13)	1.1014 (14)	1.1714 (11)	1.1187 (13)	1.5775 (4)	1.6104 (4)	1.701 (3)	1.7666 (3)	1.7415 (3)	1.3874 (3)
S22	0.8625 (33)	1.0253 (16)	0.9331 (21)	1.0163 (18)	0.9837 (21)	1.0438 (18)	1.0324 (19)	1.0781 (16)	1.2854 (11)	1.1838 (12)	1.4956 (6)	1.3807 (6)	0.9521 (24)	1.2664 (5)	1.1858 (14)	1.2238 (8)	1.2281 (7)	1.2598 (6)	1.4141 (2)	1.2273 (9)	1.7452 (2)	1.911 (2)	1.9249 (1)	1.8344 (2)	1.8746 (1)	1.2947 (6)
S23	1.6085 (35)	1.5327 (5)	1.5331 (4)	1.4769 (4)	1.4015 (6)	1.4577 (5)	1.4443 (5)	1.4053 (8)	1.3965 (8)	1.3687 (5)	1.6868 (2)	1.1798 (9)	1.0123 (18)	1.3448 (2)	1.2 (11)	0.9935 (20)	1.0517 (20)	1.0505 (20)	1.0015 (21)	0.9261 (25)	1.2255 (11)	1.2408 (9)	1.1572 (13)	1.184 (12)	1.1372 (13)	1.2807 (8)
S24	1.0645 (32)	1.1954 (11)	1.2029 (11)	1.2694 (10)	1.269 (10)	1.3589 (7)	1.3842 (8)	1.4037 (9)	1.4049 (7)	1.3592 (6)	1.6008 (4)	1.1172 (17)	1.0026 (19)	1.2613 (6)	1.2034 (10)	1.1972 (10)	1.1932 (8)	1.1598 (12)	1.2608 (9)	1.2755 (7)	1.9561 (1)	1.9541 (1)	1.8126 (2)	1.8708 (1)	1.8323 (2)	1.3844 (4)
S25	0.5876 (30)	0.6341 (32)	0.6314 (33)	0.6794 (31)	0.6646 (31)	0.6997 (31)	0.7083 (31)	0.7349 (30)	0.7437 (31)	0.7558 (29)	0.7945 (27)	0.6791 (32)	0.6105 (36)	0.8005 (28)	0.4937 (38)	0.7713 (30)	0.899 (27)	0.9087 (26)	1.0162 (20)	1.0487 (19)	1.6179 (3)	1.6496 (3)	1.6882 (4)	1.6982 (4)	1.6389 (5)	0.9262 (21)
S26	0.4581 (38)	0.4669 (39)	0.4591 (39)	0.4496 (39)	0.4532 (39)	0.4536 (39)	0.4447 (39)	0.4695 (39)	0.4382 (39)	0.4232 (39)	0.4373 (39)	0.4882 (39)	0.488 (39)	0.4819 (39)	0.4653 (39)	0.461 (39)	0.466 (39)	0.4668 (39)	0.4565 (39)	0.4632 (39)	0.4148 (39)	0.4047 (39)	0.4254 (39)	0.4209 (39)	0.4233 (39)	0.4512 (39)
S27	1.3018 (25)	1.3709 (8)	1.3944 (8)	1.3729 (7)	1.3765 (7)	1.4528 (6)	1.4318 (6)	1.4314 (6)	1.4073 (6)	1.3319 (9)	1.5877 (5)	1.1176 (16)	0.979 (21)	1.235 (10)	1.1261 (18)	1.1091 (16)	1.1058 (16)	1.086 (16)	1.1491 (12)	1.0981 (15)	1.5633 (5)	1.5947 (5)	1.635 (5)	1.6755 (5)	1.6476 (4)	1.3433 (5)
S28	0.8372 (26)	0.8503 (26)	0.8524 (26)	1.0047 (20)	1.0313 (17)	1.1105 (15)	1.1634 (12)	1.0992 (12)	1.2886 (10)	1.3141 (10)	1.1502 (14)	1.2939 (8)	1.0906 (15)	1.0669 (20)	1.4035 (3)	1.264 (7)	1.1849 (10)	1.2513 (7)	1.3629 (3)	1.1664 (12)	1.3421 (6)	1.4126 (7)	1.3223 (7)	1.3041 (7)	1.2859 (8)	1.1781 (13)
S29	1.4486 (39)	1.4963 (6)	1.4541 (7)	1.4427 (5)	1.4689 (3)	1.4609 (4)	1.4517 (4)	1.5329 (3)	1.4305 (5)	1.6586 (2)	1.7224 (1)	1.558 (1)	1.5062 (2)	1.3234 (4)	1.3692 (4)	1.5148 (1)	1.5318 (1)	1.5463 (1)	1.5542 (1)	1.5402 (1)	1.3155 (7)	1.2884 (8)	1.3324 (6)	1.327 (6)	1.3358 (7)	1.4644 (1)
S30	0.8588 (24)	0.8964 (22)	0.8676 (24)	0.8697 (25)	0.8929 (25)	0.8867 (26)	0.8888 (25)	0.9444 (21)	0.8776 (25)	1.1374 (15)	1.1989 (13)	0.9435 (23)	0.8787 (27)	0.7026 (34)	0.7657 (33)	0.9228 (24)	0.942 (25)	0.9475 (25)	0.9581 (24)	0.9388 (24)	0.7685 (27)	0.7748 (26)	0.8447 (23)	0.8264 (24)	0.8298 (25)	0.8945 (26)
S31	1.2589 (37)	1.1647 (12)	1.0854 (15)	1.0466 (16)	1.0357 (16)	1.0246 (19)	1.0519 (16)	1.0802 (14)	1.0209 (17)	1.169 (13)	1.2262 (11)	1.0218 (20)	1.0571 (17)	0.8559 (25)	0.912 (24)	1.1575 (13)	1.1213 (14)	1.19 (11)	1.2664 (8)	1.2808 (6)	1.0822 (16)	1.0886 (15)	1.0307 (15)	1.0877 (14)	1.1302 (14)	1.0978 (16)
S32	0.8785 (27)	0.9141 (20)	0.8839 (23)	0.8837 (24)	0.9041 (24)	0.8984 (25)	0.9028 (23)	0.9572 (20)	0.8905 (22)	1.1412 (14)	1.2024 (12)	0.9503 (21)	0.8993 (25)	0.7068 (33)	0.7714 (32)	0.9218 (25)	0.9324 (26)	0.9525 (24)	0.9632 (22)	0.9395 (23)	0.7684 (28)	0.7788 (25)	0.8092 (24)	0.8353 (23)	0.842 (23)	0.9011 (24)
S33	0.534 (2)	0.5123 (36)	0.5078 (36)	0.4981 (36)	0.4979 (36)	0.5059 (36)	0.5014 (37)	0.5156 (37)	0.4844 (37)	0.4564 (37)	0.4777 (37)	0.5308 (37)	0.8632 (28)	0.8279 (26)	0.8006 (28)	0.7802 (28)	0.777 (30)	0.7773 (29)	0.8858 (27)	0.8964 (26)	0.8166 (25)	0.7549 (27)	0.7694 (27)	0.7759 (26)	0.8118 (26)	0.6624 (35)
S34	0.8284 (5)	0.8402 (27)	0.6668 (31)	0.5146 (35)	0.6597 (32)	0.6397 (32)	0.6498 (32)	0.9129 (24)	0.6757 (32)	0.625 (32)	0.8295 (23)	0.7548 (31)	0.8991 (26)	0.9581 (22)	0.7757 (30)	0.7698 (31)	0.7719 (31)	0.7709 (30)	0.7591 (31)	0.7644 (33)	0.6933 (32)	0.6741 (33)	0.6989 (32)	0.6938 (30)	0.6922 (30)	0.7407 (31)
S35	0.8902 (7)	0.9001 (21)	0.8614 (25)	0.8675 (26)	0.8777 (26)	0.9209 (24)	0.8972 (24)	0.8996 (26)	0.8366 (26)	0.8377 (24)	0.7936 (28)	0.8775 (27)	1.1129 (13)	1.1033 (18)	0.9422 (23)	0.9411 (23)	0.9458 (24)	0.9577 (23)	0.9317 (25)	0.961 (22)	0.8295 (24)	0.8135 (24)	0.8514 (22)	0.8406 (22)	0.8398 (24)	0.9012 (23)
S36	0.6784 (3)	0.7952 (28)	0.7729 (28)	0.7804 (28)	0.8036 (28)	0.8082 (28)	0.7944 (28)	0.8525 (27)	0.8065 (28)	0.7813 (27)	0.811 (26)	0.9117 (25)	1.0848 (16)	1.0768 (19)	1.0227 (19)	1.0259 (19)	1.0345 (21)	1.0517 (19)	0.9595 (23)	0.9751 (21)	0.8937 (21)	0.8887 (21)	0.9298 (19)	0.9205 (19)	0.9232 (20)	0.8953 (25)
S37	0.5097 (4)	0.5045 (37)	0.4856 (37)	0.4877 (37)	0.4906 (37)	0.5055 (37)	0.5157 (36)	0.541 (36)	0.5072 (36)	0.5648 (35)	0.5166 (36)	0.5877 (35)	0.5883 (37)	0.5912 (37)	0.5633 (36)	0.5546 (37)	0.5593 (37)	0.566 (37)	0.565 (37)	0.5668 (37)	0.5113 (37)	0.4993 (37)	0.5311 (37)	0.5184 (37)	0.5319 (37)	0.5345 (37)
S38	0.4678 (8)	0.4771 (38)	0.4691 (38)	0.4665 (38)	0.4688 (38)	0.4742 (38)	0.4659 (38)	0.4819 (38)	0.4496 (38)	0.4342 (38)	0.4592 (38)	0.5243 (38)	0.5512 (38)	0.5383 (38)	0.5095 (37)	0.5134 (38)	0.5137 (38)	0.5183 (38)	0.4903 (38)	0.4988 (38)	0.4461 (38)	0.4309 (38)	0.452 (38)	0.4454 (38)	0.4475 (38)	0.4798 (38)
S39	0.5547 (11)	0.6089 (35)	0.5964 (35)	0.5865 (34)	0.5976 (35)	0.6066 (34)	0.603 (35)	0.6301 (32)	0.5911 (34)	0.6106 (33)	0.5744 (33)	0.6601 (33)	0.7262 (33)	0.68 (35)	0.6641 (35)	0.6875 (36)	0.7113 (35)	0.727 (33)	0.8416 (28)	0.8518 (28)	0.7713 (26)	0.7415 (28)	0.7736 (26)	0.7571 (27)	0.7524 (27)	0.6762 (33)

Source: Results obtained from the model developed in Chapter 4.

Table VII-6: Inter-industry weighted total backward indices and ranks, 1975-2015

(Reformulated System of Weights developed by this research)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S01	1.2137 (9)	1.0757 (11)	1.112 (11)	1.0926 (10)	0.9671 (11)	1.0255 (29)	1.1437 (7)	1.1783 (10)	1.1012 (8)	1.1669 (6)	1.0841 (9)	1.0669 (9)	1.2592 (7)	1.359 (7)	1.201 (8)	0.6929 (8)	1.0209 (9)	0.8782 (10)	0.8067 (12)	0.6435 (15)	0.9401 (10)	0.2786 (18)	1.0332 (10)	1.0362 (10)	1.051 (10)	1.0171 (10)
S02	0.1097 (21)	0.3105 (23)	0.3994 (19)	0.4039 (22)	0.2192 (21)	1.3164 (4)	1.1442 (6)	0.2894 (19)	1.0509 (14)	0.9642 (18)	0.9188 (22)	0.9787 (14)	0.96 (13)	0.971 (13)	1.0334 (10)	0.6228 (12)	0.943 (12)	0.7937 (14)	0.8368 (11)	0.6611 (14)	0.927 (11)	0.6122 (10)	1.0887 (9)	1.0934 (9)	1.0693 (9)	0.7887 (15)
S03	0.0601 (31)	0.2418 (36)	0.2924 (36)	0.3618 (32)	0.1528 (34)	1.2508 (19)	1.0516 (21)	0.112 (32)	1.0391 (18)	0.954 (21)	0.9127 (25)	0.952 (25)	0.7697 (30)	0.8181 (29)	0.8251 (28)	0.4661 (29)	0.7454 (28)	0.6516 (29)	0.6214 (30)	0.4817 (32)	0.7083 (28)	0.2237 (21)	0.7785 (25)	0.7809 (27)	0.8018 (27)	0.6421 (33)
S04	0.0509 (34)	0.2468 (32)	0.296 (34)	0.3557 (34)	0.1583 (31)	1.2617 (10)	1.0587 (15)	0.1108 (33)	1.0329 (24)	0.947 (32)	0.9165 (24)	0.9538 (22)	0.766 (32)	0.8176 (31)	0.827 (26)	0.4777 (25)	0.7502 (24)	0.6617 (25)	0.6535 (24)	0.5143 (24)	0.7292 (25)	0.2966 (17)	0.7783 (26)	0.7934 (23)	0.8023 (25)	0.6503 (26)
S05	0.0662 (28)	0.2509 (31)	0.3061 (30)	0.3983 (24)	0.3457 (17)	1.2987 (6)	1.0757 (10)	0.1633 (24)	1.0367 (20)	0.9503 (24)	0.9105 (27)	0.9494 (27)	0.7708 (29)	0.8257 (25)	0.8272 (25)	0.4654 (30)	0.7457 (27)	0.6583 (26)	0.6423 (26)	0.549 (20)	0.7423 (22)	0.2621 (19)	0.804 (22)	0.8127 (20)	0.8255 (21)	0.6673 (24)
S06	0.2799 (14)	0.4744 (17)	0.4817 (15)	0.5272 (16)	0.4305 (13)	1.2181 (25)	1.0613 (14)	0.4422 (15)	1.0712 (11)	0.9968 (14)	0.9856 (14)	1.0586 (11)	0.9073 (16)	0.9679 (14)	0.97 (12)	0.5352 (18)	0.8772 (14)	0.8667 (11)	0.9766 (9)	0.9628 (7)	1.0495 (9)	0.8041 (6)	0.9787 (13)	1.0213 (11)	0.9719 (13)	0.8367 (14)
S07	6.8182 (1)	5.8108 (1)	6.3693 (1)	5.457 (1)	6.0652 (1)	0.3119 (33)	3.0763 (1)	5.7674 (1)	2.2808 (1)	2.5164 (1)	2.5218 (1)	2.5269 (1)	2.6733 (1)	2.6742 (1)	2.314 (1)	1.4405 (3)	2.123 (2)	1.8576 (3)	1.6561 (2)	1.1782 (5)	1.6111 (3)	0.788 (7)	1.8293 (3)	1.8059 (3)	1.9086 (2)	2.9353 (2)
S08	1.0454 (10)	1.2205 (9)	1.1487 (10)	0.8467 (11)	0.9931 (10)	1.4357 (1)	1.2436 (2)	1.0906 (11)	1.2606 (3)	1.113 (8)	1.2341 (4)	1.176 (6)	1.2323 (8)	1.1767 (8)	1.0402 (9)	0.5606 (17)	0.8579 (16)	0.7457 (19)	0.7032 (19)	0.5386 (21)	0.7859 (17)	0.1844 (22)	0.8171 (20)	0.8012 (22)	0.826 (20)	0.9631 (12)
S09	0.0646 (29)	0.3538 (20)	0.3011 (31)	0.3553 (35)	0.154 (33)	1.2529 (13)	1.0502 (26)	0.2697 (21)	1.0349 (22)	0.9486 (27)	0.9101 (28)	0.9495 (26)	0.7906 (24)	0.81 (37)	0.8172 (33)	0.4573 (37)	0.7352 (32)	0.6433 (34)	0.6123 (33)	0.4758 (35)	0.7029 (33)	0.126 (34)	0.7614 (35)	0.7662 (32)	0.7889 (34)	0.6453 (29)
S10	0.1357 (19)	0.4875 (15)	0.3338 (24)	0.3807 (26)	0.2042 (23)	1.2389 (22)	1.056 (16)	0.2374 (23)	1.0411 (16)	0.9605 (19)	0.9262 (19)	0.965 (18)	0.7891 (26)	0.8345 (23)	0.8737 (21)	0.4701 (28)	0.7561 (22)	0.6547 (27)	0.6525 (25)	0.4968 (27)	0.7166 (27)	0.1327 (31)	0.7626 (32)	0.7654 (34)	0.7922 (32)	0.6666 (25)
S11	0.2329 (17)	0.4615 (18)	0.4068 (18)	0.4598 (18)	0.2953 (18)	1.0258 (28)	0.9955 (31)	0.5044 (13)	0.9972 (31)	0.9535 (23)	0.9271 (18)	0.972 (16)	0.8408 (19)	0.8885 (17)	0.8781 (20)	0.5046 (20)	0.8283 (18)	0.736 (20)	0.7264 (16)	0.5964 (16)	0.7413 (23)	0.2318 (20)	0.8375 (18)	0.8341 (18)	0.8569 (17)	0.7093 (21)
S12	0.1229 (20)	0.3978 (19)	0.4072 (17)	0.5136 (17)	0.2637 (19)	1.4005 (2)	1.2388 (3)	0.3386 (18)	1.1471 (4)	1.1179 (7)	1.0997 (7)	1.109 (7)	0.8453 (18)	0.9828 (12)	0.9284 (16)	0.6268 (11)	0.8706 (15)	0.773 (17)	0.7649 (15)	0.6645 (13)	0.8532 (13)	0.1639 (24)	0.8564 (17)	0.8688 (15)	0.8804 (15)	0.7694 (16)
S13	0.0492 (36)	0.2409 (37)	0.2919 (37)	0.352 (37)	0.1489 (37)	1.2514 (16)	1.0505 (23)	0.0972 (37)	1.0321 (26)	0.9472 (30)	0.9067 (29)	0.9482 (31)	0.7607 (36)	0.8131 (33)	0.8161 (37)	0.4585 (34)	0.7338 (36)	0.6407 (37)	0.6096 (38)	0.4736 (38)	0.6999 (38)	0.1233 (37)	0.76 (37)	0.7627 (37)	0.7861 (38)	0.6302 (37)
S14	0.7014 (12)	1.0633 (12)	0.585 (12)	0.5796 (12)	0.4302 (14)	1.0844 (27)	1.0759 (9)	1.0525 (12)	1.1037 (7)	1.0255 (11)	1.0925 (8)	1.0591 (10)	0.9778 (12)	0.9998 (11)	0.9167 (18)	0.5619 (16)	0.9479 (10)	0.8378 (12)	0.8813 (10)	0.7074 (11)	0.9071 (12)	0.3121 (16)	1.0132 (11)	0.9927 (13)	1.0277 (11)	0.8775 (13)
S15	0.0869 (23)	0.2822 (26)	0.3273 (25)	0.3844 (25)	0.1874 (26)	1.2159 (26)	1.0503 (25)	0.1357 (28)	1.0371 (19)	0.9592 (20)	0.9204 (21)	0.963 (19)	0.7763 (28)	0.8313 (24)	0.827 (27)	0.4644 (31)	0.7464 (26)	0.6454 (33)	0.6343 (27)	0.4894 (30)	0.7077 (29)	0.1238 (35)	0.7587 (38)	0.7615 (38)	0.7888 (35)	0.6442 (32)
S16	0.17 (18)	0.3357 (21)	0.3679 (21)	0.4274 (20)	0.2184 (22)	1.252 (15)	1.0525 (19)	0.1471 (26)	1.0597 (12)	0.992 (15)	0.9389 (16)	0.9935 (12)	0.8356 (20)	0.8754 (20)	0.8831 (19)	0.4779 (24)	0.7899 (21)	0.6828 (22)	0.6625 (22)	0.5165 (23)	0.7353 (24)	0.1284 (32)	0.7616 (34)	0.7698 (31)	0.8022 (26)	0.6751 (22)
S17	0.2612 (16)	0.5085 (14)	0.5146 (14)	0.5792 (13)	0.3795 (15)	1.3817 (3)	1.2297 (4)	0.3738 (16)	1.2618 (2)	1.2468 (4)	1.1903 (5)	1.2156 (5)	1.3864 (6)	1.519 (4)	1.2523 (6)	0.8003 (6)	1.2287 (6)	1.169 (7)	1.4527 (5)	1.1894 (4)	1.5063 (4)	0.447 (13)	1.3641 (5)	1.2707 (6)	1.2894 (5)	1.0407 (9)
S18	0.2632 (15)	0.4872 (16)	0.4691 (16)	0.5284 (15)	0.3579 (16)	0.9911 (30)	1.0432 (29)	0.3565 (17)	1.0775 (9)	1.0481 (9)	0.9985 (13)	0.9914 (13)	0.7993 (22)	0.8391 (22)	0.8582 (22)	0.4882 (21)	0.8008 (20)	0.7002 (21)	0.7059 (17)	0.549 (19)	0.7583 (21)	0.1535 (28)	0.8112 (21)	0.8286 (19)	0.8429 (18)	0.7099 (20)
S19	2.7237 (6)	3.1823 (3)	2.5448 (5)	2.4095 (6)	2.4063 (6)	0.0046 (35)	0.513 (35)	2.5355 (6)	0.9922 (32)	1.3658 (2)	1.4639 (2)	1.3855 (2)	1.7789 (3)	1.5931 (3)	1.4864 (5)	0.842 (5)	1.711 (4)	1.5408 (4)	1.2308 (7)	0.948 (8)	1.2743 (6)	0.7845 (8)	1.3062 (6)	1.2477 (7)	1.2161 (8)	1.5395 (4)

Source: Results obtained from the model developed in Chapter 4

Table VII-6 (cont'd)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S20	0.3123 (13)	0.5326 (13)	0.5364 (13)	0.5433 (14)	0.4669 (12)	1.2286 (23)	1.0543 (17)	0.4763 (14)	1.0731 (10)	1.0316 (10)	1.053 (10)	1.07 (8)	0.9416 (15)	1.0259 (10)	0.9521 (14)	0.5647 (15)	0.945 (11)	0.7777 (16)	0.6874 (20)	0.5308 (22)	0.7651 (20)	0.1743 (23)	0.8174 (19)	0.8068 (21)	0.8291 (19)	0.7678 (17)
S21	0.0978 (22)	0.3148 (22)	0.394 (20)	0.4572 (19)	0.2242 (20)	1.303 (5)	1.1538 (5)	0.2706 (20)	1.1258 (5)	1.0209 (13)	1.0314 (11)	0.9768 (15)	1.0449 (10)	0.8801 (19)	0.936 (15)	0.6579 (9)	0.8194 (19)	0.7702 (18)	0.7714 (14)	0.6934 (12)	0.8055 (16)	0.3244 (15)	0.8585 (16)	0.8525 (16)	0.8833 (14)	0.7467 (19)
S22	0.0511 (33)	0.2439 (34)	0.2962 (33)	0.356 (33)	0.1523 (35)	1.2526 (14)	1.0517 (20)	0.1032 (35)	1.0326 (25)	0.9479 (28)	0.9064 (30)	0.9474 (33)	0.7674 (31)	0.8116 (35)	0.817 (35)	0.4615 (32)	0.7343 (35)	0.6422 (35)	0.6109 (35)	0.4775 (34)	0.7008 (35)	0.1262 (33)	0.7621 (33)	0.7656 (33)	0.7895 (33)	0.6323 (35)
S23	0.0504 (35)	0.2463 (33)	0.3004 (32)	0.3631 (31)	0.1562 (32)	1.2691 (7)	1.0724 (11)	0.1183 (30)	1.0596 (13)	0.9644 (17)	0.921 (20)	0.955 (20)	0.7985 (23)	0.8207 (26)	0.8305 (24)	0.4878 (23)	0.7554 (23)	0.6665 (24)	0.6307 (28)	0.5026 (26)	0.7242 (26)	0.1541 (27)	0.7858 (23)	0.7877 (24)	0.8142 (22)	0.6494 (27)
S24	0.0579 (32)	0.2529 (30)	0.3079 (29)	0.3668 (30)	0.1599 (30)	1.2631 (9)	1.0623 (13)	0.1172 (31)	1.0409 (17)	0.9536 (22)	0.9178 (23)	0.9488 (29)	0.7893 (25)	0.8164 (32)	0.8229 (29)	0.4746 (26)	0.7387 (31)	0.6499 (30)	0.6205 (31)	0.4883 (31)	0.7047 (32)	0.1367 (30)	0.7703 (28)	0.7732 (28)	0.7976 (29)	0.6413 (34)
S25	0.0603 (30)	0.2573 (29)	0.3131 (27)	0.3741 (28)	0.1664 (29)	1.2549 (12)	1.0541 (18)	0.1334 (29)	1.0352 (21)	0.9501 (25)	0.9111 (26)	0.9483 (30)	0.7998 (21)	0.8176 (30)	0.8225 (30)	0.4882 (22)	0.7394 (30)	0.6527 (28)	0.6243 (29)	0.4942 (29)	0.7071 (30)	0.142 (29)	0.7767 (27)	0.7816 (26)	0.8044 (24)	0.6444 (31)
S26	0.0486 (38)	0.2406 (38)	0.2917 (38)	0.3519 (38)	0.1487 (38)	1.2512 (17)	1.0503 (24)	0.0961 (38)	1.0319 (27)	0.9474 (29)	0.9063 (31)	0.9475 (32)	0.7605 (37)	0.8109 (36)	0.8162 (36)	0.4577 (36)	0.7338 (37)	0.6404 (38)	0.6097 (37)	0.4739 (37)	0.7002 (36)	0.1233 (38)	0.7612 (36)	0.764 (35)	0.7883 (36)	0.6301 (38)
S27	0.0748 (25)	0.2838 (25)	0.3521 (22)	0.4187 (21)	0.2027 (24)	1.2663 (8)	1.1205 (8)	0.2459 (22)	1.1131 (6)	1.023 (12)	1.0279 (12)	0.9669 (17)	1.0439 (11)	0.8672 (21)	0.9219 (17)	0.6564 (10)	0.8344 (17)	0.7925 (15)	0.7925 (13)	0.7383 (10)	0.8448 (15)	0.4382 (14)	0.9975 (12)	0.9965 (12)	1.0135 (12)	0.7613 (18)
S28	0.0718 (26)	0.2709 (27)	0.3198 (26)	0.3771 (27)	0.1742 (27)	1.2605 (11)	1.0653 (12)	0.1603 (25)	1.0475 (15)	0.9668 (16)	0.9349 (17)	0.9492 (28)	0.7618 (35)	0.8121 (34)	0.8172 (34)	0.4743 (27)	0.7348 (33)	0.6495 (31)	0.6111 (34)	0.4804 (33)	0.7019 (34)	0.1605 (25)	0.7674 (30)	0.7699 (30)	0.7954 (30)	0.6454 (28)
S29	0.0486 (39)	0.2406 (39)	0.2916 (39)	0.3518 (39)	0.1486 (39)	1.25 (20)	1.0491 (27)	0.096 (39)	1.0302 (29)	0.9454 (35)	0.9043 (37)	0.9454 (34)	0.7592 (38)	0.8093 (38)	0.8146 (38)	0.457 (38)	0.7324 (38)	0.6398 (39)	0.6087 (39)	0.4731 (39)	0.6981 (39)	0.1231 (39)	0.7587 (39)	0.7615 (39)	0.7857 (39)	0.6289 (39)
S30	0.0773 (24)	0.2621 (28)	0.3094 (28)	0.3682 (29)	0.1678 (28)	1.2436 (21)	1.0487 (28)	0.1071 (34)	1.0336 (23)	0.9469 (33)	0.9063 (32)	0.9536 (23)	0.7831 (27)	0.8854 (18)	0.8425 (23)	0.531 (19)	0.7477 (25)	0.6774 (23)	0.6785 (21)	0.5946 (17)	0.7772 (18)	0.4631 (12)	0.7696 (29)	0.7703 (29)	0.7929 (31)	0.6695 (23)
S31	0.0489 (37)	0.2427 (35)	0.2939 (35)	0.3545 (36)	0.1519 (36)	1.2512 (18)	1.0506 (22)	0.0973 (36)	1.0315 (28)	0.946 (34)	0.9053 (34)	0.9526 (24)	0.7654 (33)	0.8185 (28)	0.8212 (32)	0.458 (35)	0.7343 (34)	0.6408 (36)	0.61 (36)	0.4743 (36)	0.7001 (37)	0.1235 (36)	0.7633 (31)	0.7633 (36)	0.7874 (37)	0.6315 (36)
S32	0.0686 (27)	0.2986 (24)	0.3387 (23)	0.4003 (23)	0.1988 (25)	1.2233 (24)	1.0405 (30)	0.1373 (27)	1.0291 (30)	0.9471 (31)	0.9063 (33)	0.9445 (35)	0.7638 (34)	0.8198 (27)	0.8223 (31)	0.4601 (33)	0.7405 (29)	0.6466 (32)	0.6146 (32)	0.4958 (28)	0.7068 (31)	0.1597 (26)	0.7792 (24)	0.7823 (25)	0.8048 (23)	0.6452 (30)
S33	5.6682 (2)	4.179 (2)	3.7296 (3)	2.9172 (4)	4.5143 (3)	0.0046 (36)	0.0039 (37)	3.9474 (3)	0.197 (37)	1.1951 (5)	1.3413 (3)	1.2245 (4)	1.7689 (4)	1.3987 (6)	1.819 (2)	15.5848 (1)	3.7293 (1)	6.4282 (1)	7.8795 (1)	12.1319 (1)	5.4426 (1)	20.7424 (1)	2.3192 (2)	2.2571 (2)	1.7144 (4)	4.4855 (1)
S34	4.5098 (5)	3.1141 (4)	3.7907 (2)	4.2298 (2)	4.7745 (2)	0.0046 (37)	0.0039 (38)	2.8536 (5)	0.0038 (38)	0.0035 (38)	0.6042 (38)	0.0035 (38)	1.8437 (2)	1.4035 (5)	1.6419 (4)	1.1702 (4)	2.1198 (3)	2.3009 (2)	1.59 (4)	1.2688 (3)	1.7152 (2)	2.2621 (3)	2.4025 (1)	2.3694 (1)	2.3734 (1)	1.9343 (3)
S35	1.655 (7)	1.8444 (8)	1.781 (8)	1.5227 (8)	1.8001 (8)	0.0046 (38)	0.4963 (36)	1.6017 (9)	0.6962 (36)	0.8459 (37)	0.9675 (15)	0.9308 (36)	1.1397 (9)	1.0988 (9)	1.2321 (7)	0.7308 (7)	1.2278 (7)	1.1453 (8)	1.2505 (6)	1.0913 (6)	1.1065 (8)	0.6072 (11)	1.264 (7)	1.2921 (5)	1.2734 (6)	1.1442 (8)
S36	4.6948 (3)	2.9617 (5)	2.7749 (4)	3.1479 (3)	4.2927 (4)	0.0046 (39)	0.0039 (39)	5.5172 (2)	0.0038 (39)	0.0035 (39)	0.0033 (39)	0.0035 (39)	0.0028 (39)	0.003 (39)	0.003 (39)	0.2377 (39)	0.3883 (39)	0.8942 (9)	1.627 (3)	3.131 (2)	1.3071 (5)	3.4567 (2)	0.8862 (14)	0.9513 (14)	0.8008 (28)	1.484 (5)
S37	4.6477 (4)	2.0409 (7)	2.0521 (7)	2.0117 (7)	2.1662 (7)	0.8184 (31)	0.8432 (32)	2.3468 (7)	0.9283 (34)	1.3191 (3)	1.1837 (6)	1.2408 (3)	1.6992 (5)	1.6111 (2)	1.7134 (3)	2.0387 (2)	0.9004 (13)	0.8115 (13)	0.6618 (23)	0.5119 (25)	0.7661 (19)	0.6525 (9)	0.8666 (15)	0.8384 (17)	0.8765 (16)	1.4219 (7)
S38	1.4258 (8)	2.5353 (6)	2.3158 (6)	2.4523 (5)	3.2673 (5)	0.5552 (32)	0.8241 (33)	3.4276 (4)	0.9807 (33)	0.9489 (26)	0.9048 (35)	0.954 (21)	0.9001 (17)	0.9443 (16)	0.9657 (13)	0.5997 (13)	1.2429 (5)	1.2372 (5)	0.9878 (8)	0.7537 (9)	1.1813 (7)	1.5317 (4)	1.5882 (4)	1.6894 (4)	1.7158 (3)	1.4372 (6)
S39	0.8744 (11)	1.2052 (10)	1.2555 (9)	1.2222 (9)	1.2888 (9)	0.0724 (34)	0.7405 (34)	1.9439 (8)	0.8484 (35)	0.9196 (36)	0.9046 (36)	0.9223 (37)	0.947 (14)	0.9482 (15)	1.0131 (11)	0.5956 (14)	1.1896 (8)	1.1992 (6)	0.7036 (18)	0.5579 (18)	0.8487 (14)	0.9217 (5)	1.2048 (8)	1.2138 (8)	1.2317 (7)	0.9909 (11)

Source: Results obtained from the model developed in Chapter 4.

Table VII-7: Inter-industry weighted total forward linkages and ranks, 1975-2015
(Reformulated System of Weights developed by this research)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S01	2.3912 (2)	2.3547 (1)	2.863 (1)	2.8977 (1)	2.6837 (1)	2.4 (1)	2.1063 (1)	2.1775 (1)	1.9375 (1)	2.1409 (1)	1.8676 (2)	1.9708 (1)	1.857 (3)	1.756 (3)	1.9442 (1)	2.3152 (1)	1.7528 (3)	1.7385 (3)	1.4234 (4)	1.4091 (5)	1.5698 (4)	1.6003 (4)	1.233 (6)	1.2737 (6)	0.8172 (9)	1.9393 (2)
S02	0.9981 (11)	1.2929 (3)	1.1716 (6)	1.2757 (4)	1.2865 (4)	1.1014 (11)	1.095 (11)	1.1277 (9)	1.1203 (10)	1.0081 (16)	1.0214 (14)	1.1424 (5)	0.8114 (25)	0.8692 (22)	0.9537 (19)	0.8835 (19)	0.8421 (19)	0.8934 (18)	0.7624 (21)	0.6952 (21)	0.8875 (15)	0.854 (19)	0.6423 (22)	0.6241 (23)	0.1396 (28)	0.94 (16)
S03	0.8954 (19)	1.0565 (13)	1.2621 (3)	1.0467 (13)	1.0055 (16)	1.1098 (9)	1.118 (9)	1.1459 (7)	1.1262 (9)	1.137 (9)	1.1801 (6)	1.099 (9)	0.9641 (14)	1.0674 (10)	1.016 (13)	1.0794 (11)	1.1383 (9)	1.3075 (5)	1.0977 (9)	1.0597 (11)	1.0906 (10)	1.0276 (13)	0.8673 (15)	0.8556 (14)	0.2772 (20)	1.0412 (12)
S04	0.8621 (23)	1.0424 (14)	1.0212 (17)	0.9082 (19)	0.9359 (17)	0.9062 (21)	0.9174 (19)	0.9823 (19)	0.9984 (17)	0.9553 (19)	0.936 (19)	0.9504 (24)	0.9108 (16)	0.9096 (18)	0.9184 (21)	0.8999 (18)	0.8371 (20)	0.854 (20)	0.7308 (22)	0.678 (22)	0.8533 (18)	0.9009 (18)	0.767 (17)	0.6949 (20)	0.2906 (19)	0.8664 (20)
S05	0.8195 (25)	0.9917 (17)	1.0479 (13)	0.888 (25)	0.9065 (18)	0.9159 (18)	0.952 (18)	0.9968 (18)	0.9573 (20)	0.8986 (22)	0.8821 (26)	0.9559 (21)	0.8931 (19)	0.9467 (17)	0.9618 (18)	0.9302 (17)	0.9077 (17)	0.9431 (16)	0.8154 (18)	0.7396 (19)	0.8187 (21)	0.9129 (17)	0.6802 (21)	0.7052 (19)	0.2003 (23)	0.8667 (19)
S06	1.2295 (4)	1.3514 (2)	1.3856 (2)	1.4862 (2)	1.3251 (2)	1.1895 (6)	1.2218 (6)	1.1918 (5)	1.25 (2)	1.2425 (5)	1.1152 (7)	1.1289 (6)	1.1724 (7)	1.1573 (8)	1.1898 (8)	1.0963 (9)	1.146 (7)	1.2847 (6)	1.2886 (5)	1.1379 (8)	1.1307 (8)	1.2581 (6)	1.1356 (7)	1.1322 (7)	0.686 (11)	1.1973 (5)
S07	1.101 (6)	1.236 (4)	1.1771 (5)	1.2029 (6)	1.1512 (8)	1.1501 (8)	1.1841 (7)	1.1134 (10)	1.1324 (8)	1.0816 (12)	1.0789 (9)	1.075 (11)	1.3561 (5)	1.2071 (6)	1.2584 (5)	1.2535 (5)	1.1418 (8)	1.1959 (7)	1.0404 (10)	1.0827 (9)	1.1485 (7)	1.1862 (7)	0.9886 (12)	1.0253 (12)	0.6451 (12)	1.1285 (9)
S08	0.9816 (12)	1.1215 (8)	1.1453 (8)	1.0785 (10)	1.0161 (15)	1.0188 (16)	1.0106 (17)	1.0394 (15)	1.0486 (15)	0.9646 (18)	0.9489 (17)	0.9886 (18)	0.8531 (20)	0.8608 (23)	0.9187 (20)	0.8388 (23)	0.7915 (25)	0.7972 (27)	0.6809 (26)	0.626 (25)	0.7319 (24)	0.7818 (24)	0.6157 (25)	0.6115 (25)	0.1779 (25)	0.8659 (21)
S09	0.8464 (24)	0.9777 (18)	1.0225 (15)	0.9211 (17)	0.8977 (20)	0.9099 (19)	0.9155 (21)	0.8975 (26)	0.9824 (18)	0.893 (23)	0.8903 (23)	0.9524 (23)	0.7993 (28)	0.8082 (35)	0.827 (31)	0.7995 (29)	0.7765 (28)	0.7851 (29)	0.6583 (31)	0.5979 (30)	0.6961 (31)	0.7525 (31)	0.5806 (32)	0.5872 (31)	0.1274 (30)	0.7961 (27)
S10	0.8742 (20)	1.0237 (15)	1.0573 (12)	1.0217 (15)	1.0209 (14)	1.0246 (15)	1.0131 (16)	1.0077 (17)	1.0311 (16)	0.9771 (17)	0.9429 (18)	0.9818 (19)	0.9845 (12)	0.9849 (14)	1.0122 (14)	0.9653 (16)	1.0136 (13)	1.016 (13)	0.9933 (12)	1.0747 (10)	0.9992 (13)	1.0278 (12)	1.0209 (11)	1.0623 (9)	1.3022 (6)	1.0173 (14)
S11	0.7801 (38)	0.8659 (36)	0.9095 (34)	0.8832 (27)	0.8701 (25)	0.8846 (27)	0.902 (25)	0.8747 (37)	0.9107 (33)	0.8543 (30)	0.8563 (29)	0.9161 (26)	0.9643 (13)	1.0682 (9)	0.9929 (17)	1.0038 (13)	0.9441 (16)	0.9424 (17)	0.8229 (17)	0.7432 (18)	0.8414 (19)	0.9203 (16)	0.7492 (19)	0.6777 (21)	0.2556 (21)	0.8573 (23)
S12	0.8039 (28)	0.9689 (20)	1.0113 (19)	0.9082 (18)	0.9006 (19)	0.9086 (20)	0.9164 (20)	0.9112 (22)	0.9301 (23)	0.8907 (24)	0.9113 (20)	1.0072 (16)	0.8224 (24)	0.86 (24)	0.859 (27)	0.82 (26)	0.8249 (22)	0.8721 (19)	0.8137 (19)	0.784 (16)	0.8282 (20)	0.831 (20)	0.7027 (20)	0.7181 (18)	0.2964 (17)	0.844 (24)
S13	0.796 (32)	0.953 (27)	1.0081 (23)	0.882 (29)	0.8634 (29)	0.8694 (31)	0.8782 (31)	0.8902 (30)	0.9107 (32)	0.8459 (35)	0.8413 (33)	0.8886 (31)	0.7692 (37)	0.8062 (37)	0.8191 (37)	0.7746 (37)	0.7519 (37)	0.7654 (35)	0.6462 (36)	0.5833 (36)	0.6824 (36)	0.7354 (36)	0.5698 (35)	0.5673 (36)	0.1068 (37)	0.7682 (36)
S14	1.0695 (7)	1.1073 (10)	1.1009 (10)	1.2274 (5)	1.3215 (3)	1.3506 (2)	1.2895 (3)	1.1334 (8)	1.2465 (3)	1.2553 (4)	1.1104 (8)	1.1577 (4)	1.1568 (8)	1.1679 (7)	1.212 (7)	1.1336 (7)	1.1231 (10)	1.1095 (10)	1.1002 (8)	1.1457 (7)	1.0439 (11)	1.0445 (11)	1.0806 (10)	1.0871 (8)	1.1769 (7)	1.1581 (8)
S15	1.011 (9)	1.0988 (11)	0.9992 (28)	1.0677 (11)	1.0756 (13)	1.0885 (13)	1.0629 (13)	1.068 (13)	1.0842 (13)	1.0585 (15)	1.0218 (13)	1.0578 (13)	1.0867 (10)	1.0544 (12)	1.1572 (9)	1.0846 (10)	1.2126 (6)	1.1905 (8)	1.2367 (7)	1.3055 (6)	1.216 (6)	1.1165 (9)	1.3645 (5)	1.4196 (4)	2.0879 (4)	1.1691 (7)
S16	1.2282 (5)	1.2273 (5)	1.2107 (4)	1.2899 (3)	1.2666 (5)	1.2466 (5)	1.114 (10)	1.2251 (3)	1.1716 (6)	1.1176 (10)	1.0492 (12)	1.0799 (10)	1.0276 (11)	0.8592 (25)	1.0426 (12)	0.9698 (15)	1.0032 (14)	0.9805 (15)	0.9196 (15)	0.9269 (13)	0.9238 (14)	0.9248 (15)	0.7908 (16)	0.7913 (16)	0.562 (13)	1.038 (13)
S17	0.9227 (16)	1.0767 (12)	1.0948 (11)	1.1059 (8)	1.0941 (11)	1.0371 (14)	1.0278 (15)	1.0318 (16)	1.0866 (12)	1.0693 (14)	0.9577 (16)	1.0248 (15)	0.9102 (17)	0.996 (13)	1.0106 (15)	0.8821 (20)	0.8343 (21)	0.8217 (24)	0.7886 (20)	0.7015 (20)	0.7723 (22)	0.8244 (22)	0.5816 (31)	0.5832 (32)	0.132 (29)	0.8947 (18)
S18	0.9093 (18)	1.0148 (16)	0.9721 (31)	1.0227 (14)	1.081 (12)	1.1016 (10)	1.0837 (12)	1.056 (14)	1.074 (14)	1.072 (13)	1.0677 (11)	1.1056 (8)	1.0987 (9)	1.0596 (11)	0.9938 (16)	1.1219 (8)	1.2541 (5)	1.183 (9)	1.2729 (6)	1.4247 (4)	1.3058 (5)	1.2655 (5)	1.4212 (4)	1.3597 (5)	1.941 (5)	1.1705 (6)
S19	1.0644 (8)	1.1192 (9)	0.9795 (30)	1.1756 (7)	1.2127 (6)	1.2907 (3)	1.3327 (2)	1.1734 (6)	1.1909 (5)	1.1919 (7)	1.0784 (10)	1.1231 (7)	1.428 (4)	1.2386 (5)	1.228 (6)	1.1959 (6)	1.1 (11)	1.0681 (11)	0.9983 (11)	0.8526 (14)	0.8853 (16)	0.9481 (14)	0.9246 (13)	0.9323 (13)	0.7164 (10)	1.0979 (10)

Source: Results obtained from the model developed in Chapter 4

Table VII-7 (cont'd)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S20	0.7948 (34)	0.9561 (23)	1.01 (21)	0.891 (24)	0.8746 (24)	0.8913 (24)	0.8944 (27)	0.8978 (25)	0.9274 (24)	0.864 (28)	0.8511 (30)	0.8971 (28)	0.8463 (22)	0.8739 (21)	0.9099 (23)	0.8343 (24)	0.8199 (23)	0.8326 (23)	0.6933 (25)	0.6306 (24)	0.7132 (26)	0.7575 (28)	0.6044 (27)	0.5895 (30)	0.1776 (26)	0.8013 (25)
S21	0.9678 (13)	1.1329 (7)	1.1205 (9)	1.0623 (12)	1.106 (10)	1.097 (12)	1.1595 (8)	1.1963 (4)	1.1712 (7)	1.1891 (8)	1.3988 (4)	1.0032 (17)	0.9052 (18)	0.9496 (16)	1.072 (11)	0.9935 (14)	0.9908 (15)	0.9818 (14)	0.8583 (16)	0.7575 (17)	1.0132 (12)	1.0528 (10)	0.917 (14)	0.8343 (15)	0.294 (18)	1.009 (15)
S22	0.7982 (31)	0.9612 (22)	1.0142 (18)	0.8912 (23)	0.869 (27)	0.8796 (28)	0.8909 (28)	0.9025 (24)	0.9229 (25)	0.8544 (29)	0.8571 (28)	0.8922 (30)	0.7709 (34)	0.8088 (34)	0.8217 (34)	0.7777 (35)	0.7552 (35)	0.7701 (34)	0.6522 (33)	0.5856 (34)	0.6913 (32)	0.7421 (35)	0.5751 (33)	0.5813 (33)	0.1077 (36)	0.7749 (34)
S23	0.8103 (27)	0.9678 (21)	1.0216 (16)	0.8914 (22)	0.8803 (22)	0.8879 (26)	0.8944 (26)	0.8917 (29)	0.9188 (26)	0.8708 (26)	0.8735 (27)	0.8938 (29)	0.777 (30)	0.8123 (29)	0.8365 (29)	0.7928 (30)	0.756 (34)	0.7642 (37)	0.6654 (27)	0.601 (27)	0.6976 (30)	0.7517 (32)	0.608 (26)	0.6108 (26)	0.1262 (31)	0.7841 (30)
S24	0.813 (26)	0.9732 (19)	1.0279 (14)	0.9026 (20)	0.8896 (21)	0.8994 (22)	0.9132 (22)	0.9229 (20)	0.9436 (21)	0.884 (25)	0.8975 (21)	0.8998 (27)	0.7848 (29)	0.8226 (28)	0.8531 (28)	0.8 (28)	0.7742 (29)	0.7859 (28)	0.6645 (28)	0.5973 (31)	0.7119 (27)	0.7621 (26)	0.6023 (28)	0.6002 (27)	0.1234 (32)	0.794 (28)
S25	0.7952 (33)	0.9548 (25)	1.0102 (20)	0.8842 (26)	0.8649 (28)	0.8728 (29)	0.8827 (29)	0.8939 (28)	0.9158 (28)	0.8506 (32)	0.8502 (31)	0.8866 (32)	0.7711 (33)	0.809 (33)	0.8196 (36)	0.7792 (34)	0.7625 (30)	0.7776 (30)	0.6597 (30)	0.598 (29)	0.7158 (25)	0.7722 (25)	0.6361 (23)	0.6416 (22)	0.145 (27)	0.782 (32)
S26	0.7917 (36)	0.9511 (29)	1.0065 (25)	0.8798 (31)	0.8603 (33)	0.8671 (34)	0.8763 (34)	0.8881 (33)	0.9111 (31)	0.8451 (36)	0.8391 (36)	0.8845 (36)	0.7685 (38)	0.8059 (38)	0.8188 (38)	0.7737 (38)	0.7502 (38)	0.7628 (38)	0.6417 (38)	0.5781 (38)	0.6817 (38)	0.7324 (38)	0.5561 (38)	0.5602 (38)	0.0972 (39)	0.7651 (38)
S27	0.9987 (10)	1.1536 (6)	1.1476 (7)	1.1037 (9)	1.1442 (9)	1.1658 (7)	1.2309 (5)	1.2444 (2)	1.2174 (4)	1.2303 (6)	1.5237 (3)	1.0296 (14)	0.9319 (15)	0.9747 (15)	1.1278 (10)	1.0482 (12)	1.0377 (12)	1.0296 (12)	0.9381 (13)	0.8337 (15)	1.1108 (9)	1.1546 (8)	1.134 (8)	1.0541 (11)	0.4237 (16)	1.0795 (11)
S28	0.7997 (30)	0.9533 (26)	1.0084 (22)	0.8967 (21)	0.88 (23)	0.8958 (23)	0.9101 (23)	0.9175 (21)	0.9666 (19)	0.9061 (20)	0.8959 (22)	0.9604 (20)	0.8052 (26)	0.8315 (27)	0.8915 (24)	0.8245 (25)	0.7905 (27)	0.8078 (25)	0.7015 (24)	0.6198 (26)	0.7054 (29)	0.7566 (29)	0.5871 (30)	0.5933 (29)	0.1177 (34)	0.8009 (26)
S29	0.7921 (35)	0.9515 (28)	1.0065 (26)	0.8804 (30)	0.8611 (31)	0.8681 (32)	0.8773 (32)	0.8887 (31)	0.9116 (30)	0.8461 (33)	0.8404 (34)	0.8854 (35)	0.7703 (36)	0.8076 (36)	0.821 (35)	0.7758 (36)	0.7522 (36)	0.7648 (36)	0.6435 (37)	0.5798 (37)	0.6819 (37)	0.7345 (37)	0.5576 (37)	0.5617 (37)	0.0974 (38)	0.7663 (37)
S30	0.9343 (15)	0.9493 (30)	1.0003 (27)	0.8782 (32)	0.8606 (32)	0.8681 (33)	0.8771 (33)	0.8887 (32)	0.9118 (29)	0.8461 (34)	0.84 (35)	0.8855 (34)	0.7707 (35)	0.8097 (32)	0.8242 (33)	0.7811 (32)	0.76 (31)	0.7702 (33)	0.6502 (34)	0.5857 (33)	0.6888 (34)	0.7525 (30)	0.6224 (24)	0.6221 (24)	0.2549 (22)	0.7853 (29)
S31	0.8022 (29)	0.9551 (24)	1.0071 (24)	0.8827 (28)	0.8626 (30)	0.8713 (30)	0.8814 (30)	0.8972 (27)	0.9165 (27)	0.8528 (31)	0.8463 (32)	0.8864 (33)	0.7721 (32)	0.8108 (30)	0.8257 (32)	0.7869 (31)	0.7567 (32)	0.7757 (31)	0.6551 (32)	0.5881 (32)	0.6896 (33)	0.7447 (34)	0.5579 (36)	0.578 (34)	0.1157 (35)	0.7727 (35)
S32	0.9145 (17)	0.9443 (31)	0.9847 (29)	0.8701 (34)	0.858 (34)	0.8665 (35)	0.8752 (35)	0.8866 (34)	0.9103 (34)	0.8438 (37)	0.8357 (37)	0.8833 (37)	0.7741 (31)	0.8108 (31)	0.8275 (30)	0.7806 (33)	0.7563 (33)	0.7714 (32)	0.6493 (35)	0.5838 (35)	0.6876 (35)	0.7504 (33)	0.5893 (29)	0.5976 (28)	0.187 (24)	0.7775 (33)
S33	0.9579 (14)	0.6438 (37)	0.0297 (37)	0.6933 (37)	0.7566 (38)	0.7165 (38)	0.7178 (38)	0.7593 (38)	0.7822 (37)	0.8137 (38)	0.8126 (38)	0.8675 (38)	1.2257 (6)	1.2469 (4)	1.4447 (4)	2.0526 (2)	3.2033 (1)	2.6538 (1)	5.287 (1)	6.3731 (1)	4.1203 (1)	3.359 (1)	6.1471 (1)	6.5118 (1)	15.7583 (1)	2.7174 (1)
S34	0.0029 (39)	0.0035 (38)	0.0037 (38)	0.6018 (38)	0.7721 (37)	0.9658 (17)	1.0506 (14)	1.1064 (11)	0.6262 (38)	1.3869 (2)	2.0185 (1)	1.478 (2)	2.6536 (1)	2.3243 (1)	1.4581 (3)	1.998 (3)	1.8335 (2)	1.8801 (2)	2.1126 (2)	2.3675 (2)	2.2363 (2)	2.1746 (2)	3.0875 (2)	3.0276 (2)	4.3519 (2)	1.6609 (3)
S35	0.7818 (37)	0.8726 (35)	0.4069 (36)	0.93 (16)	1.1664 (7)	1.2641 (4)	1.2815 (4)	1.1036 (12)	1.1077 (11)	1.38 (3)	1.2899 (5)	1.2246 (3)	2.3108 (2)	2.2154 (2)	1.6732 (2)	1.6219 (4)	1.6375 (4)	1.623 (4)	1.9699 (3)	2.0881 (3)	1.9635 (3)	1.6891 (3)	2.07 (3)	1.9481 (3)	2.4693 (3)	1.5236 (4)
S36	3.6585 (1)	0.0035 (39)	0.0037 (39)	0.0032 (39)	0.0032 (39)	0.0032 (39)	0.0032 (39)	0.0033 (39)	0.0034 (39)	0.0031 (39)	0.0031 (39)	0.0033 (39)	0.0028 (39)	0.003 (39)	0.003 (39)	0.0029 (39)	0.0028 (39)	0.0028 (39)	0.1744 (39)	0.2851 (39)	0.1439 (39)	0.0027 (39)	0.0021 (39)	0.0198 (39)	0.455 (15)	0.1918 (39)
S37	1.2657 (3)	0.9287 (33)	0.9558 (32)	0.8543 (35)	0.8527 (36)	0.8623 (37)	0.8663 (37)	0.8751 (36)	0.9066 (36)	1.1085 (11)	0.9986 (15)	1.0616 (12)	0.8416 (23)	0.8772 (20)	0.8822 (25)	0.8441 (22)	0.8113 (24)	0.8426 (22)	0.7032 (23)	0.6326 (23)	0.7458 (23)	0.8117 (23)	0.7637 (18)	0.7276 (17)	0.4745 (14)	0.8598 (22)
S38	0.8702 (21)	0.9275 (34)	0.9433 (33)	0.8417 (36)	0.8534 (35)	0.8626 (36)	0.8694 (36)	0.885 (35)	0.9076 (35)	0.8675 (27)	0.8835 (25)	0.9527 (22)	0.7998 (27)	0.8419 (26)	0.8614 (26)	0.816 (27)	0.7914 (26)	0.8033 (26)	0.661 (29)	0.5985 (28)	0.7075 (28)	0.7602 (27)	0.5718 (34)	0.5761 (35)	0.1211 (33)	0.783 (31)
S39	0.8665 (22)	0.9355 (32)	0.8516 (35)	0.8721 (33)	0.8698 (26)	0.8909 (25)	0.9069 (24)	0.9073 (23)	0.9316 (22)	0.9028 (21)	0.8872 (24)	0.9184 (25)	0.8518 (21)	0.887 (19)	0.9128 (22)	0.8686 (21)	0.8623 (18)	0.8512 (21)	0.9287 (14)	0.9483 (12)	0.8685 (17)	0.8258 (21)	1.0944 (9)	1.0563 (10)	1.1639 (8)	0.9144 (17)

Source: Results obtained from the model developed in Chapter 4.

Table VII-8: Inter-industry weighted total backward linkages and ranks, 1975-2015
(Traditional System of Weights)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S01	1.4694 (9)	1.0674 (11)	1.2008 (10)	1.1994 (10)	1.0639 (10)	1.1222 (10)	0.9348 (10)	1.369 (10)	1.0843 (10)	1.1059 (10)	0.9026 (11)	0.852 (10)	1.0006 (11)	1.2672 (10)	0.8894 (11)	0.9257 (11)	0.6693 (11)	0.6542 (13)	0.5861 (14)	0.5947 (14)	0.6437 (14)	0.5785 (15)	0.7005 (14)	0.6872 (14)	0.6593 (14)	0.9291 (10)
S02	0.2006 (22)	0.2123 (21)	0.3418 (18)	0.2008 (22)	0.2033 (21)	0.3998 (18)	0.5375 (14)	0.3999 (19)	0.4909 (16)	0.3853 (18)	0.4558 (16)	0.4372 (16)	0.4903 (17)	0.5645 (15)	0.5783 (13)	0.5586 (12)	0.5979 (13)	0.7197 (11)	0.692 (12)	0.676 (12)	1.2085 (11)	0.9703 (12)	0.9306 (13)	0.9161 (13)	0.8369 (13)	0.5602 (15)
S03	0.0404 (30)	0.0028 (36)	0.0031 (36)	0.0377 (31)	0.009 (35)	0 (38)	0.0116 (34)	0.0347 (34)	0.0898 (24)	0.0813 (24)	0.0938 (23)	0.0588 (28)	0.0676 (28)	0.0776 (26)	0.0501 (28)	0.0698 (27)	0.1313 (23)	0.1334 (23)	0.1398 (24)	0.1821 (22)	0.1226 (24)	0.1615 (23)	0.1902 (22)	0.1961 (20)	0.186 (21)	0.0868 (25)
S04	0.0201 (33)	0.045 (30)	0.0128 (34)	0.0137 (33)	0.0421 (30)	0.0434 (30)	0.04 (31)	0.0536 (30)	0.0102 (34)	0 (38)	0.0914 (24)	0.0621 (27)	0.0655 (30)	0.0714 (27)	0.0637 (27)	0.1533 (22)	0.0955 (24)	0.1312 (24)	0.1959 (22)	0.1744 (23)	0.2048 (21)	0.1951 (21)	0.2949 (17)	0.331 (17)	0.2797 (17)	0.1076 (23)
S05	0.0312 (32)	0.0238 (33)	0.018 (32)	0.053 (28)	0.1655 (23)	0.2737 (21)	0.1772 (22)	0.0528 (31)	0.026 (32)	0.0198 (30)	0.0304 (31)	0.0237 (29)	0.1207 (23)	0.158 (22)	0.0909 (25)	0.0754 (26)	0.0875 (26)	0.1019 (25)	0.1447 (23)	0.1651 (24)	0.1957 (22)	0.1642 (22)	0.1672 (23)	0.151 (23)	0.1197 (26)	0.1055 (24)
S06	0.4094 (16)	0.4237 (17)	0.356 (17)	0.3666 (17)	0.3847 (17)	0.4006 (17)	0.4654 (17)	0.4722 (16)	0.5522 (14)	0.6893 (13)	0.7548 (14)	0.8024 (11)	0.5033 (16)	0.5746 (14)	0.5158 (14)	0.424 (16)	0.482 (15)	0.6989 (12)	0.8085 (11)	0.8702 (11)	1.1335 (12)	1.0753 (11)	1.5354 (9)	1.7924 (6)	1.4261 (10)	0.7167 (12)
S07	4.5064 (2)	4.5195 (2)	4.6466 (3)	4.3922 (3)	4.5886 (3)	4.2231 (4)	4.3727 (4)	4.4446 (3)	3.5286 (5)	3.1445 (5)	3.8226 (3)	3.6386 (5)	2.9382 (5)	3.053 (4)	2.5428 (6)	2.6034 (5)	2.2702 (7)	2.0278 (7)	2.2022 (6)	1.934 (7)	1.8724 (8)	1.8476 (7)	1.7235 (7)	1.7152 (7)	1.8174 (6)	3.135 (5)
S08	1.276 (10)	1.2507 (10)	1.1437 (11)	1.0416 (11)	1.0061 (11)	1.0517 (11)	0.9134 (11)	1.1365 (11)	0.8754 (11)	0.7393 (12)	1.0494 (10)	0.7404 (12)	0.9824 (12)	0.9199 (12)	0.6161 (12)	0.4493 (15)	0.3893 (17)	0.3194 (19)	0.3037 (19)	0.2792 (18)	0.2805 (18)	0.2485 (20)	0.1996 (20)	0.1754 (22)	0.1901 (20)	0.7031 (13)
S09	0.0348 (31)	0.2098 (22)	0.0211 (31)	0.01 (35)	0.0121 (34)	0.0178 (33)	0 (38)	0.2071 (22)	0.0202 (33)	0.0105 (31)	0.0219 (32)	0.014 (34)	0.0848 (25)	0 (38)	0.0059 (35)	0 (38)	0.0095 (34)	0.0118 (34)	0.0101 (33)	0.0124 (34)	0.0163 (33)	0.0141 (33)	0.009 (34)	0.0147 (33)	0.0094 (35)	0.0311 (34)
S10	0.1656 (23)	0.2892 (18)	0.0814 (23)	0.0703 (26)	0.0977 (24)	0.0982 (24)	0.0964 (23)	0.1707 (23)	0.1009 (23)	0.0833 (23)	0.0889 (25)	0.0796 (24)	0.0726 (26)	0.0689 (28)	0.0983 (24)	0.0617 (28)	0.0595 (28)	0.0454 (29)	0.1174 (26)	0.0707 (28)	0.0512 (29)	0.038 (31)	0.0094 (33)	0.009 (35)	0.0166 (32)	0.0856 (27)
S11	0.2601 (20)	0.1966 (23)	0.2487 (21)	0.2495 (20)	0.2583 (19)	0.2346 (22)	0.2469 (21)	0.2902 (21)	0.2554 (21)	0.2754 (20)	0.323 (21)	0.3196 (18)	0.3739 (19)	0.4143 (17)	0.3263 (19)	0.3589 (17)	0.326 (19)	0.301 (20)	0.3149 (18)	0.2723 (19)	0.228 (20)	0.2623 (18)	0.2202 (19)	0.205 (19)	0.2198 (19)	0.2793 (21)
S12	0.264 (19)	0.4512 (16)	0.3618 (16)	0.5794 (13)	0.5382 (13)	0.4812 (15)	0.5487 (13)	0.6214 (14)	0.6592 (13)	0.4061 (17)	0.3974 (18)	0.3368 (17)	0.2172 (20)	0.3675 (18)	0.295 (20)	0.2594 (20)	0.2923 (20)	0.3675 (16)	0.3217 (17)	0.382 (16)	0.3249 (17)	0.2715 (17)	0.2495 (18)	0.2661 (18)	0.239 (18)	0.38 (18)
S13	0.0041 (36)	0.0014 (37)	0.001 (37)	0.001 (37)	0.002 (37)	0.0016 (36)	0.0021 (36)	0.0044 (37)	0.003 (37)	0.0014 (35)	0.0022 (36)	0.0027 (36)	0.0006 (38)	0.0046 (35)	0.001 (38)	0.0016 (37)	0.0011 (38)	0.0016 (38)	0.0013 (38)	0.0003 (38)	0.0029 (38)	0.0009 (38)	0.0026 (37)	0.0014 (37)	0.0006 (38)	0.0019 (38)
S14	0.8392 (12)	0.9438 (12)	0.5348 (13)	0.4868 (15)	0.4937 (16)	0.4869 (14)	0.4832 (16)	0.959 (12)	0.4757 (17)	0.4644 (15)	0.8652 (12)	0.5872 (15)	0.5668 (14)	0.5775 (13)	0.4177 (16)	0.5261 (13)	0.612 (12)	0.5874 (14)	0.6713 (13)	0.6279 (13)	0.679 (13)	0.7074 (14)	0.5876 (16)	0.5627 (16)	0.5851 (16)	0.6131 (14)
S15	0.0669 (24)	0.0736 (26)	0.0711 (25)	0.0731 (24)	0.0706 (26)	0.0785 (25)	0.0616 (27)	0.0571 (29)	0.0602 (26)	0.0687 (25)	0.0685 (27)	0.0682 (25)	0.0438 (34)	0.0602 (29)	0.035 (30)	0.0352 (30)	0.0369 (30)	0.0149 (33)	0.0809 (29)	0.0588 (29)	0.0318 (31)	0.0032 (37)	0 (38)	0 (38)	0.0077 (36)	0.0491 (31)
S16	0.3144 (17)	0.194 (24)	0.2049 (22)	0.2229 (21)	0.1876 (22)	0.127 (23)	0.013 (33)	0.1335 (24)	0.1018 (22)	0.153 (22)	0.1375 (22)	0.1746 (21)	0.1609 (21)	0.1545 (23)	0.1756 (21)	0.0918 (23)	0.1576 (22)	0.1456 (22)	0.1302 (25)	0.1144 (25)	0.091 (27)	0.0656 (29)	0.0047 (36)	0.0191 (31)	0.0481 (30)	0.1329 (22)
S17	0.5957 (13)	0.6461 (13)	0.5788 (12)	0.6894 (12)	0.6196 (12)	0.5599 (12)	0.5559 (12)	0.6827 (13)	0.6649 (12)	0.7586 (11)	0.7832 (13)	0.7211 (13)	1.1969 (10)	1.2479 (11)	0.9025 (10)	1.0959 (10)	0.8872 (10)	1.0726 (10)	1.3742 (10)	1.2782 (10)	1.3459 (10)	1.1731 (10)	1.09 (12)	0.9569 (12)	0.9652 (12)	0.8977 (11)
S18	0.5858 (15)	0.5384 (14)	0.447 (15)	0.4994 (14)	0.4952 (15)	0.4587 (16)	0.4112 (19)	0.4584 (17)	0.3549 (19)	0.4447 (16)	0.3546 (20)	0.187 (20)	0.1362 (22)	0.148 (25)	0.1365 (22)	0.1648 (21)	0.1843 (21)	0.1646 (21)	0.2668 (20)	0.2299 (21)	0.1646 (23)	0.1314 (24)	0.1238 (25)	0.1496 (24)	0.1308 (24)	0.2947 (20)
S19	3.4756 (5)	3.3578 (6)	3.0397 (6)	3.1352 (6)	2.8768 (6)	3.0096 (6)	2.6307 (6)	2.7683 (6)	2.364 (6)	2.6693 (7)	2.6827 (7)	2.5545 (7)	2.1673 (7)	2.2333 (7)	1.878 (9)	1.8584 (8)	2.4535 (5)	2.5177 (5)	2.1295 (7)	2.4729 (5)	2.2752 (6)	2.1704 (6)	1.654 (8)	1.4354 (10)	1.4657 (8)	2.451 (7)

Source: Results obtained from the model developed in Chapter 4

Table VII-8 (cont'd)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S20	0.5886 (14)	0.5173 (15)	0.4662 (14)	0.4814 (16)	0.5122 (14)	0.5002 (13)	0.5013 (15)	0.5594 (15)	0.5352 (15)	0.5369 (14)	0.6391 (15)	0.6542 (14)	0.442 (18)	0.558 (16)	0.4218 (15)	0.5024 (14)	0.4906 (14)	0.3661 (17)	0.2482 (21)	0.2594 (20)	0.2431 (19)	0.2544 (19)	0.1996 (21)	0.1842 (21)	0.1811 (22)	0.4337 (17)
S21	0.2145 (21)	0.2382 (20)	0.27 (20)	0.2585 (19)	0.2515 (20)	0.2967 (20)	0.3702 (20)	0.3773 (20)	0.3149 (20)	0.256 (21)	0.369 (19)	0.1677 (22)	0.5367 (15)	0.2568 (20)	0.3433 (18)	0.2918 (19)	0.3389 (18)	0.3425 (18)	0.3337 (16)	0.3819 (17)	0.4078 (16)	0.5701 (16)	0.6552 (15)	0.6856 (15)	0.6416 (15)	0.3668 (19)
S22	0.0147 (35)	0.0144 (34)	0.0143 (33)	0.013 (34)	0.0133 (33)	0.0142 (34)	0.0164 (32)	0.0165 (35)	0.0061 (35)	0.0057 (33)	0.0044 (35)	0.0025 (37)	0.0118 (35)	0.004 (36)	0.0036 (36)	0.004 (34)	0.0053 (35)	0.0051 (35)	0.0041 (36)	0.007 (35)	0.0072 (35)	0.0105 (34)	0.0133 (31)	0.0191 (32)	0.0159 (33)	0.0099 (35)
S23	0.015 (34)	0.025 (32)	0.0264 (30)	0.0328 (32)	0.0391 (31)	0.0432 (31)	0.0566 (28)	0.0787 (26)	0.06 (27)	0.0391 (27)	0.0425 (29)	0.0195 (32)	0.0649 (31)	0.0244 (33)	0.0359 (29)	0.0532 (29)	0.0559 (29)	0.0565 (28)	0.0491 (30)	0.0587 (30)	0.0762 (28)	0.1039 (26)	0.14 (24)	0.1489 (25)	0.1394 (23)	0.0594 (29)
S24	0.0533 (28)	0.0475 (29)	0.0512 (28)	0.0421 (29)	0.0429 (29)	0.0439 (29)	0.0487 (29)	0.0506 (32)	0.0376 (30)	0.0276 (28)	0.0435 (28)	0.0181 (33)	0.0582 (32)	0.0261 (32)	0.0287 (32)	0.0243 (33)	0.0281 (33)	0.0277 (32)	0.0243 (32)	0.0247 (32)	0.0273 (32)	0.0457 (30)	0.0767 (29)	0.0858 (29)	0.0766 (29)	0.0425 (33)
S25	0.0472 (29)	0.0429 (31)	0.0451 (29)	0.0384 (30)	0.0385 (32)	0.0389 (32)	0.0425 (30)	0.0445 (33)	0.0341 (31)	0.0265 (29)	0.0329 (30)	0.0196 (31)	0.0675 (29)	0.0318 (31)	0.0326 (31)	0.0285 (31)	0.0348 (32)	0.0351 (30)	0.032 (31)	0.0352 (31)	0.0388 (30)	0.0659 (28)	0.1176 (26)	0.1481 (26)	0.1217 (25)	0.0496 (30)
S26	0.0013 (37)	0.0009 (38)	0.0009 (38)	0.0008 (38)	0.0008 (38)	0.001 (37)	0.001 (37)	0.001 (38)	0.0007 (38)	0.0009 (36)	0.0009 (37)	0.0006 (38)	0.0015 (37)	0.0009 (37)	0.0012 (37)	0.0017 (36)	0.0043 (36)	0.005 (36)	0.005 (35)	0.0065 (36)	0.0056 (36)	0.007 (35)	0.0096 (32)	0.0126 (34)	0.0111 (34)	0.0033 (37)
S27	0.2812 (18)	0.2854 (19)	0.3034 (19)	0.2961 (18)	0.3092 (18)	0.3365 (19)	0.4199 (18)	0.4575 (18)	0.3702 (18)	0.3137 (19)	0.4322 (17)	0.1959 (19)	0.6345 (13)	0.2794 (19)	0.3783 (17)	0.3471 (18)	0.4281 (16)	0.4345 (15)	0.4143 (15)	0.4897 (15)	0.5709 (15)	0.9099 (13)	1.4949 (10)	1.6946 (9)	1.4369 (9)	0.5406 (16)
S28	0.0661 (25)	0.0655 (28)	0.06 (27)	0.0535 (27)	0.0566 (28)	0.0699 (27)	0.0795 (25)	0.0763 (27)	0.0591 (28)	0.0634 (26)	0.0869 (26)	0.0216 (30)	0.0493 (33)	0.0521 (30)	0.0121 (34)	0.027 (32)	0.0366 (31)	0.0324 (31)	0.0091 (34)	0.0203 (33)	0.0139 (34)	0.0215 (32)	0.0257 (30)	0.0269 (30)	0.0334 (31)	0.0447 (32)
S29	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)
S30	0.0633 (26)	0.0724 (27)	0.0706 (26)	0.0704 (25)	0.0686 (27)	0.0622 (28)	0.0675 (26)	0.0602 (28)	0.0583 (29)	0.0056 (34)	0.0073 (34)	0.0678 (26)	0.0678 (27)	0.154 (24)	0.0838 (26)	0.0813 (25)	0.0824 (27)	0.0826 (27)	0.0837 (28)	0.0988 (27)	0.1136 (26)	0.1119 (25)	0.1041 (27)	0.1125 (27)	0.1077 (27)	0.0783 (28)
S31	0.0003 (38)	0.0036 (35)	0.0051 (35)	0.0061 (36)	0.0075 (36)	0.0063 (35)	0.0061 (35)	0.0047 (36)	0.0048 (36)	0.0006 (37)	0.0008 (38)	0.0126 (35)	0.0097 (36)	0.0168 (34)	0.0144 (33)	0.0037 (35)	0.0041 (37)	0.0033 (37)	0.0036 (37)	0.0038 (37)	0.0048 (37)	0.0042 (36)	0.0085 (35)	0.0058 (36)	0.0052 (37)	0.0059 (36)
S32	0.0543 (27)	0.0801 (25)	0.0794 (24)	0.0837 (23)	0.0835 (25)	0.0753 (26)	0.0815 (24)	0.0834 (25)	0.0827 (25)	0.0089 (32)	0.0127 (33)	0.1132 (23)	0.1015 (24)	0.1586 (21)	0.1193 (23)	0.0822 (24)	0.0902 (25)	0.0839 (26)	0.0883 (27)	0.102 (26)	0.1175 (25)	0.1038 (27)	0.0926 (28)	0.0913 (28)	0.0949 (28)	0.0866 (26)
S33	6.4709 (1)	6.0053 (1)	6.0494 (1)	5.8743 (1)	6.4595 (1)	6.6089 (1)	6.4749 (1)	6.0326 (1)	5.9484 (1)	5.8084 (2)	4.6801 (2)	4.6749 (3)	4.3758 (3)	4.2809 (3)	4.831 (3)	4.7482 (3)	5.6851 (3)	5.9563 (3)	5.945 (3)	6.2734 (1)	5.9514 (1)	5.9838 (2)	6.2414 (1)	6.0754 (2)	5.9991 (2)	5.7374 (1)
S34	4.2433 (3)	3.8663 (5)	5.2446 (2)	5.4636 (2)	4.9153 (2)	5.1337 (2)	4.8328 (2)	2.8421 (5)	5.6121 (2)	5.8569 (1)	2.9669 (6)	5.5332 (1)	6.1455 (1)	5.4817 (2)	6.9494 (1)	7.1723 (1)	6.6417 (1)	6.5451 (1)	6.3378 (1)	6.0541 (3)	5.3745 (3)	5.2951 (3)	5.0345 (3)	4.9881 (3)	5.0162 (3)	5.3419 (3)
S35	1.5529 (8)	1.6826 (8)	1.7093 (8)	1.6656 (8)	1.6631 (8)	1.3511 (9)	1.3819 (9)	1.546 (8)	1.6686 (8)	1.4628 (9)	2.0358 (9)	1.9944 (8)	1.6221 (9)	1.7911 (9)	2.0319 (7)	1.9863 (7)	1.9984 (8)	1.9261 (8)	1.7956 (8)	1.8001 (8)	1.8747 (7)	1.8293 (8)	1.7462 (6)	1.7052 (8)	1.7767 (7)	1.7439 (8)
S36	3.7322 (4)	4.2444 (3)	4.174 (4)	4.1395 (4)	4.2206 (4)	4.5267 (3)	4.7922 (3)	4.6359 (2)	4.7541 (3)	5.0581 (3)	5.5838 (1)	5.2037 (2)	6.0362 (2)	6.1843 (1)	6.2424 (2)	6.5434 (2)	6.0893 (2)	6.0676 (2)	6.226 (2)	6.1332 (2)	5.7866 (2)	5.9909 (1)	5.9784 (2)	6.0896 (1)	6.455 (1)	5.3955 (2)
S37	2.7466 (7)	2.1619 (7)	2.207 (7)	2.1397 (7)	2.2022 (7)	1.8885 (7)	2.0631 (7)	2.1799 (7)	2.3304 (7)	2.8982 (6)	3.3807 (5)	3.2838 (6)	2.5495 (6)	2.5292 (6)	2.6828 (5)	2.4475 (6)	2.3045 (6)	2.2336 (6)	2.3906 (5)	2.4087 (6)	2.4927 (5)	2.514 (5)	2.6103 (5)	2.456 (5)	2.4863 (5)	2.4635 (6)
S38	3.0288 (6)	3.9428 (4)	3.5234 (5)	3.8074 (5)	3.8344 (5)	3.4746 (5)	3.7433 (5)	4.0926 (4)	3.7688 (4)	3.5078 (4)	3.7081 (4)	3.6438 (4)	3.0267 (4)	3.0426 (5)	3.1417 (4)	3.0986 (4)	3.1652 (4)	3.0318 (4)	3.1026 (4)	3.0709 (4)	3.651 (4)	3.7284 (4)	3.3862 (4)	3.5313 (4)	3.7903 (4)	3.4737 (4)
S39	1.2657 (11)	1.256 (9)	1.3867 (9)	1.2108 (9)	1.1664 (9)	1.4597 (8)	1.5184 (8)	1.5448 (9)	1.6359 (9)	1.6221 (8)	2.0462 (8)	1.7126 (9)	2.0094 (8)	2.1645 (8)	2.027 (8)	1.8433 (9)	1.7737 (9)	1.7479 (9)	1.4159 (9)	1.376 (9)	1.3697 (9)	1.3708 (9)	1.3723 (11)	1.3548 (11)	1.4076 (11)	1.5623 (9)

Source: Results obtained from the model developed in Chapter 4.

Table VII-9: Inter-industry weighted total forward linkages and ranks, 1975-2015
(Traditional System of Weights)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S01	2.5713 (3)	1.9697 (6)	2.8197 (3)	2.8597 (3)	2.4427 (4)	2.1745 (5)	1.6654 (6)	1.9681 (6)	1.6108 (6)	1.9767 (5)	1.4876 (6)	1.6636 (5)	1.3686 (6)	1.3487 (6)	1.4699 (6)	1.8378 (6)	1.367 (6)	1.3173 (6)	1.0973 (9)	1.1666 (9)	1.1517 (8)	1.0976 (10)	1.0118 (10)	1.0358 (10)	1.1375 (9)	1.6647 (6)
S02	0.6328 (19)	0.8284 (15)	0.7089 (18)	1.0479 (13)	1.0366 (12)	0.7807 (15)	0.7527 (16)	0.6944 (15)	0.8382 (13)	0.5978 (17)	0.6056 (17)	0.8024 (13)	0.2791 (23)	0.2976 (20)	0.4146 (18)	0.4294 (18)	0.3924 (18)	0.6061 (15)	0.4648 (18)	0.4903 (16)	1.104 (11)	0.5539 (16)	0.413 (16)	0.36 (18)	0.3601 (18)	0.6197 (16)
S03	0.2859 (23)	0.217 (25)	0.5081 (20)	0.3796 (23)	0.3149 (23)	0.5323 (19)	0.5284 (18)	0.5583 (19)	0.4854 (19)	0.6448 (16)	0.7229 (13)	0.4386 (18)	0.3648 (20)	0.4774 (17)	0.3768 (19)	0.6019 (16)	0.7456 (12)	0.8458 (10)	0.809 (10)	0.915 (10)	0.7709 (13)	0.5741 (14)	0.4618 (14)	0.5517 (13)	0.379 (15)	0.5396 (18)
S04	0.2548 (24)	0.2956 (23)	0.049 (33)	0.0887 (31)	0.2423 (25)	0.1121 (32)	0.1181 (31)	0.2694 (25)	0.2605 (25)	0.2732 (25)	0.248 (24)	0.1944 (27)	0.3344 (21)	0.2677 (22)	0.2647 (23)	0.3523 (19)	0.2236 (23)	0.2442 (22)	0.2147 (23)	0.2202 (24)	0.414 (19)	0.3549 (19)	0.3756 (19)	0.3056 (19)	0.3211 (19)	0.252 (24)
S05	0.0803 (33)	0.1004 (30)	0.0931 (32)	0.0203 (35)	0.1182 (32)	0.1277 (30)	0.1796 (28)	0.2229 (27)	0.0949 (31)	0.1112 (32)	0.0811 (33)	0.1181 (31)	0.2069 (26)	0.2239 (23)	0.2267 (25)	0.2631 (23)	0.2601 (21)	0.2554 (21)	0.2886 (21)	0.3079 (19)	0.2305 (23)	0.2843 (20)	0.2553 (20)	0.2755 (20)	0.2608 (20)	0.1875 (25)
S06	1.1501 (10)	0.9074 (13)	0.9951 (12)	1.2734 (9)	0.9693 (13)	0.7525 (17)	0.8339 (14)	0.7277 (14)	0.8111 (15)	0.8919 (12)	0.6813 (14)	0.6671 (16)	0.7679 (14)	0.6755 (15)	0.7047 (14)	0.6404 (14)	0.7888 (10)	1.0444 (9)	1.3639 (8)	1.26 (8)	1.1515 (9)	1.2872 (7)	1.4629 (6)	1.4955 (6)	1.1358 (10)	0.9776 (11)
S07	1.1385 (11)	1.0127 (10)	0.95 (13)	0.9498 (14)	0.9106 (14)	0.888 (13)	0.9288 (13)	0.8886 (11)	0.8361 (14)	0.7963 (14)	0.8049 (12)	0.7721 (14)	0.8605 (10)	0.7553 (13)	0.8707 (10)	0.7639 (11)	0.7064 (13)	0.7104 (13)	0.6611 (13)	0.7014 (11)	0.6643 (15)	0.6586 (12)	0.5611 (12)	0.5849 (12)	0.5522 (12)	0.7971 (13)
S08	0.6669 (18)	0.5432 (19)	0.534 (19)	0.6086 (19)	0.476 (21)	0.4677 (21)	0.4316 (21)	0.5011 (20)	0.4335 (20)	0.3394 (23)	0.3521 (21)	0.3021 (23)	0.2571 (24)	0.218 (24)	0.2438 (24)	0.1634 (27)	0.1291 (27)	0.1039 (29)	0.0887 (28)	0.0936 (28)	0.1107 (27)	0.113 (28)	0.0656 (31)	0.062 (31)	0.0636 (32)	0.2947 (22)
S09	0.1386 (29)	0.0798 (33)	0.1534 (28)	0.1473 (28)	0.1464 (29)	0.1351 (29)	0.1318 (30)	0.0571 (32)	0.1874 (28)	0.1354 (30)	0.1197 (31)	0.1356 (30)	0.0885 (30)	0.0037 (36)	0.0171 (33)	0.055 (33)	0.0594 (32)	0.0458 (33)	0.0371 (34)	0.0377 (34)	0.0349 (34)	0.0342 (34)	0.0255 (35)	0.0292 (35)	0.0201 (36)	0.0822 (32)
S10	0.4239 (21)	0.3052 (22)	0.4045 (22)	0.4594 (22)	0.4177 (22)	0.4108 (22)	0.3633 (22)	0.2919 (24)	0.3066 (24)	0.2866 (24)	0.2269 (25)	0.2331 (25)	0.3178 (22)	0.2816 (21)	0.2774 (22)	0.236 (24)	0.2345 (22)	0.2412 (23)	0.1977 (25)	0.2134 (25)	0.2093 (24)	0.1926 (24)	0.1398 (25)	0.1455 (25)	0.1492 (24)	0.2786 (23)
S11	0.7729 (17)	0.7622 (16)	0.7583 (16)	0.7723 (18)	0.7242 (18)	0.7944 (14)	0.7777 (15)	0.6775 (16)	0.7846 (16)	0.68 (15)	0.6445 (16)	0.7525 (15)	0.7928 (12)	0.83 (11)	0.8215 (12)	0.7423 (12)	0.6894 (14)	0.6431 (14)	0.648 (14)	0.6435 (12)	0.6771 (14)	0.6098 (13)	0.4271 (15)	0.3909 (16)	0.3692 (16)	0.6874 (15)
S12	0.1248 (30)	0.1274 (29)	0.1649 (27)	0.1463 (29)	0.1296 (30)	0.1215 (31)	0.1144 (32)	0.0883 (31)	0.0731 (32)	0.1081 (33)	0.1596 (28)	0.3092 (22)	0.0773 (32)	0.0851 (30)	0.0789 (31)	0.0771 (31)	0.125 (28)	0.1697 (26)	0.2105 (24)	0.2445 (23)	0.1548 (25)	0.1252 (26)	0.1265 (27)	0.1303 (26)	0.134 (25)	0.1362 (29)
S13	0.012 (36)	0.0066 (37)	0.0074 (37)	0.0062 (37)	0.0076 (36)	0.0056 (37)	0.0055 (37)	0.0065 (37)	0.0019 (37)	0.0038 (37)	0.0056 (37)	0.0103 (37)	0.0018 (37)	0.0017 (37)	0.0007 (38)	0.0015 (38)	0.003 (38)	0.0043 (37)	0.0061 (37)	0.0067 (38)	0.0032 (38)	0.0045 (38)	0.0055 (37)	0.0038 (38)	0.0032 (38)	0.005 (37)
S14	1.0015 (13)	0.9676 (12)	1.1399 (9)	1.22 (10)	1.1255 (11)	1.0954 (10)	0.9581 (12)	0.8062 (13)	0.9298 (12)	0.8601 (13)	0.6712 (15)	0.8457 (12)	0.778 (13)	0.7701 (12)	0.7864 (13)	0.6733 (13)	0.6379 (15)	0.5793 (16)	0.5648 (15)	0.5995 (15)	0.5112 (18)	0.5163 (17)	0.4122 (17)	0.4142 (15)	0.4123 (14)	0.7711 (14)
S15	0.5599 (20)	0.4937 (20)	0.4809 (21)	0.5323 (21)	0.4858 (20)	0.5217 (20)	0.439 (20)	0.4041 (21)	0.3848 (22)	0.4335 (21)	0.3868 (19)	0.3926 (20)	0.4888 (16)	0.3841 (19)	0.4448 (17)	0.324 (20)	0.3301 (19)	0.3305 (19)	0.3005 (20)	0.2903 (21)	0.3124 (20)	0.247 (21)	0.2531 (21)	0.2495 (21)	0.2526 (21)	0.3889 (20)
S16	0.9784 (14)	0.6854 (18)	0.8231 (15)	0.873 (15)	0.797 (16)	0.7279 (18)	0.4843 (19)	0.6547 (17)	0.5259 (18)	0.4756 (20)	0.3818 (20)	0.3948 (19)	0.4128 (18)	0.0861 (29)	0.3485 (20)	0.2824 (22)	0.3218 (20)	0.2812 (20)	0.2643 (22)	0.2734 (22)	0.2523 (21)	0.2192 (23)	0.1148 (28)	0.1159 (28)	0.1059 (29)	0.4352 (19)
S17	0.3712 (22)	0.3687 (21)	0.3942 (23)	0.549 (20)	0.501 (19)	0.3709 (23)	0.3496 (23)	0.339 (22)	0.4128 (21)	0.4906 (19)	0.3159 (23)	0.3725 (21)	0.3772 (19)	0.4449 (18)	0.4702 (16)	0.2824 (21)	0.2104 (24)	0.1799 (25)	0.3582 (19)	0.303 (20)	0.24 (22)	0.2226 (22)	0.0552 (33)	0.0581 (33)	0.0698 (31)	0.3243 (21)
S18	0.8296 (15)	0.746 (17)	0.7551 (17)	0.8049 (17)	0.7663 (17)	0.7766 (16)	0.6681 (17)	0.6341 (18)	0.5887 (17)	0.597 (18)	0.5449 (18)	0.6354 (17)	0.4733 (17)	0.4926 (16)	0.2788 (21)	0.4809 (17)	0.4987 (17)	0.4602 (18)	0.4716 (17)	0.471 (17)	0.519 (17)	0.4699 (18)	0.4088 (18)	0.3792 (17)	0.3632 (17)	0.5645 (17)
S19	2.0527 (7)	1.5528 (7)	1.4897 (7)	1.5742 (7)	1.3572 (8)	1.3978 (8)	1.4551 (8)	1.2973 (8)	1.2014 (10)	1.2236 (9)	0.9227 (11)	1.17 (8)	1.0285 (9)	0.958 (8)	0.9613 (9)	0.827 (9)	0.8124 (9)	0.7592 (11)	0.7196 (11)	0.6243 (13)	0.5554 (16)	0.5636 (15)	0.5099 (13)	0.484 (14)	0.4526 (13)	1.038 (10)

Source: Results obtained from the model developed in Chapter 4

Table VII-9 (cont'd):

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S20	0.1975 (26)	0.1986 (27)	0.1828 (26)	0.1889 (26)	0.1634 (27)	0.1853 (26)	0.1842 (26)	0.1733 (28)	0.1711 (30)	0.1661 (29)	0.1422 (30)	0.172 (29)	0.213 (25)	0.2018 (25)	0.2231 (26)	0.1737 (26)	0.1504 (26)	0.1438 (27)	0.0763 (30)	0.0763 (29)	0.0769 (30)	0.0667 (31)	0.0555 (32)	0.0473 (34)	0.0532 (33)	0.1473 (28)
S21	1.033 (12)	0.9994 (11)	0.8725 (14)	1.0978 (12)	1.1526 (10)	1.049 (12)	1.2042 (10)	1.2757 (9)	1.2433 (8)	1.3322 (8)	1.4502 (7)	0.8466 (11)	0.6491 (15)	0.7283 (14)	0.6711 (15)	0.6171 (15)	0.6281 (16)	0.5728 (17)	0.4927 (16)	0.4227 (18)	0.8219 (12)	0.8606 (11)	0.8688 (11)	0.7301 (11)	0.7151 (11)	0.8934 (12)
S22	0.035 (35)	0.0405 (35)	0.0331 (35)	0.0427 (33)	0.0362 (35)	0.045 (34)	0.0512 (34)	0.0487 (33)	0.0361 (35)	0.0283 (35)	0.043 (35)	0.0222 (35)	0.0084 (35)	0.0092 (34)	0.0068 (36)	0.0106 (36)	0.0129 (35)	0.0173 (35)	0.023 (36)	0.0177 (36)	0.0311 (35)	0.0304 (35)	0.0519 (34)	0.0606 (32)	0.0441 (34)	0.0314 (35)
S23	0.1194 (31)	0.0995 (31)	0.1026 (30)	0.0766 (32)	0.1065 (33)	0.1044 (33)	0.0896 (33)	0.018 (36)	0.0422 (33)	0.1194 (31)	0.1114 (32)	0.058 (33)	0.0413 (33)	0.0323 (32)	0.0498 (32)	0.0624 (32)	0.0173 (34)	0.0043 (38)	0.0618 (31)	0.0645 (31)	0.0507 (33)	0.0598 (32)	0.1439 (24)	0.1477 (24)	0.1219 (26)	0.0762 (33)
S24	0.1519 (28)	0.1405 (28)	0.1492 (29)	0.1544 (27)	0.16 (28)	0.1676 (27)	0.1822 (27)	0.1714 (29)	0.1801 (29)	0.1778 (28)	0.1904 (27)	0.1115 (32)	0.0825 (31)	0.0907 (28)	0.0968 (29)	0.0784 (30)	0.0671 (31)	0.0647 (31)	0.0547 (32)	0.046 (33)	0.0951 (29)	0.0973 (29)	0.1296 (26)	0.1213 (27)	0.1087 (28)	0.1228 (30)
S25	0.0569 (34)	0.0434 (34)	0.0464 (34)	0.0426 (34)	0.0436 (34)	0.0439 (35)	0.0454 (35)	0.0438 (34)	0.0379 (34)	0.0336 (34)	0.0466 (34)	0.0243 (34)	0.0244 (34)	0.0212 (33)	0.0122 (35)	0.0235 (34)	0.0411 (33)	0.0485 (32)	0.0471 (33)	0.051 (32)	0.1025 (28)	0.1248 (27)	0.2167 (22)	0.2357 (22)	0.1882 (23)	0.0658 (34)
S26	0.0014 (38)	0.001 (38)	0.001 (38)	0.0009 (38)	0.0008 (38)	0.0011 (38)	0.001 (38)	0.0011 (38)	0.0008 (38)	0.0009 (38)	0.0009 (38)	0.0007 (38)	0.0016 (38)	0.001 (38)	0.0014 (37)	0.0019 (37)	0.0052 (37)	0.0061 (36)	0.0061 (38)	0.008 (37)	0.0068 (37)	0.0086 (37)	0.0125 (36)	0.0168 (37)	0.0143 (37)	0.0041 (38)
S27	1.2995 (8)	1.1965 (8)	1.2402 (8)	1.4364 (8)	1.4075 (7)	1.439 (7)	1.5992 (7)	1.5721 (7)	1.5497 (7)	1.5634 (7)	1.8608 (5)	1.0663 (9)	0.8071 (11)	0.885 (10)	0.8404 (11)	0.7937 (10)	0.7734 (11)	0.7169 (12)	0.6914 (12)	0.6193 (14)	1.1079 (10)	1.1882 (9)	1.4571 (7)	1.3649 (8)	1.2346 (7)	1.1884 (8)
S28	0.1059 (32)	0.0939 (32)	0.0979 (31)	0.1335 (30)	0.1249 (31)	0.1511 (28)	0.161 (29)	0.1581 (30)	0.2048 (27)	0.1954 (27)	0.1554 (29)	0.2078 (26)	0.1402 (28)	0.1175 (27)	0.1471 (27)	0.1008 (29)	0.0845 (30)	0.0923 (30)	0.1213 (27)	0.0943 (27)	0.0519 (32)	0.0547 (33)	0.0746 (30)	0.0768 (30)	0.0726 (30)	0.1207 (31)
S29	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)
S30	0.205 (25)	0.2328 (24)	0.2187 (24)	0.2425 (25)	0.2306 (26)	0.1965 (25)	0.2214 (25)	0.2271 (26)	0.2213 (26)	0.2032 (26)	0.2026 (26)	0.19 (28)	0.0956 (29)	0.0636 (31)	0.0889 (30)	0.1798 (25)	0.1897 (25)	0.1908 (24)	0.1462 (26)	0.146 (26)	0.1177 (26)	0.136 (25)	0.2083 (23)	0.2035 (23)	0.199 (22)	0.1823 (27)
S31	0.0073 (37)	0.0084 (36)	0.0089 (36)	0.0109 (36)	0.0062 (37)	0.0103 (36)	0.0145 (36)	0.0211 (35)	0.0198 (36)	0.0156 (36)	0.0186 (36)	0.0149 (36)	0.0044 (36)	0.0089 (35)	0.0145 (34)	0.0159 (35)	0.0116 (36)	0.0203 (34)	0.0236 (35)	0.0181 (35)	0.0155 (36)	0.0178 (36)	0.0033 (38)	0.029 (36)	0.0316 (35)	0.0148 (36)
S32	0.1916 (27)	0.2036 (26)	0.2147 (25)	0.2491 (24)	0.26 (24)	0.2394 (24)	0.2789 (24)	0.3117 (23)	0.3273 (23)	0.36 (22)	0.3271 (22)	0.2974 (24)	0.1748 (27)	0.1255 (26)	0.1232 (28)	0.105 (28)	0.1127 (29)	0.1265 (28)	0.0803 (29)	0.0724 (30)	0.0746 (31)	0.0948 (30)	0.0972 (29)	0.1097 (29)	0.1119 (27)	0.1868 (26)
S33	2.3886 (5)	2.1182 (5)	2.0587 (6)	2.021 (6)	1.8852 (6)	2.1096 (6)	2.0566 (5)	2.1381 (5)	2.1563 (5)	1.6335 (6)	1.3299 (8)	1.4442 (6)	2.1614 (5)	2.0598 (5)	2.1882 (4)	2.0204 (4)	2.3802 (4)	2.3864 (4)	4.1025 (3)	4.1677 (3)	3.9999 (3)	3.1645 (3)	3.2495 (3)	3.3252 (3)	3.5484 (3)	2.4838 (4)
S34	7.6729 (1)	6.8596 (2)	5.9234 (2)	3.7392 (2)	5.449 (2)	5.1454 (2)	5.0252 (2)	5.8044 (2)	5.5298 (2)	4.4957 (2)	5.7417 (2)	5.0637 (2)	5.3746 (2)	5.8677 (2)	4.9583 (2)	4.7544 (2)	4.7596 (2)	4.5423 (2)	4.4098 (2)	4.3142 (2)	4.2806 (2)	4.2955 (2)	4.1957 (2)	4.1501 (2)	4.1067 (2)	5.0584 (2)
S35	2.4026 (4)	2.1621 (4)	2.1043 (5)	2.3065 (5)	2.304 (5)	2.5568 (4)	2.487 (4)	2.4536 (4)	2.5087 (4)	2.3993 (3)	2.1155 (4)	2.1536 (4)	2.5788 (3)	2.449 (3)	2.1503 (5)	1.994 (5)	2.0832 (5)	2.0536 (5)	2.1315 (5)	2.1238 (5)	1.9923 (5)	1.9465 (5)	1.9635 (5)	1.9223 (5)	1.9511 (5)	2.2118 (5)
S36	4.7997 (2)	7.995 (1)	8.0253 (1)	8.3003 (1)	8.2246 (1)	8.4318 (1)	8.9852 (1)	8.722 (1)	9.0884 (1)	10.9153 (1)	11.3506 (1)	12.2074 (1)	12.8389 (1)	13.2801 (1)	13.9188 (1)	14.4913 (1)	14.4971 (1)	14.5073 (1)	12.59 (1)	12.9603 (1)	12.3977 (1)	13.8672 (1)	14.0588 (1)	14.2655 (1)	14.6617 (1)	11.4152 (1)
S37	1.2077 (9)	1.125 (9)	1.0552 (11)	1.181 (11)	1.1626 (9)	1.2594 (9)	1.3548 (9)	1.2266 (10)	1.2316 (9)	1.2225 (10)	1.1124 (9)	1.1772 (7)	1.0426 (7)	1.0858 (7)	1.0388 (7)	1.0244 (8)	1.0279 (8)	1.0519 (8)	1.412 (7)	1.3192 (6)	1.2792 (6)	1.3113 (6)	1.4187 (8)	1.4009 (7)	1.4462 (6)	1.207 (7)
S38	2.271 (6)	2.6258 (3)	2.3641 (4)	2.6256 (4)	2.5124 (3)	2.599 (3)	2.7549 (3)	2.7204 (3)	2.657 (3)	2.237 (4)	2.481 (3)	2.6946 (3)	2.4518 (4)	2.4134 (4)	2.4102 (3)	2.4452 (3)	2.4813 (3)	2.496 (3)	2.3382 (4)	2.3035 (4)	2.2339 (4)	2.3119 (4)	2.4984 (4)	2.5309 (4)	2.6404 (4)	2.4839 (3)
S39	0.807 (16)	0.8867 (14)	1.0716 (10)	0.8375 (16)	0.8009 (15)	1.0724 (11)	1.1179 (11)	0.8259 (12)	1.0264 (11)	0.975 (11)	0.9568 (10)	1.0375 (10)	1.0335 (8)	0.9574 (9)	1.0028 (8)	1.0736 (7)	1.141 (7)	1.1362 (7)	1.4249 (6)	1.3126 (7)	1.1966 (7)	1.2348 (8)	1.2105 (9)	1.1902 (9)	1.208 (8)	1.0615 (9)

Source: Results obtained from the model developed in Chapter 4.

Table VII-10: Highest contributors to unweighted total linkage indices, 2008-09

Sector	BL-H1	BL-H2	BL-H3	BL-H4	BL-H5	BL-H6	BL-RST	BL-H1	BL-H2	BL-H3	BL-H4	BL-H5	BL-H6	BL-RST	TOTAL-BL	FL-H1	FL-H2	FL-H3	FL-H4	FL-H5	FL-H6	FL-RST	FL-H1	FL-H2	FL-H3	FL-H4	FL-H5	FL-H6	FL-RST	TOTAL-FL
S01	S01	S36	S34	S14	S35	S33	RST	0.6069	0.0939	0.0620	0.0400	0.0388	0.0384	0.1608	1.0407	S01	S07	S34	S33	S36	S38	RST	0.5140	0.2164	0.0801	0.0285	0.0190	0.0155	0.0871	0.9606
S02	S02	S36	S33	S05	S34	S35	RST	0.4987	0.0645	0.0311	0.0271	0.0235	0.0234	0.1177	0.7859	S02	S21	S33	S06	S17	S34	RST	0.4223	0.0504	0.0174	0.0167	0.0151	0.0145	0.0773	0.6137
S03	S03	S36	S04	S34	S33	S35	RST	0.4902	0.0280	0.0138	0.0101	0.0098	0.0091	0.0382	0.5993	S03	S12	S34	S33	S35	S36	RST	0.4151	0.2801	0.0772	0.0720	0.0719	0.0324	0.1921	1.1407
S04	S04	S36	S33	S35	S28	S34	RST	0.5245	0.0218	0.0113	0.0097	0.0088	0.0088	0.0430	0.6279	S04	S14	S33	S23	S17	S34	RST	0.4441	0.0507	0.0441	0.0377	0.0364	0.0342	0.2351	0.8823
S05	S05	S36	S33	S34	S35	S19	RST	0.4932	0.2422	0.0513	0.0425	0.0256	0.0202	0.1729	1.0480	S05	S06	S02	S17	S33	S16	RST	0.4176	0.1732	0.0827	0.0744	0.0180	0.0118	0.0835	0.8613
S06	S06	S36	S33	S05	S34	S12	RST	0.4957	0.0823	0.0522	0.0434	0.0263	0.0204	0.1569	0.8772	S06	S17	S33	S19	S16	S18	RST	0.4198	0.1757	0.0334	0.0242	0.0228	0.0164	0.0699	0.7623
S07	S07	S01	S36	S34	S35	S33	RST	0.5672	0.1823	0.0889	0.0590	0.0500	0.0354	0.1510	1.1339	S07	S34	S38	S33	S36	S01	RST	0.4804	0.0963	0.0200	0.0177	0.0177	0.0128	0.0591	0.7038
S08	S08	S34	S01	S36	S07	S35	RST	0.5377	0.0347	0.0306	0.0286	0.0168	0.0138	0.0562	0.7184	S08	S34	S33	S38	S36	S39	RST	0.4554	0.0366	0.0327	0.0264	0.0231	0.0157	0.0969	0.6867
S09	S09	S36	S01	S35	S34	S14	RST	0.5034	0.0441	0.0392	0.0313	0.0264	0.0231	0.1414	0.8090	S09	S11	S34	S36	S33	S37	RST	0.4263	0.1892	0.1000	0.0985	0.0807	0.0506	0.2145	1.1598
S10	S10	S36	S01	S35	S34	S33	RST	0.5433	0.0860	0.0743	0.0633	0.0609	0.0433	0.1798	1.0510	S10	S33	S36	S34	S35	S37	RST	0.4601	0.3297	0.0800	0.0610	0.0273	0.0206	0.1747	1.1533
S11	S11	S36	S33	S34	S14	S35	RST	0.5090	0.0957	0.0527	0.0394	0.0359	0.0320	0.1385	0.9031	S11	S36	S34	S33	S38	S39	RST	0.4310	0.1168	0.1045	0.0780	0.0474	0.0417	0.1653	0.9847
S12	S12	S03	S36	S33	S34	S35	RST	0.5029	0.2194	0.0289	0.0221	0.0156	0.0111	0.0520	0.8520	S12	S35	S33	S34	S36	S01	RST	0.4259	0.1061	0.1017	0.0543	0.0431	0.0379	0.2280	0.9969
S13	S13	S03	S36	S33	S34	S12	RST	0.4891	0.1736	0.0228	0.0175	0.0124	0.0110	0.0498	0.7763	S13	S33	S14	S04	S21	S16	RST	0.4142	0.1425	0.1151	0.0963	0.0511	0.0458	0.3618	1.2268
S14	S14	S36	S34	S33	S35	S04	RST	0.5758	0.0602	0.0362	0.0338	0.0277	0.0162	0.1193	0.8693	S14	S33	S36	S34	S07	S01	RST	0.4876	0.0962	0.0478	0.0471	0.0353	0.0325	0.1875	0.9339
S15	S15	S36	S35	S34	S33	S06	RST	0.5599	0.0916	0.0519	0.0444	0.0375	0.0358	0.1954	1.0164	S15	S33	S36	S34	S19	S07	RST	0.4741	0.3916	0.0747	0.0549	0.0266	0.0253	0.1869	1.2342
S16	S16	S06	S36	S35	S34	S33	RST	0.5962	0.0773	0.0620	0.0405	0.0352	0.0350	0.1993	1.0453	S16	S33	S19	S18	S36	S34	RST	0.5048	0.2167	0.1211	0.1051	0.0577	0.0449	0.1868	1.2371
S17	S17	S06	S36	S33	S21	S34	RST	0.5858	0.2927	0.0872	0.0507	0.0476	0.0365	0.2386	1.3391	S17	S19	S33	S18	S36	S34	RST	0.4961	0.0531	0.0370	0.0342	0.0193	0.0157	0.0686	0.7239
S18	S18	S16	S36	S17	S06	S34	RST	0.5365	0.0969	0.0662	0.0642	0.0434	0.0413	0.1879	1.0365	S18	S33	S36	S34	S19	S37	RST	0.4543	0.2435	0.0750	0.0467	0.0386	0.0292	0.2220	1.1093
S19	S19	S36	S16	S34	S17	S33	RST	0.5303	0.0448	0.0252	0.0243	0.0225	0.0180	0.0954	0.7605	S19	S33	S36	S34	S35	S38	RST	0.4491	0.0397	0.0362	0.0337	0.0210	0.0177	0.0780	0.6753
S20	S20	S36	S34	S17	S16	S10	RST	0.4938	0.0381	0.0279	0.0263	0.0253	0.0214	0.1540	0.7868	S20	S33	S34	S36	S39	S38	RST	0.4182	0.0357	0.0287	0.0222	0.0210	0.0202	0.0684	0.6143
S21	S21	S36	S02	S33	S34	S19	RST	0.8963	0.1316	0.1272	0.0665	0.0389	0.0343	0.2325	1.5272	S21	S34	S33	S36	S17	S35	RST	0.7606	0.1255	0.1006	0.0921	0.0807	0.0423	0.3757	1.5775
S22	S22	S21	S36	S33	S02	S34	RST	0.7304	0.1655	0.1209	0.0613	0.0518	0.0351	0.2362	1.4013	S22	S21	S34	S33	S36	S17	RST	0.6185	0.1432	0.1365	0.1136	0.0973	0.0827	0.5534	1.7452
S23	S23	S04	S21	S36	S28	S33	RST	0.6600	0.2310	0.1133	0.1098	0.0610	0.0586	0.2458	1.4795	S23	S21	S34	S33	S36	S17	RST	0.5590	0.0966	0.0852	0.0696	0.0626	0.0555	0.2970	1.2255
S24	S24	S21	S36	S33	S02	S34	RST	0.8398	0.2256	0.1647	0.0835	0.0706	0.0477	0.3001	1.7320	S24	S21	S34	S33	S36	S17	RST	0.7114	0.1934	0.1684	0.1346	0.1236	0.1080	0.5166	1.9561
S25	S25	S21	S36	S33	S02	S34	RST	0.7582	0.1751	0.1279	0.0648	0.0548	0.0371	0.2362	1.4542	S25	S21	S34	S33	S36	S17	RST	0.6422	0.1502	0.1312	0.1051	0.0963	0.0841	0.4088	1.6179
S26	S26	S36	S33	S34	S35	S12	RST	0.4890	0.0004	0.0002	0.0001	0.0001	0.0000	0.0002	0.4899	S26	S36	S33	S38	S37	S39	RST	0.4141	0.0002	0.0002	0.0001	0.0001	0.0000	0.0001	0.4148
S27	S27	S36	S02	S33	S04	S34	RST	0.9450	0.1292	0.1057	0.0656	0.0418	0.0381	0.1869	1.5123	S27	S34	S33	S36	S17	S35	RST	0.8044	0.1238	0.0995	0.0909	0.0795	0.0414	0.3238	1.5633
S28	S28	S36	S33	S34	S19	S39	RST	0.4895	0.1776	0.1160	0.0514	0.0337	0.0309	0.1714	1.0705	S28	S14	S23	S33	S17	S34	RST	0.4146	0.1102	0.0834	0.0802	0.0751	0.0642	0.5145	1.3421
S29	S29	S36	S27	S33	S34	S35	RST	0.6210	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.6210	S29	S30	S36	S33	S31	S34	RST	0.5259	0.3806	0.0794	0.0583	0.0459	0.0366	0.1888	1.3155
S30	S30	S33	S36	S18	S14	S34	RST	0.4898	0.1176	0.0955	0.0394	0.0352	0.0339	0.1842	0.9957	S30	S36	S33	S34	S35	S39	RST	0.4147	0.0822	0.0597	0.0346	0.0238	0.0170	0.1366	0.7685
S31	S31	S30	S36	S33	S21	S18	RST	0.4892	0.1602	0.0598	0.0459	0.0335	0.0252	0.1571	0.9709	S31	S01	S07	S34	S36	S33	RST	0.4143	0.2720	0.1189	0.0582	0.0495	0.0435	0.1258	1.0822
S32	S32	S36	S33	S34	S14	S19	RST	0.4930	0.2014	0.0773	0.0603	0.0425	0.0291	0.1893	1.0929	S32	S36	S33	S34	S01	S35	RST	0.4175	0.0803	0.0587	0.0360	0.0275	0.0233	0.1251	0.7684
S33	S33	S36	S34	S35	S18	S15	RST	0.6730	0.1610	0.0460	0.0306	0.0291	0.0245	0.1983	1.1625	S33	S36	S34	S35	S37	S39	RST	0.5699	0.0689	0.0363	0.0202	0.0173	0.0135	0.0906	0.8166
S34	S34	S36	S33	S35	S07	S01	RST	0.5365	0.1256	0.0502	0.0381	0.0370	0.0219	0.1471	0.9564	S34	S33	S36	S35	S07	S38	RST	0.4543	0.0457	0.0414	0.0219	0.0162	0.0146	0.0991	0.6933
S35	S35	S36	S33	S34	S12	S19	RST	0.5386	0.1142	0.0599	0.0554	0.0390	0.0279	0.1195	0.9543	S35	S34	S33	S36	S07	S37	RST	0.4561	0.0692	0.0651	0.0444	0.0295	0.0166	0.1487	0.8295
S36	S36	S33	S34	S39	S35	S19	RST	0.6693	0.0502	0.0257	0.0147	0.0129	0.0118	0.0699	0.8544	S36	S33	S34	S37	S35	S38	RST	0.5668	0.0841	0.0559	0.0241	0.0237	0.0196	0.1195	0.8937
S37	S37	S36	S33	S34	S35	S19	RST	0.5057	0.1494	0.0660	0.0331	0.0252	0.0161	0.1184	0.9140	S37	S36	S33	S34	S38	S39	RST	0.4282	0.0210	0.0149	0.0090	0.0084	0.0053	0.0245	0.5113
S38	S38	S36	S34	S33	S19	S35	RST	0.4943	0.0763	0.0300	0.0274	0.0190	0.0136	0.1039	0.7644	S38	S36	S33	S34	S37	S39	RST	0.4186	0.0081	0.0047	0.0027	0.0020	0.0017	0.0083	0.4461
S39	S39	S36	S33	S34	S35	S11	RST	0.5347	0.1408	0.0635	0.0468	0.0206	0.0206	0.1433	0.9703	S39	S36	S33	S34	S38	S35	RST	0.4528	0.0804	0.0714	0.0382	0.0194	0.0169	0.0922	0.7713

RST (Rest of the sectors), H1 (Intra-Industry Linkages), H2 to H6 (Top 5 highest contributors), BL (Backward Linkages), FL (Forward Linkages)

Source: Results obtained from the model developed in Chapter 4.

Table VII-11: Highest contributors to weighted total linkages (RSOW method), 2008-09

Sector	BL-RST	BL-H6	BL-H5	BL-H4	BL-H3	BL-H2	BL-H1	BL-RST	BL-H6	BL-H4	BL-H4	BL-H3	BL-H2	BL-H1	TOTAL-BL	FL-H1	FL-H2	FL-H3	FL-H4	FL-H5	FL-H6	FL-RST	FL-H1	FL-H2	FL-H3	FL-H4	FL-H5	FL-H6	FL-RST	TOTAL-FL
S01	RST	S12	S14	S35	S07	S34	S01	0.0261	0.0169	0.0204	0.0247	0.0248	0.0327	0.7946	0.9401	S01	S07	S34	S33	S35	S39	RST	0.8422	0.3387	0.1167	0.0920	0.0253	0.0235	0.1314	1.5698
S02	RST	S34	S19	S12	S35	S05	S02	0.0569	0.0164	0.0230	0.0280	0.0337	0.0555	0.7135	0.9270	S02	S21	S06	S16	S17	S33	RST	0.6956	0.0663	0.0332	0.0243	0.0213	0.0146	0.0322	0.8875
S03	RST	S05	S28	S34	S35	S04	S03	0.0029	0.0006	0.0009	0.0009	0.0014	0.0035	0.6981	0.7083	S03	S12	S34	S33	S35	S07	RST	0.6801	0.2458	0.0478	0.0428	0.0166	0.0079	0.0497	1.0906
S04	RST	S13	S34	S05	S35	S28	S04	0.0057	0.0014	0.0015	0.0016	0.0032	0.0036	0.7123	0.7292	S04	S14	S33	S23	S17	S06	RST	0.6971	0.0262	0.0242	0.0163	0.0156	0.0112	0.0627	0.8533
S05	RST	S23	S02	S38	S09	S36	S05	0.0022	0.0001	0.0001	0.0002	0.0002	0.0408	0.6988	0.7424	S05	S06	S02	S17	S33	S16	RST	0.6808	0.0612	0.0291	0.0276	0.0046	0.0039	0.0116	0.8187
S06	RST	S02	S18	S12	S05	S33	S06	0.1144	0.0209	0.0227	0.0326	0.0750	0.0785	0.7055	1.0495	S06	S17	S33	S16	S15	S19	RST	0.6877	0.3070	0.0490	0.0336	0.0115	0.0095	0.0324	1.1307
S07	RST	S11	S14	S34	S35	S01	S07	0.0601	0.0220	0.0345	0.0845	0.0957	0.4138	0.9005	1.6111	S07	S34	S33	S38	S35	S01	RST	0.7715	0.1309	0.0722	0.0293	0.0256	0.0241	0.0949	1.1485
S08	RST	S14	S35	S07	S34	S01	S08	0.0080	0.0020	0.0074	0.0130	0.0153	0.0180	0.7222	0.7859	S08	S33	S34	S38	S35	S39	RST	0.6880	0.0119	0.0061	0.0048	0.0029	0.0028	0.0154	0.7319
S09	RST	S11	S34	S14	S35	S01	S09	0.0018	0.0002	0.0004	0.0004	0.0007	0.0010	0.6984	0.7029	S09	S11	S34	S33	S37	S07	RST	0.6803	0.0071	0.0020	0.0014	0.0011	0.0007	0.0034	0.6961
S10	RST	S14	S07	S34	S35	S01	S10	0.0034	0.0009	0.0010	0.0025	0.0035	0.0044	0.7009	0.7166	S10	S33	S35	S34	S06	S37	RST	0.6904	0.2297	0.0130	0.0096	0.0081	0.0050	0.0434	0.9993
S11	RST	S07	S34	S35	S09	S14	S11	0.0085	0.0028	0.0045	0.0067	0.0086	0.0086	0.7017	0.7413	S11	S34	S38	S39	S07	S37	RST	0.6906	0.0492	0.0282	0.0225	0.0193	0.0082	0.0234	0.8414
S12	RST	S34	S35	S14	S33	S03	S12	0.0119	0.0036	0.0038	0.0042	0.0137	0.1109	0.7052	0.8532	S12	S33	S35	S34	S01	S06	RST	0.6826	0.0553	0.0246	0.0109	0.0082	0.0074	0.0393	0.8282
S13	RST	S37	S38	S39	S33	S03	S13	0.0007	0.0001	0.0001	0.0001	0.0001	0.0009	0.6980	0.6999	S13	S33	S14	S04	S16	S21	RST	0.6798	0.0010	0.0003	0.0003	0.0001	0.0001	0.0007	0.6824
S14	RST	S12	S07	S04	S34	S35	S14	0.0397	0.0126	0.0143	0.0144	0.0224	0.0236	0.7801	0.9071	S14	S33	S07	S01	S34	S35	RST	0.7291	0.1453	0.0210	0.0202	0.0192	0.0124	0.0968	1.0439
S15	RST	S12	S14	S34	S06	S35	S15	0.0028	0.0004	0.0006	0.0009	0.0012	0.0016	0.7002	0.7077	S15	S33	S35	S06	S34	S17	RST	0.6979	0.3898	0.0187	0.0142	0.0129	0.0090	0.0736	1.2160
S16	RST	S34	S17	S02	S35	S06	S16	0.0088	0.0021	0.0023	0.0030	0.0036	0.0073	0.7081	0.7353	S16	S33	S19	S18	S35	S06	RST	0.7008	0.1278	0.0250	0.0229	0.0070	0.0060	0.0343	0.9238
S17	RST	S21	S12	S35	S05	S06	S17	0.1602	0.0260	0.0282	0.0363	0.0417	0.3893	0.8247	1.5063	S17	S19	S33	S18	S16	S34	RST	0.7109	0.0181	0.0151	0.0117	0.0033	0.0023	0.0109	0.7723
S18	RST	S35	S34	S06	S17	S16	S18	0.0107	0.0046	0.0047	0.0057	0.0117	0.0154	0.7056	0.7583	S18	S33	S35	S06	S19	S37	RST	0.7027	0.4130	0.0248	0.0229	0.0175	0.0155	0.1096	1.3058
S19	RST	S35	S06	S34	S16	S17	S19	0.1113	0.0297	0.0427	0.0592	0.0753	0.0907	0.8653	1.2743	S19	S33	S34	S35	S38	S06	RST	0.7144	0.0589	0.0223	0.0203	0.0136	0.0069	0.0489	0.8852
S20	RST	S14	S10	S16	S34	S17	S20	0.0291	0.0055	0.0068	0.0071	0.0071	0.0097	0.6999	0.7651	S20	S33	S34	S39	S38	S19	RST	0.6805	0.0123	0.0037	0.0032	0.0029	0.0016	0.0090	0.7132
S21	RST	S12	S05	S35	S19	S02	S21	0.0067	0.0016	0.0017	0.0024	0.0034	0.0219	0.7677	0.8055	S21	S33	S34	S17	S35	S07	RST	0.8114	0.0357	0.0344	0.0252	0.0143	0.0111	0.0811	1.0132
S22	RST	S36	S37	S38	S39	S21	S22	0.0013	0.0001	0.0001	0.0001	0.0001	0.0001	0.6991	0.7008	S22	S33	S34	S03	S17	S12	RST	0.6830	0.0011	0.0011	0.0008	0.0007	0.0007	0.0038	0.6913
S23	RST	S02	S19	S21	S28	S04	S23	0.0021	0.0003	0.0004	0.0009	0.0029	0.0110	0.7065	0.7242	S23	S33	S34	S17	S21	S35	RST	0.6856	0.0018	0.0018	0.0013	0.0011	0.0006	0.0054	0.6976
S24	RST	S39	S35	S02	S19	S21	S24	0.0016	0.0001	0.0001	0.0001	0.0002	0.0004	0.7022	0.7047	S24	S33	S34	S17	S21	S35	RST	0.6908	0.0034	0.0034	0.0025	0.0022	0.0012	0.0084	0.7119
S25	RST	S12	S35	S02	S19	S21	S25	0.0017	0.0001	0.0001	0.0002	0.0003	0.0006	0.7041	0.7071	S25	S33	S34	S17	S21	S35	RST	0.6920	0.0039	0.0038	0.0028	0.0024	0.0015	0.0095	0.7159
S26	RST	S34	S36	S37	S38	S39	S26	0.0019	0.0001	0.0001	0.0001	0.0001	0.0001	0.6980	0.7002	S26	S36	S35	S34	S28	S25	RST	0.6798	0.0001	0.0001	0.0001	0.0001	0.0001	0.0016	0.6817
S27	RST	S28	S35	S19	S04	S02	S27	0.0079	0.0023	0.0030	0.0044	0.0089	0.0231	0.7951	0.8448	S27	S33	S34	S17	S35	S07	RST	0.8583	0.0460	0.0444	0.0326	0.0179	0.0143	0.0973	1.1108
S28	RST	S19	S18	S15	S16	S33	S28	0.0017	0.0002	0.0002	0.0002	0.0003	0.0012	0.6980	0.7019	S28	S14	S23	S04	S17	S33	RST	0.6798	0.0047	0.0030	0.0030	0.0025	0.0023	0.0101	0.7054
S29	RST	S37	S38	S39	S33	S36	S29	0.0000	0.0000	0.0000	0.0000	0.0001	0.0001	0.6980	0.6981	S29	S39	S38	S37	S36	S35	RST	0.6798	0.0001	0.0001	0.0001	0.0001	0.0001	0.0017	0.6819
S30	RST	S16	S14	S15	S18	S33	S30	0.0122	0.0038	0.0067	0.0068	0.0101	0.0398	0.6977	0.7772	S30	S31	S32	S35	S39	S16	RST	0.6797	0.0025	0.0023	0.0010	0.0005	0.0003	0.0025	0.6888
S31	RST	S35	S37	S38	S39	S30	S31	0.0007	0.0001	0.0001	0.0001	0.0001	0.0011	0.6980	0.7001	S31	S01	S07	S34	S33	S35	RST	0.6798	0.0051	0.0021	0.0006	0.0004	0.0002	0.0013	0.6896
S32	RST	S07	S19	S34	S30	S14	S32	0.0025	0.0004	0.0005	0.0008	0.0020	0.0022	0.6983	0.7068	S32	S01	S07	S35	S39	S30	RST	0.6801	0.0025	0.0013	0.0007	0.0004	0.0003	0.0023	0.6876
S33	RST	S14	S16	S10	S15	S18	S33	0.3867	0.2428	0.2566	0.2711	0.4649	0.4765	3.3440	5.4426	S33	S35	S06	S17	S37	S34	RST	3.3015	0.1527	0.1142	0.0657	0.0650	0.0643	0.3570	4.1203
S34	RST	S19	S11	S35	S01	S07	S34	0.1150	0.0478	0.0569	0.1692	0.1979	0.3046	0.8237	1.7152	S34	S33	S35	S07	S01	S38	RST	0.8844	0.4623	0.1568	0.1153	0.0870	0.0706	0.4599	2.2363
S35	RST	S01	S07	S19	S34	S12	S35	0.0429	0.0200	0.0298	0.0446	0.0745	0.0919	0.8027	1.1066	S35	S33	S34	S07	S01	S14	RST	0.8294	0.3836	0.1923	0.0990	0.0563	0.0416	0.3614	1.9635
S36	RST	S34	S35	S37	S39	S38	S36	0.0022	0.0006	0.0418	0.0523	0.0842	0.1397	1.2960	1.6167	S36	S39	S38	S37	S35	S34	RST	1.8414	0.5732	0.2513	0.1075	0.0001	0.0001	0.0021	2.7757
S37	RST	S01	S08	S09	S11	S07	S37	0.0045	0.0015	0.0031	0.0040	0.0054	0.0098	0.7379	0.7661	S37	S35	S38	S39	S14	S11	RST	0.7125	0.0132	0.0055	0.0035	0.0029	0.0025	0.0057	0.7458
S38	RST	S11	S01	S19	S34	S07	S38	0.1013	0.0527	0.0577	0.0731	0.0733	0.0991	0.7240	1.1813	S38	S14	S39	S37	S08	S36	RST	0.7003	0.0023	0.0016	0.0010	0.0001	0.0001	0.0021	0.7075
S39	RST	S14	S34	S11	S07	S01	S39	0.0178	0.0066	0.0163	0.0193	0.0208	0.0226	0.7454	0.8487	S39	S33	S38	S11	S06	S01	RST	0.7340	0.0835	0.0105	0.0083	0.0072	0.0055	0.0195	0.8685

Source: Results obtained from the model developed in Chapter 4.

Table VII-12: Highest contributors to weighted total linkage indices (TSOW method), 2008-09

Sector	BL-H1	BL-H2	BL-H3	BL-H4	BL-H5	BL-H6	BL-RST	BL-H1	BL-H2	BL-H3	BL-H4	BL-H5	BL-H6	BL-RST	TOTAL-BL	FL-H1	FL-H2	FL-H3	FL-H4	FL-H5	FL-H6	FL-RST	FL-H1	FL-H2	FL-H3	FL-H4	FL-H5	FL-H6	FL-RST	TOTAL-FL
S01	S01	S36	S34	S14	S35	S33	RST	0.3754	0.0581	0.0384	0.0247	0.0240	0.0237	0.0994	**0.6437**	S01	S07	S34	S33	S36	S38	RST	0.6162	0.2595	0.0961	0.0342	0.0228	0.0185	0.1045	**1.1517**
S02	S02	S36	S33	S05	S34	S35	RST	0.7668	0.0991	0.0478	0.0416	0.0362	0.0360	0.1809	**1.2085**	S02	S21	S33	S06	S17	S34	RST	0.7597	0.0906	0.0314	0.0301	0.0272	0.0260	0.1391	**1.1040**
S03	S03	S36	S04	S34	S33	S35	RST	0.1003	0.0057	0.0028	0.0021	0.0020	0.0019	0.0078	**0.1226**	S03	S12	S34	S33	S35	S36	RST	0.2805	0.1893	0.0522	0.0486	0.0486	0.0219	0.1298	**0.7709**
S04	S04	S36	S33	S35	S28	S34	RST	0.1711	0.0071	0.0037	0.0032	0.0029	0.0029	0.0140	**0.2048**	S04	S14	S33	S23	S17	S34	RST	0.2084	0.0238	0.0207	0.0177	0.0171	0.0160	0.1103	**0.4140**
S05	S05	S36	S33	S34	S35	S19	RST	0.0921	0.0452	0.0096	0.0079	0.0048	0.0038	0.0323	**0.1957**	S05	S06	S02	S17	S33	S16	RST	0.1118	0.0464	0.0221	0.0199	0.0048	0.0032	0.0224	**0.2305**
S06	S06	S36	S33	S05	S34	S12	RST	0.6406	0.1064	0.0675	0.0560	0.0340	0.0263	0.2028	**1.1336**	S06	S17	S33	S19	S16	S18	RST	0.6342	0.2655	0.0505	0.0365	0.0344	0.0247	0.1056	**1.1515**
S07	S07	S01	S36	S34	S35	S33	RST	0.9367	0.3010	0.1468	0.0974	0.0826	0.0585	0.2494	**1.8724**	S07	S34	S38	S33	S36	S01	RST	0.4534	0.0908	0.0189	0.0167	0.0167	0.0120	0.0558	**0.6643**
S08	S08	S34	S01	S36	S07	S35	RST	0.2100	0.0136	0.0119	0.0111	0.0066	0.0054	0.0219	**0.2805**	S08	S34	S33	S38	S36	S39	RST	0.0734	0.0059	0.0053	0.0043	0.0037	0.0025	0.0156	**0.1107**
S09	S09	S36	S01	S35	S34	S14	RST	0.0102	0.0009	0.0008	0.0006	0.0005	0.0005	0.0029	**0.0163**	S09	S11	S34	S36	S33	S37	RST	0.0128	0.0057	0.0030	0.0030	0.0024	0.0015	0.0065	**0.0349**
S10	S10	S36	S01	S35	S34	S33	RST	0.0265	0.0042	0.0036	0.0031	0.0030	0.0021	0.0088	**0.0512**	S10	S33	S36	S34	S35	S37	RST	0.0835	0.0598	0.0145	0.0111	0.0050	0.0037	0.0317	**0.2093**
S11	S11	S36	S33	S34	S14	S35	RST	0.1285	0.0242	0.0133	0.0099	0.0091	0.0081	0.0350	**0.2280**	S11	S36	S34	S33	S38	S39	RST	0.2964	0.0803	0.0719	0.0536	0.0326	0.0287	0.1136	**0.6771**
S12	S12	S03	S36	S33	S34	S35	RST	0.1918	0.0837	0.0110	0.0084	0.0060	0.0042	0.0198	**0.3249**	S12	S35	S33	S34	S36	S01	RST	0.0661	0.0165	0.0158	0.0084	0.0067	0.0059	0.0354	**0.1548**
S13	S13	S03	S36	S33	S34	S12	RST	0.0018	0.0006	0.0001	0.0001	0.0000	0.0000	0.0002	**0.0029**	S13	S33	S14	S04	S21	S16	RST	0.0011	0.0004	0.0003	0.0002	0.0001	0.0001	0.0009	**0.0032**
S14	S14	S36	S34	S33	S35	S04	RST	0.4498	0.0470	0.0283	0.0264	0.0216	0.0127	0.0932	**0.6790**	S14	S33	S36	S34	S07	S01	RST	0.2669	0.0526	0.0261	0.0258	0.0193	0.0178	0.1026	**0.5112**
S15	S15	S36	S35	S34	S33	S06	RST	0.0175	0.0029	0.0016	0.0014	0.0012	0.0011	0.0061	**0.0318**	S15	S33	S36	S34	S19	S07	RST	0.1200	0.0991	0.0189	0.0139	0.0067	0.0064	0.0473	**0.3124**
S16	S16	S06	S36	S35	S34	S33	RST	0.0519	0.0067	0.0054	0.0035	0.0031	0.0030	0.0173	**0.0910**	S16	S33	S19	S18	S36	S34	RST	0.1030	0.0442	0.0247	0.0214	0.0118	0.0091	0.0381	**0.2523**
S17	S17	S06	S36	S33	S21	S34	RST	0.5888	0.2942	0.0877	0.0510	0.0478	0.0367	0.2398	**1.3459**	S17	S19	S33	S18	S36	S34	RST	0.1645	0.0176	0.0123	0.0113	0.0064	0.0052	0.0227	**0.2400**
S18	S18	S16	S36	S17	S06	S34	RST	0.0852	0.0154	0.0105	0.0102	0.0069	0.0066	0.0299	**0.1646**	S18	S33	S36	S34	S19	S37	RST	0.2125	0.1139	0.0351	0.0218	0.0181	0.0136	0.1039	**0.5190**
S19	S19	S36	S16	S34	S17	S33	RST	1.5865	0.1341	0.0755	0.0728	0.0673	0.0537	0.2853	**2.2752**	S19	S33	S36	S34	S35	S38	RST	0.3694	0.0327	0.0297	0.0278	0.0173	0.0145	0.0641	**0.5554**
S20	S20	S36	S34	S17	S16	S10	RST	0.1526	0.0118	0.0086	0.0081	0.0078	0.0066	0.0476	**0.2431**	S20	S33	S34	S36	S39	S38	RST	0.0524	0.0045	0.0036	0.0028	0.0026	0.0025	0.0086	**0.0769**
S21	S21	S36	S02	S33	S34	S19	RST	0.2393	0.0351	0.0340	0.0178	0.0104	0.0092	0.0621	**0.4078**	S21	S34	S33	S36	S17	S35	RST	0.3963	0.0654	0.0524	0.0480	0.0420	0.0221	0.1957	**0.8219**
S22	S22	S21	S36	S33	S02	S34	RST	0.0038	0.0009	0.0006	0.0003	0.0003	0.0002	0.0012	**0.0072**	S22	S21	S34	S33	S36	S17	RST	0.0110	0.0025	0.0024	0.0020	0.0017	0.0015	0.0098	**0.0311**
S23	S23	S04	S21	S36	S28	S33	RST	0.0340	0.0119	0.0058	0.0057	0.0031	0.0030	0.0127	**0.0762**	S23	S21	S34	S33	S36	S17	RST	0.0231	0.0040	0.0035	0.0029	0.0026	0.0023	0.0123	**0.0507**
S24	S24	S21	S36	S33	S02	S34	RST	0.0132	0.0036	0.0026	0.0013	0.0011	0.0008	0.0047	**0.0273**	S24	S21	S34	S33	S36	S17	RST	0.0346	0.0094	0.0082	0.0065	0.0060	0.0053	0.0251	**0.0951**
S25	S25	S21	S36	S33	S02	S34	RST	0.0202	0.0047	0.0034	0.0017	0.0015	0.0010	0.0063	**0.0388**	S25	S21	S34	S33	S36	S17	RST	0.0407	0.0095	0.0083	0.0067	0.0061	0.0053	0.0259	**0.1025**
S26	S26	S36	S33	S34	S35	S39	RST	0.0056	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0056**	S26	S36	S33	S38	S37	S39	RST	0.0068	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0068**
S27	S27	S02	S04	S19	S35	S28	RST	0.7951	0.0231	0.0089	0.0044	0.0030	0.0023	0.0079	**0.8448**	S27	S34	S33	S36	S17	S35	RST	0.5701	0.0878	0.0705	0.0644	0.0564	0.0293	0.2295	**1.1079**
S28	S28	S36	S33	S34	S19	S39	RST	0.0064	0.0023	0.0015	0.0007	0.0004	0.0004	0.0022	**0.0140**	S28	S14	S23	S33	S17	S34	RST	0.0160	0.0043	0.0032	0.0031	0.0029	0.0025	0.0199	**0.0519**
S29	S29	S36	S33	S39	S38	S37	RST	0.6980	0.0001	0.0001	0.0000	0.0000	0.0000	0.0000	**0.6981**	S39	S38	S37	S36	S35	S34	RST	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	**0.0000**
S30	S30	S33	S36	S18	S14	S34	RST	0.0559	0.0134	0.0109	0.0045	0.0040	0.0039	0.0210	**0.1136**	S30	S36	S33	S34	S35	S39	RST	0.0635	0.0126	0.0091	0.0053	0.0036	0.0026	0.0209	**0.1177**
S31	S31	S30	S36	S33	S21	S18	RST	0.0024	0.0008	0.0003	0.0002	0.0002	0.0001	0.0008	**0.0048**	S31	S01	S07	S34	S36	S33	RST	0.0059	0.0039	0.0017	0.0008	0.0007	0.0006	0.0018	**0.0155**
S32	S32	S36	S33	S34	S14	S19	RST	0.0530	0.0217	0.0083	0.0065	0.0046	0.0031	0.0204	**0.1175**	S32	S36	S33	S34	S01	S35	RST	0.0405	0.0078	0.0057	0.0035	0.0027	0.0023	0.0121	**0.0746**
S33	S33	S36	S34	S35	S18	S15	RST	3.4455	0.8241	0.2356	0.1567	0.1490	0.1252	1.0155	**5.9514**	S33	S36	S34	S35	S37	S39	RST	2.7916	0.3375	0.1776	0.0989	0.0845	0.0661	0.4437	**3.9999**
S34	S34	S36	S33	S35	S07	S01	RST	3.0149	0.7056	0.2821	0.2143	0.2077	0.1233	0.8267	**5.3745**	S34	S33	S36	S35	S07	S38	RST	2.8051	0.2822	0.2559	0.1353	0.1003	0.0902	0.6117	**4.2806**
S35	S35	S36	S33	S34	S12	S19	RST	1.0580	0.2242	0.1176	0.1088	0.0765	0.0547	0.2347	**1.8748**	S35	S34	S33	S36	S07	S37	RST	1.0954	0.1661	0.1563	0.1066	0.0708	0.0398	0.3572	**1.9923**
S36	S36	S33	S34	S39	S35	S19	RST	4.5329	0.3397	0.1742	0.0995	0.0872	0.0799	0.4731	**5.7866**	S36	S33	S34	S37	S35	S38	RST	7.8630	1.1661	0.7757	0.3343	0.3293	0.2715	1.6579	**12.3977**
S37	S37	S36	S33	S34	S35	S19	RST	1.3791	0.4076	0.1800	0.0904	0.0688	0.0440	0.3229	**2.4927**	S37	S36	S33	S34	S35	S38	RST	1.0714	0.0525	0.0374	0.0225	0.0209	0.0132	0.0613	**1.2792**
S38	S38	S36	S34	S33	S19	S35	RST	2.3607	0.3644	0.1431	0.1307	0.0909	0.0647	0.4964	**3.6510**	S38	S36	S33	S34	S37	S39	RST	2.0961	0.0404	0.0237	0.0135	0.0101	0.0087	0.0415	**2.2339**
S39	S39	S36	S33	S34	S35	S11	RST	0.7547	0.1987	0.0896	0.0661	0.0291	0.0291	0.2023	**1.3697**	S39	S36	S33	S34	S38	S35	RST	0.7024	0.1248	0.1108	0.0593	0.0301	0.0262	0.1431	**1.1966**

Source: Results obtained from the model developed in Chapter 4.

Table VII-13: Un-weighted primary factors total backward linkage indices, 1975-2015.

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S01	1.031 (25)	1.0311 (24)	1.024 (30)	1.0212 (34)	1.0214 (30)	1.015 (29)	1.0129 (19)	1.0075 (24)	1.0061 (23)	1.0007 (24)	0.972 (23)	1.0228 (14)	1.0218 (32)	1.0214 (32)	1.0146 (31)	1.0132 (34)	1.002 (30)	1.0039 (30)	0.9973 (27)	0.9917 (29)	0.8949 (20)	0.8348 (22)	0.7211 (25)	0.7036 (23)	0.7432 (23)	0.9652 (26)
S02	1.0546 (6)	1.0509 (6)	1.0422 (10)	1.0341 (11)	1.0326 (12)	1.0325 (12)	1.025 (11)	1.0243 (12)	1.0158 (14)	1.0128 (15)	0.9965 (15)	1.0207 (19)	1.0406 (8)	1.0394 (10)	1.0323 (10)	1.0291 (12)	1.0181 (11)	1.0149 (13)	1.0078 (14)	1.0006 (15)	0.8914 (26)	0.8666 (13)	0.7574 (16)	0.7445 (16)	0.765 (18)	0.982 (14)
S03	1.0462 (10)	1.0403 (12)	1.0234 (34)	1.0226 (29)	1.0255 (20)	1.0139 (33)	1.0061 (32)	1.0068 (26)	1.0038 (25)	0.9938 (34)	0.9724 (21)	1.0278 (12)	1.0209 (34)	1.0181 (36)	1.0132 (35)	1.0112 (36)	0.9966 (36)	0.9999 (35)	0.9941 (31)	0.9844 (36)	0.8788 (35)	0.8096 (34)	0.6896 (32)	0.6611 (32)	0.7172 (30)	0.9591 (31)
S04	1.0371 (15)	1.0258 (36)	1.035 (13)	1.0319 (14)	1.02 (35)	1.0142 (32)	1.0088 (25)	1.0047 (30)	1.0083 (21)	1.0129 (14)	0.9972 (14)	1.0399 (8)	1.0273 (20)	1.0277 (17)	1.0221 (15)	1.021 (18)	1.0121 (16)	1.0171 (11)	1.0157 (11)	1.0003 (17)	0.8935 (24)	0.8242 (27)	0.7064 (27)	0.7007 (26)	0.7321 (26)	0.9694 (20)
S05	1.1792 (1)	1.0282 (33)	1.0234 (33)	1.0242 (22)	1.0221 (28)	1.0162 (24)	1.007 (29)	1.0018 (35)	0.9979 (34)	0.9936 (35)	1.0304 (9)	1.0601 (3)	1.0212 (33)	1.0227 (29)	1.0145 (32)	1.0128 (35)	1.0005 (33)	1.0037 (32)	0.9923 (35)	0.9939 (24)	0.897 (19)	0.8138 (33)	0.6902 (31)	0.667 (31)	0.712 (31)	0.969 (22)
S06	1.0316 (24)	1.04 (13)	1.0378 (11)	1.0333 (12)	1.038 (10)	1.033 (11)	1.025 (12)	1.0266 (11)	1.0186 (13)	1.0141 (13)	1.0271 (10)	1.0188 (22)	1.033 (13)	1.0327 (12)	1.0238 (14)	1.0263 (14)	1.0151 (12)	1.0133 (17)	1.0054 (15)	1.0003 (16)	0.9025 (16)	0.8424 (17)	0.7884 (12)	0.7744 (11)	0.7854 (15)	0.9835 (13)
S07	1.0326 (22)	1.0333 (17)	1.0267 (21)	1.0261 (21)	1.0261 (19)	1.0186 (20)	1.0137 (17)	1.0123 (21)	1.0085 (20)	1.0039 (20)	0.9746 (19)	1.0066 (28)	1.0284 (18)	1.0272 (19)	1.0214 (16)	1.0209 (19)	1.0101 (21)	1.0097 (21)	1.0039 (18)	0.9974 (19)	0.8973 (18)	0.8396 (19)	0.7541 (17)	0.7385 (18)	0.7635 (19)	0.9718 (19)
S08	0.9848 (37)	1.0272 (35)	1.0243 (27)	1.0241 (23)	1.0254 (21)	1.0137 (34)	1.0062 (31)	1.0051 (28)	0.9999 (32)	0.9964 (32)	0.9609 (36)	0.9681 (36)	1.0261 (24)	1.025 (24)	1.0184 (25)	1.0175 (26)	1.0019 (31)	1.0002 (34)	0.9917 (36)	0.9858 (35)	0.8766 (37)	0.8086 (36)	0.6735 (37)	0.6482 (37)	0.7061 (35)	0.9526 (37)
S09	1.1167 (3)	1.054 (5)	1.0319 (14)	1.0332 (13)	1.0305 (14)	1.0387 (10)	1.0478 (8)	1.0628 (4)	1.0341 (8)	1.0497 (9)	1.002 (13)	0.9973 (32)	1.0353 (10)	1.0301 (15)	1.029 (11)	1.0389 (8)	1.0126 (15)	1.0171 (12)	1.0199 (10)	1.0052 (13)	0.916 (12)	0.8587 (14)	0.8931 (9)	0.8488 (9)	0.872 (8)	1.003 (10)
S10	1.0242 (31)	1.0313 (23)	1.0278 (19)	1.0292 (17)	1.0271 (18)	1.018 (21)	1.0133 (18)	1.0124 (20)	1.0085 (19)	1.0051 (19)	0.9695 (27)	1.0017 (30)	1.0304 (16)	1.0274 (18)	1.0212 (17)	1.022 (16)	1.0106 (19)	1.0135 (15)	1.004 (16)	1.0023 (14)	0.9098 (13)	0.8765 (10)	0.7427 (21)	0.7634 (13)	0.789 (13)	0.9752 (16)
S11	1.0392 (14)	1.0287 (31)	1.025 (24)	1.0239 (26)	1.0239 (23)	1.0158 (25)	1.0092 (24)	1.0088 (23)	1.0033 (26)	1.0036 (21)	0.9662 (31)	0.9661 (37)	1.0261 (23)	1.0252 (23)	1.0197 (22)	1.0192 (22)	1.0081 (22)	1.0089 (23)	1.0003 (22)	0.9942 (23)	0.8932 (25)	0.8307 (23)	0.7449 (19)	0.7319 (19)	0.7687 (17)	0.9674 (25)
S12	1.0412 (13)	1.0384 (14)	1.0234 (32)	1.0286 (18)	1.0234 (25)	1.0151 (28)	1.0092 (23)	1.0139 (18)	1.0097 (17)	0.997 (31)	0.9729 (20)	1.0222 (15)	1.0221 (31)	1.0213 (33)	1.0149 (30)	1.015 (30)	0.9985 (34)	1.0019 (33)	0.9928 (34)	0.9864 (34)	0.8804 (34)	0.8087 (35)	0.6938 (30)	0.682 (28)	0.7103 (34)	0.9609 (30)
S13	1.0332 (21)	1.0322 (20)	1.0207 (36)	1.0224 (30)	1.0177 (36)	1.0097 (36)	1.0014 (36)	1.0027 (32)	1.0066 (22)	0.9933 (36)	0.9653 (32)	1.0209 (17)	1.02 (35)	1.0207 (34)	1.0171 (27)	1.0146 (32)	0.997 (35)	0.9992 (36)	0.9897 (37)	0.9838 (37)	0.8784 (36)	0.8078 (37)	0.6938 (29)	0.6811 (29)	0.7187 (29)	0.9579 (34)
S14	1.0022 (35)	1.0317 (21)	1.0297 (17)	1.0316 (15)	1.0308 (13)	1.0212 (16)	1.0198 (14)	1.0192 (15)	1.0109 (16)	1.0052 (18)	0.9685 (29)	0.9807 (35)	1.0319 (15)	1.0314 (14)	1.0268 (13)	1.0295 (11)	1.0138 (13)	1.0069 (26)	1.001 (20)	0.9951 (20)	0.8945 (22)	0.8382 (20)	0.7343 (23)	0.7013 (24)	0.732 (27)	0.9675 (24)
S15	1.0357 (17)	1.0359 (15)	1.0358 (12)	1.0345 (10)	1.036 (11)	1.0275 (13)	1.0245 (13)	1.0234 (13)	1.0199 (12)	1.019 (11)	0.9905 (16)	1.0191 (20)	1.0335 (12)	1.0323 (13)	1.0273 (12)	1.0284 (13)	1.0221 (10)	1.0264 (8)	1.033 (8)	1.0224 (10)	0.9262 (10)	0.8817 (9)	0.7752 (15)	0.7647 (12)	0.7862 (14)	0.9864 (12)
S16	1.049 (8)	1.0436 (10)	1.0439 (8)	1.0457 (6)	1.0463 (8)	1.0513 (6)	1.0473 (9)	1.034 (8)	1.0334 (9)	1.0166 (12)	0.9831 (17)	1.0115 (26)	1.0351 (11)	1.0402 (9)	1.0431 (7)	1.0417 (7)	1.0299 (8)	1.0468 (6)	1.041 (6)	1.0159 (11)	0.9165 (11)	0.8739 (12)	0.7829 (14)	0.7582 (15)	0.79 (12)	0.9928 (11)
S17	1.0353 (18)	1.0429 (11)	1.0432 (9)	1.039 (9)	1.0426 (9)	1.05 (8)	1.0504 (7)	1.0575 (6)	1.0634 (6)	1.0638 (8)	1.0557 (7)	1.0478 (7)	1.0468 (7)	1.0436 (7)	1.0342 (9)	1.0467 (6)	1.0223 (9)	1.0247 (9)	1.0109 (12)	1.0422 (7)	0.9846 (7)	0.9761 (7)	0.9864 (8)	1.0091 (7)	0.968 (7)	1.0315 (8)
S18	1.0254 (29)	1.0332 (18)	1.0306 (16)	1.0298 (16)	1.0298 (15)	1.026 (14)	1.0192 (15)	1.0162 (16)	1.0128 (15)	1.007 (17)	0.9721 (22)	1.0079 (27)	1.0374 (9)	1.0342 (11)	1.039 (8)	1.0242 (15)	1.0108 (18)	1.0148 (14)	1.0039 (17)	1.0002 (18)	0.9011 (17)	0.8461 (16)	0.7494 (18)	0.7275 (20)	0.7442 (22)	0.9737 (18)
S19	1.0144 (34)	1.0302 (25)	1.0254 (23)	1.0241 (24)	1.023 (26)	1.017 (22)	1.0084 (26)	1.0074 (25)	1.0022 (28)	0.9977 (30)	0.963 (33)	0.9919 (33)	1.0242 (27)	1.0242 (27)	1.0164 (29)	1.0182 (25)	1.0017 (32)	1.0054 (28)	0.9964 (30)	0.9901 (31)	0.8873 (29)	0.8207 (30)	0.6834 (36)	0.6593 (34)	0.6994 (37)	0.9573 (36)

Source: Results obtained from the model developed in Chapter 4.

Table VII-13 (cont'd)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S20	0.9895 (36)	1.0295 (27)	1.0275 (20)	1.0269 (20)	1.0274 (17)	1.0192 (17)	1.0121 (20)	1.0096 (22)	1.0048 (24)	1.0003 (25)	0.9671 (30)	0.9998 (31)	1.0277 (19)	1.0254 (22)	1.0184 (24)	1.0202 (21)	1.0057 (26)	1.0068 (27)	0.9969 (28)	0.9906 (30)	0.8855 (32)	0.8243 (26)	0.7266 (24)	0.701 (25)	0.7361 (24)	0.9632 (28)
S21	1.1507 (2)	1.1646 (1)	1.1848 (2)	1.1789 (2)	1.1888 (1)	1.2161 (1)	1.2441 (1)	1.2494 (1)	1.2546 (1)	1.241 (2)	1.4231 (2)	1.0485 (6)	1.0725 (3)	1.1019 (3)	1.1285 (3)	1.1209 (2)	1.1557 (2)	1.1474 (2)	1.1948 (2)	1.2039 (2)	1.6958 (3)	1.9342 (5)	2.4216 (4)	2.6292 (3)	2.4629 (3)	1.3926 (2)
S22	1.0501 (7)	1.0479 (9)	1.0493 (6)	1.0449 (7)	1.0505 (7)	1.0439 (9)	1.0405 (10)	1.0436 (7)	1.0725 (4)	1.0846 (5)	1.0999 (4)	1.0312 (9)	1.0468 (6)	1.0753 (4)	1.0621 (4)	1.0851 (4)	1.1379 (4)	1.1235 (4)	1.1428 (4)	1.1783 (4)	1.6855 (4)	2.1263 (3)	2.4723 (3)	2.3879 (5)	2.4204 (4)	1.3041 (3)
S23	1.0974 (5)	1.0921 (3)	1.187 (1)	1.183 (1)	1.114 (3)	1.192 (2)	1.2249 (2)	1.2258 (3)	1.2379 (3)	1.1427 (3)	1.4351 (1)	1.0554 (4)	1.0744 (1)	1.1146 (1)	1.1381 (2)	1.0971 (3)	1.1427 (3)	1.1386 (3)	1.1326 (5)	1.1292 (5)	1.4305 (6)	1.5779 (6)	1.6015 (6)	1.6494 (6)	1.5953 (6)	1.2404 (5)
S24	1.109 (4)	1.1313 (2)	1.1387 (3)	1.1545 (3)	1.1598 (2)	1.1839 (3)	1.2202 (3)	1.2318 (2)	1.2463 (2)	1.2448 (1)	1.4226 (3)	1.0491 (5)	1.0732 (2)	1.1046 (2)	1.1406 (1)	1.1325 (1)	1.1765 (1)	1.1648 (1)	1.2266 (1)	1.2631 (1)	1.981 (1)	2.281 (1)	2.6016 (2)	2.8122 (2)	2.6083 (2)	1.4343 (1)
S25	1.0456 (11)	1.0486 (8)	1.0449 (7)	1.0494 (5)	1.0506 (6)	1.0507 (7)	1.0539 (6)	1.0576 (5)	1.0665 (5)	1.076 (7)	1.0902 (5)	1.028 (10)	1.0326 (14)	1.054 (5)	1.0133 (34)	1.0611 (5)	1.1038 (5)	1.104 (5)	1.1538 (3)	1.1831 (3)	1.7328 (2)	1.984 (4)	2.4089 (5)	2.528 (4)	2.3276 (5)	1.294 (4)
S26	1.0296 (27)	1.0235 (37)	1.0176 (37)	1.0138 (37)	1.0127 (37)	1.0046 (37)	0.9938 (37)	0.9921 (37)	0.9858 (37)	0.9823 (37)	0.9469 (38)	1.0186 (23)	1.0145 (37)	1.0141 (37)	1.0063 (37)	1.0065 (37)	0.9933 (37)	0.9955 (37)	0.9857 (38)	0.9812 (38)	0.8706 (38)	0.7978 (38)	0.6511 (38)	0.6193 (38)	0.6782 (38)	0.9454 (38)
S27	0.3668 (38)	0.4055 (38)	0.4413 (38)	0.4886 (38)	0.5294 (38)	0.5713 (38)	0.6574 (38)	0.7126 (38)	0.7718 (38)	0.8287 (38)	1.0266 (11)	0.5164 (38)	0.7716 (38)	0.6615 (38)	0.7816 (38)	0.7936 (38)	0.9588 (38)	0.9598 (38)	1.003 (19)	1.0656 (6)	1.6741 (5)	2.1866 (2)	3.4465 (1)	3.7344 (1)	3.2877 (1)	1.1456 (6)
S28	1.0325 (23)	1.0293 (29)	1.0257 (22)	1.0203 (35)	1.0205 (34)	1.0214 (15)	1.0026 (35)	1.0001 (36)	0.9963 (36)	0.9979 (29)	0.9717 (24)	1.0207 (18)	1.0187 (36)	1.0196 (35)	1.012 (36)	1.0141 (33)	1.0026 (28)	1.0037 (31)	0.9935 (32)	0.9899 (32)	0.8907 (27)	0.8369 (21)	0.6843 (35)	0.6585 (35)	0.7112 (32)	0.959 (32)
S29	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)
S30	1.0482 (9)	1.0507 (7)	1.05 (5)	1.0446 (8)	1.0552 (5)	1.0568 (5)	1.0584 (5)	1.0281 (10)	1.0292 (10)	1.0785 (6)	1.0462 (8)	1.0636 (2)	1.0475 (5)	1.0414 (8)	1.0478 (6)	1.0335 (10)	1.0314 (7)	1.0244 (10)	1.0326 (9)	1.0284 (9)	0.9372 (9)	0.8763 (11)	0.8543 (10)	0.8265 (10)	0.8439 (10)	1.0094 (9)
S31	1.0437 (12)	1.0554 (4)	1.0565 (4)	1.0523 (4)	1.0656 (4)	1.0653 (4)	1.067 (4)	1.033 (9)	1.0344 (7)	1.0881 (4)	1.0564 (6)	1.8091 (1)	1.0558 (4)	1.0453 (6)	1.0554 (5)	1.0388 (9)	1.042 (6)	1.0271 (7)	1.0398 (7)	1.039 (8)	0.9507 (8)	0.8878 (8)	1.0034 (7)	0.8574 (8)	0.8687 (9)	1.0535 (7)
S32	1.0349 (20)	1.0329 (19)	1.0279 (18)	1.0238 (27)	1.0254 (22)	1.0192 (18)	1.0116 (21)	1.002 (34)	0.9967 (35)	1.0029 (22)	0.9706 (25)	1.0265 (13)	1.0235 (29)	1.0235 (28)	1.0199 (19)	1.0218 (17)	1.0137 (14)	1.011 (19)	1.0101 (13)	1.0061 (12)	0.906 (14)	0.8408 (18)	0.7849 (13)	0.7441 (17)	0.7736 (16)	0.9741 (17)
S33	1.0151 (33)	1.0284 (32)	1.0243 (26)	1.0222 (31)	1.0222 (27)	1.0155 (26)	1.0079 (27)	1.0046 (31)	0.9995 (33)	0.9999 (26)	0.9629 (34)	0.9918 (34)	1.0259 (25)	1.0248 (25)	1.0191 (23)	1.0175 (27)	1.0066 (25)	1.0091 (22)	1.0006 (21)	0.995 (21)	0.8935 (23)	0.8298 (24)	0.7036 (28)	0.6791 (30)	0.7251 (28)	0.961 (29)
S34	1.0253 (30)	1.03 (26)	1.024 (29)	1.0226 (28)	1.0209 (32)	1.0154 (27)	1.0077 (28)	1.0132 (19)	1.0018 (30)	0.9999 (27)	0.9623 (35)	1.0222 (16)	1.0268 (21)	1.0256 (21)	1.0197 (21)	1.0191 (23)	1.0102 (20)	1.0116 (18)	0.9997 (23)	0.9948 (22)	0.904 (15)	0.8483 (15)	0.7415 (22)	0.7208 (21)	0.7618 (20)	0.9692 (21)
S35	1.0358 (16)	1.0294 (28)	1.0239 (31)	1.022 (32)	1.0211 (31)	1.0143 (31)	1.0064 (30)	1.0055 (27)	1.0007 (31)	0.9997 (28)	0.9701 (26)	1.0279 (11)	1.0284 (17)	1.0283 (16)	1.0205 (18)	1.0207 (20)	1.0116 (17)	1.0133 (16)	0.9995 (24)	0.9926 (27)	0.8945 (21)	0.8257 (25)	0.7105 (26)	0.6876 (27)	0.7325 (25)	0.9649 (27)
S36	1.0284 (28)	1.0273 (34)	1.0217 (35)	1.0194 (36)	1.0205 (33)	1.0144 (30)	1.0051 (34)	1.0024 (33)	1.0024 (27)	0.9962 (33)	0.9606 (37)	1.0191 (21)	1.025 (26)	1.0245 (26)	1.0141 (33)	1.0147 (31)	1.0024 (29)	1.0045 (29)	0.9934 (33)	0.9881 (33)	0.8835 (33)	0.8182 (32)	0.6878 (33)	0.6602 (33)	0.7105 (33)	0.9578 (35)
S37	1.0351 (19)	1.0345 (16)	1.0315 (15)	1.0279 (19)	1.0283 (16)	1.0191 (19)	1.0156 (16)	1.0205 (14)	1.0239 (11)	1.0375 (10)	1.0027 (12)	1.0174 (24)	1.0241 (28)	1.0222 (31)	1.0165 (28)	1.0173 (28)	1.0079 (23)	1.0087 (24)	0.9969 (29)	0.9925 (28)	0.8868 (31)	0.819 (31)	0.8095 (11)	0.763 (14)	0.7966 (11)	0.9782 (15)
S38	1.0184 (32)	1.0288 (30)	1.0241 (28)	1.0217 (33)	1.0216 (29)	1.0125 (35)	1.0053 (33)	1.0047 (29)	1.0019 (29)	1.0015 (23)	0.969 (28)	1.0173 (25)	1.0226 (30)	1.0225 (30)	1.0174 (26)	1.0162 (29)	1.0056 (27)	1.0071 (25)	0.9975 (26)	0.9927 (26)	0.887 (30)	0.8224 (29)	0.6862 (34)	0.6578 (36)	0.705 (36)	0.9587 (33)
S39	1.0302 (26)	1.0315 (22)	1.0249 (25)	1.0239 (25)	1.0235 (24)	1.0169 (23)	1.0101 (22)	1.0156 (17)	1.0094 (18)	1.0115 (16)	0.9761 (18)	1.0054 (29)	1.0264 (22)	1.026 (20)	1.0197 (20)	1.0187 (24)	1.0078 (24)	1.0107 (20)	0.9987 (25)	0.9936 (25)	0.8901 (28)	0.824 (28)	0.7432 (20)	0.7183 (22)	0.7516 (21)	0.9683 (23)

Source: Results obtained from the model developed in Chapter 4.

Table VII-14: Primary factors un-weighted overall-average cumulative backward linkages, 1975-2015

	Sec Code	Compensation of employees	Gross operating surplus & mixed income	Taxes less subsidies on products	Other taxes less subsidies on production	Complementary Imports	Competing Imports	UnWtd Total Value Added BL Indices	UnWtd Total Factor Inputs BL Indices (a)	UnWtd Inter-industry Total BL Indices(b)	UnWtd OVERALL BL Indices*
Ag., Forest & Fish'g	S01	0.2532 (34)	0.5645 (11)	0.0182 (6)	0.0321 (14)	0 (33)	0.0972 (21)	0.8497 (21)	0.9652 (26)	0.9634 (23)	1.9286 (24)
Coal	S02	0.3045 (30)	0.5666 (10)	0.0034 (38)	0.021 (30)	0 (15)	0.0866 (24)	0.892 (14)	0.982 (14)	0.9198 (28)	1.9018 (27)
Crude Oil	S03	0.1841 (35)	0.493 (17)	0.0045 (37)	0.0153 (36)	0 (9)	0.2621 (8)	0.6925 (31)	0.9591 (31)	0.7398 (36)	1.6989 (36)
Nat Gas	S04	0.1599 (37)	0.5448 (13)	0.0047 (36)	0.0186 (35)	0 (11)	0.2414 (9)	0.7234 (30)	0.9694 (20)	0.7483 (35)	1.7177 (35)
Explor. Mining	S05	0.4893 (4)	0.3467 (23)	0.0212 (3)	0.0407 (10)	0 (2)	0.0711 (30)	0.8767 (17)	0.969 (22)	1.1939 (7)	2.1629 (10)
Oth. Mining	S06	0.2925 (32)	0.5376 (14)	0.0109 (22)	0.0243 (27)	0 (26)	0.1182 (19)	0.8543 (20)	0.9835 (13)	0.9276 (27)	1.9111 (25)
Food & Bev	S07	0.3584 (21)	0.4006 (19)	0.016 (7)	0.0315 (16)	0 (32)	0.1653 (15)	0.7905 (24)	0.9718 (19)	1.2121 (6)	2.1839 (8)
Textile & Clothing	S08	0.3113 (27)	0.1857 (36)	0.0097 (28)	0.0203 (33)	0 (27)	0.4257 (3)	0.5172 (36)	0.9526 (37)	0.9172 (29)	1.8698 (30)
Pulp & Paper Mfg	S09	0.3014 (31)	0.2725 (32)	0.0091 (30)	0.0244 (26)	0 (5)	0.3957 (5)	0.5983 (33)	1.003 (10)	0.989 (20)	1.9921 (17)
Wood Prod.	S10	0.3913 (15)	0.3252 (27)	0.0104 (23)	0.0265 (24)	0 (14)	0.2218 (12)	0.743 (27)	0.9752 (16)	1.0602 (15)	2.0354 (15)
Print & Pub.	S11	0.4258 (13)	0.306 (28)	0.0141 (14)	0.0292 (21)	0 (25)	0.1922 (14)	0.7611 (26)	0.9674 (25)	0.9927 (19)	1.9601 (20)
Petro. Prod. Mfg	S12	0.1762 (36)	0.3382 (25)	0.0195 (4)	0.0153 (37)	0 (13)	0.4117 (4)	0.5297 (35)	0.9609 (30)	1.0403 (16)	2.0013 (16)
Coal Prod. Mfg	S13	0.1469 (38)	0.2803 (30)	0.0254 (1)	0.0135 (38)	0 (7)	0.4919 (1)	0.4406 (38)	0.9579 (34)	0.8854 (31)	1.8433 (32)
Chem. Prod.	S14	0.3167 (24)	0.2487 (33)	0.0089 (32)	0.0284 (22)	0 (28)	0.3648 (6)	0.5938 (34)	0.9675 (24)	1.0066 (18)	1.9741 (19)
Non-Metal & Min. Prod.	S15	0.391 (16)	0.3632 (21)	0.0094 (29)	0.0304 (17)	0 (17)	0.1925 (13)	0.7846 (25)	0.9864 (12)	1.0702 (14)	2.0566 (14)
Iron & Steel Mfg	S16	0.375 (17)	0.3273 (26)	0.0253 (2)	0.0298 (19)	0 (19)	0.2354 (10)	0.7321 (29)	0.9928 (11)	1.1512 (8)	2.144 (11)
Non-Ferrous Mfg	S17	0.3483 (22)	0.4982 (16)	0.0101 (26)	0.0299 (18)	0 (18)	0.145 (17)	0.8764 (18)	1.0315 (8)	1.2775 (3)	2.309 (7)
Oth. Metal Prod.	S18	0.4334 (12)	0.2767 (31)	0.0122 (17)	0.0281 (23)	0 (23)	0.2234 (11)	0.7382 (28)	0.9737 (18)	1.093 (13)	2.0667 (13)
Mach. & Transp Prod.	S19	0.3102 (28)	0.1634 (38)	0.0104 (24)	0.0189 (34)	0 (36)	0.4543 (2)	0.4926 (37)	0.9573 (36)	0.9134 (30)	1.8707 (29)
Mfg Oth.	S20	0.3726 (18)	0.2355 (34)	0.0101 (25)	0.0233 (29)	0 (12)	0.3217 (7)	0.6314 (32)	0.9632 (28)	1.011 (17)	1.9742 (18)
Elec. Gen. Coal	S21	0.4686 (8)	0.7582 (2)	0.0137 (15)	0.0685 (5)	0 (20)	0.0835 (25)	1.2953 (2)	1.3926 (2)	1.3117 (2)	2.7042 (1)
Elec. Gen. Oil	S22	0.4453 (9)	0.7078 (3)	0.0142 (12)	0.0688 (4)	0 (22)	0.068 (31)	1.222 (3)	1.3041 (3)	1.0977 (12)	2.4018 (5)
Elec. Gen. Nat. Gas	S23	0.3717 (19)	0.6745 (5)	0.0112 (19)	0.0537 (6)	0 (10)	0.1293 (18)	1.0999 (5)	1.2404 (5)	1.3442 (1)	2.5846 (3)
Elec. Gen. Hydro	S24	0.4846 (5)	0.7802 (1)	0.0149 (9)	0.0737 (2)	0 (21)	0.0809 (26)	1.3385 (1)	1.4343 (1)	1.253 (4)	2.6873 (2)
Elec. Gen. Renew.	S25	0.4413 (10)	0.6969 (4)	0.0141 (13)	0.07 (3)	0 (24)	0.0717 (29)	1.2082 (4)	1.294 (4)	1.1221 (10)	2.416 (4)
Elec. Gen Oth. Fuel	S26	0.3153 (26)	0.5737 (9)	0.0091 (31)	0.039 (11)	0 (1)	0.0084 (38)	0.9279 (9)	0.9454 (38)	0.543 (39)	1.4885 (38)
Elec. T&D	S27	0.3674 (20)	0.6141 (7)	0.0112 (18)	0.0742 (1)	0 (29)	0.0787 (27)	1.0557 (6)	1.1456 (6)	1.2364 (5)	2.3821 (6)
Gas Supply	S28	0.3046 (29)	0.5487 (12)	0.0073 (34)	0.0346 (13)	0 (3)	0.0637 (33)	0.8879 (15)	0.959 (32)	0.9497 (25)	1.9087 (26)
Upstrm Water	S29	0 (39)	0 (39)	0 (39)	0 (39)	0 (8)	0 (39)	0 (39)	0 (39)	0.67 (38)	0.67 (39)
Urb Water	S30	0.2597 (33)	0.6718 (6)	0.0097 (27)	0.0209 (31)	0 (4)	0.0472 (35)	0.9525 (7)	1.0094 (9)	0.8305 (34)	1.8398 (33)
Rurl Water	S31	0.3166 (25)	0.61 (8)	0.011 (20)	0.0236 (28)	0 (6)	0.0923 (23)	0.9502 (8)	1.0535 (7)	1.1208 (11)	2.1743 (9)
Water Serv.	S32	0.4687 (7)	0.4088 (18)	0.0145 (11)	0.0253 (25)	0 (16)	0.0568 (34)	0.9028 (12)	0.9741 (17)	0.8744 (32)	1.8485 (31)
Const.	S33	0.435 (11)	0.367 (20)	0.0146 (10)	0.0296 (20)	0 (31)	0.1149 (20)	0.8315 (22)	0.961 (29)	1.1352 (9)	2.0962 (12)
Wsale & Retail	S34	0.4837 (6)	0.3554 (22)	0.0158 (8)	0.0412 (9)	0 (38)	0.0731 (28)	0.8803 (16)	0.9692 (21)	0.9281 (26)	1.8972 (28)
Trsprt & Storage Serv.	S35	0.4192 (14)	0.3413 (24)	0.0193 (5)	0.0357 (12)	0 (35)	0.1495 (16)	0.7961 (23)	0.9649 (27)	0.9725 (21)	1.9374 (21)
Comm, Fin. & Bus. Serv.	S36	0.347 (23)	0.5013 (15)	0.0109 (21)	0.0517 (7)	0 (39)	0.0469 (36)	0.9 (13)	0.9578 (35)	0.836 (33)	1.7937 (34)
Govt Admin	S37	0.641 (2)	0.2323 (35)	0.0082 (33)	0.0316 (15)	0 (34)	0.0651 (32)	0.9049 (11)	0.9782 (15)	0.9576 (24)	1.9358 (22)
Edu, Hlth & Cmty Serv.	S38	0.7151 (1)	0.1738 (37)	0.0053 (35)	0.0204 (32)	0 (37)	0.0441 (37)	0.9093 (10)	0.9587 (33)	0.7394 (37)	1.698 (37)
Oth. Comml Serv.	S39	0.5127 (3)	0.2993 (29)	0.0126 (16)	0.0466 (8)	0 (30)	0.0971 (22)	0.8586 (19)	0.9683 (23)	0.9652 (22)	1.9336 (23)

* Summation of (a) and (b)   Note: The indices of Complementary Input were zeros, therefore were not shown in the Table.

Source: Results obtained from the model developed in Chapter 4.

Table VII-15: Final demand unweighted overall-average cumulative forward linkages, 1975-2015

Sector	Sec Code	Households	Government	Private	Public Enterprise	General Government	Changes In Inventories	Exports	UnWtd Total FD-FL Indicies	UnWtd Inter-industry Total FL Indices	UnWtd Grand Total FL Indices
Ag., Forest & Fish'g	S01	0.4605 (22)	0.032 (35)	0.0555 (35)	0.0035 (36)	0.0075 (35)	0.0341 (1)	0.3186 (8)	0.9117 (34)	0.9033 (22)	1.8149 (27)
Coal	S02	0.2336 (32)	0.041 (33)	0.0688 (33)	0.0148 (27)	0.0126 (33)	0.0181 (4)	0.6897 (1)	1.0787 (9)	0.8811 (28)	1.9598 (21)
Crude Oil	S03	0.424 (25)	0.0518 (29)	0.0842 (30)	0.0129 (30)	0.0147 (30)	0.0322 (2)	0.3332 (6)	0.9531 (12)	1.281 (7)	2.2341 (10)
Nat Gas	S04	0.5358 (20)	0.0961 (15)	0.1394 (17)	0.0267 (16)	0.0258 (14)	0.0171 (5)	0.4592 (4)	1.3 (4)	1.2614 (9)	2.5613 (4)
Explor. Mining	S05	0.1699 (35)	0.0789 (19)	0.2662 (7)	0.0136 (29)	0.0143 (31)	0.0158 (7)	0.4189 (5)	0.9775 (11)	1.2404 (12)	2.2179 (11)
Oth. Mining	S06	0.0799 (37)	0.0186 (38)	0.1077 (24)	0.023 (18)	0.0224 (19)	0.0138 (10)	0.6485 (2)	0.9138 (33)	0.8882 (27)	1.802 (28)
Food & Bev	S07	0.6372 (10)	0.019 (37)	0.0236 (37)	0.0026 (37)	0.0038 (37)	0.0097 (18)	0.2134 (11)	0.9093 (36)	0.6626 (34)	1.5718 (35)
Textile & Clothing	S08	0.6748 (8)	0.0403 (34)	0.0585 (34)	0.007 (34)	0.0124 (34)	0.0165 (6)	0.1097 (24)	0.9191 (26)	0.725 (32)	1.6441 (32)
Pulp & Paper Mfg	S09	0.4601 (23)	0.0964 (14)	0.1781 (10)	0.0296 (15)	0.0348 (9)	0.0134 (11)	0.1233 (22)	0.9356 (16)	1.2529 (11)	2.1885 (13)
Wood Prod.	S10	0.2763 (30)	0.0698 (21)	0.3205 (6)	0.0496 (4)	0.0632 (3)	0.0107 (14)	0.1415 (20)	0.9315 (17)	1.1479 (15)	2.0795 (16)
Print & Pub.	S11	0.5525 (17)	0.1258 (8)	0.1005 (26)	0.0138 (28)	0.0185 (21)	0.0098 (17)	0.097 (26)	0.9178 (27)	1.0414 (20)	1.9592 (22)
Petro. Prod. Mfg	S12	0.516 (21)	0.0662 (25)	0.105 (25)	0.0156 (26)	0.0182 (22)	0.0116 (13)	0.2177 (10)	0.9503 (13)	1.0553 (19)	2.0056 (18)
Coal Prod. Mfg	S13	0.3432 (27)	0.0697 (22)	0.2335 (8)	0.0384 (11)	0.04 (7)	0.0147 (9)	0.3271 (7)	1.0666 (10)	1.4122 (2)	2.4787 (7)
Chem. Prod.	S14	0.4559 (24)	0.1068 (13)	0.1431 (15)	0.0192 (19)	0.0227 (18)	0.0132 (12)	0.1589 (18)	0.9196 (25)	1.0656 (17)	1.9852 (20)
Non-Metal & Min. Prod.	S15	0.2163 (34)	0.0643 (26)	0.4261 (2)	0.0736 (2)	0.0859 (2)	0.0076 (19)	0.0706 (29)	0.9444 (14)	1.1729 (14)	2.1173 (14)
Iron & Steel Mfg	S16	0.233 (33)	0.0546 (28)	0.3322 (5)	0.0465 (5)	0.0508 (6)	0.0189 (3)	0.2042 (12)	0.9401 (15)	1.2595 (10)	2.1997 (12)
Non-Ferrous Mfg	S17	0.1064 (36)	0.0209 (36)	0.1109 (23)	0.0173 (24)	0.0164 (27)	0.0061 (25)	0.6372 (3)	0.9152 (30)	0.7974 (29)	1.7126 (29)
Oth. Metal Prod.	S18	0.2659 (31)	0.0684 (24)	0.3682 (4)	0.0509 (3)	0.0567 (4)	0.0073 (20)	0.1124 (23)	0.9299 (18)	1.0578 (18)	1.9877 (19)
Mach. & Transp Prod.	S19	0.3194 (28)	0.0516 (30)	0.3803 (3)	0.0434 (6)	0.0383 (8)	0.0052 (28)	0.0892 (28)	0.9275 (19)	0.7521 (30)	1.6796 (30)
Mfg Oth.	S20	0.5401 (19)	0.0456 (31)	0.1933 (9)	0.0183 (21)	0.0538 (5)	0.0048 (29)	0.0585 (33)	0.9146 (31)	0.648 (36)	1.5626 (36)
Elec. Gen. Coal	S21	0.7879 (3)	0.1457 (4)	0.1735 (11)	0.0404 (8)	0.0286 (10)	0.0069 (21)	0.1708 (15)	1.3538 (2)	1.3874 (3)	2.7412 (2)
Elec. Gen. Oil	S22	0.7204 (7)	0.0897 (17)	0.1346 (18)	0.0309 (14)	0.023 (16)	0.0098 (16)	0.1774 (13)	1.1858 (6)	1.2947 (6)	2.4805 (6)
Elec. Gen. Nat. Gas	S23	0.7604 (5)	0.1303 (7)	0.1632 (14)	0.0408 (7)	0.0271 (13)	0.0064 (23)	0.1464 (19)	1.2747 (5)	1.2807 (8)	2.5553 (5)
Elec. Gen. Hydro	S24	0.8106 (2)	0.1446 (5)	0.1734 (12)	0.039 (10)	0.0283 (11)	0.0064 (24)	0.164 (16)	1.3663 (1)	1.3844 (4)	2.7507 (1)
Elec. Gen. Renew.	S25	0.8109 (1)	0.0696 (23)	0.1253 (19)	0.0358 (13)	0.0227 (17)	0.0028 (32)	0.0933 (27)	1.1605 (7)	0.9262 (21)	2.0867 (15)
Elec. Gen Oth. Fuel	S26	0.7588 (6)	0.0053 (39)	0.0799 (31)	0.0365 (12)	0.0157 (28)	0.0001 (39)	0.0072 (39)	0.9034 (39)	0.4512 (39)	1.3546 (39)
Elec. T&D	S27	0.7853 (4)	0.1383 (6)	0.1685 (13)	0.0399 (9)	0.0279 (12)	0.0066 (22)	0.1623 (17)	1.3289 (3)	1.3433 (5)	2.6721 (3)
Gas Supply	S28	0.6622 (9)	0.0879 (18)	0.1394 (16)	0.0262 (17)	0.0248 (15)	0.0055 (27)	0.1397 (21)	1.0857 (8)	1.1781 (13)	2.2639 (9)
Upstrm Water	S29	0.6176 (14)	0.1089 (12)	0.0954 (29)	0.0182 (23)	0.0165 (25)	0.0038 (30)	0.0621 (31)	0.9225 (23)	1.4644 (1)	2.387 (8)
Urb Water	S30	0.6236 (11)	0.1122 (9)	0.0971 (27)	0.0188 (20)	0.0168 (23)	0.0026 (33)	0.0519 (34)	0.9231 (21)	0.8945 (26)	1.8176 (25)
Rurl Water	S31	0.5515 (18)	0.0748 (20)	0.0789 (32)	0.0121 (33)	0.0133 (32)	0.0157 (8)	0.1714 (14)	0.9177 (28)	1.0978 (16)	2.0155 (17)
Water Serv.	S32	0.6183 (13)	0.1092 (11)	0.0956 (28)	0.0183 (22)	0.0165 (24)	0.0037 (31)	0.0609 (32)	0.9226 (22)	0.9011 (24)	1.8237 (24)
Const.	S33	0.0797 (38)	0.058 (27)	0.5409 (1)	0.0969 (1)	0.1129 (1)	0.0009 (36)	0.0267 (36)	0.9161 (29)	0.6624 (35)	1.5784 (34)
Wsale & Retail	S34	0.6218 (12)	0.043 (32)	0.1113 (22)	0.0122 (32)	0.0165 (26)	0.0101 (15)	0.0992 (25)	0.9141 (32)	0.7407 (31)	1.6548 (31)
Trsprt & Storage Serv.	S35	0.4063 (26)	0.1116 (10)	0.1183 (21)	0.0161 (25)	0.0189 (20)	0.0056 (26)	0.2491 (9)	0.9258 (20)	0.9012 (23)	1.827 (23)
Comm, Fin. & Bus. Serv.	S36	0.6128 (15)	0.0899 (16)	0.1192 (20)	0.0124 (31)	0.0148 (29)	0.0025 (34)	0.0702 (30)	0.9218 (24)	0.8953 (25)	1.8171 (26)
Govt Admin	S37	0.0535 (39)	0.8125 (1)	0.0206 (38)	0.0021 (38)	0.0036 (38)	0.0005 (37)	0.0133 (38)	0.9061 (37)	0.5345 (37)	1.4407 (37)
Edu, Hlth & Cmty Serv.	S38	0.318 (29)	0.5536 (2)	0.0061 (39)	0.0006 (39)	0.0011 (39)	0.0002 (38)	0.0248 (37)	0.9044 (38)	0.4798 (38)	1.3841 (38)
Oth. Comml Serv.	S39	0.5698 (16)	0.2444 (3)	0.0438 (36)	0.0041 (35)	0.0075 (36)	0.0011 (35)	0.0397 (35)	0.9104 (35)	0.6762 (33)	1.5866 (33)

Source: Results obtained from the model developed in Chapter 4.

Table VII-16: Total final demand unweighted cumulative forward linkage indices, 1975-2015

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S01	0.9132 (34)	0.9194 (17)	0.9062 (36)	0.9027 (34)	0.9154 (36)	0.9108 (36)	0.9143 (17)	0.8866 (34)	0.911 (23)	0.8877 (35)	0.8936 (21)	0.9764 (35)	0.978 (29)	0.9567 (33)	0.958 (31)	0.9527 (35)	0.9466 (34)	0.9499 (32)	0.9585 (25)	0.9446 (34)	0.8542 (25)	0.8235 (35)	0.8463 (35)	0.8447 (35)	0.8403 (35)	0.9117 (34)
S02	0.9692 (10)	1.0092 (8)	1.2135 (6)	1.0508 (7)	1.0462 (8)	1.2612 (5)	1.2263 (6)	1.089 (6)	1.1816 (6)	1.1376 (8)	1.1461 (5)	1.079 (2)	1.0612 (4)	1.0592 (8)	1.1716 (1)	1.1121 (3)	1.0804 (8)	1.0803 (8)	1.1229 (7)	1.1279 (6)	0.9596 (10)	0.9598 (10)	0.9424 (9)	0.9367 (11)	0.9436 (9)	1.0787 (9)
S03	0.9453 (13)	0.9857 (11)	0.965 (11)	0.9384 (13)	0.9665 (13)	0.9783 (12)	0.9615 (14)	1.0147 (14)	0.9291 (15)	0.9141 (13)	0.9259 (14)	0.9903 (14)	0.9842 (19)	0.9736 (17)	0.9753 (15)	1.1775 (1)	0.9641 (15)	0.9647 (19)	0.9803 (12)	0.9585 (21)	0.8818 (13)	0.8576 (16)	0.8609 (30)	0.8678 (22)	0.8655 (20)	0.9531 (12)
S04	2.1592 (1)	1.8448 (1)	1.4836 (1)	2.0483 (1)	1.6789 (1)	1.21 (6)	1.3616 (5)	1.6256 (1)	1.6403 (1)	2.0856 (1)	1.0682 (9)	1.1299 (1)	1.0694 (2)	1.0918 (7)	1.0877 (7)	1.0191 (12)	1.1407 (3)	1.1216 (4)	0.9597 (19)	0.9778 (11)	1.0294 (8)	0.9969 (9)	0.8906 (14)	0.8863 (14)	0.8921 (12)	1.3 (4)
S05	0.9965 (6)	1.0155 (7)	1.1045 (7)	1.0443 (9)	0.9915 (11)	1.0119 (11)	1.0366 (10)	1.0386 (10)	0.9927 (11)	1.0561 (9)	0.9208 (16)	1.004 (10)	0.9837 (20)	0.9778 (14)	1.0041 (10)	1.0002 (14)	0.9808 (13)	0.9776 (15)	0.9834 (10)	0.9788 (10)	0.8694 (16)	0.8609 (15)	0.8692 (23)	0.8681 (21)	0.8702 (18)	0.9775 (11)
S06	0.914 (31)	0.9065 (33)	0.9343 (14)	0.9037 (29)	0.9169 (31)	0.9122 (30)	0.8987 (27)	0.9137 (18)	0.898 (33)	0.8884 (33)	0.8844 (31)	0.9792 (30)	0.9747 (31)	0.9656 (25)	0.9568 (32)	0.9562 (32)	0.9537 (28)	0.9494 (33)	0.9459 (34)	0.9457 (33)	0.8491 (34)	0.8299 (31)	0.8698 (22)	0.8486 (33)	0.8502 (32)	0.9138 (33)
S07	0.9122 (36)	0.9163 (21)	0.9058 (38)	0.9023 (37)	0.9152 (37)	0.9104 (37)	0.8848 (35)	0.8835 (36)	0.8927 (36)	0.8872 (36)	0.9141 (18)	0.9762 (38)	0.9705 (33)	0.9564 (34)	0.9654 (21)	0.9557 (33)	0.9486 (32)	0.9552 (29)	0.9439 (36)	0.9442 (36)	0.8454 (36)	0.8215 (36)	0.8442 (37)	0.8425 (37)	0.8375 (37)	0.9093 (36)
S08	0.9188 (19)	0.9044 (34)	0.9069 (33)	0.9033 (31)	0.9172 (30)	0.9118 (32)	0.8984 (29)	1.0416 (9)	0.9303 (14)	0.9008 (19)	0.8761 (36)	0.977 (32)	0.9702 (36)	0.9556 (37)	0.9556 (34)	0.9534 (34)	0.9464 (35)	0.9473 (35)	0.9825 (11)	0.9466 (31)	0.8478 (35)	0.8258 (34)	0.8527 (34)	0.8565 (31)	0.8505 (31)	0.9191 (26)
S09	0.9142 (29)	0.904 (37)	0.9113 (25)	0.9059 (25)	0.919 (25)	0.9165 (25)	0.9591 (15)	0.8837 (35)	0.9227 (16)	0.8965 (22)	0.8882 (24)	0.9795 (29)	0.9745 (32)	1.1351 (1)	0.9851 (12)	1.0194 (11)	1.011 (12)	1.0206 (12)	0.9749 (13)	0.961 (14)	0.856 (22)	0.8502 (17)	0.8829 (17)	0.8628 (28)	0.8562 (26)	0.9356 (16)
S10	0.9145 (26)	0.9278 (15)	0.9118 (24)	0.9088 (20)	0.9212 (21)	0.9169 (24)	0.8972 (31)	0.8921 (31)	0.905 (30)	0.8951 (24)	0.8817 (32)	0.98 (28)	0.9945 (13)	0.9661 (24)	0.9642 (23)	0.9616 (23)	0.9548 (26)	0.9882 (14)	0.9601 (18)	0.9552 (25)	0.8878 (11)	0.8936 (13)	0.9334 (11)	0.9453 (10)	0.9312 (10)	0.9315 (17)
S11	0.9141 (30)	0.9178 (18)	0.9123 (22)	0.9077 (22)	0.9217 (20)	0.9189 (21)	0.8988 (26)	0.9072 (25)	0.9064 (28)	0.8946 (25)	0.8857 (30)	0.9801 (27)	0.9789 (27)	0.9654 (26)	0.9965 (11)	0.9586 (29)	0.9526 (30)	0.9554 (27)	0.9523 (32)	0.9541 (27)	0.8554 (23)	0.8337 (27)	0.86 (31)	0.8644 (26)	0.8537 (29)	0.9178 (27)
S12	0.9534 (12)	0.9858 (10)	0.9646 (12)	0.9425 (12)	0.9677 (12)	0.9776 (13)	0.9623 (13)	1.027 (12)	0.9397 (12)	0.9184 (12)	0.9244 (15)	0.9934 (12)	0.9937 (14)	0.9813 (13)	0.9828 (13)	1.0163 (13)	0.9745 (14)	0.9757 (16)	0.9658 (16)	0.9672 (13)	0.8657 (18)	0.8459 (18)	0.8721 (21)	0.8786 (17)	0.8821 (15)	0.9503 (13)
S13	0.9766 (8)	1.1455 (6)	1.0874 (8)	1.0652 (6)	1.0504 (7)	1.0788 (8)	1.1123 (9)	1.0447 (8)	1.1187 (8)	1.1681 (7)	1.0085 (10)	1.0387 (8)	1.0667 (3)	1.0461 (10)	1.114 (6)	1.0612 (9)	1.1442 (2)	1.0669 (10)	1.0165 (9)	1.1027 (8)	1.0094 (9)	1.0793 (8)	0.9192 (13)	1.0336 (7)	1.1091 (7)	1.0666 (10)
S14	0.9154 (23)	0.9095 (30)	0.911 (27)	0.9068 (23)	0.9201 (24)	0.9177 (22)	0.909 (18)	0.9043 (27)	0.908 (25)	0.8956 (23)	0.8924 (22)	0.9837 (22)	0.9879 (16)	0.9719 (19)	0.9678 (19)	0.9676 (19)	0.9592 (19)	0.9606 (20)	0.9539 (30)	0.9547 (26)	0.8536 (27)	0.8404 (23)	0.8802 (20)	0.865 (25)	0.8541 (28)	0.9196 (25)
S15	0.9158 (22)	0.9128 (26)	0.9088 (30)	0.9047 (27)	0.918 (28)	0.9138 (28)	0.8945 (32)	0.8963 (29)	0.9053 (29)	0.8932 (27)	0.8951 (20)	0.9864 (19)	1.0187 (10)	0.9685 (22)	0.9791 (14)	0.9828 (15)	1.0288 (11)	1.0494 (11)	0.9681 (15)	0.9714 (12)	0.8772 (14)	0.9313 (11)	0.9875 (8)	0.9764 (9)	0.9266 (11)	0.9444 (14)
S16	0.9185 (20)	0.9163 (20)	0.9155 (21)	0.9085 (21)	0.9237 (17)	0.9238 (16)	1.1316 (8)	0.9398 (16)	0.921 (17)	0.8974 (21)	0.8921 (23)	0.9837 (23)	0.9933 (15)	0.9752 (16)	0.968 (18)	0.9701 (16)	0.9603 (18)	0.9664 (17)	0.9592 (23)	0.9597 (17)	0.8678 (17)	0.8892 (14)	0.9417 (10)	0.9107 (12)	0.8702 (17)	0.9401 (15)
S17	0.9145 (27)	0.9071 (32)	0.9237 (16)	0.9041 (28)	0.9175 (29)	0.9133 (29)	0.8986 (28)	0.9121 (19)	0.9013 (32)	0.8891 (32)	0.8876 (25)	0.9854 (20)	0.9703 (35)	0.962 (27)	0.9565 (33)	0.9589 (28)	0.9469 (33)	0.9481 (34)	0.9443 (35)	0.9443 (35)	0.8511 (33)	0.829 (33)	0.8666 (26)	0.8667 (24)	0.8821 (14)	0.9152 (30)
S18	0.9148 (24)	0.9199 (16)	0.9096 (29)	0.9054 (26)	0.9187 (26)	0.9156 (26)	0.898 (30)	0.9051 (26)	0.9068 (27)	0.8931 (28)	0.8865 (26)	0.9831 (25)	1.0085 (12)	0.9725 (18)	0.97 (16)	0.9678 (18)	0.9624 (17)	0.9964 (13)	0.9603 (17)	0.9608 (15)	0.8821 (12)	0.9112 (12)	0.9294 (12)	0.8859 (15)	0.8835 (13)	0.9299 (18)
S19	0.9201 (18)	0.9101 (28)	0.9113 (26)	0.9064 (24)	0.9212 (22)	0.917 (23)	0.9045 (20)	1.0487 (7)	0.9354 (13)	0.894 (26)	0.8859 (28)	0.9834 (24)	0.9772 (30)	0.9752 (15)	0.9641 (24)	0.9696 (17)	0.9558 (25)	0.9553 (28)	0.9571 (27)	0.9582 (22)	0.8714 (15)	0.8415 (21)	0.8677 (25)	0.8896 (13)	0.8667 (19)	0.9275 (19)

Source: Results obtained from the model developed in Chapter 4.

Table VII-16 (cont'd)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S20	0.9134 (33)	0.9097 (29)	0.907 (32)	0.9034 (30)	0.9163 (32)	0.9117 (33)	0.9021 (21)	0.8935 (30)	0.9068 (26)	0.8902 (30)	0.8763 (35)	0.9926 (13)	0.983 (21)	0.9603 (28)	0.9585 (30)	0.964 (20)	0.9545 (27)	0.9655 (18)	0.9745 (14)	0.9465 (32)	0.8577 (21)	0.8331 (29)	0.8593 (32)	0.8449 (34)	0.8405 (34)	0.9146 (31)
S21	1.3401 (3)	1.3651 (3)	1.4196 (3)	1.3427 (3)	1.3516 (2)	1.4123 (1)	1.4142 (1)	1.3788 (2)	1.3571 (2)	1.2824 (4)	1.6122 (3)	1.0414 (5)	1.0454 (7)	1.1022 (5)	1.1265 (4)	1.1082 (4)	1.1351 (4)	1.1224 (3)	1.1874 (2)	1.1871 (2)	1.6509 (3)	1.6933 (4)	1.685 (3)	1.7368 (2)	1.7469 (2)	1.3538 (2)
S22	0.9909 (7)	1.0037 (9)	1.016 (9)	0.9968 (10)	1.0194 (9)	1.0228 (9)	1.0034 (12)	1.0215 (13)	1.0586 (9)	1.0514 (10)	1.1397 (6)	1.0091 (9)	1.0089 (11)	1.0584 (9)	1.0365 (9)	1.1009 (6)	1.1167 (6)	1.0993 (7)	1.1387 (4)	1.1624 (5)	1.648 (4)	1.8473 (2)	1.7178 (2)	1.6417 (5)	1.7352 (3)	1.1858 (6)
S23	1.4304 (2)	1.4125 (2)	1.4362 (2)	1.3602 (2)	1.3345 (3)	1.3623 (3)	1.3794 (2)	1.3351 (5)	1.3309 (5)	1.2963 (2)	1.6284 (1)	1.0486 (4)	1.0472 (6)	1.1217 (3)	1.14 (3)	1.073 (7)	1.1132 (7)	1.1045 (6)	1.1114 (8)	1.1036 (7)	1.3868 (6)	1.4144 (6)	1.2937 (6)	1.2994 (6)	1.3025 (6)	1.2747 (5)
S24	1.193 (5)	1.2568 (5)	1.2835 (5)	1.2792 (5)	1.2808 (5)	1.3407 (4)	1.3669 (4)	1.3456 (4)	1.3457 (3)	1.2903 (3)	1.6132 (2)	1.041 (6)	1.0475 (5)	1.1083 (4)	1.147 (2)	1.1261 (2)	1.1604 (1)	1.1436 (1)	1.2242 (1)	1.2531 (1)	1.9315 (1)	1.9619 (1)	1.773 (1)	1.8216 (1)	1.8231 (1)	1.3663 (1)
S25	0.9685 (11)	0.9825 (12)	0.9896 (10)	0.9946 (11)	1.0061 (10)	1.0175 (10)	1.005 (11)	1.0055 (15)	1.0252 (10)	1.025 (11)	1.0947 (8)	0.9951 (11)	0.9852 (18)	1.0152 (11)	0.9544 (35)	1.0216 (10)	1.0717 (10)	1.0706 (9)	1.1375 (5)	1.164 (4)	1.688 (2)	1.7331 (3)	1.683 (4)	1.697 (3)	1.6813 (4)	1.1605 (7)
S26	0.9117 (38)	0.9032 (38)	0.9065 (34)	0.9015 (39)	0.9144 (39)	0.9092 (39)	0.879 (39)	0.881 (39)	0.8892 (39)	0.8854 (39)	0.8747 (39)	0.9759 (39)	0.9669 (39)	0.9534 (39)	0.9508 (39)	0.948 (39)	0.9426 (39)	0.9442 (38)	0.9406 (39)	0.9407 (39)	0.8417 (39)	0.816 (39)	0.8397 (39)	0.8367 (39)	0.8328 (39)	0.9034 (39)
S27	1.2925 (4)	1.3252 (4)	1.3708 (4)	1.3118 (4)	1.3184 (4)	1.3723 (2)	1.3782 (3)	1.3468 (3)	1.3369 (4)	1.2729 (5)	1.5863 (4)	1.0399 (7)	1.042 (8)	1.0999 (6)	1.123 (5)	1.1019 (5)	1.1297 (5)	1.1172 (5)	1.1761 (3)	1.1776 (3)	1.6386 (5)	1.6818 (5)	1.6366 (5)	1.668 (4)	1.6779 (5)	1.3289 (3)
S28	0.9727 (9)	0.9436 (13)	0.9354 (13)	1.0496 (8)	1.0781 (6)	1.1291 (7)	1.1708 (7)	1.0281 (11)	1.1607 (7)	1.2261 (6)	1.1294 (7)	1.0701 (3)	1.1161 (1)	1.1231 (2)	1.0843 (8)	1.0655 (8)	1.076 (9)	1.1229 (2)	1.1249 (6)	1.0578 (9)	1.1679 (7)	1.1296 (7)	1.0643 (7)	1.0328 (8)	1.0844 (8)	1.0857 (8)
S29	0.9214 (17)	0.9129 (25)	0.9177 (20)	0.9131 (18)	0.9236 (19)	0.9227 (19)	0.9018 (23)	0.9109 (22)	0.9115 (21)	0.9122 (16)	0.9325 (13)	0.9868 (17)	0.979 (25)	0.9599 (31)	0.9596 (28)	0.9596 (27)	0.9571 (22)	0.9557 (26)	0.9595 (22)	0.9594 (20)	0.8523 (29)	0.8363 (26)	0.882 (18)	0.8728 (20)	0.8634 (23)	0.9225 (23)
S30	0.9218 (15)	0.9126 (27)	0.9181 (18)	0.9134 (16)	0.9238 (16)	0.9231 (17)	0.9013 (24)	0.9119 (20)	0.9116 (19)	0.9138 (14)	0.9349 (11)	0.9869 (15)	0.9791 (24)	0.9599 (29)	0.9596 (26)	0.9599 (25)	0.9574 (20)	0.9559 (24)	0.9596 (20)	0.9601 (16)	0.8523 (31)	0.8369 (24)	0.8833 (15)	0.8744 (18)	0.8649 (21)	0.9231 (21)
S31	0.9136 (32)	0.9167 (19)	0.9122 (23)	0.909 (19)	0.921 (23)	0.919 (20)	0.9061 (19)	0.9011 (28)	0.9113 (22)	0.9009 (18)	0.916 (17)	0.9852 (21)	0.9787 (28)	0.9592 (32)	0.9593 (29)	0.9564 (31)	0.9534 (29)	0.953 (30)	0.959 (24)	0.9513 (29)	0.8533 (28)	0.8296 (32)	0.868 (24)	0.8584 (30)	0.8506 (30)	0.9177 (28)
S32	0.9214 (16)	0.9129 (24)	0.9177 (19)	0.9131 (17)	0.9236 (18)	0.9227 (18)	0.9018 (22)	0.9109 (21)	0.9115 (20)	0.9122 (15)	0.9325 (12)	0.9868 (16)	0.979 (26)	0.9599 (30)	0.9596 (27)	0.9597 (26)	0.9572 (21)	0.9557 (25)	0.9595 (21)	0.9596 (18)	0.8523 (30)	0.8364 (25)	0.8829 (16)	0.8731 (19)	0.8637 (22)	0.9226 (22)
S33	0.9144 (28)	0.9043 (35)	0.9064 (35)	0.903 (33)	0.9158 (35)	0.911 (35)	0.8819 (37)	0.8833 (37)	0.8907 (37)	0.8864 (37)	0.8769 (33)	0.9765 (34)	1.0272 (9)	0.9713 (20)	0.9683 (17)	0.9622 (22)	0.957 (23)	0.9572 (22)	0.9577 (26)	0.9595 (19)	0.8551 (24)	0.8432 (20)	0.8649 (27)	0.8674 (23)	0.8601 (24)	0.9161 (29)
S34	0.9172 (21)	0.9129 (23)	0.9099 (28)	0.9026 (35)	0.9187 (27)	0.9145 (27)	0.8937 (33)	0.9077 (24)	0.9016 (31)	0.8905 (29)	0.886 (27)	0.979 (31)	0.9812 (23)	0.9713 (21)	0.9598 (25)	0.9569 (30)	0.9517 (31)	0.9519 (31)	0.9505 (33)	0.951 (30)	0.8515 (32)	0.8302 (30)	0.8559 (33)	0.8561 (32)	0.8492 (33)	0.9141 (32)
S35	0.926 (14)	0.9372 (14)	0.9229 (17)	0.9162 (15)	0.9366 (14)	0.9351 (14)	0.9168 (16)	0.9168 (17)	0.9193 (18)	0.9094 (17)	0.8966 (19)	0.9866 (18)	0.9868 (17)	0.9851 (12)	0.9667 (20)	0.9634 (21)	0.9628 (16)	0.9597 (21)	0.9568 (28)	0.9567 (24)	0.8597 (19)	0.8439 (19)	0.8643 (28)	0.8629 (27)	0.8566 (25)	0.9258 (20)
S36	0.9124 (35)	0.9152 (22)	0.9242 (15)	0.9229 (14)	0.9241 (15)	0.9242 (15)	0.9007 (25)	0.9098 (23)	0.908 (24)	0.8985 (20)	0.8858 (29)	0.9801 (26)	0.9822 (22)	0.9681 (23)	0.9648 (22)	0.9612 (24)	0.9569 (24)	0.9569 (23)	0.9549 (29)	0.9571 (23)	0.8581 (20)	0.8414 (22)	0.8813 (19)	0.8821 (16)	0.8738 (16)	0.9218 (24)
S37	0.9118 (37)	0.9043 (36)	0.9059 (37)	0.9026 (36)	0.9158 (34)	0.912 (31)	0.8851 (34)	0.889 (32)	0.8947 (34)	0.8894 (31)	0.8754 (37)	0.9762 (37)	0.969 (38)	0.9556 (36)	0.9526 (38)	0.9495 (38)	0.944 (38)	0.944 (39)	0.943 (37)	0.9433 (37)	0.8438 (37)	0.8199 (37)	0.8452 (36)	0.843 (36)	0.8387 (36)	0.9061 (37)
S38	0.9117 (39)	0.9032 (39)	0.905 (39)	0.9017 (38)	0.9146 (38)	0.9098 (38)	0.88 (38)	0.8815 (38)	0.8896 (38)	0.8856 (38)	0.8751 (38)	0.9762 (36)	0.9691 (37)	0.9553 (38)	0.9526 (37)	0.95 (37)	0.9447 (37)	0.9445 (37)	0.9416 (38)	0.9422 (38)	0.8426 (38)	0.8175 (38)	0.8415 (38)	0.8386 (38)	0.8343 (38)	0.9044 (38)
S39	0.9148 (25)	0.9074 (31)	0.9082 (31)	0.9031 (32)	0.916 (33)	0.9115 (34)	0.8835 (36)	0.8868 (33)	0.8931 (35)	0.8882 (34)	0.8763 (34)	0.9766 (33)	0.9704 (34)	0.9559 (35)	0.9534 (36)	0.9512 (36)	0.946 (36)	0.9466 (36)	0.953 (31)	0.9538 (28)	0.8536 (26)	0.8333 (28)	0.8614 (29)	0.8621 (29)	0.8544 (27)	0.9104 (35)

Source: Results obtained from the model developed in Chapter 4.

Table VII-17: Overall direct purchases of primary factors by sectors of final demand, 1975-2015

Sector	Primary Factors	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
Households	Comp. of employ.	0.5579	0.4593	0.4537	0.4340	0.4472	0.5462	0.4793	0.4691	0.4502	0.4625	0.4892	0.4961	0.4817	0.4794	0.4311	0.5595	0.4576	0.4485	0.4386	0.4385	0.4283	0.4408	0.4099	0.4187	0.5312
	Gross Profit.	0.7053	0.6019	0.5747	0.5607	0.5861	0.6603	0.5839	0.5508	0.5475	0.5252	0.5752	0.5530	0.5340	0.5380	0.4902	0.6080	0.4941	0.4714	0.4709	0.4659	0.4551	0.4714	0.4575	0.4589	0.6030
	Taxes on products	0.9325	0.7925	0.8167	0.7634	0.7918	0.9908	0.8297	0.7462	0.7066	0.6684	0.7447	0.6604	0.5281	0.5135	0.6158	0.8463	0.6968	0.6849	0.6744	0.6677	0.6672	0.6376	0.6114	0.6215	0.7468
	Taxes on production	0.7076	0.5563	0.5649	0.5011	0.5350	0.6923	0.5978	0.5796	0.5773	0.5251	0.5377	0.5996	0.5522	0.5358	0.4895	0.6329	0.5243	0.5163	0.5177	0.5128	0.5068	0.5247	0.6509	0.6359	0.6853
	Complementary imp.	0.0000	0.4703	0.4267	0.4330	0.4259	0.0000	0.4401	0.4733	0.4166	0.3975	0.4076	0.3934	0.3926	0.4009	0.3620	0.0000	0.3748	0.3660	0.3771	0.3681	0.3725	0.3777	0.3506	0.3570	0.0000
	Competing imports	0.4916	0.4417	0.4083	0.4129	0.4095	0.5484	0.4179	0.3847	0.3999	0.3813	0.4060	0.3792	0.4483	0.4554	0.4211	0.5358	0.4032	0.3905	0.4139	0.3847	0.3629	0.3748	0.3555	0.3731	0.4735
	Total Dir. Purch. of PF	3.3949	3.3221	3.2451	3.1050	3.1954	3.4380	3.3488	3.2036	3.0981	2.9600	3.1604	3.0817	2.9369	2.9231	2.8098	3.1824	2.9507	2.8777	2.8925	2.8377	2.7929	2.8271	2.8357	2.8652	3.0399
Government	Comp. of employ.	0.2550	0.2332	0.2326	0.2334	0.2362	0.2781	0.2314	0.2487	0.2520	0.2258	0.2404	0.2394	0.2358	0.2328	0.2129	0.2762	0.2305	0.2305	0.2186	0.2154	0.2153	0.2205	0.2132	0.2165	0.2731
	Gross Profit.	0.1141	0.0960	0.0913	0.0857	0.0875	0.1276	0.1126	0.1183	0.1161	0.1200	0.1396	0.1257	0.1149	0.1104	0.1085	0.1296	0.1068	0.1019	0.1006	0.0996	0.1058	0.1084	0.1029	0.1015	0.1324
	Taxes on products	0.0025	0.0068	0.0084	0.0182	0.0127	0.0145	0.0146	0.0213	0.0322	0.0274	0.0305	0.0339	0.0431	0.0215	0.0357	0.0294	0.0226	0.0222	0.0213	0.0216	0.0151	0.0154	0.0160	0.0139	0.0177
	Taxes on production	0.1524	0.1222	0.1195	0.1896	0.1673	0.1221	0.1057	0.1013	0.1108	0.1479	0.1635	0.1288	0.1478	0.1584	0.1485	0.1871	0.1528	0.1478	0.1352	0.1503	0.1395	0.1433	0.1610	0.1502	0.1610
	Complementary imp.	0.0000	0.1364	0.1391	0.1330	0.1346	0.0000	0.1333	0.1354	0.1455	0.1526	0.1517	0.1444	0.1337	0.1309	0.1534	0.0000	0.1335	0.1308	0.1208	0.1216	0.1256	0.1220	0.1153	0.1163	0.0000
	Competing imports	0.0480	0.0572	0.0704	0.0623	0.0731	0.0803	0.0818	0.0537	0.0861	0.0872	0.0918	0.0787	0.0826	0.0793	0.0900	0.1113	0.0821	0.0782	0.0663	0.0664	0.0741	0.0760	0.0620	0.0667	0.0848
	Total Dir. Purch. of PF	0.5721	0.6517	0.6613	0.7223	0.7114	0.6226	0.6795	0.6788	0.7427	0.7609	0.8175	0.7508	0.7578	0.7334	0.7489	0.7336	0.7283	0.7115	0.6629	0.6749	0.6753	0.6856	0.6705	0.6652	0.6690
Private	Comp. of employ.	0.1827	0.1496	0.1565	0.1515	0.1677	0.2153	0.1438	0.1302	0.1367	0.1513	0.1148	0.1133	0.1220	0.1187	0.1281	0.1638	0.1483	0.1550	0.1749	0.1797	0.1667	0.1506	0.1531	0.1512	0.1819
	Gross Profit.	0.1393	0.1312	0.1390	0.1385	0.1599	0.2206	0.1452	0.1425	0.1501	0.1666	0.1272	0.1280	0.1545	0.1483	0.1628	0.1964	0.1855	0.1878	0.1844	0.1896	0.1715	0.1763	0.1762	0.1685	0.2123
	Taxes on products	0.1411	0.1064	0.0825	0.0918	0.0888	0.0807	0.0383	0.1376	0.1197	0.1821	0.0992	0.1950	0.2953	0.3302	0.2032	0.2233	0.2044	0.2108	0.2368	0.2357	0.2255	0.2189	0.2160	0.2282	0.3202
	Taxes on production	0.1395	0.1483	0.1498	0.1290	0.1475	0.2161	0.1428	0.1320	0.1387	0.1377	0.1089	0.1107	0.1270	0.1261	0.1379	0.1726	0.1513	0.1597	0.1694	0.1709	0.1845	0.1727	0.2183	0.2030	0.2162
	Complementary imp.	0.0000	0.1516	0.1729	0.1794	0.1948	0.0000	0.1753	0.1504	0.1611	0.1796	0.1574	0.1512	0.1640	0.1554	0.1805	0.0000	0.1784	0.1885	0.1849	0.1928	0.1916	0.1916	0.2034	0.1959	0.0000
	Competing imports	0.2303	0.2143	0.2287	0.2313	0.2418	0.2519	0.2046	0.1601	0.2152	0.2335	0.2195	0.2229	0.1700	0.1754	0.1847	0.2173	0.2340	0.2442	0.2229	0.2465	0.2345	0.2240	0.2368	0.2284	0.2730
	Total Dir. Purch. of PF	0.8328	0.9015	0.9294	0.9215	1.0005	0.9847	0.8500	0.8528	0.9215	1.0508	0.8270	0.9212	1.0329	1.0541	0.9972	0.9734	1.1018	1.1460	1.1733	1.2152	1.1743	1.1341	1.2037	1.1752	1.2037
Public Enterprise	Comp. of employ.	0.0434	0.0313	0.0303	0.0308	0.0299	0.0407	0.0348	0.0336	0.0278	0.0248	0.0179	0.0164	0.0200	0.0134	0.0135	0.0135	0.0129	0.0145	0.0159	0.0164	0.0169	0.0176	0.0120	0.0109	0.0119
	Gross Profit.	0.0344	0.0269	0.0258	0.0275	0.0274	0.0404	0.0334	0.0377	0.0293	0.0271	0.0199	0.0188	0.0268	0.0169	0.0188	0.0171	0.0193	0.0208	0.0184	0.0184	0.0195	0.0226	0.0138	0.0121	0.0143
	Taxes on products	0.0018	0.0017	0.0019	0.0067	0.0048	0.0047	0.0045	0.0056	0.0083	0.0098	0.0050	0.0051	0.0130	0.0056	0.0126	0.0033	0.0031	0.0035	0.0037	0.0038	0.0047	0.0058	0.0047	0.0045	0.0036
	Taxes on production	0.0324	0.0311	0.0272	0.0244	0.0244	0.0383	0.0316	0.0311	0.0247	0.0205	0.0159	0.0151	0.0191	0.0138	0.0140	0.0140	0.0141	0.0152	0.0147	0.0151	0.0198	0.0217	0.0200	0.0161	0.0151
	Complementary imp.	0.0000	0.0515	0.0564	0.0577	0.0563	0.0000	0.0622	0.0585	0.0550	0.0527	0.0467	0.0462	0.0524	0.0445	0.1415	0.0000	0.0441	0.0461	0.0445	0.0457	0.0474	0.0499	0.0403	0.0383	0.0000
	Competing imports	0.0393	0.0355	0.0415	0.0434	0.0458	0.0569	0.0586	0.0343	0.0480	0.0393	0.0302	0.0249	0.0224	0.0164	0.0169	0.0151	0.0130	0.0143	0.0136	0.0136	0.0151	0.0167	0.0184	0.0139	0.0135
	Total Dir. Purch. of PF	0.1514	0.1781	0.1830	0.1906	0.1886	0.1811	0.2251	0.2007	0.1929	0.1743	0.1356	0.1265	0.1538	0.1106	0.2174	0.0630	0.1066	0.1144	0.1109	0.1130	0.1234	0.1343	0.1092	0.0959	0.0584

Source: Results obtained from the model developed in Chapter 4.

Table VII-17 (cont'd)

General Government	Comp. of employ.	0.0519	0.0361	0.0315	0.0278	0.0251	0.0285	0.0241	0.0253	0.0257	0.0213	0.0203	0.0193	0.0211	0.0188	0.0156	0.0228	0.0171	0.0179	0.0243	0.0254	0.0267	0.0298	0.0227	0.0223	0.0272
	Gross Profit.	0.0429	0.0322	0.0284	0.0267	0.0245	0.0306	0.0250	0.0297	0.0286	0.0232	0.0228	0.0216	0.0284	0.0232	0.0203	0.0277	0.0215	0.0217	0.0248	0.0261	0.0267	0.0340	0.0257	0.0242	0.0310
	Taxes on products	0.0023	0.0022	0.0021	0.0066	0.0043	0.0035	0.0035	0.0045	0.0080	0.0080	0.0082	0.0076	0.0170	0.0077	0.0139	0.0058	0.0043	0.0048	0.0062	0.0063	0.0204	0.0369	0.0115	0.0086	0.0101
	Taxes on production	0.0399	0.0364	0.0288	0.0231	0.0208	0.0268	0.0226	0.0237	0.0229	0.0181	0.0181	0.0177	0.0203	0.0193	0.0166	0.0235	0.0168	0.0178	0.0226	0.0231	0.0285	0.0328	0.0297	0.0279	0.0313
	Complementary imp.	0.0000	0.0558	0.0573	0.0532	0.0516	0.0000	0.0527	0.0514	0.0540	0.0487	0.0498	0.0498	0.0555	0.0504	0.1425	0.0000	0.0460	0.0475	0.0507	0.0521	0.0537	0.0600	0.0525	0.0523	0.0000
	Competing imports	0.0407	0.0307	0.0343	0.0298	0.0298	0.0336	0.0311	0.0213	0.0354	0.0283	0.0303	0.0283	0.0234	0.0217	0.0195	0.0258	0.0220	0.0239	0.0313	0.0344	0.0374	0.0434	0.0363	0.0393	0.0484
	Total Dir. Purch. of PF	0.1777	0.1934	0.1824	0.1672	0.1561	0.1230	0.1590	0.1559	0.1745	0.1477	0.1495	0.1442	0.1658	0.1412	0.2283	0.1055	0.1278	0.1335	0.1599	0.1673	0.1934	0.2370	0.1784	0.1745	0.1478
Change in Inventories	Comp. of employ.	0.0102	0.0007	0.0063	0.0060	0.0026	0.0067	0.0005	0.0443	0.0022	0.0072	0.0042	0.0020	0.0064	0.0058	0.0061	0.0033	0.0043	0.0026	0.0031	0.0029	0.0012	0.0014	0.0039	0.0023	0.0034
	Gross Profit.	0.0179	0.0011	0.0186	0.0087	0.0036	0.0108	0.0010	0.0514	0.0043	0.0169	0.0047	0.0030	0.0089	0.0114	0.0116	0.0108	0.0067	0.0048	0.0048	0.0058	0.0036	0.0031	0.0052	0.0048	0.0055
	Taxes on products	0.0059	0.0005	0.0078	0.0083	0.0026	0.0095	0.0003	0.0110	-0.0008	0.0071	0.0013	0.0020	-0.0139	0.0158	-0.0018	0.0073	0.0009	0.0006	0.0005	0.0034	-0.0005	0.0006	0.0075	0.0001	0.0039
	Taxes on production	0.0126	0.0008	0.0097	0.0053	0.0024	0.0074	0.0005	0.0568	0.0026	0.0055	0.0034	0.0018	0.0058	0.0064	0.0069	0.0042	0.0058	0.0039	0.0034	0.0035	0.0013	0.0015	0.0052	0.0035	0.0040
	Complementary imp.	0.0000	0.0291	0.0381	0.0423	0.0335	0.0000	0.0283	0.0530	0.0322	0.0420	0.0351	0.0314	0.0394	0.0357	0.1331	0.0000	0.0354	0.0321	0.0368	0.0352	0.0309	0.0295	0.0331	0.0306	0.0000
	Competing imports	0.0199	0.0015	0.0122	0.0147	0.0059	0.0144	0.0014	0.0141	0.0031	0.0139	0.0114	0.0053	0.0132	0.0089	0.0114	0.0075	0.0116	0.0062	0.0080	0.0078	0.0040	0.0024	0.0157	0.0041	0.0091
	Total Dir. Purch. of PF	0.0664	0.0336	0.0928	0.0853	0.0506	0.0488	0.0321	0.2305	0.0435	0.0927	0.0601	0.0455	0.0598	0.0840	0.1674	0.0331	0.0647	0.0502	0.0566	0.0585	0.0406	0.0386	0.0706	0.0454	0.0259
Exports	Comp. of employ.	0.0991	0.0789	0.0810	0.1063	0.0795	0.0927	0.0808	0.0821	0.0939	0.1017	0.1023	0.1066	0.1066	0.1233	0.1287	0.1521	0.1171	0.1199	0.1158	0.1139	0.1247	0.1200	0.1194	0.1226	0.1497
	Gross Profit.	0.1869	0.1368	0.1444	0.1799	0.1407	0.1496	0.1244	0.1325	0.1548	0.1631	0.1754	0.1721	0.1571	0.1760	0.1586	0.2429	0.1835	0.2079	0.2087	0.2048	0.2453	0.2080	0.1925	0.2099	0.2365
	Taxes on products	0.0729	0.0441	0.0392	0.0697	0.0564	0.0571	0.0544	0.0593	0.0895	0.0661	0.0758	0.0824	0.1008	0.0761	0.0387	0.0559	0.0382	0.0431	0.0268	0.0322	0.0141	0.0223	0.0300	0.0279	0.0287
	Taxes on production	0.1294	0.0955	0.0975	0.1185	0.0908	0.1039	0.0904	0.0935	0.1148	0.1110	0.1097	0.1068	0.1108	0.1255	0.1287	0.1772	0.1363	0.1371	0.1334	0.1265	0.1339	0.1294	0.1789	0.1798	0.1827
	Complementary imp.	0.0000	0.1654	0.1652	0.1507	0.1534	0.0000	0.1687	0.1652	0.1852	0.1844	0.2097	0.2137	0.1918	0.2191	0.1870	0.0000	0.2278	0.2310	0.2315	0.2271	0.2415	0.2366	0.2151	0.2279	0.0000
	Competing imports	0.3163	0.1990	0.1787	0.1829	0.1765	0.1984	0.1869	0.1450	0.1886	0.1874	0.1771	0.2485	0.2260	0.2337	0.1893	0.2810	0.2173	0.2276	0.2276	0.2287	0.2407	0.2269	0.1959	0.2104	0.2576
	Total Dir. Purch. of PF	0.8046	0.7197	0.7061	0.8081	0.6974	0.6017	0.7056	0.6776	0.8268	0.8137	0.8499	0.9301	0.8930	0.9537	0.8311	0.9090	0.9202	0.9667	0.9439	0.9333	1.0001	0.9432	0.9319	0.9785	0.8552
Total Direct Purchases	Comp. of employ.	1.2002	0.9892	0.9918	0.9899	0.9882	1.2083	0.9948	1.0333	0.9885	0.9947	0.9890	0.9929	0.9936	0.9923	0.9359	1.1910	0.9877	0.9889	0.9913	0.9921	0.9799	0.9808	0.9343	0.9445	1.1785
	Gross Profit.	1.2409	1.0261	1.0223	1.0277	1.0296	1.2399	1.0256	1.0627	1.0306	1.0421	1.0649	1.0222	1.0247	1.0243	0.9708	1.2325	1.0175	1.0162	1.0127	1.0103	1.0274	1.0238	0.9737	0.9799	1.2350
	Taxes on products	1.1591	0.9543	0.9586	0.9646	0.9614	1.1609	0.9453	0.9855	0.9634	0.9690	0.9647	0.9865	0.9833	0.9704	0.9181	1.1713	0.9703	0.9700	0.9697	0.9707	0.9464	0.9375	0.8971	0.9048	1.1310
	Taxes on production	1.2137	0.9904	0.9974	0.9911	0.9883	1.2068	0.9913	1.0181	0.9917	0.9659	0.9572	0.9804	0.9830	0.9855	0.9421	1.2115	1.0014	0.9978	0.9964	1.0022	1.0142	1.0261	1.2640	1.2165	1.2957
	Complementary imp.	0.0000	1.0601	1.0557	1.0492	1.0500	0.0000	1.0606	1.0873	1.0495	1.0575	1.0579	1.0302	1.0295	1.0368	1.3000	0.0000	1.0399	1.0421	1.0463	1.0426	1.0632	1.0675	1.0103	1.0183	0.0000
	Competing imports	1.1861	0.9799	0.9742	0.9774	0.9824	1.1841	0.9824	0.8132	0.9762	0.9708	0.9663	0.9878	0.9858	0.9908	0.9330	1.1937	0.9831	0.9850	0.9837	0.9821	0.9688	0.9643	0.9206	0.9359	1.1599
	Total Dir. Purch. of PF	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000	6.0000

Source: Results obtained from the model developed in Chapter 4.

Table VII-18: Results of unweighted traditional sectoral classification system, 1975 to 2015

Sectors	Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
Ag., Forest & Fish'g	S01	K	K	K	K	F	K	K	K	K	K	K	K	K	K	K	F	K	F	K	K	K	F	K	K	B
Coal	S02	F	K	K	K	K	K	K	K	K	F	F	F	B	B	B	W	B	W	B	B	W	W	B	B	B
Crude Oil	S03	F	K	K	K	K	K	K	K	K	K	K	K	F	K	K	K	K	K	K	K	K	K	F	F	W
Nat Gas	S04	F	K	K	F	F	K	K	F	K	F	F	F	F	F	F	W	F	F	W	W	W	W	W	W	W
Explor. Mining	S05	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	W	B	W	W	W	W
Oth. Mining	S06	F	F	K	K	K	K	K	F	K	F	K	K	F	K	K	F	F	F	F	F	K	F	F	K	W
Food & Bev	S07	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	B	K	B
Textile & Clothing	S08	B	K	K	K	K	K	K	K	K	B	B	B	B	B	B	B	W	W	W	W	W	W	W	W	W
Pulp & Paper Mfg	S09	K	B	K	K	K	K	K	B	K	K	F	F	K	K	K	K	F	F	K	F	F	F	F	F	F
Wood Prod.	S10	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
Print & Pub.	S11	K	K	K	B	K	K	K	K	K	B	B	K	K	K	K	K	K	K	K	K	W	W	W	W	W
Petro. Prod. Mfg	S12	K	K	K	K	K	K	K	K	K	B	K	K	F	K	F	K	K	K	F	F	W	W	W	W	F
Coal Prod. Mfg	S13	F	F	K	F	F	K	K	F	K	K	K	F	F	F	K	K	F	F	F	F	F	F	F	F	F
Chem. Prod.	S14	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	F	F	K	F	K
Non-Metal & Min. Prod.	S15	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
Iron & Steel Mfg	S16	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	F	F	F	F
Non-Ferrous Mfg	S17	B	K	K	K	K	K	K	K	K	K	B	K	B	B	K	B	B	B	B	B	B	B	B	B	B
Oth. Metal Prod.	S18	B	K	B	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K
Mach. & Transp Prod.	S19	K	K	B	K	K	K	K	K	K	K	K	K	K	K	K	F	K	K	B	W	B	W	B	B	B
Mfg Oth.	S20	B	B	K	B	B	B	B	B	B	B	B	B	B	B	B	B	B	W	W	W	W	W	W	W	W
Elec. Gen. Coal	S21	F	K	K	K	K	K	K	K	K	K	K	K	B	F	K	K	K	K	K	K	K	K	K	K	K
Elec. Gen. Oil	S22	W	F	F	F	W	K	K	F	K	F	F	F	B	K	K	K	K	K	K	K	K	K	K	K	K
Elec. Gen. Nat. Gas	S23	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	B	K	K	K	B	K	K	K	K	K
Elec. Gen. Hydro	S24	F	F	K	F	F	K	K	K	K	F	K	F	K	F	F	F	K	K	K	K	K	K	K	K	K
Elec. Gen. Renew.	S25	W	W	F	W	W	B	B	W	B	W	W	W	B	B	W	B	B	B	K	K	K	K	K	K	K
Elec. Gen Oth. Fuel	S26	W	W	F	W	W	B	B	W	B	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. T&D	S27	F	K	K	K	K	K	K	K	K	K	K	K	B	F	K	K	K	K	K	K	K	K	K	K	K
Gas Supply	S28	W	W	F	F	F	K	K	F	K	K	K	F	F	F	F	K	K	K	F	F	K	K	F	F	F
Upstrm Water	S29	F	F	K	F	F	K	K	F	K	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F	F
Urb Water	S30	W	W	F	W	W	B	B	W	B	F	F	W	W	B	W	W	W	W	B	B	W	W	W	W	W
Rurl Water	S31	K	K	K	K	K	K	K	F	K	K	K	K	K	B	B	F	F	F	F	K	F	F	K	F	F
Water Serv.	S32	W	W	W	W	W	B	B	W	B	F	F	W	W	W	W	W	B	B	B	B	B	W	W	W	W
Const.	S33	B	B	B	B	B	B	B	B	B	B	B	B	K	K	K	K	K	K	K	K	K	K	K	K	K
Wsale & Retail	S34	B	B	B	B	B	W	F	K	W	F	F	F	K	K	K	K	K	K	K	K	K	K	K	K	K
Trsprt & Storage Serv.	S35	B	B	B	B	K	F	F	K	F	F	F	K	K	K	K	K	K	K	K	K	K	F	K	K	K
Comm, Fin. & Bus. Serv.	S36	K	B	B	B	B	W	W	B	W	W	W	W	F	F	F	F	F	F	B	B	B	B	W	W	W
Govt Admin	S37	K	B	B	B	B	W	W	B	W	K	B	K	B	B	B	B	B	B	W	W	W	W	W	W	W
Edu, Hlth & Cmty Serv.	S38	B	B	B	B	B	W	W	B	W	W	W	W	W	W	W	W	B	B	W	W	B	B	B	B	B
Oth. Comml Serv.	S39	W	B	B	B	B	W	W	B	W	B	B	B	B	B	B	B	B	B	B	B	W	W	K	K	K

Source: Results obtained from the model developed in Chapter 4.

Table VII-19: Results of proposed weighted sectoral classification system (incorporating RSOW and C-COV), 1975 to 2015

Sectors / Year	Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
Ag., Forest & Fish'g	S01	S	S	S	S	F-	S	S	S	S	S	S	S	S	S	S	F-	S	F-	F+	F+	F-	F-	S	S	B-
Coal	S02	W	F-	F+	F+	F-	S	S	F+	S	F+	F+	F+	W	W	B+	W	W	W	W	W	W	W	B+	B+	B+
Crude Oil	S03	W	F+	F+	F+	F+	S	S	F+	S	F+	F-	F+	W	F+	F+	F+	F+	F+	F+	F+	F+	F+	W	W	W
Nat Gas	S04	W	F+	W	W	W	B-	B-	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Explor. Mining	S05	W	W	W	W	W	B-	B-	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Oth. Mining	S06	F+	F-	F-	F-	F+	S	S	F+	S	F+	F+	K	F+	F-	F+	F+	F+	F+	F+	F+	K	F+	F+	K	W
Food & Bev	S07	S	S	S	S	S	F-	S	S	S	S	S	S	S	S	S	S	S	S	K	K	S	F+	B-	S	B-
Textile & Clothing	S08	B+	S	F-	F-	F-	S	S	S	S	B-	B-	B-	B-	B-	B-	W	W	W	W	W	W	W	W	W	W
Pulp & Paper Mfg	S09	W	W	W	W	W	B-	B-	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Wood Prod.	S10	W	F-	F+	F+	F+	S	S	F+	S	W	W	W	W	W	F+	W	F+	F+	W	F+	W	F+	F+	F+	F+
Print & Pub.	S11	W	W	W	W	W	B+	W	W	W	W	W	W	W	F-	W	F+	W	W	W	W	W	W	W	W	W
Petro. Prod. Mfg	S12	W	W	W	W	W	B-	B-	W	B-	B-	B+	S	W	W	W	W	W	W	W	W	W	W	W	W	W
Coal Prod. Mfg	S13	W	W	W	W	W	B-	B-	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Chem. Prod.	S14	F+	S	F-	F-	F-	S	S	S	S	S	S	S	F-	F-	F-	F-	F+	F+	F+	F+	F+	F+	K	F+	S
Non-Metal & Min. Prod.	S15	F+	F-	F+	F+	F+	S	S	F-	S	F-	F+	F-	F-	F-	F-	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+
Iron & Steel Mfg	S16	F+	F-	F-	F-	F-	S	S	F-	S	F-	F+	F-	F-	W	F+	W	F+	W	W	W	W	W	W	W	W
Non-Ferrous Mfg	S17	W	F-	F+	F+	F-	S	S	F-	S	S	B-	S	B-	B-	S	W	B+	B+	B+	B+	B+	W	B-	B+	B-
Oth. Metal Prod.	S18	W	F-	F+	F+	F+	F+	K	F+	S	K	F-	F-	F+	F+	W	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+
Mach. & Transp Prod.	S19	S	S	S	S	S	F-	F-	S	F-	S	S	S	S	S	S	F-	S	K	B+	W	B+	W	B-	B-	B-
Mfg Oth.	S20	W	W	W	W	W	B-	B-	W	B-	B+	B+	B+	W	B+	W	W	W	W	W	W	W	W	W	W	W
Elec. Gen. Coal	S21	W	F-	F-	F-	F-	S	S	F-	S	S	S	F-	B+	W	F-	W	W	W	W	W	F+	F-	W	W	W
Elec. Gen. Oil	S22	W	W	W	W	W	B-	B-	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. Gen. Nat. Gas	S23	W	W	W	W	W	B-	B-	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. Gen. Hydro	S24	W	W	W	W	W	B-	B-	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. Gen. Renew.	S25	W	W	W	W	W	B-	B-	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. Gen Oth. Fuel	S26	W	W	W	W	W	B-	B-	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. T&D	S27	W	F-	F-	F-	F-	S	S	F-	S	S	S	F-	B+	W	F-	F+	F+	F+	W	W	F+	F-	F+	F+	B-
Gas Supply	S28	W	W	W	W	W	B-	B-	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Upstrm Water	S29	W	W	W	W	W	B-	B-	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Urb Water	S30	W	W	W	W	W	B-	B-	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Rurl Water	S31	W	W	W	W	W	B-	B-	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Water Serv.	S32	W	W	W	W	W	B-	B-	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Const.	S33	B-	B-	B-	B-	B-	W	W	B-	W	B+	B+	B+	S	S	S	S	S	S	S	S	S	S	S	S	S
Wsale & Retail	S34	B-	B-	B-	B-	B-	W	F+	S	W	F+	F+	F+	S	S	S	S	S	S	S	S	S	S	S	S	S
Trsprt & Storage Serv.	S35	B+	B-	B+	B+	K	F-	F-	S	F-	F-	F-	F-	S	S	S	F-	K	S	K	K	S	F+	S	S	S
Comm, Fin. & Bus. Serv.	S36	S	B-	B-	B-	B-	W	W	B-	W	W	W	W	W	W	W	W	W	W	B-	B-	B-	B-	W	W	W
Govt Admin	S37	S	B-	B-	B-	B-	W	W	B-	W	S	B-	S	B-	B-	B-	B+	W	W	W	W	W	W	W	W	W
Edu, Hlth & Cmty Serv.	S38	B+	B-	B-	B-	B-	W	W	B-	W	W	W	W	W	W	W	W	B+	B+	W	W	B+	B+	B+	B+	B+
Oth. Comml Serv.	S39	W	B+	B+	B+	B+	W	W	B-	W	W	W	W	W	W	B-	W	B+	B+	W	W	W	W	K	K	S

Source: Results obtained from the model developed in Chapter 4.

Table VII-20: Results of proposed weighted sectoral classification system (incorporating TSOW and traditional COV), 1975 to 2015

Sectors / Year	Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
Ag., Forest & Fish'g	S01	S	S	S	S	S	S	F-	S	S	S	F-	F-	S	S	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-	F-
Coal	S02	W	W	W	F+	F+	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	S	W	W	W	W
Crude Oil	S03	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Nat Gas	S04	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Explor. Mining	S05	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Oth. Mining	S06	F+	W	W	F+	W	W	W	W	W	W	W	W	W	W	W	W	W	F-	F-	F-	S	S	S	S	S
Food & Bev	S07	S	S	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+
Textile & Clothing	S08	B-	B-	B-	B-	B-	B-	W	B-	W	W	B-	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Pulp & Paper Mfg	S09	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Wood Prod.	S10	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Print & Pub.	S11	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Petro. Prod. Mfg	S12	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Coal Prod. Mfg	S13	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Chem. Prod.	S14	F+	W	F+	F+	F+	F+	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Non-Metal & Min. Prod.	S15	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Iron & Steel Mfg	S16	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Non-Ferrous Mfg	S17	W	W	W	W	W	W	W	W	W	W	W	W	B+	B+	W	B+	W	B+	B+	B+	B+	B+	B+	W	W
Oth. Metal Prod.	S18	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Mach. & Transp Prod.	S19	S	S	S	S	S	S	S	S	S	S	B+	S	S	B-	B-	B-	B-	B-	B-	B-	B-	B-	B-	B-	B-
Mfg Oth.	S20	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. Gen. Coal	S21	F+	W	W	F+	F+	F+	F+	F+	F+	F+	F+	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. Gen. Oil	S22	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. Gen. Nat. Gas	S23	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. Gen. Hydro	S24	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. Gen. Renew.	S25	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. Gen Oth. Fuel	S26	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. T&D	S27	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	W	W	W	W	W	W	W	W	F+	F+	K	K	K
Gas Supply	S28	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Upstrm Water	S29	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Urb Water	S30	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Rurl Water	S31	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Water Serv.	S32	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Const.	S33	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Wsale & Retail	S34	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Trsprt & Storage Serv.	S35	K	K	S	K	K	S	S	S	S	S	S	S	K	K	S	K	K	K	K	K	S	S	S	S	S
Comm, Fin. & Bus. Serv.	S36	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Govt Admin	S37	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Edu, Hlth & Cmty Serv.	S38	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Oth. Comml Serv.	S39	B+	B+	S	B+	B+	S	S	B+	S	B+	B+	S	S	B+	S	S	S	S	S	S	S	S	S	S	S

Source: Results obtained from the model developed in Chapter 4.

Table VII-21: Results of proposed Integrated Weighted and Unweighted Sectoral Classification System (incorporating TSOW and traditional COV), 1975 to 2015

Sectors / Year	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
Ag., Forest & Fish'g	S	S	S	S	S	S	S	S	S	S	F-	F-	S	S	S	F-	F-	F-	S	S	S	F-	F-	F-	F-
Coal	F+	F+	F+	S	S	F+	F+	F+	W	W	W	W	B+	B+	B+	W	B+	W	B+	B+	S	W	W	W	W
Crude Oil	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	W
Nat Gas	F+	F+	K	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	W	F+	F+	W	W	W	W	W	W	W
Explor. Mining	K	S	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	W	B+	W	W	W	W
Oth. Mining	F+	W	F+	S	F+	W	W	W	W	W	B+	B+	W	B+	B+	W	W	F-	F-	F-	S	S	S	S	S
Food & Bev	S	S	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+
Textile & Clothing	B-	B-	B-	B-	B-	B-	B-	B-	B-	B-	B-	B-	B+	B+	B+	B-	W	W	W	W	W	W	W	W	W
Pulp & Paper Mfg	K	B+	S	S	S	S	K	B+	F+	K	F+	F+	K	K	K	K	F+	F+	K	F+	F+	F+	F+	F+	F+
Wood Prod.	K	B+	S	S	S	S	K	B+	K	S	S	K	K	K	K	K	K	K	K	K	K	K	F+	F+	F+
Print & Pub.	K	K	K	B+	K	K	K	K	K	B+	B+	K	K	F+	K	K	K	K	K	K	W	W	W	W	W
Petro. Prod. Mfg	K	K	K	K	K	K	K	K	K	B+	K	K	F+	K	F+	K	K	K	F+	F+	W	W	W	W	F+
Coal Prod. Mfg	F+	F+	F+	F+	F+	F+	F+	F+	K	K	K	F+	F+	F+	K	K	F+	F+	F+	F+	F+	F+	F+	F+	F+
Chem. Prod.	K	B+	S	S	S	S	S	B+	S	S	B+	S	S	S	F+	S	F+	F+	F+	F+	W	W	W	W	W
Non-Metal & Min. Prod.	K	K	S	S	S	S	S	K	S	B+	K	K	K	K	K	K	K	K	K	K	K	F+	F+	F+	F+
Iron & Steel Mfg	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	F+	F+	F+	F+
Non-Ferrous Mfg	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+
Oth. Metal Prod.	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	K	K	K	K	K	K	K	K	K	K	F+	F+	F+	F+
Mach. & Transp Prod.	S	S	S	S	S	S	S	S	S	S	B+	S	S	B-	B-	B-	B-	B-	B-	B-	B-	B-	B-	B-	B-
Mfg Oth.	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	B+	W	W	W	W	W	W	W	W
Elec. Gen. Coal	S	K	K	K	K	K	K	K	K	K	K	F+	B+	F+	K	K	K	K	K	K	K	K	K	K	K
Elec. Gen. Oil	W	F+	W	F+	W	F+	F+	F+	F+	F+	F+	F+	B+	K	K	K	K	K	K	K	K	K	K	K	K
Elec. Gen. Nat. Gas	K	K	K	K	K	K	K	K	K	K	K	K	K	K	K	B+	K	K	K	B+	K	K	K	K	K
Elec. Gen. Hydro	F+	F+	F+	F+	F+	F+	K	K	K	F+	K	F+	K	F+	F+	F+	K	K	K	K	K	K	K	K	K
Elec. Gen. Renew.	W	W	W	W	W	W	W	W	W	W	W	W	B+	B+	W	B+	B+	B+	K	K	K	K	K	K	K
Elec. Gen Oth. Fuel	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W	W
Elec. T&D	S	S	S	S	S	S	S	S	S	S	S	S	W	F+	F+	F+	K	K	K	K	K	K	K	K	K
Gas Supply	W	W	W	F+	F+	F+	K	F+	F+	K	K	F+	F+	F+	F+	K	K	K	F+	F+	K	K	F+	F+	F+
Upstrm Water	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+	F+
Urb Water	W	W	W	W	W	W	W	W	W	F+	F+	W	W	B+	W	W	W	W	B+	B+	W	W	W	W	W
Rurl Water	K	K	K	K	K	K	K	F+	F+	K	K	K	K	B+	B+	F+	F+	F+	F+	K	F+	F+	K	F+	F+
Water Serv.	W	W	W	W	W	W	W	W	W	F+	F+	W	W	W	W	W	B+	B+	B+	B+	B+	W	W	W	W
Const.	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Wsale & Retail	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Trsprt & Storage Serv.	K	K	S	K	K	S	S	S	S	S	S	S	K	K	S	K	K	K	K	K	S	S	S	S	S
Comm, Fin. & Bus. Serv.	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Govt Admin	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Edu, Hlth & Cmty Serv.	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Oth. Comml Serv.	B+	B+	S	B+	B+	S	S	B+	S	B+	B+	S	S	B+	S	S	S	S	S	S	S	S	S	S	S

Source: Results obtained from the model developed in Chapter 4.

Figure VII-1: Unweighted Total Linkage Indices, Coal Mining, 1975-2015

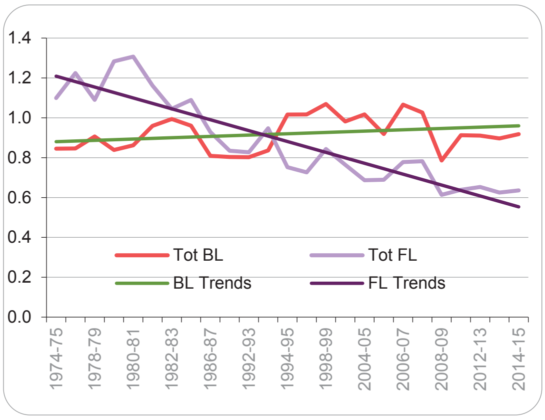


Figure VII-2: Unweighted Total Linkage Indices, Crude Oil, 1975-2015

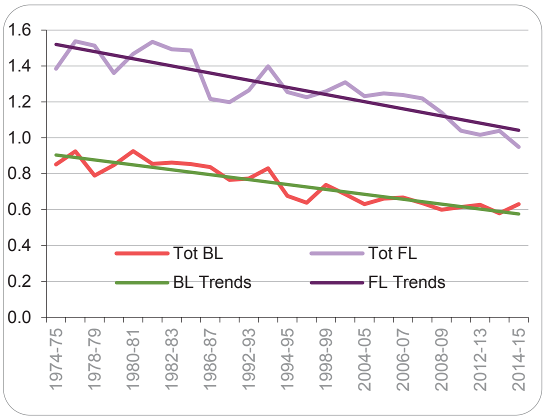


Figure VIII-3: Unweighted Total Linkage Indices, Nat. Gas, 1975-2015

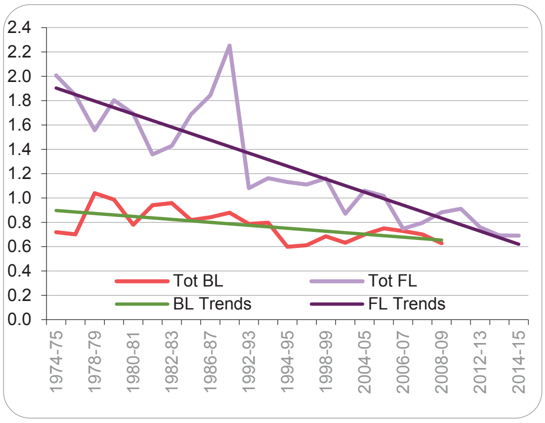


Figure VII-4: Unweighted Total Linkages, Exploration & Mining Services, 1975-2015

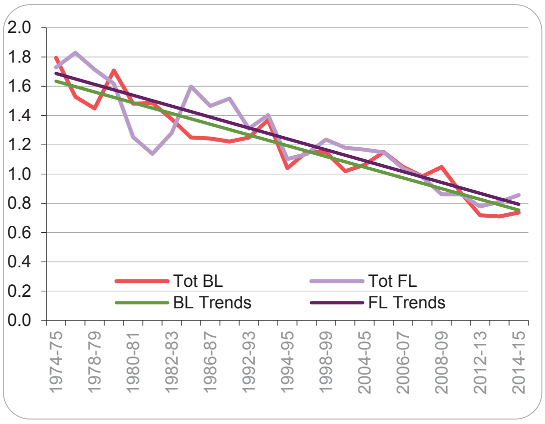


Figure VII-5: Unweighted Total Linkage Indices, Other Minerals Mining, 1975-2015

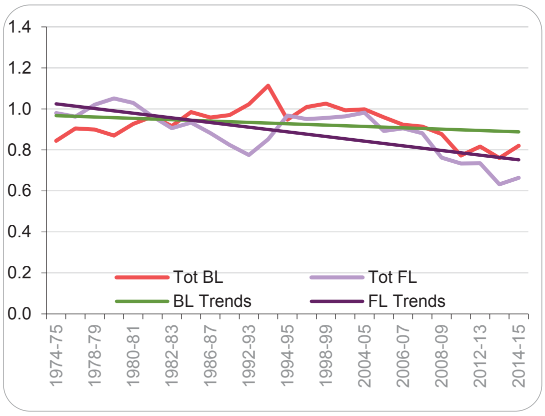
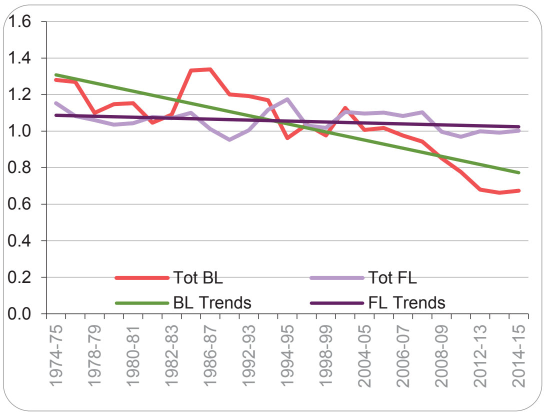


Figure VII-6: Unweighted Total Linkage Indices, Petrol. Prod. Mfg, 1975-2015



Source: Results obtained from the model developed in Chapter 4.

Figure VII-7: Unweighted Total Linkage Indices, Coal Prod. Mfg, 1975-2015

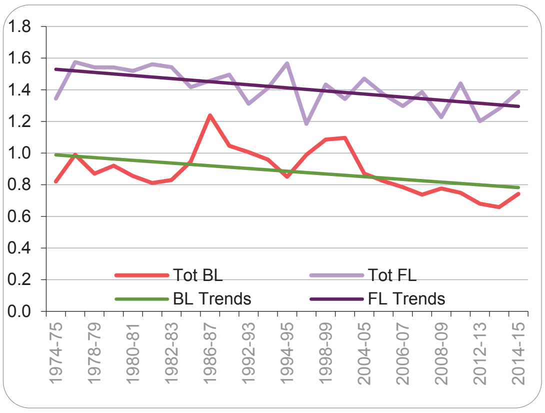


Figure VII-8: Unweighted Total Linkage Indices, Elect. Gen. Coal, 1975-2015

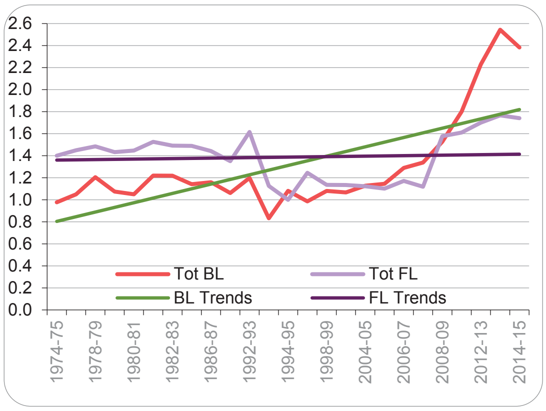


Figure VII-9: Unweighted Total Linkage Indices, Elect. Gen. Oil, 1975-2015

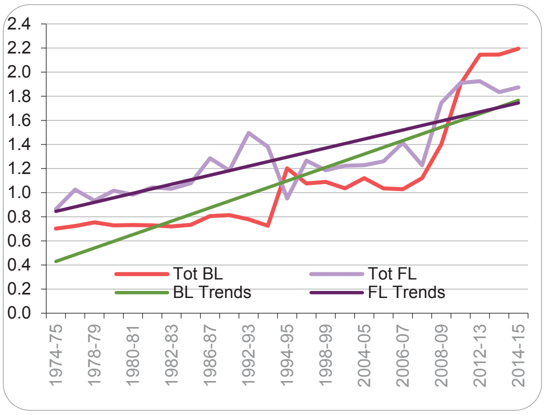


Figure VII-10: Unweighted Total Linkage Indices, Elect. Gen. Gas, 1975-2015

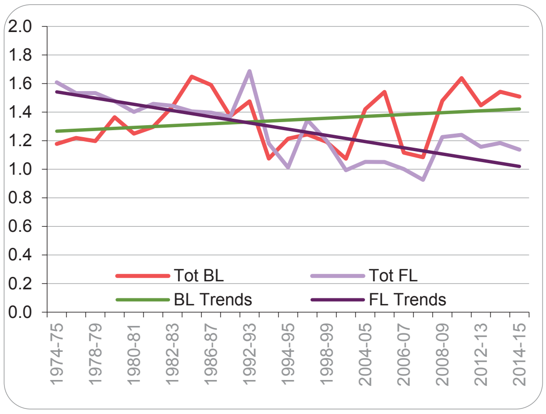


Figure VII-11: Unweighted Total Linkage Indices, Elect. Gen. Hydro, 1975-2015

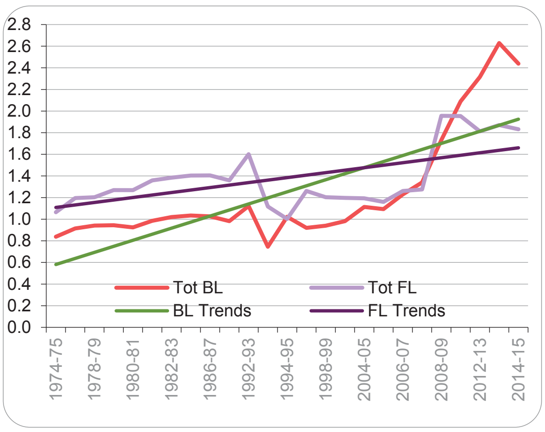
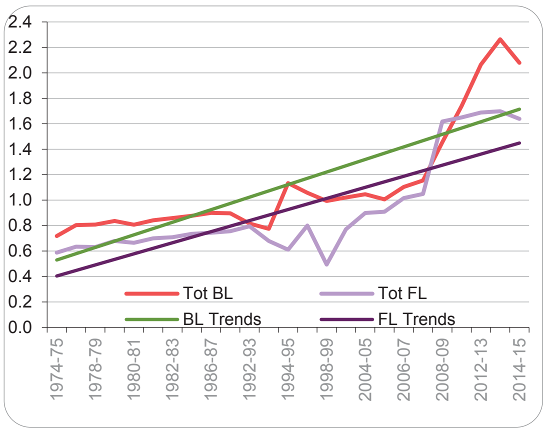


Figure VII-12: Unweighted Total Linkage Indices, Elect. Gen. Renewable, 1975-2015



Source: Results obtained from the model developed in Chapter 4.

Figure VII-13: Unweighted Total Linkage Indices, Elect. Gen. Oth. Fuels, 1975-2015

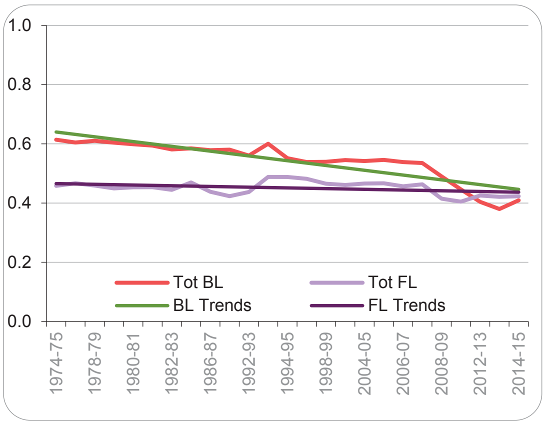


Figure VII-14: Unweighted Total Linkage Indices, Elect. T&D, 1975-2015

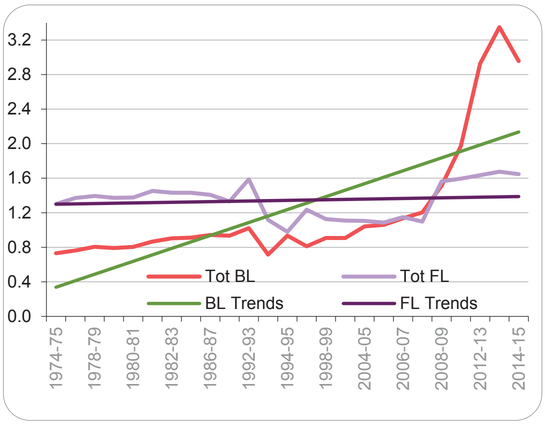


Figure VII-15: Unweighted Total Linkage Indices, Gas Supply, 1975-2015

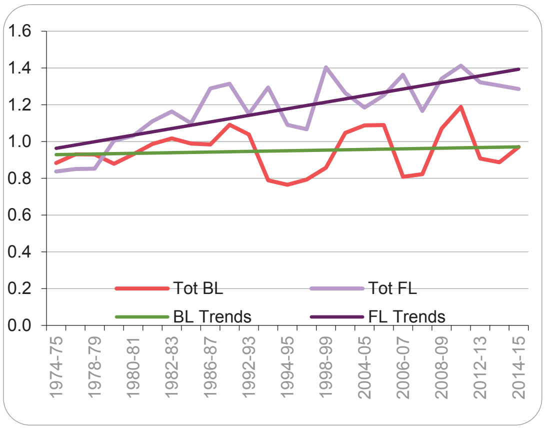


Figure VII-16: Unweighted Total Linkage Indices, Upstream Water, 1975-2015

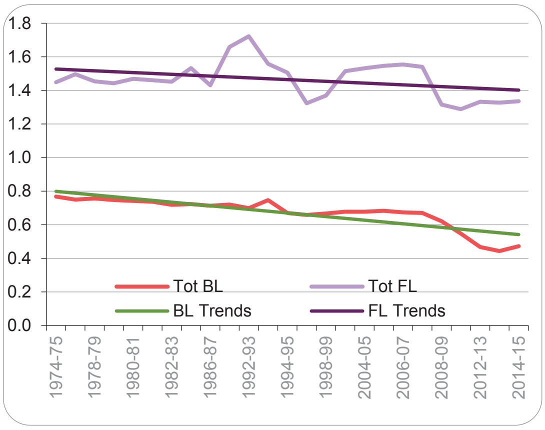


Figure VII-17: Unweighted Total Linkage Indices, Urb. Water, 1975-2015

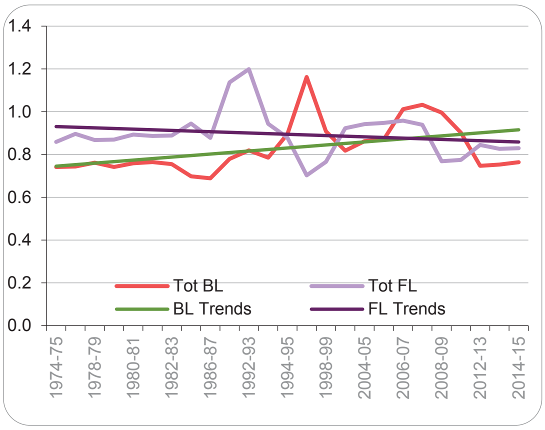
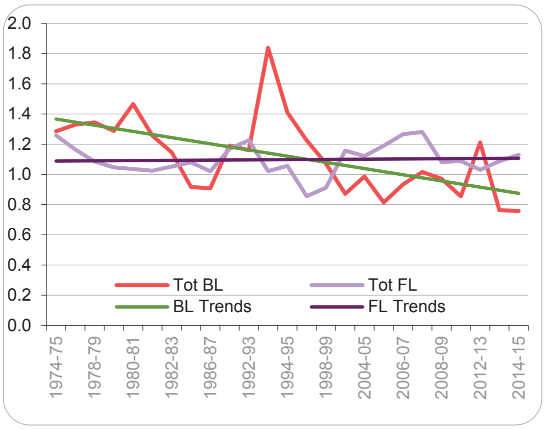


Figure VII-18: Unweighted Total Linkage Indices, Rurl. Water, 1975-2015



Source: Results obtained from the model developed in Chapter 4.

Figure VII-19: Unweighted Total Linkage Indices, Water Services (Sewerage & Drainage), 1975-2015

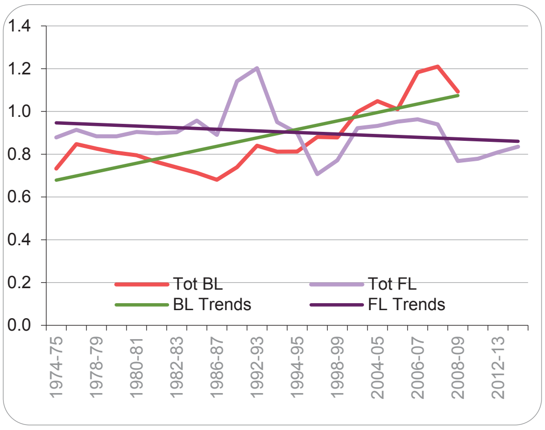


Figure VII-20: Unweighted Total Linkage Indices, Construction, 1975-2015

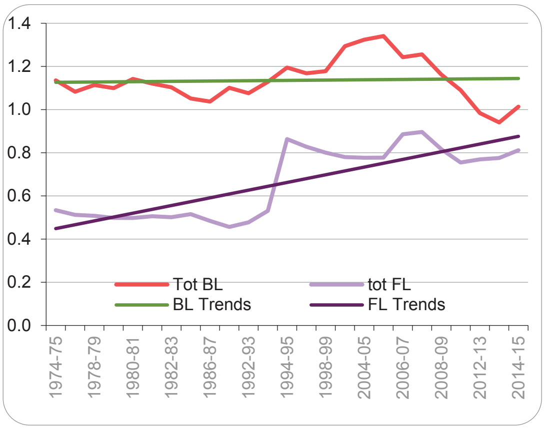


Figure VII-21: Weighted total linkages (RSOW), Coal Mining, 1975-2015

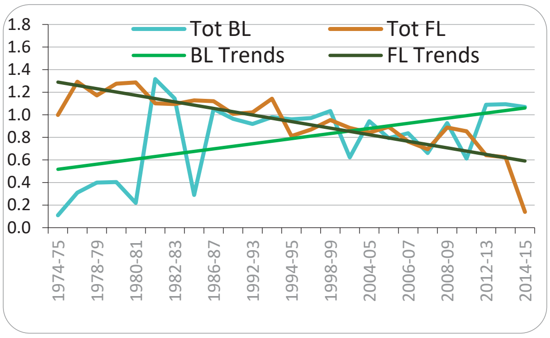


Figure VII-22: Weighted total linkages (TSOW), Coal Mining, 1975-2015

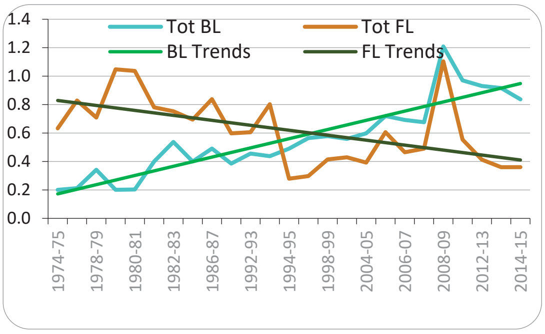


Figure VII-23: Weighted total linkages (RSOW), Crude Oil, 1975-2015

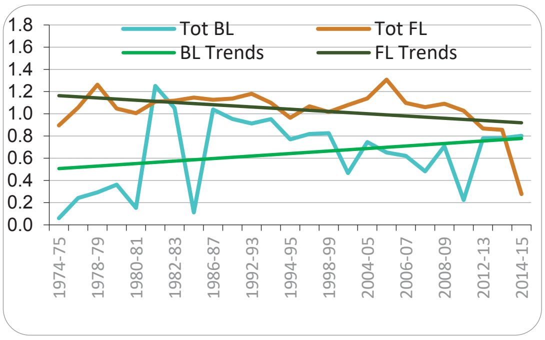


Figure VII-24: Weighted total linkages (TSOW), Crude Oil, 1975-2015

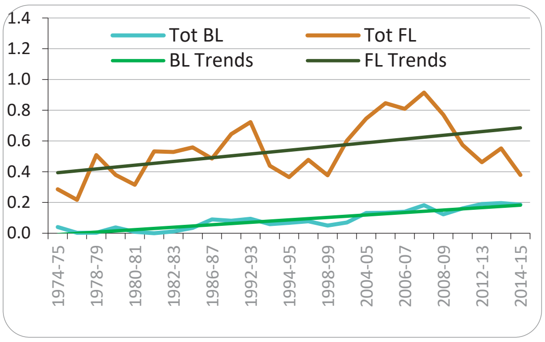


Figure VII-25: Weighted total linkages (RSOW), Nat. Gas, 1975-2015

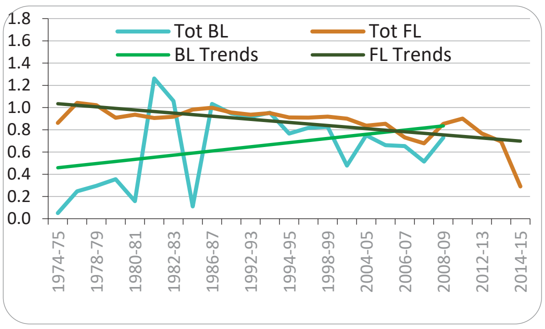
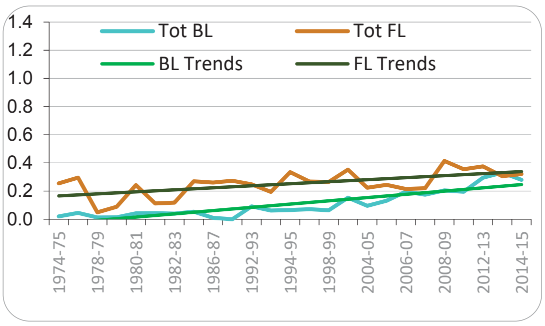


Figure VII-26: Weighted total linkages (TSOW), Nat. Gas, 1975-2015



Source: Results obtained from the model developed in Chapter 4

Figure VII-27: Weighted total linkages (RSOW), Exploration Services, 1975-2015

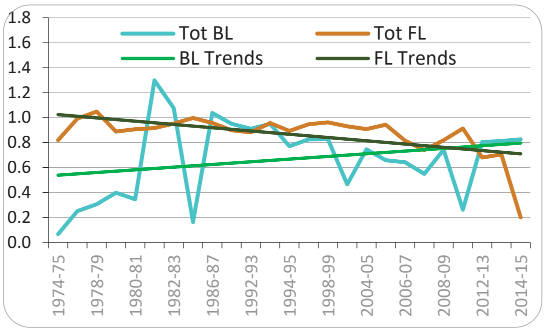


Figure VII-28: Weighted total linkages (TSOW), Exploration Services, 1975-2015

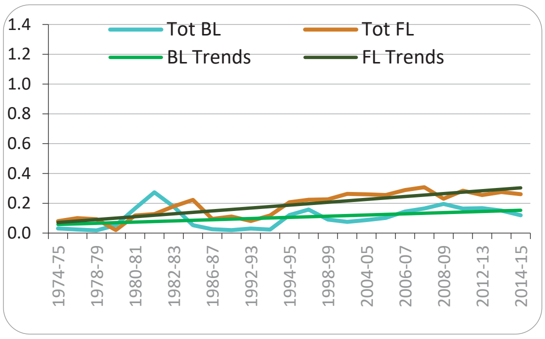


Figure VII-29: Weighted total linkages (RSOW), Other Mining, 1975-2015

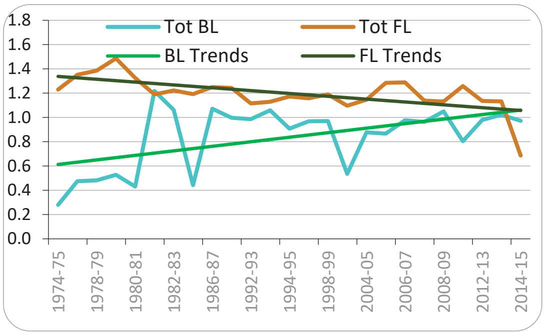


Figure VII-30: Weighted total linkages (TSOW), Other Mining, 1975-2015

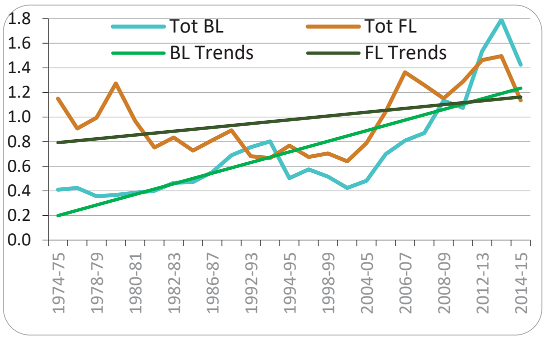


Figure VII-31: Weighted Total Linkage Indices (RSOW), Petrol. Mfg., 1975-2015

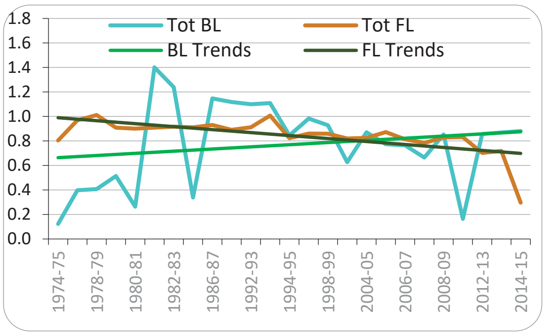


Figure VII-32: Weighted Total Linkage Indices (TSOW), Petrol. Mfg., 1975-2015

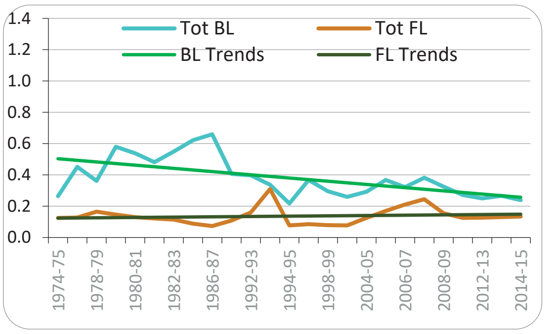


Figure VII-33: Weighted Total Linkage Indices (RSOW), Elect. Gen. by Coal, 1975-2015

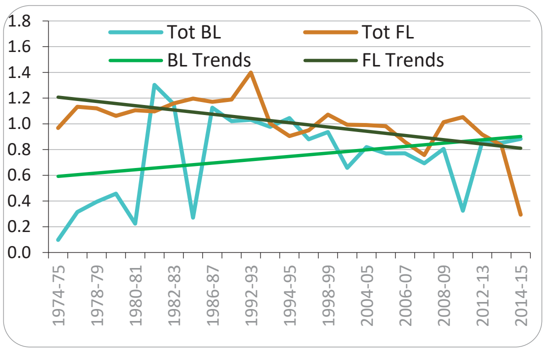
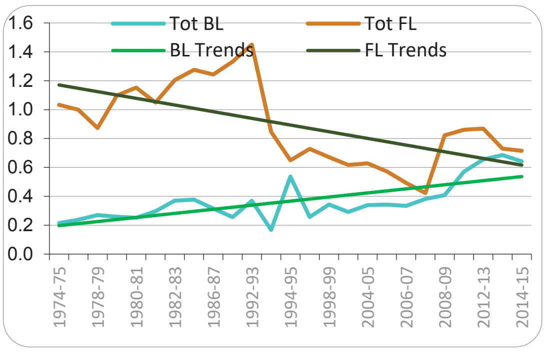


Figure VII-34: Weighted Total Linkage Indices (TSOW), Elect. Gen. by Coal, 1975-2015



Source: Results obtained from the model developed in Chapter 4

Figure VII-35: Weighted Total Linkage Indices (RSOW), Elect. Gen. by Oil, 1975-2015

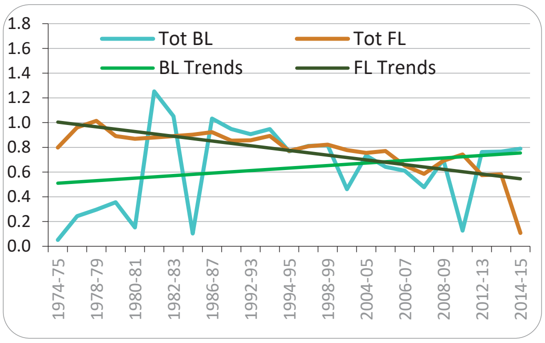


Figure VII-36: Weighted Total Linkage Indices (TSOW), Elect. Gen. by Oil, 1975-2015

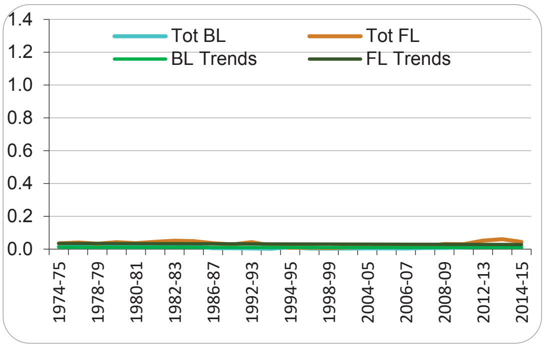


Figure VII-37: Weighted Total Linkage Indices (RSOW), Elect. Gen. by Gas, 1975-2015

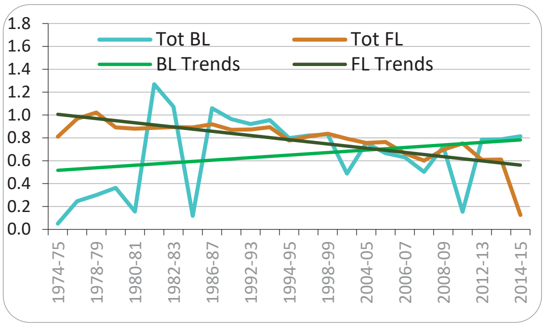


Figure VII-38: Weighted Total Linkage Indices (TSOW), Elect. Gen. by Gas, 1975-2015

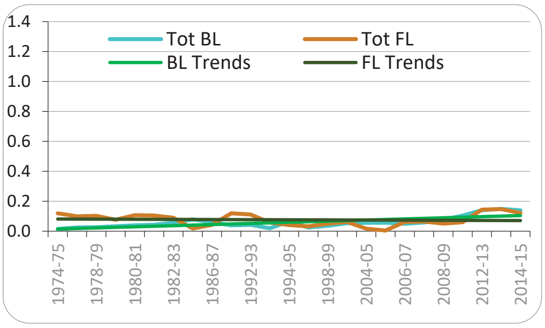


Figure VII-39: Weighted Total Linkage Indices (RSOW), Elect. Gen. by Hydro, 1975-2015

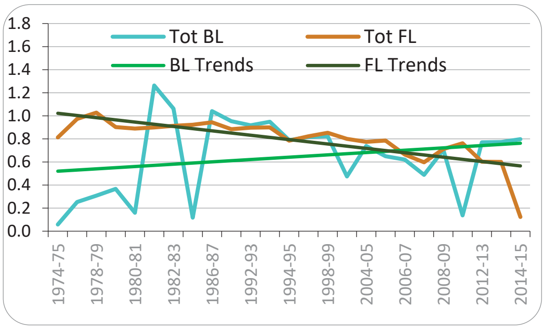


Figure VII-40: Weighted Total Linkage Indices (TSOW), Elect. Gen. by Hydro, 1975-2015

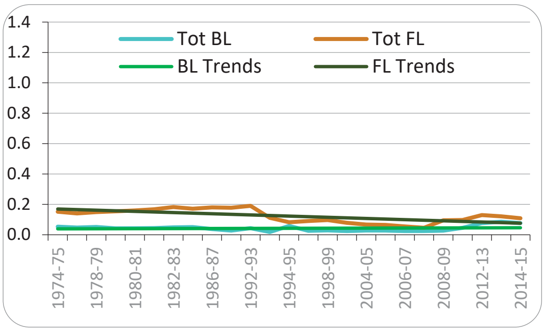


Figure VII-41: Weighted Total Linkage Indices (RSOW), Elect. Gen. by Rnew., 1975-2015

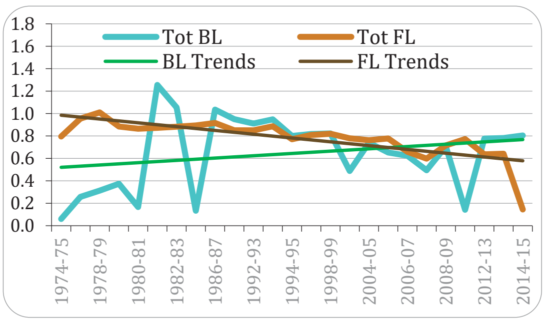
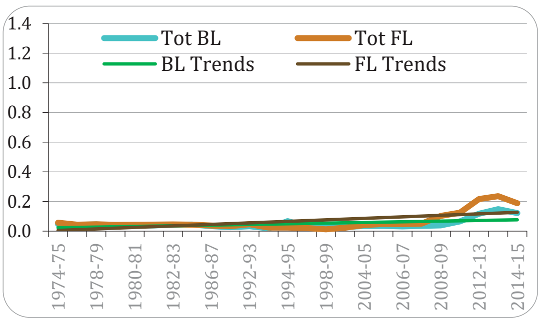


Figure VII-42: Weighted Total Linkage Indices (TSOW), Elect. Gen by Renew., 1975-2015



Source: Results obtained from the model developed in Chapter 4.

Figure VII-43: Weighted Total Linkage Indices (RSOW), Elect. Gen. Oth. Fuels, 1975-2015

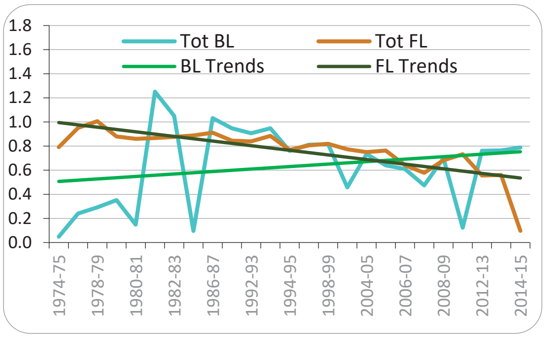


Figure VII-44: Weighted Total Linkage Indices (TSOW), Elect. Gen. Oth. Fuels, 1975-2015

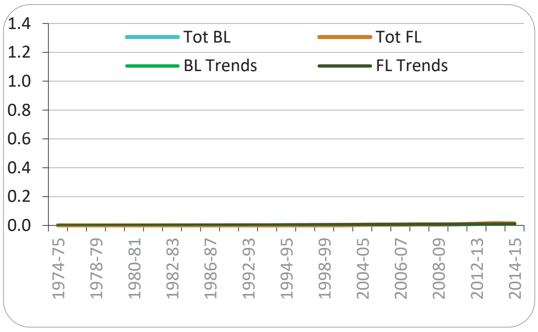


Figure VII-45: Weighted Total Linkage Indices (RSOW), Elect. T & D, 1975-2015

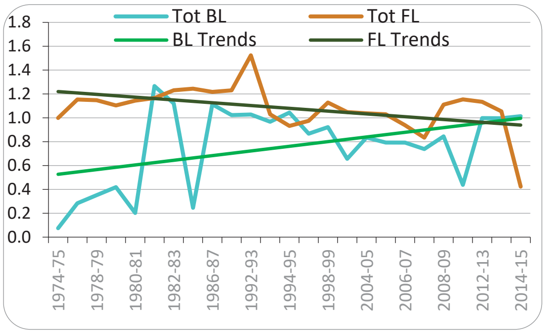


Figure VII-46: Weighted Total Linkage Indices (TSOW), Elect. T & D, 1975-2015

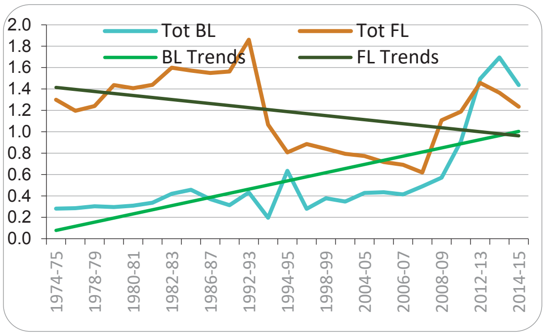


Figure VII-47: Weighted Total Linkage Indices (RSOW), Gas Supply, 1975-2015

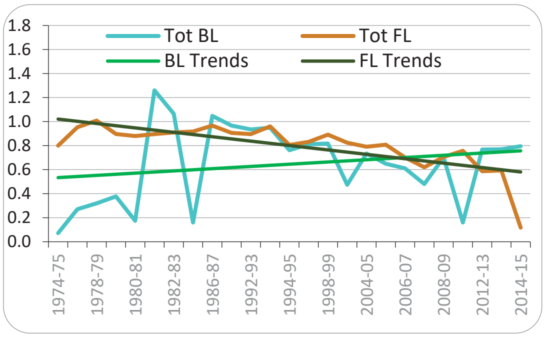


Figure VII-48: Weighted Total Linkage Indices (TSOW), Gas Supply, 1975-2015

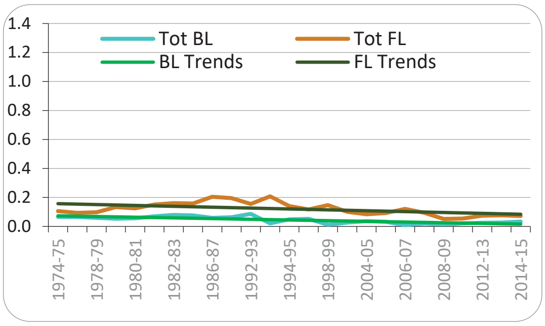


Figure VII-49: Weighted Total Linkage Indices (RSOW), Upstream Water, 1975-2015

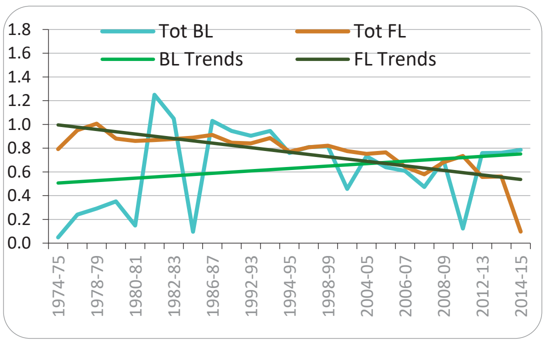
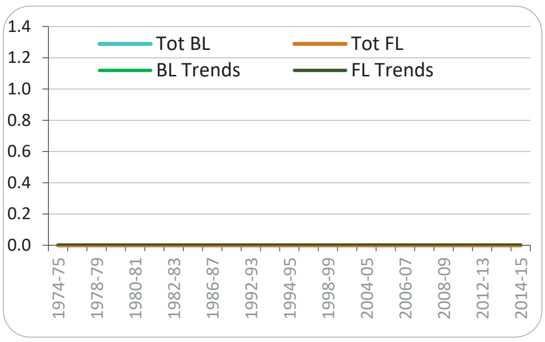


Figure VII-50: Weighted Total Linkage Indices (TSOW), Upstream Water, 1975-2015



Source: Results obtained from the model developed in Chapter 4.

Figure VII-51: Weighted Total Linkage Indices (RSOW), Urban Water, 1975-2015

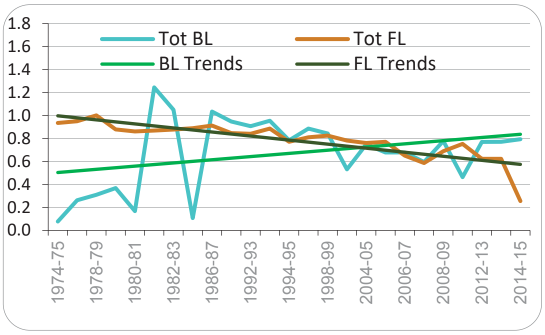


Figure VII-52: Weighted Total Linkage Indices (TSOW), Urban Water, 1975-2015

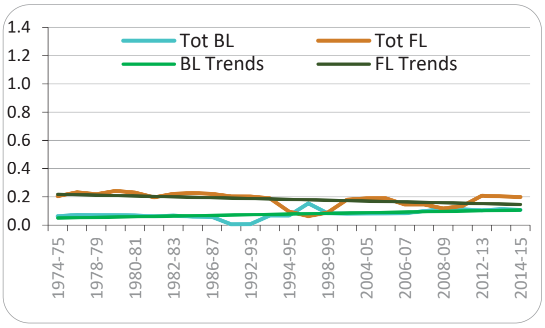


Figure VII-53: Weighted Total Linkage Indices (RSOW), Rural Water, 1975-2015

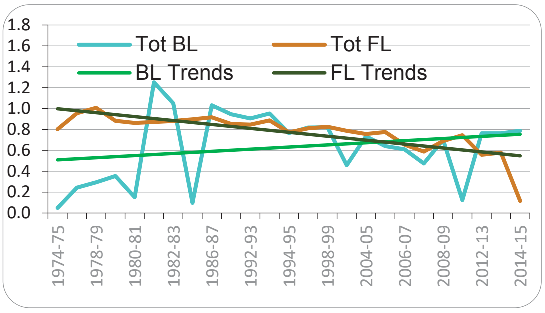


Figure VII-54: Weighted Total Linkage Indices (TSOW), Rural Water, 1975-2015

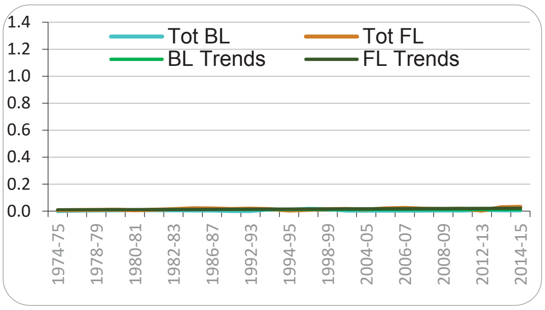


Figure VII-55: Weighted Total Linkage Indices (RSOW), Water Services, 1975-2015

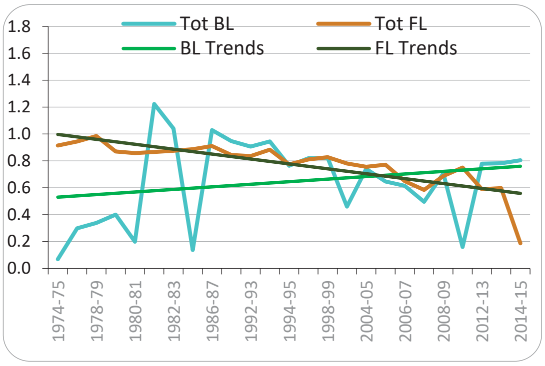
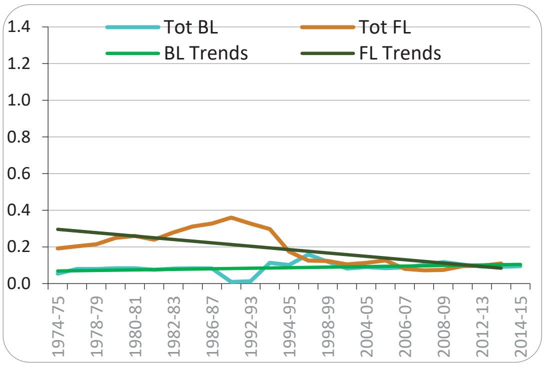


Figure VII-56: Weighted Total Linkage Indices (TSOW), Water Services, 1975-2015



Source: Results obtained from the model developed in Chapter 4.

Figure VII-57: Primary Factors Un-Weighted total BL, Coal Mining, 1975-2015

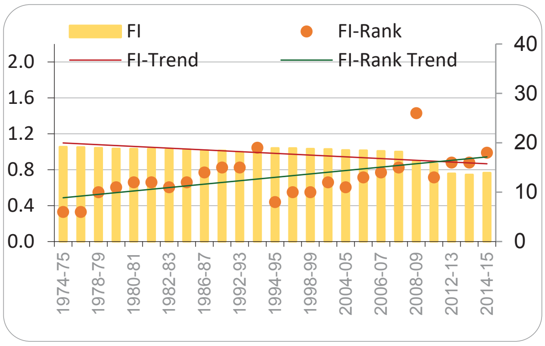


Figure VII-58: Final Demand Un-Weighted Total FL, Coal Mining, 1975-2015

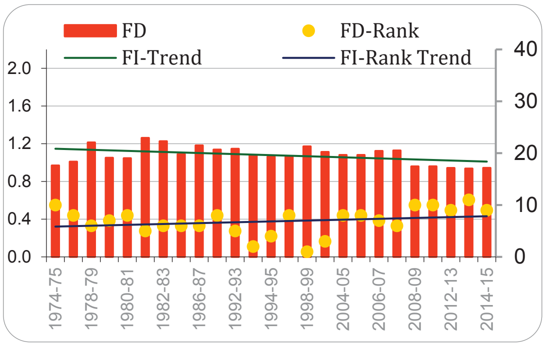


Figure VII-59: Primary Factors Un-Weighted Total BL, Crude Oil, 1975-2015

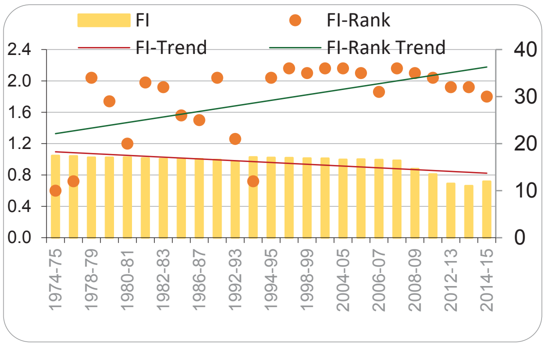


Figure VII-60: Final Demand Weighted Total FL, Crude Oil, 1975-2015

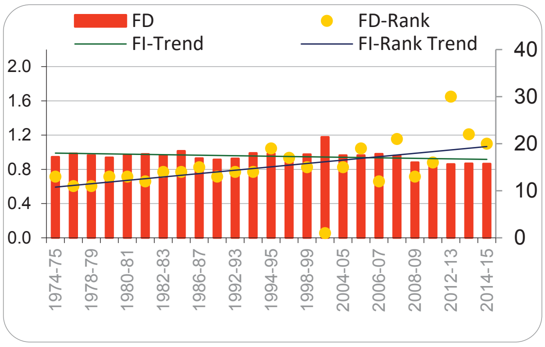


Figure VII-61: Primary Factors Un-Weighted Total BL, Nat. Gas, 1975-2015

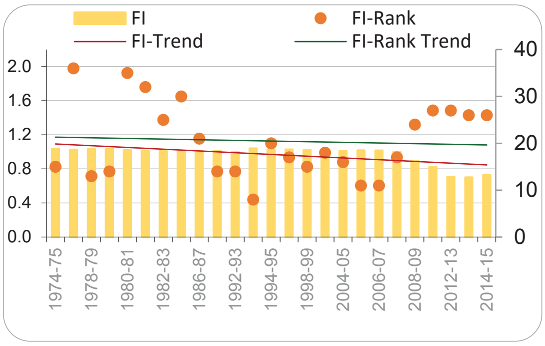


Figure VII-62: Final Demand Un-Weighted Total FL, Nat. Gas, 1975-2015

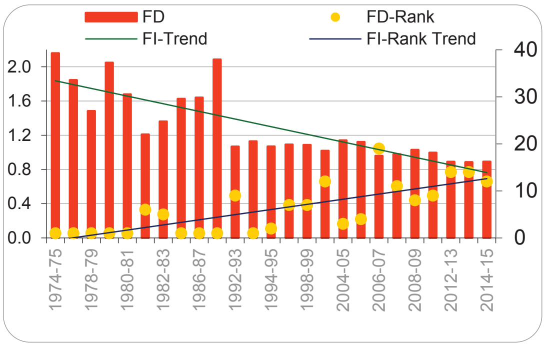


Figure VII-63: Primary Factors Un-Weighted total BL, Exploration Services, 1975-2015

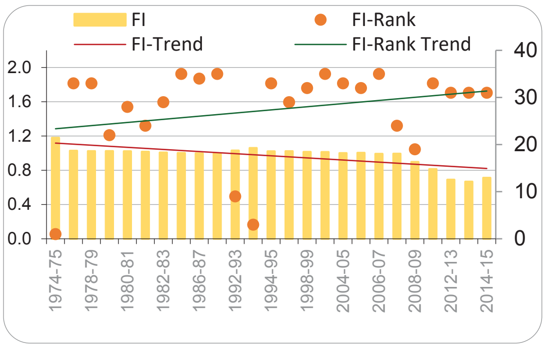
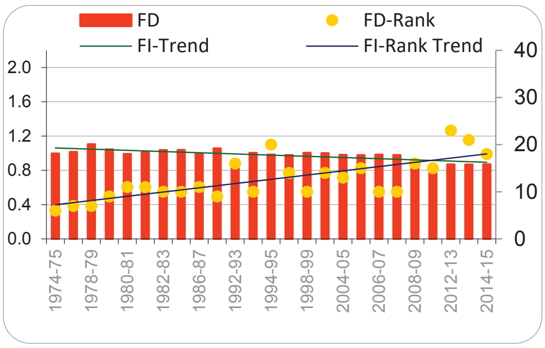


Figure VII-64: Final Demand Un-Weighted Total FL, Exploration Services, 1975-2015



Source: Results obtained from the model developed in Chapter 4.

Figure VII-65: Primary Factors Un-Weighted total BL, Other Mining, 1975-2015

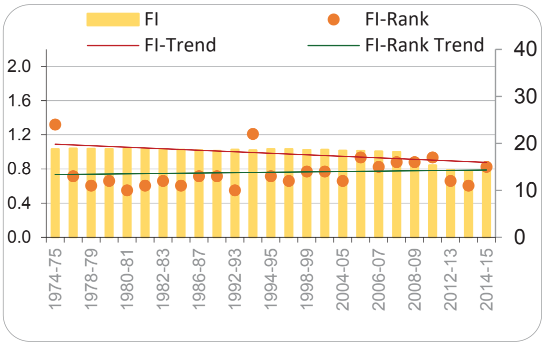


Figure VII-66: Final Demand Un-Weighted Total FL, Other Mining, 1975-2015

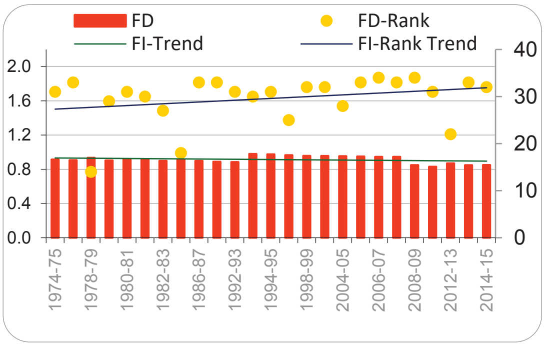


Figure VII-67: Primary Factors Un-Weighted Total BL, Petrol. Mfg., 1975-2015

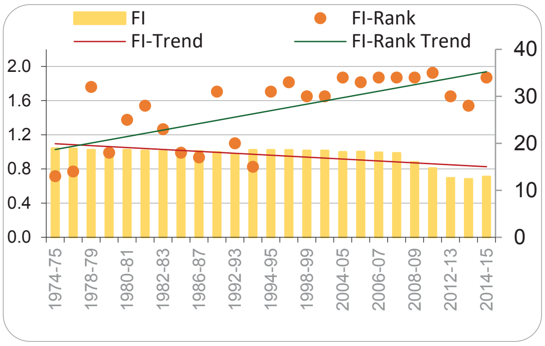


Figure VII-68: Final Demand Un-Weighted Total FL, Petrol. Mfg., 1975-2015

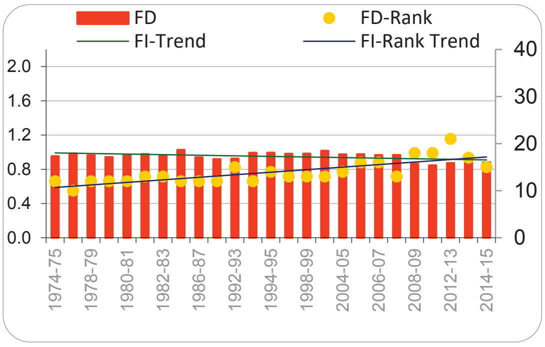


Figure VII-69: Primary Factors Un-Weighted Total BL, Elect. Gen. by Coal, 1975-2015

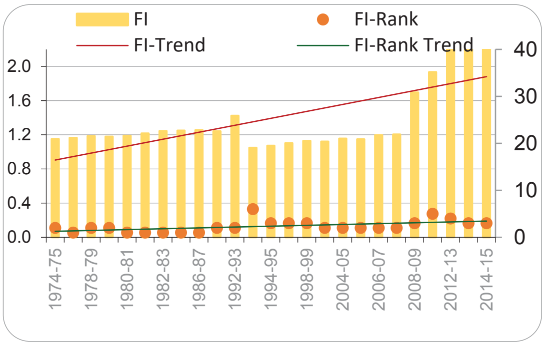


Figure VII-70: Final Demand Un-Weighted Total FL, Elect. Gen. by Coal, 1975-2015

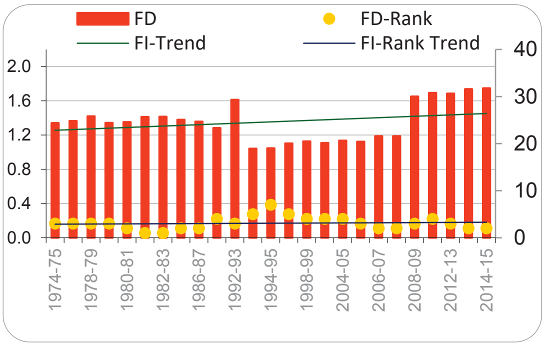


Figure VII-71: Primary Factors Un-Weighted Total BL, Elect. Gen. by Oil, 1975-2015

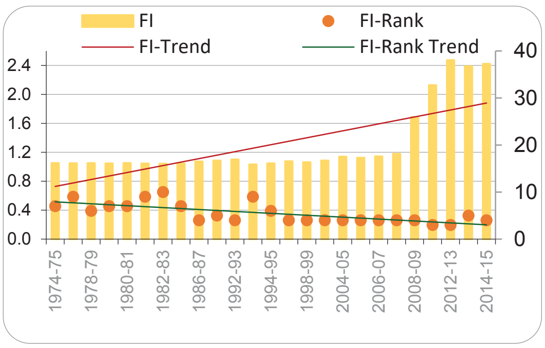
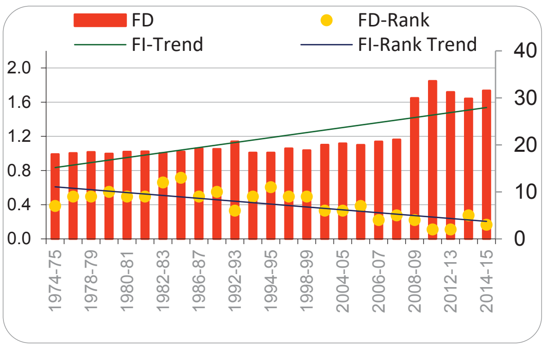


Figure VII-72: Final Demand Un-Weighted Total FL, Elect. Gen. by Oil, 1975-2015



Source: Results obtained from the model developed in Chapter 4.

Figure VII-73: Primary Factors Un-Weighted Total BL, Elect. Gen. by Gas, 1975-2015

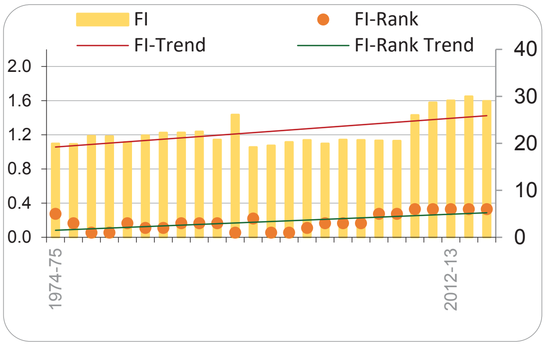


Figure VII-74: Final Demand Un-Weighted Total FL, Elect. Gen. by Gas, 1975-2015

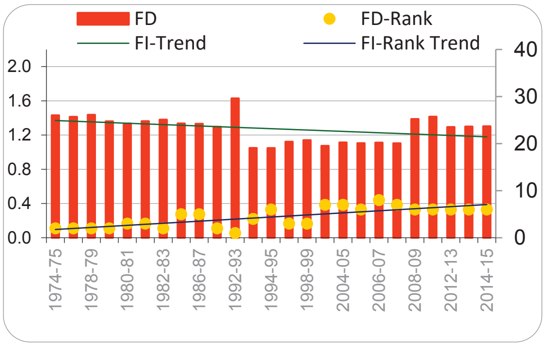


Figure VII-75: Primary Factors Un-Weighted Total BL, Elect. Gen. by Hydro, 1975-2015

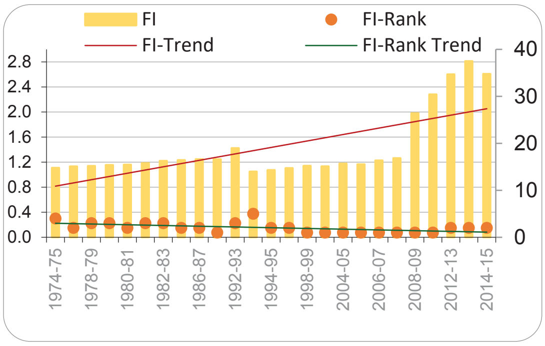


Figure VII-76: Final Demand Un-Weighted Total FL, Elect. Gen. by Hydro, 1975-2015

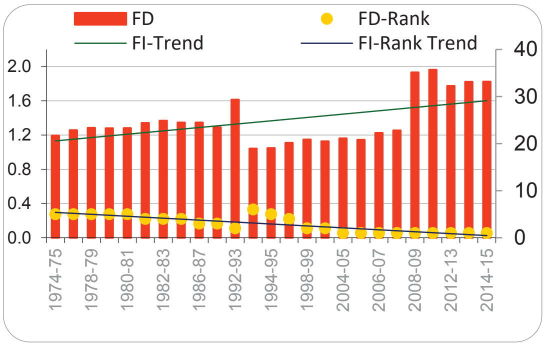


Figure VII-77: Primary Factors Un-Weighted Total BL, Elect. Gen. by Renew.1975-2015

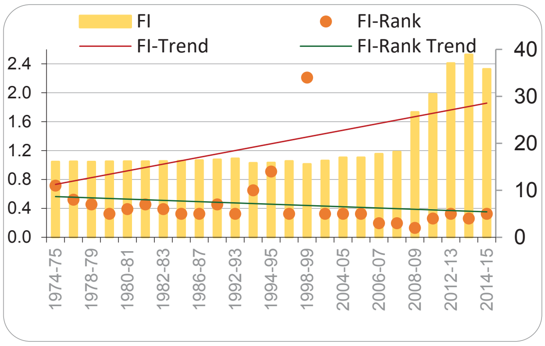


Figure VII-78: Final Demand Un-Weighted Total FL, Elect. Gen by Renew., 1975-2015

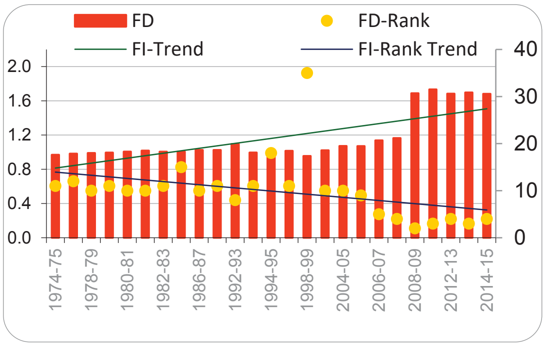


Figure VII-79: Primary Factors Un-Weighted Total BL, Coal Prod. Mfg, 1975-2015

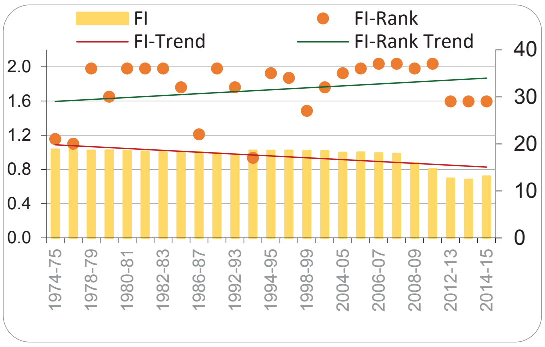
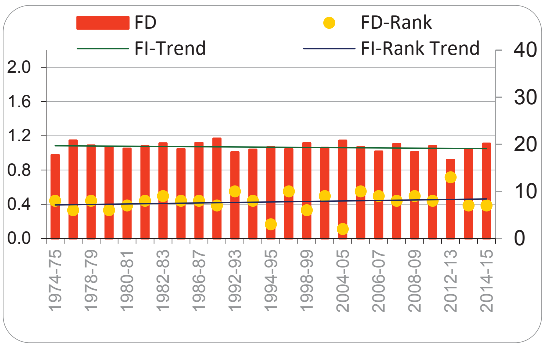


Figure VII-80: Final Demand Un-Weighted Total FL, Coal Prod. Mfg, 1975-2015



Source: Results obtained from the model developed in Chapter 4.

APPENDIX VIII

Detailed tables of multiplier and elasticity indices, 1975-2015

This Appendix provides full details of multipliers and elasticity indices over the period 1975-2015 to support the discussions in Chapter 8 by the following tables:

Sources of all Tables in this appendix

This author's analysis based on the models developed in chapter 4 and the results generated by these models.

Table VIII.1: Comparison of output multipliers and IOFQLAF results, 2008-09 and 2014-15

		Un-Weighted, Not Normalised			
		2008-09		2014-15	
Sectors	Sec Code	Output Multipliers (Type I)	IOFQLAF (Inter-Industry Open Model, Total BL)	Output Multipliers (Type I)	IOFQLAF (Inter-Industry Open Model, Total BL)
Ag., Forest & Fish'g	S01	2.1284	2.1284	2.1142	2.1142
Coal	S02	1.6073	1.6073	2.2486	2.2486
Crude Oil	S03	1.2256	1.2256	1.5438	1.5438
Nat Gas	S04	1.2842	1.2842	1.4090	1.4090
Explor. Mining	S05	2.1433	2.1433	1.8057	1.8057
Oth. Mining	S06	1.7941	1.7941	2.0095	2.0095
Food & Bev	S07	2.3190	2.3190	2.3273	2.3273
Textile & Clothing	S08	1.4692	1.4692	1.2461	1.2461
Pulp & Paper Mfg	S09	1.6545	1.6545	2.1101	2.1101
Wood Prod.	S10	2.1494	2.1494	2.3031	2.3031
Print & Pub.	S11	1.8471	1.8471	1.8450	1.8450
Petro. Prod. Mfg	S12	1.7425	1.7425	1.6501	1.6501
Coal Prod. Mfg	S13	1.5876	1.5876	1.8182	1.8182
Chem. Prod.	S14	1.7778	1.7778	1.7063	1.7063
Non-Metal & Min. Prod.	S15	2.0787	2.0787	2.2158	2.2158
Iron & Steel Mfg	S16	2.1379	2.1379	1.9022	1.9022
Non-Ferrous Mfg	S17	2.7387	2.7387	3.0969	3.0969
Oth. Metal Prod.	S18	2.1198	2.1198	1.9624	1.9624
Mach. & Transp Prod.	S19	1.5554	1.5554	1.3644	1.3644
Mfg Oth.	S20	1.6090	1.6090	1.5575	1.5575
Elec. Gen. Coal	S21	3.1235	3.1235	5.8385	5.8385
Elec. Gen. Oil	S22	2.8658	2.8658	5.3758	5.3758
Elec. Gen. Nat. Gas	S23	3.0258	3.0258	3.6954	3.6954
Elec. Gen. Hydro	S24	3.5421	3.5421	5.9734	5.9734
Elec. Gen. Renew.	S25	2.9741	2.9741	5.0922	5.0922
Elec. Gen Oth. Fuel	S26	1.0020	1.0020	1.0023	1.0023
Elec. T&D	S27	3.0928	3.0928	7.2397	7.2397
Gas Supply	S28	2.1893	2.1893	2.3773	2.3773
Upstrm Water	S29	1.2700	1.2700	1.1570	1.1570
Urb Water	S30	2.0363	2.0363	1.8716	1.8716
Rurl Water	S31	1.9857	1.9857	1.8587	1.8587
Water Serv.	S32	2.2352	2.2352	2.0803	2.0803
Const.	S33	2.3774	2.3774	2.4825	2.4825
Wsale & Retail	S34	1.9561	1.9561	1.9899	1.9899
Trsprt & Storage Serv.	S35	1.9518	1.9518	2.0249	2.0249
Comm, Fin. & Bus. Serv.	S36	1.7474	1.7474	1.7532	1.7532
Govt Admin	S37	1.8692	1.8692	1.9647	1.9647
Edu, Hlth & Cmty Serv.	S38	1.5634	1.5634	1.4969	1.4969
Oth. Comml Serv.	S39	1.9844	1.9844	2.0194	2.0194

Source: Results obtained from the model developed in this research.

Table VIII.2: Overall average output multipliers, for IOI and other sectors, 2009-2015

		Output Multipliers				
		Type I			Induced	Type II
Sectors	Sec Code	Direcrt	Indirect	Total		
Ag., Forest & Fish'g	S01	0.5393	1.5847	2.1240	2.2311	4.3550
Chem. Prod.	S14	0.3760	1.3936	1.7696	1.8021	3.5717
Coal	S02	0.5143	1.5896	2.1039	2.7326	4.8365
Coal Prod. Mfg	S13	0.4370	1.2659	1.7029	0.8450	2.5480
Comm, Fin. & Bus. Serv.	S36	0.3912	1.3597	1.7509	2.8663	4.6172
Const.	S33	0.6747	1.7721	2.4468	3.3676	5.8143
Crude Oil	S03	0.2162	1.2303	1.4465	1.3059	2.7524
Edu, Hlth & Cmty Serv.	S38	0.2643	1.2561	1.5204	5.4420	6.9624
Elec. Gen Oth. Fuel	S26	0.0012	1.0011	1.0024	2.0884	3.0908
Elec. Gen. Coal	S21	0.6303	4.4207	5.0510	9.0008	14.0517
Elec. Gen. Hydro	S24	0.6050	4.7739	5.3789	9.9279	15.3068
Elec. Gen. Nat. Gas	S23	0.5971	3.0156	3.6127	5.6108	9.2235
Elec. Gen. Oil	S22	0.5198	4.1804	4.7002	8.8216	13.5218
Elec. Gen. Renew.	S25	0.5018	4.1120	4.6139	8.7257	13.3396
Elec. T&D	S27	0.7839	5.3900	6.1739	11.6862	17.8601
Explor. Mining	S05	0.4793	1.4335	1.9128	3.4924	5.4052
Food & Bev	S07	0.6025	1.7322	2.3347	2.7415	5.0762
Gas Supply	S28	0.6341	1.7320	2.3661	2.1103	4.4764
Govt Admin	S37	0.4188	1.5319	1.9507	5.0780	7.0287
Iron & Steel Mfg	S16	0.5212	1.6338	2.1550	2.5081	4.6631
Mach. & Transp Prod.	S19	0.2348	1.2299	1.4647	1.2518	2.7165
Mfg Oth.	S20	0.2887	1.3651	1.6537	1.7162	3.3700
Nat Gas	S04	0.2032	1.2413	1.4444	1.1623	2.6067
Non-Ferrous Mfg	S17	0.8268	2.2133	3.0401	3.2389	6.2789
Non-Metal & Min. Prod.	S15	0.5561	1.6591	2.2152	3.0476	5.2628
Oth. Comml Serv.	S39	0.4984	1.5213	2.0197	3.6865	5.7062
Oth. Metal Prod.	S18	0.4780	1.5993	2.0773	2.9725	5.0498
Oth. Mining	S06	0.3931	1.5214	1.9145	2.2132	4.1278
Petro. Prod. Mfg	S12	0.4494	1.2653	1.7147	0.8355	2.5503
Print & Pub.	S11	0.4250	1.4652	1.8901	2.9509	4.8410
Pulp & Paper Mfg	S09	0.3551	1.5927	1.9478	2.2601	4.2080
Rurl Water	S31	0.4707	1.6863	2.1570	3.9796	6.1366
Textile & Clothing	S08	0.1791	1.1702	1.3493	1.0201	2.3694
Trsprt & Storage Serv.	S35	0.5060	1.4948	2.0008	3.0178	5.0186
Upstrm Water	S29	0.1637	1.0337	1.1974	0.0000	1.1974
Urb Water	S30	0.3445	1.6107	1.9552	3.5263	5.4815
Water Serv.	S32	0.5419	1.5934	2.1353	3.6148	5.7501
Wood Prod.	S10	0.5473	1.6890	2.2363	3.2390	5.4752
Wsale & Retail	S34	0.4643	1.5253	1.9896	3.9489	5.9384

Source: Results obtained from the model developed in this research.

Table VIII.3: Relative change in induced output multipliers and trends, 1975-2015 (indexed, 1975=100)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Trends
S02	100.00	97.63	94.43	74.29	90.86	115.84	127.89	117.62	86.30	87.23	80.98	75.56	132.30	133.83	114.92	87.77	82.64	70.63	92.87	92.84	58.97	105.43	154.10	170.38	145.72	▲ (Increase)
S03	100.00	107.33	74.85	69.17	95.08	91.43	101.41	106.29	87.42	84.29	78.25	73.87	41.89	35.25	49.19	33.44	22.39	27.54	27.89	27.32	31.87	49.07	77.54	83.75	85.63	▼ (Decrease)
S04	100.00	101.22	132.60	101.64	105.99	129.29	149.16	133.70	114.12	125.70	105.85	92.28	40.75	40.76	56.85	35.42	36.38	47.25	46.29	45.70	42.51	68.69	95.75	126.16	105.51	▼ (Decrease)
S05	100.00	91.53	68.60	45.86	68.65	63.75	69.31	58.78	49.90	65.93	67.02	56.16	48.45	50.76	54.81	45.61	43.02	49.27	47.52	44.10	55.47	52.51	66.48	66.98	59.42	▼ (Decrease)
S06	100.00	102.38	85.60	74.33	93.21	113.24	104.35	111.07	85.48	87.81	93.64	84.66	80.16	89.64	88.53	74.37	62.97	56.36	54.40	57.15	63.78	67.57	106.27	108.69	102.40	▼ (Decrease)
S12	100.00	96.95	65.11	58.89	73.18	64.38	75.92	107.41	97.75	78.96	77.73	60.69	59.55	62.32	55.80	55.99	32.15	35.62	29.78	29.69	30.46	35.08	43.71	52.69	44.80	▼ (Decrease)
S13	100.00	118.12	79.00	66.93	78.12	68.16	77.20	116.69	134.72	100.66	99.61	71.38	78.37	90.20	93.51	82.69	44.16	40.44	36.24	32.64	39.34	49.64	65.69	78.14	81.14	▼ (Decrease)
S21	100.00	88.86	81.98	71.63	75.99	96.69	103.61	97.60	81.45	77.07	84.00	45.38	59.05	58.84	55.06	53.31	56.31	57.78	71.62	76.85	117.10	166.56	250.97	317.35	259.42	▼ (Decrease)
S22	100.00	87.57	80.41	68.99	72.32	94.04	96.66	88.90	77.67	75.31	67.20	51.98	71.26	70.91	63.12	62.49	66.96	68.41	80.60	90.32	140.52	218.85	297.08	331.16	296.26	▼ (Decrease)
S23	100.00	85.49	122.44	100.52	86.09	135.25	144.96	115.23	106.23	96.23	128.54	64.42	79.43	80.00	71.16	66.10	60.66	59.66	87.88	95.46	121.50	176.70	225.86	273.85	229.32	▼ (Decrease)
S24	100.00	90.97	84.49	75.13	78.23	102.63	109.77	102.70	88.07	83.48	89.75	48.46	61.31	60.82	55.83	57.31	62.25	64.93	80.87	90.04	153.87	214.25	285.85	359.60	291.79	▼ (Decrease)
S25	100.00	87.67	79.44	68.99	72.80	93.16	96.80	91.04	77.76	76.03	67.78	53.07	68.79	69.34	57.73	61.10	63.84	67.08	82.87	91.57	146.03	203.21	289.28	353.21	284.67	▼ (Decrease)
S26	100.00	87.78	80.02	68.43	70.22	93.92	95.34	85.82	70.31	65.46	52.83	50.60	53.04	51.02	43.26	46.10	48.65	54.79	65.03	70.72	60.90	67.49	57.34	66.12	65.33	▼ (Decrease)
S27	100.00	96.76	99.54	96.22	108.01	148.04	178.12	178.37	162.32	167.37	197.83	72.88	137.81	114.65	122.64	121.79	149.55	154.84	194.91	221.36	375.46	611.39	1156.00	1458.80	1121.50	▼ (Decrease)
S28	100.00	85.26	80.70	71.88	76.12	81.76	90.65	79.40	63.03	69.95	66.53	56.44	62.91	61.04	47.89	55.20	43.48	44.33	31.01	33.43	63.13	69.13	59.41	65.38	60.70	▼ (Decrease)
S29	100.00	74.54	65.26	53.05	56.51	71.31	68.94	65.52	51.89	59.12	52.36	37.36	52.97	37.33	37.07	24.35	19.31	18.70	19.91	18.65	22.21	25.02	27.31	28.75	24.17	▼ (Decrease)
S30	100.00	94.04	86.89	77.47	82.67	90.93	93.96	94.37	82.48	89.87	93.16	74.52	87.79	93.39	80.76	75.97	83.09	76.08	91.88	94.13	98.65	93.81	99.67	107.96	96.53	▲ (Slight Inc)
S31	100.00	91.81	83.44	76.09	85.61	86.11	86.23	78.92	69.05	79.27	78.84	101.09	78.01	75.26	67.75	63.18	72.35	59.99	73.75	77.99	81.13	74.00	111.37	85.90	76.37	▼ (Slight Dec)
S32	100.00	88.52	78.95	68.22	74.74	82.08	84.76	93.08	80.42	83.32	84.12	68.54	81.59	71.55	68.16	67.53	68.81	65.41	72.09	71.05	75.48	76.87	92.05	97.26	85.18	▼ (Slight Dec)
S15	100.00	83.64	74.58	67.13	72.83	76.82	82.07	79.54	68.18	68.33	67.71	61.13	63.86	69.62	60.75	59.85	59.24	60.91	60.34	60.13	61.86	71.35	83.94	90.55	78.12	▼ (Slight Dec)
S33	100.00	86.35	73.90	67.73	72.75	71.60	75.82	70.73	62.84	61.64	62.77	58.67	62.95	62.05	56.47	58.56	54.25	55.39	65.60	68.30	69.34	68.23	77.39	84.27	76.19	▼ (Slight Dec)
S34	100.00	87.46	77.61	74.75	78.48	84.36	88.81	86.95	72.04	78.39	83.92	73.90	77.64	78.27	76.71	71.51	69.51	70.23	69.15	76.60	79.88	84.86	99.03	106.99	96.03	↕ (Stable)
S37	100.00	98.33	87.78	80.74	85.76	94.19	92.22	91.33	82.03	73.98	70.95	66.17	76.18	75.36	70.32	69.08	67.33	69.68	71.38	71.86	72.71	77.43	100.71	108.10	95.48	▼ (Slight Dec)
S38	100.00	89.48	82.47	79.70	85.33	86.41	87.59	87.52	80.72	79.73	79.28	74.77	84.72	83.17	80.51	77.61	74.37	76.65	76.70	78.62	76.37	81.56	97.84	103.17	92.46	▼ (Slight Dec)
S39	100.00	96.14	93.91	82.34	86.70	87.53	90.28	86.67	86.97	92.90	92.57	87.09	92.38	94.03	89.75	86.89	80.61	81.85	71.31	72.90	75.03	78.95	97.10	105.49	91.20	▼ (Slight Dec)

Sectors with the highest Induced Output Multipliers. ▲ Increase ▲ Slight Inc ▼ Decrease ▼ Slight Dec ↕ Stable

Source: Results obtained from the model developed in Chapter 4.

Table VIII.4: Indirect employment multipliers and ranks, 1975-2015

Sec-Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
S01	92.871 (8)	121.671 (5)	74.581 (10)	72.174 (8)	83.454 (7)	89.65 (5)	133.868 (3)	80.452 (6)	93.405 (3)	63.338 (6)	67.041 (5)	62.59 (4)	58.02 (5)	51.66 (6)	51.851 (5)	34.15 (7)	31.319 (7)	29.643 (8)	32.267 (7)	28.177 (7)	26.051 (8)	28.621 (7)	19.565 (10)	19.552 (11)	16.112 (11)
S02	22.377 (24)	14.336 (29)	15.996 (30)	9.898 (30)	10.484 (31)	14.359 (30)	13.712 (31)	13.728 (31)	8.395 (31)	8.216 (28)	4.339 (30)	3.118 (31)	6.397 (29)	4.525 (29)	2.617 (30)	1.832 (31)	1.704 (34)	1.234 (34)	1.858 (32)	1.503 (33)	0.519 (34)	2.151 (33)	3.302 (33)	4.93 (29)	4.187 (31)
S03	1.516 (34)	2.134 (34)	0.849 (37)	1.116 (34)	1.293 (35)	0.707 (36)	0.861 (35)	0.523 (37)	0.361 (38)	0.265 (38)	0.346 (37)	0.338 (36)	0.067 (37)	0 (37)	0.312 (36)	0 (37)	0 (37)	0 (38)	0.025 (37)	0 (37)	0.009 (36)	0.202 (35)	0.58 (35)	0.69 (35)	0.625 (35)
S04	0.076 (38)	0.006 (38)	0.248 (38)	0.124 (38)	0.065 (38)	0.014 (38)	0.037 (38)	0.298 (38)	0.45 (37)	0.622 (37)	0.295 (38)	0.218 (37)	0 (38)	0 (38)	0.148 (37)	0 (38)	0 (38)	0.023 (36)	0.028 (36)	0.001 (36)	0 (38)	0.152 (36)	0.313 (36)	0.49 (36)	0.262 (37)
S05	96.094 (7)	90.63 (7)	60.766 (12)	44.602 (15)	22.03 (23)	13.278 (31)	14.149 (30)	16.26 (28)	42.662 (13)	43.735 (12)	31.088 (11)	15.6 (18)	6.662 (28)	5.909 (25)	5.257 (23)	3.843 (26)	4.322 (24)	5.559 (22)	5.135 (23)	6.1 (24)	9.208 (20)	5.358 (29)	14.165 (13)	14.743 (15)	12.992 (18)
S06	11.25 (30)	14.013 (30)	13.226 (31)	8.48 (31)	14.152 (29)	18.112 (28)	15.969 (29)	17.294 (27)	12.606 (28)	8.521 (27)	6.528 (28)	5.702 (29)	4.888 (30)	5.31 (26)	4.586 (24)	4.206 (23)	3.494 (26)	2.596 (30)	1.821 (33)	1.789 (32)	2.2 (32)	2.143 (34)	4.028 (32)	2.842 (33)	4.027 (33)
S07	33.172 (22)	35.258 (19)	28.172 (24)	25.401 (24)	22.619 (21)	25.958 (20)	29.776 (20)	23.952 (22)	25.059 (21)	22.529 (19)	18.471 (18)	16.247 (16)	16.005 (18)	14.798 (18)	12.602 (16)	11.119 (16)	11.32 (13)	10.746 (13)	10.788 (14)	11.326 (13)	11.168 (14)	11.12 (16)	10.889 (20)	10.793 (22)	9.438 (22)
S08	78.909 (10)	83.954 (10)	83.988 (6)	82.559 (6)	92.086 (6)	81.061 (7)	91.322 (6)	64.114 (10)	59.395 (8)	63.154 (7)	29.045 (13)	45.619 (10)	32.06 (12)	36.488 (8)	29.586 (9)	28.426 (9)	19.436 (10)	30.503 (7)	23.703 (8)	21.837 (8)	17.744 (10)	17.968 (9)	29.342 (7)	33.311 (8)	33.098 (6)
S09	360.493 (1)	219.264 (1)	240.978 (1)	225.198 (1)	215.266 (1)	209.841 (1)	205.011 (1)	179.728 (1)	85.171 (5)	91.481 (3)	78.894 (4)	57.997 (5)	57.031 (6)	146.399 (1)	138.765 (1)	92.706 (1)	75.478 (2)	91.599 (1)	112.114 (2)	66.795 (3)	82.133 (2)	56.426 (3)	65.741 (3)	38.689 (4)	50.188 (3)
S10	91.202 (9)	86.669 (9)	88.877 (5)	70.884 (9)	70.63 (8)	64.268 (10)	73.48 (8)	69.431 (9)	45.03 (11)	58.576 (9)	49.75 (9)	47.209 (9)	34.842 (10)	29.941 (11)	17.954 (11)	27.508 (10)	26.25 (8)	23.983 (9)	21.964 (9)	19.664 (9)	19.144 (9)	18.636 (8)	21.789 (9)	33.982 (7)	19.155 (10)
S11	69.982 (12)	64.848 (13)	52.842 (15)	48.551 (12)	46.749 (14)	41.405 (16)	41.089 (15)	47.214 (13)	33.601 (17)	33.321 (15)	30.842 (12)	20.774 (13)	19.469 (14)	20.021 (12)	14.234 (13)	11.913 (15)	11.628 (12)	12.463 (12)	12.564 (13)	11.957 (12)	10.721 (17)	10.095 (18)	14.16 (14)	11.368 (20)	13.933 (15)
S12	4.211 (32)	2.981 (32)	1.705 (33)	1.09 (35)	1.34 (34)	0.959 (34)	1.097 (34)	1.415 (34)	1.238 (35)	1.001 (35)	0.877 (34)	0.478 (35)	1.083 (35)	0.955 (35)	0.617 (35)	0.928 (35)	0.143 (35)	0.161 (35)	0.05 (35)	0.031 (35)	0.05 (35)	0.047 (37)	0.207 (38)	0.126 (37)	0.225 (38)
S13	1.341 (35)	1.666 (35)	0.861 (36)	0.54 (37)	0.502 (37)	0.353 (37)	0.421 (37)	0.57 (36)	1.052 (36)	0.693 (36)	0.548 (36)	0.217 (38)	0.742 (36)	0.847 (36)	0.83 (34)	0.867 (36)	0.033 (36)	0.011 (37)	-0.05 (39)	-0.067 (39)	0.003 (37)	0.029 (38)	0.208 (37)	0.121 (38)	0.345 (36)
S14	36.096 (20)	35.274 (18)	32.341 (22)	26.656 (22)	26.971 (19)	25.283 (22)	27.789 (21)	27.375 (19)	18.156 (25)	19.35 (21)	16.479 (20)	12.483 (21)	13.397 (20)	12.748 (19)	10.284 (19)	9.166 (17)	4.518 (22)	4.862 (24)	5.044 (24)	4.636 (25)	4.269 (30)	4.189 (30)	4.989 (30)	4.917 (30)	4.455 (29)
S15	56.894 (16)	51.261 (16)	50.683 (17)	42.589 (17)	41.236 (17)	34.88 (18)	40.087 (16)	44.456 (15)	33.44 (18)	23.011 (18)	22.387 (16)	19.082 (14)	16.429 (17)	16.549 (16)	12.307 (17)	12.252 (14)	6.787 (18)	7.278 (19)	6.649 (21)	8.933 (18)	8.077 (22)	8.215 (23)	8.498 (24)	7.868 (24)	7.094 (24)
S16	21.835 (26)	29.47 (23)	22.18 (25)	18.249 (28)	22.179 (22)	22.495 (24)	32.047 (19)	22.883 (23)	18.577 (24)	13.751 (24)	13.415 (23)	11.757 (22)	8.476 (23)	16.814 (15)	7.461 (21)	8.582 (18)	6.165 (20)	8.192 (18)	8.146 (20)	7.032 (20)	7.116 (24)	8.616 (22)	10.85 (21)	15.331 (13)	23.425 (9)
S17	23.228 (23)	20.824 (27)	18.152 (29)	10.619 (29)	14.9 (28)	19.184 (27)	18.573 (26)	15.762 (29)	9.346 (30)	5.685 (30)	6.119 (29)	4.878 (30)	2.624 (33)	2.023 (33)	1.414 (33)	2.004 (30)	2.95 (29)	2.506 (31)	1.221 (34)	1.368 (34)	1.654 (33)	2.156 (32)	5.223 (29)	4.972 (28)	5.444 (27)
S18	61.191 (15)	59.471 (14)	54.397 (14)	46.148 (13)	52.907 (11)	48.032 (12)	54.993 (11)	48.138 (12)	46.016 (10)	40.365 (13)	35.184 (10)	39.034 (11)	61.04 (4)	55.502 (5)	54.177 (4)	19.99 (11)	7.707 (16)	10.631 (14)	9.201 (17)	8.959 (16)	7.224 (23)	7.04 (25)	5.602 (27)	8.114 (23)	6.863 (25)
S19	44.132 (18)	50.118 (17)	51.896 (16)	45.185 (14)	49.982 (13)	42.675 (15)	43.657 (14)	45.41 (14)	34.926 (16)	26.99 (17)	21.537 (17)	15.944 (17)	17.318 (16)	18.341 (14)	12.63 (15)	15.158 (12)	7.833 (15)	8.333 (16)	9.5 (16)	8.809 (19)	9.138 (21)	9.339 (21)	10.483 (22)	13.229 (18)	13.057 (17)

Source: Results obtained from the model developed in Chapter 4.

Table VIII.4 (cont'd)

Sec-Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
S20	154.129 (3)	143.487 (3)	155.151 (3)	140.02 (4)	132.62 (3)	112.687 (4)	105.543 (5)	97.275 (4)	71.633 (7)	86.136 (5)	59.526 (6)	50.207 (8)	45.03 (8)	34.72 (9)	38.568 (8)	46.938 (4)	99.288 (1)	84.167 (2)	188.415 (1)	229.32 (1)	245.788 (1)	211.74 (1)	327.503 (1)	267.074 (1)	314.688 (1)
S21	34.339 (21)	34.813 (21)	38.57 (19)	30.869 (21)	26.549 (20)	30.135 (19)	27.718 (22)	25.287 (20)	19.426 (23)	9.22 (25)	8.841 (26)	7.155 (25)	7.472 (25)	4.895 (27)	3.686 (28)	4.084 (24)	3.513 (25)	4.226 (27)	3.892 (27)	4.577 (26)	6.885 (26)	9.624 (20)	13.488 (16)	14.553 (16)	13.988 (14)
S22	0.685 (36)	0.861 (37)	1.255 (35)	0.846 (36)	1 (36)	0.768 (35)	0.737 (36)	0.913 (35)	2.215 (34)	1.512 (34)	0.789 (35)	0.987 (33)	4.068 (31)	3.976 (30)	1.71 (31)	2.728 (28)	3.31 (27)	3.18 (28)	2.065 (30)	3.32 (28)	6.377 (28)	11.998 (15)	13.294 (17)	10.877 (21)	12.569 (19)
S23	11.642 (29)	9.371 (31)	38.269 (20)	35.971 (19)	10.571 (30)	25.71 (21)	27.425 (23)	24.855 (21)	21.02 (22)	5.354 (31)	10.592 (24)	9.415 (23)	8.038 (24)	7.19 (23)	4.257 (25)	2.503 (29)	3.23 (28)	4.42 (26)	1.957 (31)	1.942 (31)	4.114 (31)	5.484 (28)	4.404 (31)	4.443 (31)	4.329 (30)
S24	14.697 (28)	20.299 (28)	19.312 (28)	21.8 (25)	17.982 (27)	19.93 (26)	20.8 (25)	20.99 (24)	16.831 (27)	8.626 (26)	8.3 (27)	6.693 (27)	7.363 (26)	4.839 (28)	3.697 (27)	4.56 (22)	4.35 (23)	5.06 (23)	4.768 (25)	6.732 (21)	11.149 (15)	14.649 (12)	15.337 (11)	16.208 (12)	15.367 (13)
S25	0.519 (37)	1.495 (36)	1.32 (34)	1.861 (33)	1.499 (33)	1.81 (33)	2.192 (33)	2.563 (33)	2.741 (33)	1.873 (33)	0.913 (33)	0.736 (34)	1.588 (34)	2.253 (32)	0.051 (38)	1.66 (33)	2.07 (33)	2.408 (33)	2.614 (28)	3.613 (27)	7.082 (25)	9.768 (19)	12.354 (19)	12.284 (19)	11.285 (21)
S26	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (38)	0 (38)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)
S27	1.87 (33)	2.615 (33)	3.49 (32)	3.729 (32)	3.713 (32)	4.872 (32)	6.109 (32)	6.699 (32)	6.295 (32)	3.641 (32)	4.058 (32)	1.036 (32)	3.368 (32)	1.437 (34)	1.453 (32)	1.642 (34)	2.187 (32)	2.687 (29)	2.386 (29)	3.197 (29)	6.609 (27)	12.276 (14)	26.959 (8)	28.756 (10)	24.341 (8)
S28	22.231 (25)	24.637 (24)	28.472 (23)	25.781 (23)	20.904 (24)	17.108 (29)	16.534 (28)	14.348 (30)	11.097 (29)	7.926 (29)	4.293 (31)	6.763 (26)	7.138 (27)	7.667 (22)	3.908 (26)	3.312 (27)	2.681 (30)	5.97 (21)	6.472 (22)	11.025 (14)	27.127 (7)	15.412 (11)	12.698 (18)	30.054 (9)	15.949 (12)
S29	47.155 (17)	33.535 (22)	35.174 (21)	32.141 (20)	28.302 (18)	38.228 (17)	34.504 (18)	32.5 (18)	26.181 (19)	18.542 (22)	9.646 (25)	6.352 (28)	9.99 (22)	2.546 (31)	3.328 (29)	1.779 (32)	2.442 (31)	2.423 (32)	3.919 (26)	2.542 (30)	4.455 (29)	2.16 (31)	1.78 (34)	1.198 (34)	1.377 (34)
S30	101.939 (6)	76.136 (11)	80.966 (7)	72.471 (7)	66.525 (10)	87.318 (6)	79.103 (7)	70.035 (8)	57.064 (9)	45.965 (11)	28.692 (14)	18.893 (15)	32.228 (11)	15.381 (17)	13.305 (14)	7.439 (20)	8.962 (14)	8.86 (15)	14.276 (11)	10.772 (15)	16.495 (11)	10.492 (17)	9.428 (23)	7.517 (25)	7.677 (23)
S31	8.082 (31)	34.949 (20)	42.874 (18)	42.492 (18)	41.743 (16)	55.645 (11)	52.554 (12)	51.191 (11)	43.428 (12)	27.084 (16)	18.111 (19)	14.892 (19)	20.02 (13)	12.432 (20)	11.052 (18)	4.927 (21)	6.723 (19)	6.477 (20)	9.091 (18)	6.499 (22)	11.059 (16)	6.521 (26)	6.329 (26)	5.261 (27)	5.079 (28)
S32	20.317 (27)	21.472 (25)	21.762 (26)	19.833 (26)	19.585 (26)	24.355 (23)	22.501 (24)	20.956 (25)	17.742 (26)	17.053 (23)	14.607 (21)	8.043 (24)	13.467 (19)	6.983 (24)	6.502 (22)	3.881 (25)	4.739 (21)	4.506 (25)	8.154 (19)	6.472 (23)	9.44 (18)	5.96 (27)	5.438 (28)	4.14 (32)	4.176 (32)
S33	64.698 (13)	65.788 (12)	61.619 (11)	58.997 (11)	52.055 (12)	43.561 (14)	39.355 (17)	40.602 (17)	41.895 (14)	55.67 (10)	58.396 (7)	53.463 (6)	36.434 (9)	34.042 (10)	26.521 (10)	32.565 (8)	24.948 (9)	23.939 (10)	15.107 (10)	13.703 (10)	14.813 (13)	17.709 (10)	14.668 (12)	14.927 (14)	13.464 (16)
S34	119.087 (5)	134.988 (4)	119.876 (4)	172.104 (2)	119.751 (4)	118.628 (3)	128.032 (4)	159.197 (2)	79.076 (6)	89.95 (4)	106.057 (3)	72.048 (3)	53.963 (7)	48.378 (7)	42.871 (6)	37.582 (6)	35.358 (6)	35.875 (6)	36.421 (5)	37.772 (5)	40.268 (5)	39.316 (5)	38.081 (5)	36.553 (5)	35.386 (5)
S35	61.418 (14)	53.252 (15)	54.936 (13)	43.976 (16)	43.267 (15)	45.654 (13)	47.569 (13)	42.423 (16)	40.775 (15)	34.813 (14)	24.989 (15)	24.62 (12)	19.384 (15)	19.372 (13)	16.821 (12)	14.664 (13)	12.353 (11)	12.82 (11)	12.682 (12)	12.612 (11)	14.984 (12)	14.129 (13)	13.708 (15)	13.264 (17)	12.33 (20)
S36	39.326 (19)	20.944 (26)	20.583 (27)	19.745 (27)	20.167 (25)	20.163 (25)	18.114 (27)	20.227 (26)	25.536 (20)	19.493 (20)	13.706 (22)	12.675 (20)	12.136 (21)	11.7 (21)	9.265 (20)	8.008 (19)	7.65 (17)	8.262 (17)	9.559 (15)	8.941 (17)	9.336 (19)	7.78 (24)	7.176 (25)	6.751 (26)	5.924 (26)
S37	71.021 (11)	87.027 (8)	79.681 (8)	70.345 (10)	67.223 (9)	66.847 (9)	68.026 (9)	74.491 (7)	85.242 (4)	61.611 (8)	56.122 (8)	51.947 (7)	62.741 (3)	57.713 (4)	42.859 (7)	46.923 (5)	47.799 (5)	47.55 (5)	33.78 (6)	31.816 (6)	34.179 (6)	31.448 (6)	31.086 (6)	34.216 (6)	29.287 (7)
S38	176.444 (2)	146.328 (2)	176.809 (2)	152.412 (3)	147.573 (2)	154.209 (2)	144.047 (2)	140.108 (3)	110.267 (2)	130.288 (2)	109.087 (1)	102.862 (2)	106.766 (1)	103.391 (2)	91.137 (2)	87.857 (2)	75.376 (3)	82.261 (3)	79.122 (3)	81.461 (2)	73.205 (3)	70.019 (2)	71.302 (2)	65.415 (2)	54.345 (2)
S39	129.193 (4)	109.046 (6)	76.765 (9)	107.796 (5)	107.708 (5)	67.33 (8)	65.308 (10)	87.11 (5)	138.361 (1)	149.194 (1)	107.988 (2)	110.868 (1)	93.936 (2)	88.054 (3)	75.605 (3)	71.546 (3)	56.857 (4)	56.336 (4)	51.324 (4)	59.266 (4)	63.295 (4)	55.944 (4)	52.565 (4)	56.414 (3)	48.816 (4)

Source: Results obtained from the model developed in Chapter 4.

Table VIII.5: Induced employment multipliers and ranks, 1975-2015

Sec-Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
S01	71.755 (18)	73.752 (14)	39.294 (23)	34.581 (22)	44.682 (16)	48.546 (17)	76.193 (9)	45.353 (16)	49.47 (10)	37.939 (15)	39.702 (11)	35.032 (9)	34.857 (8)	31.136 (11)	28.081 (8)	17.893 (11)	17.155 (9)	16.79 (9)	19.885 (7)	18.317 (8)	17.792 (11)	19.127 (10)	16.86 (17)	18.046 (19)	13.954 (18)
S02	37.617 (27)	26.38 (29)	25.654 (29)	16.437 (29)	20.331 (29)	27.363 (29)	28.186 (30)	25.277 (30)	15.481 (30)	15.638 (27)	9.104 (30)	7.631 (30)	12.974 (22)	9.77 (24)	5.245 (29)	3.754 (29)	3.37 (32)	2.684 (33)	3.587 (31)	3.337 (31)	1.36 (33)	4.056 (31)	6.64 (32)	9.181 (27)	7.386 (29)
S03	6.225 (35)	6.259 (34)	3.761 (35)	3.587 (34)	4.364 (34)	3.542 (34)	3.964 (34)	2.568 (35)	1.454 (37)	1.773 (37)	1.754 (36)	1.742 (34)	0.671 (36)	0.396 (36)	1.109 (35)	0.246 (36)	0.303 (36)	0.465 (34)	0.459 (34)	0.464 (34)	0.589 (34)	0.981 (34)	1.609 (34)	2.105 (34)	1.924 (34)
S04	1.593 (37)	0.703 (37)	0.586 (37)	0.318 (37)	0.756 (37)	0.076 (37)	0.165 (37)	1.778 (37)	1.549 (36)	2.016 (36)	1.356 (37)	1.396 (36)	0.419 (37)	0.351 (37)	0.865 (36)	0.161 (37)	0.192 (37)	0.301 (37)	0.302 (36)	0.249 (36)	0.429 (35)	0.7 (35)	1.224 (35)	1.495 (35)	1.309 (35)
S05	142.842 (7)	131.868 (6)	80.481 (7)	38.968 (18)	38.997 (19)	23.894 (30)	29.587 (28)	29.587 (26)	45.98 (13)	62.155 (6)	46.772 (7)	24.699 (14)	12.808 (23)	10.019 (23)	10.098 (21)	8.138 (21)	8 (18)	9.992 (16)	9.998 (18)	11.195 (16)	15.875 (13)	11.244 (23)	27.046 (8)	26.39 (9)	22.392 (8)
S06	28.591 (29)	28.972 (27)	23.488 (30)	16.273 (30)	25.302 (26)	33.171 (25)	29.573 (29)	29.66 (25)	18.549 (28)	14.778 (28)	11.159 (28)	9.703 (28)	8.635 (29)	8.951 (25)	7.768 (23)	6.506 (23)	4.927 (26)	3.788 (31)	3.081 (32)	3.278 (32)	3.74 (31)	3.997 (32)	7.004 (31)	5.549 (33)	6.676 (31)
S07	45.92 (25)	40.179 (24)	28.35 (27)	23.422 (27)	23.334 (28)	27.366 (28)	31.328 (27)	26.734 (28)	23.553 (26)	22.189 (21)	18.707 (21)	15.958 (20)	16.557 (19)	15.24 (18)	12.128 (18)	10.372 (19)	10.049 (15)	9.691 (17)	10.343 (16)	11.095 (17)	11.304 (21)	11.501 (21)	13.364 (21)	13.562 (22)	10.791 (23)
S08	112.772 (11)	89.69 (11)	75.801 (9)	70.593 (8)	78.281 (7)	76.252 (7)	83.712 (7)	64.901 (8)	48.054 (12)	51.061 (10)	30.357 (15)	32.463 (11)	29.066 (11)	31.597 (9)	23.446 (10)	20.197 (10)	11.003 (14)	14.304 (13)	13.453 (13)	11.963 (14)	10.313 (25)	10.06 (25)	11.787 (23)	11.63 (24)	9.35 (25)
S09	239.33 (2)	187.971 (2)	122.465 (5)	120.576 (4)	112.531 (5)	109.56 (4)	132.608 (4)	138.968 (3)	48.877 (11)	55.159 (8)	42.137 (9)	28.897 (12)	22.653 (14)	44.873 (6)	34.727 (6)	37.457 (4)	21.203 (6)	22.781 (6)	38.279 (5)	21.231 (6)	25.187 (6)	24.72 (6)	38.03 (7)	29.357 (8)	31.004 (7)
S10	98.947 (14)	93.65 (9)	73.834 (11)	59.516 (12)	62.591 (12)	60.742 (10)	73.632 (11)	62.896 (10)	43.394 (15)	55.073 (9)	45.25 (8)	41.007 (8)	37.556 (7)	32.515 (8)	17.813 (13)	23.696 (8)	20.995 (7)	20.482 (7)	19.315 (8)	19.317 (7)	19.28 (8)	20.577 (8)	26.309 (9)	35.146 (7)	21.226 (10)
S11	115.131 (10)	90.414 (10)	67.848 (13)	62.652 (10)	62.737 (11)	60.593 (11)	63.622 (12)	57.728 (12)	44.455 (14)	43.194 (14)	34.203 (12)	26.448 (13)	28.214 (12)	24.725 (13)	19.134 (12)	14.874 (14)	13.574 (11)	14.922 (11)	14.249 (12)	14.431 (12)	14.01 (16)	13.535 (17)	19.885 (14)	18.31 (18)	18.601 (14)
S12	8.652 (32)	5.883 (35)	4.314 (34)	2.286 (35)	3.238 (35)	3.036 (35)	3.068 (35)	3.113 (34)	1.762 (34)	2.381 (34)	2.054 (34)	1.421 (35)	2.176 (34)	1.942 (34)	1.352 (34)	1.622 (34)	0.544 (34)	0.458 (35)	0.318 (35)	0.282 (35)	0.318 (36)	0.348 (36)	0.751 (37)	0.561 (36)	0.739 (37)
S13	5.801 (36)	4.795 (36)	3.5 (36)	1.74 (36)	2.312 (36)	2.153 (36)	2.089 (36)	2.265 (36)	1.619 (35)	2.025 (35)	1.76 (35)	1.115 (37)	1.911 (35)	1.873 (35)	1.507 (33)	1.596 (35)	0.499 (35)	0.347 (36)	0.259 (37)	0.207 (37)	0.274 (37)	0.328 (37)	0.752 (36)	0.554 (37)	0.889 (36)
S14	64.634 (19)	49.785 (21)	40.425 (21)	35.017 (21)	34.353 (22)	35.335 (22)	41.682 (22)	35.22 (21)	24.294 (23)	23.257 (20)	17.804 (22)	15.535 (21)	15.728 (20)	14.496 (20)	11.583 (19)	10.723 (18)	5.406 (24)	5.879 (24)	6.203 (25)	5.718 (28)	5.555 (30)	5.912 (29)	7.388 (30)	7.437 (31)	6.023 (32)
S15	99.229 (13)	73.581 (16)	64.095 (15)	52.462 (14)	54.476 (14)	49.838 (15)	57.66 (16)	53.947 (13)	39.426 (16)	31.751 (17)	27.976 (16)	24.626 (15)	21.322 (15)	21.652 (14)	15.88 (14)	14.897 (13)	9.996 (16)	10.67 (15)	9.799 (19)	11.694 (15)	11.463 (20)	12.07 (19)	14.052 (20)	13.524 (23)	11.067 (22)
S16	50.436 (24)	53.585 (19)	38.258 (24)	32.353 (23)	38.571 (20)	41.036 (21)	51.761 (17)	36.044 (20)	27.937 (22)	21.893 (22)	20.113 (19)	17.114 (19)	10.934 (25)	15.023 (19)	10.741 (20)	11.29 (17)	7.855 (19)	9.284 (19)	8.995 (20)	8.605 (21)	8.161 (26)	10.409 (24)	14.48 (18)	18.961 (15)	20.982 (11)
S17	43.932 (26)	36.209 (26)	29.291 (26)	18.297 (28)	24.477 (27)	33.17 (26)	34.639 (24)	26.452 (29)	15.726 (29)	10.314 (30)	11.448 (27)	9.204 (29)	5.376 (31)	4.792 (31)	3.806 (30)	3.046 (33)	3.849 (29)	3.509 (32)	1.977 (33)	2.407 (33)	2.544 (32)	3.457 (33)	8.19 (28)	8.512 (28)	7.859 (27)
S18	112.458 (12)	87.1 (12)	72.092 (12)	61.881 (11)	69.656 (8)	67.495 (9)	75.492 (10)	63.94 (9)	53.796 (7)	48.525 (11)	40.455 (10)	43.958 (7)	60.354 (4)	54.739 (4)	44.573 (4)	22.489 (9)	11.21 (13)	14.858 (12)	11.955 (15)	12.775 (13)	11.03 (23)	11.824 (20)	11.476 (24)	14.822 (20)	11.363 (21)
S19	86.158 (15)	73.619 (15)	65.229 (14)	57.133 (13)	61.559 (13)	56.8 (14)	59.974 (13)	53.773 (14)	38.43 (17)	31.298 (18)	24.478 (17)	18.45 (18)	20.007 (16)	19.796 (15)	13.977 (17)	14.554 (15)	6.73 (21)	7.155 (21)	8.039 (21)	7.276 (25)	7.435 (27)	7.472 (28)	8.793 (26)	10.258 (26)	8.307 (26)

Source: Results obtained from the model developed in Chapter 4.

Table VIII.5 (cont'd)

Sec-Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15
S20	165.1 (5)	129.393 (7)	127.699 (4)	108.981 (6)	111.912 (6)	102.623 (5)	102.986 (5)	92.619 (6)	65.399 (5)	76.767 (5)	53.737 (6)	47.785 (6)	45.124 (6)	34.51 (7)	33.109 (7)	32.928 (6)	38.245 (4)	34.116 (4)	53.389 (2)	47.087 (2)	50.106 (2)	50.368 (2)	69.766 (2)	63.15 (2)	57.046 (2)
S21	73.491 (17)	58.733 (17)	50.441 (18)	40.745 (17)	40.491 (17)	48.942 (16)	49.981 (18)	43.228 (17)	29.604 (20)	19.67 (24)	15.792 (25)	13.855 (24)	10.539 (27)	8.484 (28)	6.198 (26)	6.415 (24)	5.56 (23)	6.616 (22)	6.665 (23)	7.721 (22)	11.245 (22)	14.803 (15)	20.215 (12)	22.533 (11)	20.084 (12)
S22	14.364 (30)	11.699 (31)	11.474 (31)	8.765 (32)	9.59 (31)	10.592 (32)	10.405 (33)	9.201 (33)	10.176 (32)	8.062 (32)	4.989 (32)	5.948 (31)	5.599 (30)	6.212 (30)	2.971 (31)	4.659 (27)	5.142 (25)	5.848 (25)	5.159 (28)	7.109 (26)	11.468 (19)	18.123 (12)	20.671 (11)	18.445 (16)	19.202 (13)
S23	30.324 (28)	21.671 (30)	51.569 (17)	38.128 (19)	20.016 (30)	42.415 (19)	44.515 (20)	30.708 (24)	23.983 (25)	11.001 (29)	16.467 (23)	13.657 (25)	9.666 (28)	8.495 (27)	5.665 (28)	4.334 (28)	3.512 (31)	3.984 (30)	4.11 (30)	4.634 (30)	5.947 (29)	8.156 (27)	7.978 (29)	8.247 (29)	7.598 (28)
S24	51.098 (23)	47.339 (22)	40.292 (22)	36.513 (20)	34.948 (21)	44.67 (18)	47.376 (19)	41.111 (18)	29.939 (19)	20.43 (23)	15.963 (24)	14.25 (22)	10.652 (26)	8.599 (26)	6.516 (25)	7.157 (22)	6.418 (22)	7.74 (20)	7.99 (22)	10.284 (19)	16.425 (12)	20.846 (7)	22.961 (10)	25.333 (10)	22.259 (9)
S25	11.327 (31)	11.694 (32)	9.701 (32)	9.639 (31)	9.447 (32)	11.807 (31)	12.684 (32)	11.342 (32)	9.29 (33)	7.376 (33)	4.726 (33)	4.422 (32)	2.609 (33)	3.918 (32)	0.128 (37)	3.206 (31)	3.879 (28)	4.947 (27)	5.562 (26)	7.302 (24)	12.242 (17)	15.706 (14)	19.588 (15)	20.544 (14)	17.751 (15)
S26	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)	0 (39)
S27	6.528 (34)	6.353 (33)	6.536 (33)	6.587 (33)	7.423 (33)	10.212 (33)	13.295 (31)	13.16 (31)	10.783 (31)	8.565 (31)	8.076 (31)	3.261 (33)	5.189 (32)	2.991 (33)	2.867 (32)	3.069 (32)	3.658 (30)	4.419 (28)	4.514 (29)	5.861 (27)	10.758 (24)	18.598 (11)	40.258 (6)	44.804 (6)	35.215 (6)
S28	60.802 (22)	50.304 (20)	49.487 (19)	42.322 (16)	39.801 (18)	34.643 (23)	38.025 (23)	28.551 (27)	19.58 (27)	16.27 (26)	10.342 (29)	14.193 (23)	13.891 (21)	12.762 (21)	6.088 (27)	4.732 (26)	3.017 (33)	5.449 (26)	5.356 (27)	7.608 (23)	19.423 (7)	12.578 (18)	10.916 (25)	18.356 (17)	11.695 (20)
S29	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)	0 (38)
S30	63.256 (20)	46.407 (23)	40.539 (20)	30.601 (24)	32.506 (23)	41.872 (20)	42.733 (21)	40.218 (19)	28.045 (21)	26.91 (19)	19.686 (20)	11.626 (27)	17.647 (18)	10.253 (22)	8.284 (22)	5.632 (25)	6.916 (20)	5.909 (23)	10.052 (17)	8.894 (20)	11.739 (18)	8.211 (26)	8.733 (27)	8.04 (30)	7.136 (30)
S31	8.009 (33)	26.707 (28)	26.993 (28)	24.25 (26)	26.205 (25)	33.864 (24)	34.616 (25)	32.764 (23)	24.005 (24)	17.914 (25)	13.343 (26)	13.251 (26)	11.96 (24)	8.208 (29)	6.723 (24)	3.508 (30)	4.611 (27)	4.238 (29)	6.382 (24)	5.256 (29)	7.331 (28)	4.887 (30)	4.708 (33)	5.557 (32)	4.684 (33)
S32	78.009 (16)	58.283 (18)	54.074 (16)	44.84 (15)	48.203 (15)	58.776 (12)	59.865 (14)	61.522 (11)	49.827 (9)	46.654 (13)	32.294 (14)	23.182 (16)	30.962 (10)	15.786 (17)	14.425 (16)	8.702 (20)	9.424 (17)	9.285 (18)	12.543 (14)	10.404 (18)	14.452 (15)	11.265 (22)	12.083 (22)	10.541 (25)	9.57 (24)
S33	116.131 (9)	97.715 (8)	78.504 (8)	70.844 (7)	67.516 (10)	57.859 (13)	57.729 (15)	53.635 (15)	49.856 (8)	55.29 (7)	54.017 (5)	48.934 (5)	34.518 (9)	31.442 (10)	23.617 (9)	25.445 (7)	19.42 (8)	19.512 (8)	18.221 (9)	17.733 (9)	18.976 (9)	19.894 (9)	19.486 (16)	20.606 (12)	17.182 (17)
S34	174.342 (3)	158.871 (4)	130.051 (3)	147.774 (2)	128.545 (3)	131.027 (3)	146.985 (2)	150.438 (2)	82.831 (4)	92.98 (3)	105.373 (2)	73.182 (3)	55.493 (5)	50.274 (5)	43.749 (5)	36.758 (5)	33.134 (5)	33.932 (5)	34.539 (6)	38.521 (5)	42.344 (5)	42.985 (5)	47.456 (5)	48.298 (5)	42.596 (5)
S35	117.378 (8)	83.302 (13)	75.669 (10)	64.286 (9)	68.322 (9)	71.167 (8)	78.078 (8)	67.687 (7)	55.046 (6)	47.375 (12)	34.08 (13)	33.35 (10)	25.756 (13)	25.329 (12)	20.64 (11)	17.548 (12)	14.394 (10)	15.285 (10)	14.577 (10)	14.919 (10)	17.947 (10)	17.964 (13)	20.149 (13)	20.562 (13)	17.734 (16)
S36	61.075 (21)	39.849 (25)	34.212 (25)	29.998 (25)	31.465 (24)	32.932 (27)	33.221 (26)	32.929 (22)	31.747 (18)	32.822 (16)	23.69 (18)	22.145 (17)	19.337 (17)	18.073 (16)	15.271 (15)	12.781 (16)	11.678 (12)	12.686 (14)	14.526 (11)	14.691 (11)	14.517 (14)	14.001 (16)	14.173 (19)	14.281 (21)	11.763 (19)
S37	164.924 (6)	180.892 (3)	148.358 (2)	127.459 (3)	131.02 (2)	142.408 (2)	143.145 (3)	136.103 (4)	127.534 (2)	83.497 (4)	71.762 (4)	65.561 (4)	77.212 (3)	69.924 (3)	51.737 (3)	53.171 (3)	50.7 (2)	52.996 (2)	47.105 (3)	45.439 (4)	47.52 (4)	47.023 (3)	55.916 (3)	62.642 (3)	50.642 (3)
S38	327.39 (1)	249.724 (1)	246.694 (1)	216.131 (1)	225.553 (1)	227.688 (1)	228.582 (1)	211.849 (1)	169.753 (1)	175.329 (1)	148.161 (1)	136.688 (1)	141.668 (1)	130.792 (1)	110.554 (1)	100.719 (1)	85.021 (1)	92.83 (1)	92.008 (1)	95.227 (1)	86.525 (1)	87.452 (1)	104.636 (1)	101.975 (1)	81.985 (1)
S39	171.79 (4)	145.684 (5)	116.751 (6)	119.038 (5)	124.462 (4)	93.624 (6)	96.954 (6)	96.398 (5)	127.499 (3)	135.049 (2)	103.86 (3)	103.567 (2)	86.313 (2)	80.662 (2)	67.298 (2)	61.822 (2)	48.407 (3)	49.202 (3)	41.503 (4)	45.867 (3)	48.722 (3)	46.603 (4)	52.065 (4)	57.166 (4)	45.472 (4)

Source: Results obtained from the model developed in Chapter 4.

Table VIII.6: Indirect employment multipliers and trends, IOI sectors, 1975-2015 (indexed, 1975=100)

Sector Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Trends
S02	100.00	64.06	71.48	44.23	46.85	64.17	61.28	61.35	37.52	36.71	19.39	13.93	28.59	20.22	11.69	8.19	7.61	5.51	8.30	6.72	2.32	9.61	14.76	22.03	18.71	▲ Increase
S03	100.00	140.76	56.01	73.60	85.30	46.65	56.78	34.46	23.81	17.47	22.82	22.28	4.40	0.00	20.56	0.00	0.00	0.00	1.63	0.00	0.59	13.31	38.27	45.49	41.25	▲ Increase
S04	100.00	8.27	328.32	163.57	86.64	18.71	49.16	394.08	595.23	823.28	390.19	288.97	0.00	0.00	196.49	0.00	0.00	30.73	37.42	0.80	0.00	201.66	413.83	648.43	347.43	▲ Slight Inc
S05	100.00	94.31	63.24	46.42	22.93	13.82	14.72	16.92	44.40	45.51	32.35	16.23	6.93	6.15	5.47	4.00	4.50	5.79	5.34	6.35	9.58	5.58	14.74	15.34	13.52	▼ Decrease
S06	100.00	124.56	117.56	75.38	125.80	161.00	141.95	153.73	112.05	75.75	58.03	50.69	43.45	47.20	40.76	37.39	31.06	23.07	16.19	15.90	19.56	19.05	35.80	25.26	35.79	▼ Decrease
S12	100.00	70.79	40.49	25.89	31.82	22.77	26.05	33.59	29.40	23.77	20.83	11.36	25.72	22.68	14.66	22.04	3.40	3.82	1.18	0.74	1.18	1.11	4.92	2.99	5.34	▼ Decrease
S13	100.00	124.22	64.20	40.24	37.43	26.33	31.40	42.50	78.48	51.66	40.89	16.21	55.35	63.15	61.87	64.63	2.45	0.82	-3.70	-5.00	0.20	2.13	15.48	9.03	25.74	▼ Decrease
S21	100.00	101.38	112.32	89.89	77.31	87.76	80.72	73.64	56.57	26.85	25.75	20.84	21.76	14.25	10.73	11.89	10.23	12.31	11.33	13.33	20.05	28.03	39.28	42.38	40.74	▼ Decrease
S22	100.00	125.66	183.28	123.54	145.94	112.08	107.62	133.36	323.44	220.72	115.15	144.10	593.85	580.42	249.66	398.32	483.23	464.29	301.45	484.69	930.98	1751.68	1940.90	1587.91	1835.02	▼ Decrease
S23	100.00	80.49	328.71	308.97	90.80	220.84	235.57	213.49	180.55	45.99	90.98	80.87	69.04	61.76	36.56	21.50	27.74	37.97	16.81	16.68	35.34	47.10	37.83	38.16	37.18	▼ Decrease
S24	100.00	138.12	131.40	148.33	122.36	135.61	141.53	142.82	114.52	58.69	56.48	45.54	50.10	32.92	25.16	31.03	29.60	34.43	32.44	45.81	75.86	99.68	104.36	110.29	104.56	▼ Decrease
S25	100.00	287.87	254.29	358.30	288.73	348.59	422.08	493.62	527.84	360.77	175.86	141.70	305.77	433.82	9.87	319.69	398.67	463.71	503.30	695.75	1363.74	1881.07	2379.06	2365.53	2173.13	▼ Decrease
S26	100.00	142.83	145.13	169.46	159.18	128.11	139.38	131.28	151.83	93.13	83.27	108.10	31.51	37.08	26.25	19.46	6.98	6.60	5.06	4.22	5.86	4.91	3.64	2.37	2.86	▼ Decrease
S27	100.00	139.86	186.65	199.43	198.54	260.54	326.68	358.22	336.62	194.68	217.01	55.42	180.08	76.82	77.70	87.81	116.98	143.71	127.57	170.96	353.40	656.49	1441.64	1537.73	1301.63	▼ Decrease
S28	100.00	110.82	128.07	115.97	94.03	76.95	74.37	64.54	49.92	35.65	19.31	30.42	32.11	34.49	17.58	14.90	12.06	26.86	29.11	49.60	122.02	69.33	57.12	135.19	71.74	▼ Decrease
S29	100.00	71.12	74.59	68.16	60.02	81.07	73.17	68.92	55.52	39.32	20.46	13.47	21.19	5.40	7.06	3.77	5.18	5.14	8.31	5.39	9.45	4.58	3.77	2.54	2.92	▼ Decrease
S30	100.00	74.69	79.43	71.09	65.26	85.66	77.60	68.70	55.98	45.09	28.15	18.53	31.62	15.09	13.05	7.30	8.79	8.69	14.00	10.57	16.18	10.29	9.25	7.37	7.53	▼ Decrease
S31	100.00	432.42	530.47	525.74	516.47	688.48	650.24	633.37	537.32	335.10	224.08	184.25	247.70	153.81	136.74	60.96	83.18	80.14	112.49	80.40	136.83	80.68	78.31	65.09	62.84	▼ Decrease
S32	100.00	105.68	107.11	97.61	96.40	119.88	110.75	103.14	87.33	83.94	71.90	39.59	66.28	34.37	32.00	19.10	23.33	22.18	40.13	31.85	46.46	29.34	26.76	20.38	20.55	▼ Decrease
S33	100.00	101.68	95.24	91.19	80.46	67.33	60.83	62.76	64.75	86.05	90.26	82.63	56.31	52.62	40.99	50.33	38.56	37.00	23.35	21.18	22.90	27.37	22.67	23.07	20.81	▼ Decrease

▲ Increase ▼ Decrease ▲ SlightInc ▼ Slight Dec

Source: Results obtained from the model developed in Chapter 4.

Table VIII.7: Induced employment multipliers and trends, IOI sectors, 1975-2015 (indexed, 1975=100)

Sector Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Trends
S02	100.00	70.13	68.20	43.70	54.05	72.74	74.93	67.20	41.15	41.57	24.20	20.29	34.49	25.97	13.94	9.98	8.96	7.13	9.54	8.87	3.62	10.78	17.65	24.41	19.64	Decrease
S03	100.00	100.56	60.41	57.62	70.11	56.90	63.69	41.25	23.36	28.49	28.17	27.99	10.79	6.36	17.82	3.95	4.87	7.47	7.37	7.46	9.47	15.77	25.85	33.82	30.92	Decrease
S04	100.00	44.13	36.78	19.97	47.43	4.80	10.34	111.63	97.20	126.53	85.10	87.64	26.31	22.06	54.33	10.12	12.04	18.91	18.94	15.66	26.94	43.93	76.83	93.84	82.17	Slight Dec
S05	100.00	92.32	56.34	27.28	27.30	16.73	20.71	20.71	32.19	43.51	32.74	17.29	8.97	7.01	7.07	5.70	5.60	7.00	7.00	7.84	11.11	7.87	18.93	18.47	15.68	Decrease
S06	100.00	101.33	82.15	56.92	88.50	116.02	103.44	103.74	64.88	51.69	39.03	33.94	30.20	31.31	27.17	22.76	17.23	13.25	10.78	11.47	13.08	13.98	24.50	19.41	23.35	Decrease
S12	100.00	67.99	49.86	26.42	37.42	35.09	35.46	35.98	20.36	27.52	23.74	16.42	25.15	22.45	15.63	18.74	6.29	5.29	3.67	3.26	3.68	4.02	8.69	6.49	8.54	Decrease
S13	100.00	82.66	60.34	29.99	39.85	37.11	36.01	39.05	27.91	34.91	30.35	19.22	32.94	32.30	25.98	27.51	8.61	5.98	4.46	3.57	4.73	5.65	12.97	9.56	15.33	Decrease
S21	100.00	79.92	68.63	55.44	55.10	66.60	68.01	58.82	40.28	26.77	21.49	18.85	14.34	11.54	8.43	8.73	7.57	9.00	9.07	10.51	15.30	20.14	27.51	30.66	27.33	Decrease
S22	100.00	81.45	79.88	61.02	66.76	73.74	72.43	64.06	70.84	56.13	34.73	41.41	38.98	43.24	20.68	32.44	35.79	40.71	35.91	49.49	79.83	126.17	143.90	128.40	133.68	Inc-Dec-Stable
S23	100.00	71.46	170.06	125.73	66.01	139.87	146.80	101.27	79.09	36.28	54.30	45.04	31.88	28.01	18.68	14.29	11.58	13.14	13.55	15.28	19.61	26.90	26.31	27.20	25.06	Decrease
S24	100.00	92.64	78.85	71.46	68.39	87.42	92.71	80.45	58.59	39.98	31.24	27.89	20.85	16.83	12.75	14.01	12.56	15.15	15.64	20.13	32.14	40.80	44.94	49.58	43.56	Decrease
S25	100.00	103.23	85.64	85.09	83.40	104.23	111.97	100.12	82.02	65.12	41.73	39.04	23.04	34.59	1.13	28.30	34.24	43.67	49.10	64.46	108.07	138.66	172.93	181.36	156.71	Increase
S26	100.00	123.24	110.83	107.76	103.09	105.75	121.61	99.25	93.18	49.69	32.17	40.21	12.37	12.87	6.73	5.02	1.77	1.90	1.76	1.59	1.92	1.72	1.06	0.77	0.90	Decrease
S27	100.00	97.32	100.12	100.89	113.70	156.43	203.65	201.58	165.18	131.20	123.71	49.96	79.48	45.81	43.92	47.00	56.04	67.68	69.14	89.78	164.78	284.89	616.67	686.30	539.42	Increase
S28	100.00	82.74	81.39	69.61	65.46	56.98	62.54	46.96	32.20	26.76	17.01	23.34	22.85	20.99	10.01	7.78	4.96	8.96	8.81	12.51	31.94	20.69	17.95	30.19	19.24	Decrease
S29	100.00	60.12	51.85	39.21	39.56	54.90	51.87	45.63	31.68	29.98	18.04	11.11	17.25	6.66	6.74	3.39	2.85	2.79	3.60	2.86	4.05	3.39	3.47	3.12	2.71	Decrease
S30	100.00	73.36	64.09	48.38	51.39	66.19	67.56	63.58	44.34	42.54	31.12	18.38	27.90	16.21	13.10	8.90	10.93	9.34	15.89	14.06	18.56	12.98	13.81	12.71	11.28	Slight Inc
S31	100.00	333.45	337.03	302.77	327.19	422.81	432.20	409.07	299.72	223.67	166.59	165.45	149.33	102.48	83.94	43.79	57.58	52.92	79.69	65.62	91.53	61.02	58.79	69.38	58.48	Decrease
S32	100.00	74.71	69.32	57.48	61.79	75.35	76.74	78.87	63.87	59.81	41.40	29.72	39.69	20.24	18.49	11.16	12.08	11.90	16.08	13.34	18.53	14.44	15.49	13.51	12.27	Decrease
S33	100.00	84.14	67.60	61.00	58.14	49.82	49.71	46.18	42.93	47.61	46.51	42.14	29.72	27.07	20.34	21.91	16.72	16.80	15.69	15.27	16.34	17.13	16.78	17.74	14.80	Slight Dec

▲ Increase ▼ Decrease ▲ Slight Inc ▼ Slight Dec ⌃ Inc-Dec-Stable

Source: Results obtained from the model developed in Chapter 4.

Table VIII.8: Indirect income multipliers and trends, 1975-2015 (indexed, 1975=100)

Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Trends
S02	100.00	101.53	104.92	91.46	100.08	105.93	120.35	115.62	95.09	92.42	106.88	99.48	113.37	117.36	148.88	150.94	149.10	145.31	169.95	149.46	178.01	199.13	184.31	196.04	186.47	Increase
S03	100.00	124.74	88.15	92.03	115.48	95.34	104.13	93.47	96.46	83.63	99.64	96.48	112.29	110.38	138.37	133.96	106.80	118.04	142.74	115.74	107.61	120.95	158.14	140.19	125.57	SlightInc
S04	100.00	94.85	243.71	176.83	115.22	162.58	184.80	120.01	136.42	160.25	145.85	123.98	113.36	139.59	167.50	150.49	203.91	241.14	269.78	224.80	161.32	195.12	184.01	222.24	145.28	Increase
S05	100.00	71.22	71.39	304.87	77.98	99.27	78.64	71.33	70.56	55.84	60.19	75.42	56.16	72.15	58.45	49.85	53.55	54.41	49.59	49.34	52.01	51.95	37.71	43.93	40.17	Decrease
S06	100.00	108.77	109.26	105.49	112.35	109.21	116.64	123.82	134.58	140.13	167.40	177.43	157.16	170.53	174.17	173.41	185.87	205.81	204.24	182.13	205.81	184.57	209.55	216.04	196.99	Increase
S12	100.00	101.85	64.49	97.92	91.11	76.03	100.14	151.87	218.26	147.34	124.62	109.27	61.06	72.10	63.49	81.41	66.11	101.32	72.22	80.75	103.58	102.34	113.91	140.34	122.60	SlightDec
S13	100.00	158.39	124.74	181.21	137.69	138.86	164.58	157.75	529.32	306.09	227.89	207.04	168.84	242.28	399.25	285.37	154.67	186.23	139.45	140.78	290.04	360.82	462.64	556.06	712.01	Increase
S21	100.00	114.06	146.32	124.79	123.29	147.74	154.85	144.24	156.16	139.26	191.38	87.38	171.46	155.17	190.15	166.67	171.72	163.80	202.56	220.64	296.02	428.95	840.58	1122.59	865.10	Increase
S22	100.00	109.21	117.66	118.76	123.54	108.13	110.59	121.60	152.39	163.51	171.92	133.46	434.09	370.07	401.84	308.27	330.75	255.59	243.12	279.49	459.66	838.46	1234.13	1169.72	1133.23	Increase
S23	100.00	126.97	98.83	144.87	138.39	118.68	167.94	160.50	173.20	181.72	215.35	107.11	197.13	250.55	180.90	116.14	347.06	210.45	103.11	95.22	252.28	330.20	264.12	289.00	254.04	SlightInc
S24	100.00	118.51	123.72	132.20	130.97	133.02	148.03	159.25	163.02	159.50	221.58	97.03	195.79	175.65	186.37	186.40	221.26	195.59	239.89	285.75	466.79	712.09	1054.40	1319.07	1037.44	Increase
S25	100.00	124.81	127.30	143.05	138.72	132.23	144.77	160.87	178.05	189.55	180.85	144.94	359.78	348.91	317.26	293.35	279.40	235.94	272.99	290.25	477.87	682.87	1096.12	1220.25	973.94	Increase
S26	100.00	104.23	106.02	114.00	116.47	97.47	97.28	106.22	115.01	118.94	129.47	130.16	137.56	136.83	141.51	136.04	130.96	125.77	116.62	112.83	123.32	120.29	134.68	130.75	126.79	Dec-Inc-Stable
S27	100.00	114.74	122.98	114.81	119.23	127.34	136.34	135.66	144.13	137.92	169.30	85.09	158.09	146.40	168.43	146.88	157.44	149.13	166.06	175.93	259.97	373.17	621.46	751.82	608.38	Increase
S28	100.00	120.89	113.93	109.57	122.95	136.39	137.68	159.65	170.72	197.40	187.50	117.92	129.73	148.71	233.21	328.79	870.54	794.41	295.67	308.62	415.27	593.57	383.50	480.72	515.57	Increase
S29	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Zero
S30	100.00	103.45	106.04	109.45	116.42	115.45	118.47	92.70	97.67	123.45	145.95	134.36	172.97	408.63	208.63	157.78	143.04	164.33	193.82	202.90	225.70	270.88	245.15	283.61	251.22	Increase
S31	100.00	120.04	116.85	115.90	211.68	98.22	79.14	40.40	42.38	83.61	79.49	128.21	211.35	128.34	82.62	46.58	52.52	38.18	42.43	50.50	53.40	59.14	578.29	73.29	62.54	Dec-Inc-Stable
S32	100.00	140.30	129.90	134.68	132.02	120.68	118.36	97.98	96.16	107.99	155.71	134.55	142.42	187.25	186.08	223.04	224.12	215.82	296.59	336.40	302.98	275.83	267.04	278.11	273.33	Increase
S09	100.00	99.02	89.20	88.28	89.57	95.52	102.93	102.59	100.16	110.60	105.48	103.60	486.86	2912.19	2961.80	126.24	94.89	113.55	124.41	119.62	129.06	141.67	163.64	191.87	172.37	Increase
S16	100.00	103.04	99.27	99.00	102.31	105.45	116.91	111.95	115.83	117.01	122.63	125.32	162.60	397.42	142.44	129.08	122.09	140.22	141.20	135.75	144.38	144.48	142.04	146.04	110.51	Increase
S17	100.00	91.70	85.01	87.17	95.15	88.86	84.86	102.68	96.87	120.00	97.98	93.45	102.76	95.93	80.66	176.21	146.87	131.73	169.79	159.60	232.16	208.82	224.63	214.31	231.16	Increase
S33	100.00	97.65	102.55	99.31	112.31	122.06	121.54	113.99	105.59	128.20	126.35	122.34	178.66	183.75	188.59	187.38	197.97	204.00	150.94	154.30	153.60	183.82	176.44	177.76	179.23	Increase
S35	100.00	116.09	110.06	98.27	100.94	95.50	94.07	93.34	95.63	107.65	124.50	120.02	151.41	161.11	150.47	155.42	154.01	152.64	151.72	155.21	150.45	150.80	155.55	157.55	155.69	Increase

▲ Increase ▼ Decrease ▲ SlightInc ▼ SlightDec ⇕ Stable Dec-Inc-Stable Inc-Dec-Stable Zero

Source: Results obtained from the model developed in Chapter 4.

Table VIII.9. Induced income multipliers and trends, 1975-2015 (indexed, 1975=100)

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Trends
S02	100.00	89.92	84.40	68.04	80.57	89.99	102.73	95.10	71.75	73.36	79.59	72.78	84.78	85.83	101.81	96.90	90.95	90.49	107.51	99.56	116.70	139.02	146.70	162.88	142.27	Slight Inc
S03	100.00	107.89	71.62	67.86	91.21	80.58	89.39	79.22	72.51	67.23	75.15	70.89	78.40	75.26	92.96	85.26	64.74	73.50	89.85	76.33	72.84	86.79	126.21	118.25	98.40	Stable
S04	100.00	85.39	182.47	123.13	91.67	130.45	150.70	99.21	99.08	119.86	106.38	89.08	78.59	93.73	111.11	94.77	120.98	146.87	166.91	145.12	107.07	136.78	145.52	183.44	112.87	Slight Inc
S05	100.00	66.69	59.50	210.12	63.70	81.55	68.35	59.92	53.21	47.37	49.01	56.29	43.23	52.54	43.98	36.48	36.55	38.52	36.35	37.19	40.38	42.08	38.15	43.94	37.70	Decrease
S06	100.00	95.36	86.00	75.95	88.27	91.94	97.86	99.55	94.55	102.36	116.74	119.05	106.15	112.79	113.59	107.20	107.95	121.54	122.74	114.68	131.38	125.18	159.42	171.67	144.66	Slight Inc
S12	100.00	89.97	52.15	72.09	73.07	63.77	85.65	125.02	161.81	114.19	94.26	80.20	45.27	52.24	45.54	55.50	42.81	67.20	48.87	56.76	74.11	77.27	96.27	124.26	99.48	Slight Dec
S13	100.00	135.56	97.74	127.13	106.70	111.74	134.67	126.24	370.03	224.56	164.18	144.49	118.94	165.70	267.81	183.36	95.19	117.06	89.81	94.07	195.52	256.37	367.73	463.09	542.93	Increase
S21	100.00	96.66	107.05	85.40	91.98	113.63	121.44	109.84	104.83	98.99	127.13	62.18	110.66	99.25	117.41	99.39	97.39	96.03	119.56	134.72	182.07	275.42	596.13	832.57	589.21	Increase
S22	100.00	91.24	86.03	77.47	85.83	87.83	91.28	90.69	92.56	100.73	99.75	79.33	215.41	182.10	193.52	144.93	147.28	120.93	119.69	140.67	225.61	423.22	690.90	688.13	610.96	Increase
S23	100.00	108.78	81.48	103.39	107.09	99.57	139.19	553.84	245.81	134.69	154.95	77.28	137.38	169.84	122.21	76.89	209.42	722.66	69.90	68.26	170.69	235.06	212.67	243.78	197.08	Slight Inc
S24	100.00	98.07	91.75	87.13	93.87	102.69	114.23	115.23	104.74	106.87	136.94	66.38	117.52	104.84	108.30	103.84	115.48	106.71	131.57	160.76	261.98	417.06	686.61	898.65	649.28	Increase
S25	100.00	98.37	90.03	87.18	92.71	97.87	106.34	108.54	103.77	113.05	104.51	84.73	182.87	174.43	157.05	140.07	127.88	114.00	133.22	146.72	236.73	351.87	623.31	726.86	534.12	Increase
S26	100.00	88.71	80.81	74.21	80.64	84.00	86.05	83.15	75.21	78.30	76.12	74.01	75.53	73.82	72.35	68.62	64.84	66.55	67.77	70.44	71.73	75.70	84.82	88.87	81.40	Decrease
S27	100.00	100.22	97.58	84.04	94.82	106.59	116.93	112.23	106.75	107.28	126.55	63.60	114.44	103.77	117.20	98.49	100.66	98.54	111.74	123.05	182.48	274.39	506.86	641.16	476.87	Increase
S28	100.00	98.23	86.21	76.16	89.26	100.76	105.29	111.34	104.36	123.98	115.31	77.01	82.65	90.04	128.80	170.25	417.97	392.25	151.05	163.83	224.74	335.73	244.82	319.78	313.76	Increase
S29	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	Zero
S30	100.00	90.21	82.80	76.22	87.34	91.98	96.42	78.40	71.57	90.21	101.20	88.96	112.44	246.16	127.99	94.85	84.19	96.10	115.33	124.98	140.32	174.28	177.49	213.64	174.39	Increase
S31	100.00	105.12	93.12	84.60	166.21	82.05	68.43	36.31	33.66	65.31	60.72	93.75	152.52	91.36	58.80	32.67	35.03	26.78	30.59	37.05	39.71	45.57	478.39	65.52	51.62	Stable
S32	100.00	101.65	88.05	80.20	86.80	88.16	89.95	82.50	72.38	79.79	92.94	80.31	84.11	94.98	92.76	100.63	96.58	95.76	125.23	143.85	134.85	131.64	143.99	156.16	140.58	Increase
S01	100.00	86.78	72.73	65.08	73.72	81.17	97.14	85.49	76.70	67.77	77.36	70.17	77.95	82.03	71.14	66.74	60.44	65.02	80.06	85.27	93.24	98.83	112.34	125.58	111.37	Increase
S07	100.00	94.38	83.56	77.63	89.37	90.61	99.95	86.27	80.79	80.54	84.12	77.43	84.03	85.78	80.11	74.28	68.66	72.86	73.81	74.66	75.93	82.53	93.00	102.39	90.59	Decrease
S08	100.00	90.62	80.46	67.09	79.74	80.90	87.80	81.37	79.69	80.74	74.94	80.74	91.01	90.18	87.28	77.60	68.47	61.46	69.43	74.90	71.96	78.52	80.02	80.88	74.47	Decrease
S09	100.00	89.56	71.25	65.68	71.15	78.19	86.60	84.92	71.06	81.56	75.57	71.38	85.47	82.53	99.04	79.96	57.44	69.38	78.28	77.28	84.62	98.00	126.74	154.60	127.96	Increase
S10	100.00	86.65	71.90	63.05	73.32	75.86	81.18	84.00	71.42	72.71	86.27	75.72	71.18	68.36	90.04	65.45	60.58	65.07	68.13	74.15	77.97	86.99	87.16	101.26	98.55	Slight Inc
S11	100.00	92.47	78.80	68.22	79.27	83.23	88.50	103.89	77.31	77.75	95.62	70.95	72.00	73.75	70.76	74.94	66.99	68.16	76.07	76.31	75.10	83.50	92.28	102.34	85.52	Slight Dec
S14	100.00	91.12	78.56	67.26	84.25	85.05	89.33	95.74	76.72	82.41	117.61	76.06	86.37	86.54	71.03	75.77	70.91	67.15	74.06	77.61	79.76	84.30	96.47	98.13	90.94	Slight Dec
S15	100.00	94.15	83.55	75.78	87.27	93.57	99.82	102.90	90.95	91.50	96.18	86.57	85.66	86.05	80.57	78.11	71.66	74.61	82.59	89.48	87.48	102.64	113.41	127.35	114.42	Slight Inc
S16	100.00	91.08	79.52	72.66	81.34	87.78	97.81	89.71	83.23	87.11	88.48	87.15	83.97	106.62	94.46	82.90	74.16	86.43	88.30	88.58	95.19	101.03	111.76	120.56	85.45	Increase
S17	100.00	81.86	69.47	64.53	76.33	75.88	74.78	84.88	72.28	91.31	74.31	68.52	74.58	68.95	58.35	115.06	91.66	84.75	110.06	107.88	159.02	151.31	182.62	183.00	180.27	Increase
S18	100.00	95.24	84.01	75.65	86.12	91.73	94.03	89.82	81.09	86.61	86.72	75.06	72.31	66.91	90.22	73.84	68.12	67.40	71.64	76.85	77.25	82.04	90.26	100.99	87.66	Decrease
S19	100.00	90.34	80.29	73.37	81.10	87.10	86.77	86.34	78.70	83.70	90.81	84.68	84.62	81.02	75.93	80.15	73.89	77.04	76.06	81.15	83.03	91.45	90.57	97.38	82.80	Stable
S20	100.00	90.22	79.11	70.79	82.61	85.23	89.82	85.76	74.99	74.91	83.08	72.13	78.94	81.17	71.70	81.03	75.23	73.08	69.99	80.85	70.98	87.58	107.55	104.19	86.97	Stable
S33	100.00	86.10	79.98	71.25	84.73	93.73	96.06	87.46	74.14	89.70	86.67	81.75	112.37	113.04	113.87	108.43	108.06	114.15	90.08	95.53	96.86	118.87	128.34	135.64	125.11	Increase
S34	100.00	85.73	76.14	69.68	75.55	80.74	82.89	82.50	77.74	85.99	71.42	79.11	94.81	91.99	88.46	84.97	80.22	83.08	83.01	85.76	83.47	88.66	101.22	108.44	96.09	Increase
S35	100.00	95.64	83.40	70.91	78.75	79.21	80.85	77.28	69.37	77.86	83.80	79.31	94.33	98.26	90.85	88.84	83.42	85.26	85.68	90.77	90.72	96.04	110.81	117.49	106.59	Increase
S36	100.00	76.91	69.31	65.94	75.55	80.70	81.18	78.52	72.90	69.42	70.68	65.38	85.74	82.59	79.36	76.96	72.00	75.14	73.85	75.26	80.06	82.97	95.83	101.85	92.85	Increase
S37	100.00	82.02	75.45	67.87	74.10	74.13	77.50	78.11	71.41	101.22	96.41	91.27	81.97	78.91	80.93	74.71	69.29	70.52	68.31	73.27	76.46	80.19	93.37	95.88	86.88	Stable
S38	100.00	90.00	81.59	74.40	81.84	84.00	86.22	84.07	74.63	80.65	77.57	74.70	74.95	73.17	72.39	69.06	66.06	67.37	69.22	72.31	77.33	81.34	88.29	93.74	85.20	Decrease
S39	100.00	81.87	70.24	67.52	74.58	79.22	81.78	93.25	72.39	81.30	80.79	71.19	82.32	80.81	78.24	71.86	69.26	72.50	78.62	82.18	85.91	90.15	106.12	110.51	98.86	Increase

Increase; Decrease; Slight Inc; Slight Dec; Stable; Dec-Inc-Stable; Inc-Dec-Stable; Zero

Source: Results obtained from the model developed in Chapter 4.

Table VIII.10: Induced value added multipliers, 1975 to 2015

Sec Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S01	0.8105	0.7744	0.5256	0.4594	0.5783	0.6228	0.8178	0.6262	0.6591	0.6203	0.7059	0.6389	0.6876	0.6957	0.6563	0.5162	0.5338	0.5365	0.6478	0.6477	0.6754	0.7206	0.8385	0.9252	0.7873	0.6683
S02	0.8566	0.8299	0.8153	0.6156	0.7724	0.9619	1.0698	0.9625	0.7025	0.7187	0.6557	0.6266	0.9726	0.9884	0.8473	0.6426	0.5962	0.5092	0.6710	0.6788	0.4371	0.7831	1.2071	1.3095	1.1230	0.8141
S03	0.7921	0.8415	0.5997	0.5300	0.7455	0.7047	0.7873	0.8073	0.6600	0.6469	0.5945	0.5665	0.2843	0.2410	0.3360	0.2272	0.1502	0.1843	0.1861	0.1858	0.2196	0.3450	0.5674	0.6029	0.6124	0.4967
S04	0.5299	0.5346	0.6995	0.5135	0.5554	0.6599	0.7664	0.6747	0.5694	0.6363	0.5261	0.4688	0.1842	0.1848	0.2576	0.1597	0.1608	0.2082	0.2016	0.2049	0.1926	0.3189	0.4597	0.5912	0.4965	0.4302
S05	2.3286	2.1327	1.6111	1.0288	1.5832	1.4370	1.5758	1.3099	1.1087	1.4822	1.5078	1.2662	0.9656	1.0162	1.0981	0.9092	0.8455	0.9667	0.9389	0.8750	1.1193	1.0841	1.4403	1.4252	1.2561	1.2925
S06	0.9799	0.9967	0.8358	0.6977	0.8961	1.0688	0.9913	1.0337	0.7916	0.8238	0.8554	0.7963	0.6720	0.7554	0.7475	0.6219	0.5182	0.4637	0.4494	0.4764	0.5387	0.5780	0.9343	0.9337	0.8877	0.7738
S07	1.3378	1.2187	0.9969	0.8538	0.9878	1.0555	1.1561	1.0758	0.9383	0.9092	0.9622	0.8743	0.8722	0.8926	0.8222	0.7638	0.7134	0.7061	0.7707	0.7903	0.8159	0.8801	1.0824	1.1258	0.9556	0.9423
S08	1.5817	1.2906	1.1129	0.9815	1.0842	1.1386	1.1801	1.1275	0.9067	0.9275	0.9067	0.7632	0.8737	0.9184	0.7922	0.6914	0.4203	0.4159	0.4580	0.4258	0.4011	0.4052	0.3807	0.3499	0.2828	0.7927
S09	1.5175	1.6802	0.9744	1.0150	0.9612	0.9587	1.1959	1.4274	0.6928	0.7986	0.6843	0.5464	0.4401	0.5735	0.4838	0.6362	0.3837	0.3728	0.5927	0.4143	0.4472	0.5749	0.9161	0.9999	0.9000	0.8075
S10	1.3752	1.3441	1.0143	0.8923	0.9901	1.0244	1.1634	1.0804	0.9292	1.0568	1.1247	1.0036	1.0584	1.0339	0.9429	0.8314	0.7631	0.7846	0.8001	0.8854	0.9008	1.0503	1.2795	1.3467	1.1656	1.0336
S11	1.7396	1.4951	1.2550	1.1729	1.2638	1.3222	1.3908	1.4093	1.1348	1.1586	1.1359	0.9546	1.0605	0.9940	0.9890	0.8780	0.8048	0.8522	0.8031	0.8418	0.8630	0.9143	1.1557	1.2499	1.0774	1.1167
S12	0.8029	0.7761	0.5284	0.4534	0.5840	0.5002	0.5933	0.8237	0.7448	0.6125	0.5983	0.4737	0.4107	0.4322	0.3857	0.3854	0.2184	0.2413	0.2024	0.2040	0.2120	0.2492	0.3165	0.3705	0.3204	0.4576
S13	0.5384	0.6326	0.4287	0.3452	0.4170	0.3547	0.4040	0.5994	0.6845	0.5208	0.5128	0.3718	0.3606	0.4168	0.4299	0.3793	0.2004	0.1830	0.1648	0.1499	0.1826	0.2350	0.3168	0.3660	0.3858	0.3832
S14	1.4747	1.2215	1.0298	0.9320	0.9945	1.0736	1.2157	1.1709	0.9185	0.8448	0.9100	0.7472	0.7570	0.7650	0.6455	0.7168	0.4954	0.4930	0.5415	0.5057	0.5204	0.5901	0.7297	0.7291	0.6145	0.8255
S15	1.5743	1.3144	1.1768	1.0159	1.1284	1.1674	1.2546	1.1915	1.0167	1.0291	1.0178	0.9303	0.8601	0.9428	0.8210	0.8039	0.7830	0.8034	0.7938	0.7997	0.8347	0.9743	1.2015	1.2698	1.0928	1.0319
S16	1.5012	1.4699	1.2277	1.1112	1.2494	1.3778	1.4277	1.1847	1.0814	1.0059	1.0063	0.9124	0.7235	0.7373	0.7937	0.8367	0.6556	0.6735	0.6305	0.6572	0.6200	0.7688	0.9981	1.1235	0.8829	0.9863
S17	1.2979	1.2087	1.0665	0.8379	1.0245	1.2494	1.3145	1.2174	1.0078	0.8892	1.0104	0.8259	0.7353	0.8011	0.7855	0.6126	0.5894	0.5671	0.4648	0.5436	0.6659	0.7957	1.3198	1.4572	1.1960	0.9394
S18	1.7236	1.4601	1.2924	1.1592	1.2837	1.3439	1.3894	1.3179	1.1279	1.1378	1.1133	1.0978	1.1461	1.1281	1.0676	0.9331	0.8124	0.8969	0.7546	0.8554	0.8359	0.9717	1.1774	1.2748	1.0432	1.1338
S19	1.5942	1.3382	1.1880	1.0836	1.1478	1.1875	1.2050	1.1009	0.9087	0.8762	0.8744	0.7414	0.7702	0.7617	0.6633	0.6723	0.4053	0.4121	0.4318	0.3989	0.4020	0.4170	0.4886	0.5156	0.4118	0.7999
S20	1.5939	1.2896	1.2810	1.1238	1.2546	1.2622	1.3012	1.2810	1.0592	1.1525	1.1070	1.0444	1.0597	1.0017	0.9022	0.8526	0.6374	0.6062	0.6097	0.4836	0.4960	0.5735	0.6911	0.6980	0.5810	0.9577
S21	1.4815	1.2912	1.1741	0.9815	1.0761	1.3605	1.4702	1.3524	1.1029	1.0627	1.0557	0.6914	0.7963	0.7759	0.7121	0.6886	0.7075	0.7317	0.9030	0.9809	1.3298	1.9642	3.1385	3.9708	3.1774	1.3591
S22	1.3572	1.1838	1.0893	0.8973	0.9601	1.2322	1.2754	1.1447	0.9745	0.9470	0.8133	0.6862	0.8278	0.8093	0.7234	0.7016	0.7216	0.7450	0.8804	0.9883	1.3641	2.1656	3.1354	3.5204	3.0738	1.2887
S23	1.0187	0.8615	1.1800	0.9172	0.8513	1.2914	1.3894	1.0560	0.9595	0.9304	1.0921	0.6581	0.7193	0.7009	0.6087	0.5790	0.5028	0.4963	0.7590	0.8378	0.9392	1.4198	1.9543	2.3674	1.9515	1.0417
S24	1.4330	1.2719	1.1775	0.9863	1.0602	1.3805	1.4786	1.3459	1.1271	1.0808	1.0602	0.6936	0.7752	0.7498	0.6688	0.6897	0.7283	0.7684	0.9501	1.0646	1.6035	2.3294	3.3349	4.2042	3.3390	1.4121
S25	1.3554	1.1781	1.0745	0.8881	0.9615	1.2083	1.2604	1.1571	0.9740	0.9563	0.8218	0.6997	0.8012	0.7985	0.6801	0.6931	0.6956	0.7336	0.8974	0.9956	1.4024	2.0169	3.0401	3.7229	2.9448	1.2783
S26	1.3247	1.1633	1.0711	0.8803	0.9244	1.2103	1.2384	1.0913	0.8933	0.8396	0.6785	0.6504	0.6017	0.5822	0.4936	0.5234	0.5447	0.6125	0.7315	0.8010	0.7041	0.7953	0.7125	0.8092	0.7919	0.8268
S27	0.4560	0.4320	0.4408	0.4061	0.4706	0.6415	0.7770	0.7583	0.6741	0.7071	0.7639	0.3395	0.5683	0.4620	0.4846	0.4816	0.5742	0.5993	0.7530	0.8653	1.3027	2.2016	4.4218	5.5864	4.2075	1.1750
S28	1.3259	1.1321	1.0803	0.9264	1.0032	1.0473	1.1793	1.0111	0.8003	0.8964	0.8487	0.7292	0.7173	0.6992	0.5478	0.6272	0.4860	0.4953	0.3479	0.3776	0.7267	0.8048	0.7309	0.7903	0.7283	0.8024
S29	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S30	0.8988	0.8076	0.7088	0.5552	0.6337	0.7289	0.7723	0.7843	0.6174	0.6963	0.7433	0.5055	0.6252	0.6971	0.5360	0.4828	0.5591	0.4779	0.6645	0.6974	0.7557	0.7197	0.8145	0.9059	0.7708	0.6863
S31	1.3327	1.1728	1.0216	0.8527	1.0390	1.0222	1.0283	0.9013	0.7205	0.8806	0.8743	1.2961	0.7944	0.7007	0.5773	0.4442	0.5484	0.4292	0.6099	0.6534	0.6973	0.6267	1.0290	0.8587	0.7153	0.8331
S32	1.6956	1.4978	1.3477	1.1191	1.2540	1.3481	1.4027	1.5155	1.3070	1.3620	1.3755	1.1244	1.1862	1.0408	0.9882	0.9688	0.9689	0.9256	1.0178	1.0095	1.0929	1.1348	1.3778	1.4679	1.2781	1.2323
S33	1.7981	1.5527	1.3396	1.1787	1.2954	1.2474	1.3304	1.2161	1.0783	1.0659	1.0881	1.0220	0.9666	0.9581	0.8705	0.8993	0.8208	0.8369	0.9975	1.0467	1.0816	1.0814	1.2879	1.3790	1.2380	1.1471
S34	1.6940	1.4806	1.3266	1.2263	1.3189	1.3868	1.4707	1.4047	1.1648	1.2799	1.3747	1.2136	1.1252	1.1407	1.1174	1.0358	0.9915	1.0007	0.9924	1.1080	1.1721	1.2637	1.5448	1.6405	1.4622	1.2775
S35	1.7172	1.4399	1.2963	1.1734	1.3146	1.3064	1.3764	1.3254	1.1021	1.0835	1.0482	1.0238	0.9661	1.0461	0.9197	0.8673	0.7884	0.8172	0.7565	0.7798	0.8769	0.9533	1.1983	1.2623	1.1389	1.1031
S36	1.0546	0.9564	0.8528	0.7658	0.8358	0.9034	0.9381	0.9132	0.7978	0.9531	0.9142	0.8562	0.8952	0.8886	0.8934	0.8261	0.7862	0.8235	0.8474	0.8815	0.8794	0.9781	1.1090	1.1797	1.0361	0.9106
S37	2.2399	2.1980	1.9779	1.7487	1.9011	2.0474	2.0162	1.9509	1.7435	1.5758	1.5126	1.4256	1.4618	1.4545	1.3562	1.3245	1.2713	1.3148	1.3568	1.3753	1.4192	1.5389	2.0605	2.1861	1.9171	1.6950
S38	2.4186	2.1641	2.0129	1.8687	2.0475	2.0315	2.0739	2.0282	1.8667	1.8595	1.8499	1.7526	1.7559	1.7332	1.6765	1.6080	1.5190	1.5636	1.5742	1.6253	1.6094	1.7492	2.2118	2.2956	2.0411	1.8775
S39	1.6439	1.5827	1.5627	1.3138	1.4161	1.3991	1.4530	1.3604	1.3651	1.4704	1.4675	1.3906	1.3041	1.3346	1.2733	1.2262	1.1213	1.1364	0.9961	1.0259	1.0752	1.1504	1.4707	1.5723	1.3518	1.3385

Source: Results obtained from the model developed in Chapter 4.

Table VIII.11: Indirect value added multipliers, 1975 to 2015

Sect. Code	1974-75	1977-78	1978-79	1979-80	1980-81	1981-82	1982-83	1983-84	1986-87	1989-90	1992-93	1993-94	1994-95	1996-97	1998-99	2001-02	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2012-13	2013-14	2014-15	Overall Avg
S01	0.2778	0.3293	0.2421	0.2349	0.2773	0.2907	0.3875	0.3032	0.3463	0.2917	0.3681	0.3340	0.3842	0.4096	0.3765	0.3288	0.3289	0.3407	0.4298	0.4282	0.4570	0.4737	0.4978	0.5340	0.4918	0.3666
S02	0.1934	0.2280	0.2570	0.1772	0.2215	0.2898	0.3460	0.3364	0.2181	0.2095	0.2579	0.2070	0.3868	0.4141	0.4293	0.3590	0.3706	0.2789	0.4114	0.3821	0.2552	0.4698	0.6046	0.6448	0.5805	0.3412
S03	0.1868	0.2993	0.1554	0.1760	0.2680	0.2042	0.2363	0.2466	0.2306	0.1664	0.2233	0.2068	0.1163	0.0958	0.1650	0.1202	0.0711	0.0907	0.1084	0.0830	0.1047	0.1658	0.2735	0.2556	0.2643	0.1806
S04	0.0834	0.0890	0.3544	0.2594	0.1447	0.2556	0.2974	0.2004	0.2172	0.2499	0.2218	0.1658	0.0518	0.0719	0.1199	0.0759	0.1255	0.1551	0.1613	0.1320	0.1328	0.2048	0.2192	0.2970	0.1996	0.1794
S05	0.8029	0.6876	0.6978	0.8056	0.7291	0.7523	0.7145	0.6149	0.5694	0.6124	0.6902	0.7346	0.4255	0.5383	0.5186	0.3982	0.4311	0.4861	0.4288	0.3798	0.5208	0.4602	0.3917	0.4329	0.3827	0.5682
S06	0.2047	0.2852	0.2732	0.2403	0.2991	0.3342	0.3213	0.3733	0.3490	0.3505	0.4586	0.4249	0.3392	0.4002	0.3930	0.3755	0.3625	0.3089	0.3055	0.3004	0.3394	0.3342	0.5147	0.4996	0.4725	0.3544
S07	0.6170	0.6320	0.6604	0.6491	0.6528	0.6304	0.6272	0.6240	0.5927	0.5906	0.6005	0.5671	0.5467	0.5693	0.5456	0.5740	0.5312	0.5260	0.5210	0.5166	0.5294	0.5457	0.6174	0.6318	0.5854	0.5874
S08	0.3762	0.3821	0.3683	0.3198	0.3631	0.3432	0.3706	0.3656	0.3749	0.3478	0.3352	0.3304	0.4445	0.4710	0.4175	0.3786	0.2195	0.1734	0.2058	0.1883	0.1697	0.1726	0.1290	0.1179	0.1054	0.2988
S09	0.4383	0.5760	0.3519	0.3840	0.3374	0.3538	0.4398	0.6301	0.3401	0.4096	0.3574	0.2967	0.3840	0.5296	0.4715	0.4118	0.2025	0.2195	0.3742	0.2394	0.2780	0.3325	0.5720	0.5978	0.5496	0.4031
S10	0.4272	0.4759	0.3763	0.3561	0.3826	0.3683	0.4067	0.4365	0.4087	0.4081	0.5030	0.4492	0.4644	0.4531	0.5520	0.4158	0.3889	0.4084	0.4163	0.4613	0.4782	0.5519	0.5500	0.6172	0.5949	0.4540
S11	0.3901	0.4436	0.3686	0.3477	0.3892	0.3830	0.4074	0.5439	0.4047	0.3796	0.4735	0.3270	0.3758	0.3716	0.3653	0.3894	0.3558	0.3592	0.3629	0.3504	0.3472	0.3743	0.4285	0.4734	0.3995	0.3925
S12	0.5755	0.6130	0.4191	0.4726	0.4929	0.3543	0.4044	0.6445	0.6643	0.5827	0.6292	0.5333	0.4323	0.5261	0.4388	0.5871	0.4259	0.4049	0.3890	0.3616	0.3702	0.3421	0.3263	0.3668	0.3011	0.4663
S13	0.1803	0.3580	0.2256	0.2784	0.2319	0.1731	0.2011	0.3159	0.5783	0.4389	0.4450	0.3386	0.3195	0.4785	0.5462	0.5561	0.3020	0.2387	0.2202	0.1805	0.2930	0.3137	0.3266	0.3612	0.3790	0.3312
S14	0.4260	0.4520	0.3972	0.3716	0.4223	0.3996	0.4472	0.5133	0.4153	0.3901	0.4996	0.3636	0.3981	0.4207	0.3221	0.4070	0.2976	0.2670	0.3064	0.2821	0.2982	0.3198	0.3609	0.3371	0.3029	0.3767
S15	0.4255	0.4553	0.4452	0.4247	0.4469	0.4412	0.4828	0.5085	0.4932	0.4721	0.5190	0.4708	0.4422	0.4826	0.4378	0.4519	0.4378	0.4512	0.4707	0.4720	0.4616	0.5500	0.5935	0.6242	0.5617	0.4809
S16	0.4945	0.5372	0.4995	0.5050	0.5053	0.5169	0.5539	0.5098	0.5335	0.5231	0.5492	0.5124	0.4642	0.6038	0.5478	0.5364	0.4410	0.4989	0.4791	0.4662	0.4484	0.5311	0.6422	0.6032	0.4352	0.5175
S17	0.6395	0.6120	0.6093	0.5838	0.5975	0.5964	0.6310	0.6669	0.6530	0.6465	0.7008	0.5730	0.5540	0.5539	0.5079	0.6204	0.6437	0.6564	0.6210	0.6343	0.7495	0.8519	1.1877	1.2588	1.0660	0.6966
S18	0.4278	0.4476	0.4359	0.4305	0.4430	0.4259	0.4277	0.4694	0.4545	0.4695	0.4696	0.4143	0.4395	0.4046	0.5591	0.4345	0.3943	0.4041	0.3659	0.4091	0.3948	0.4337	0.4525	0.4855	0.3988	0.4357
S19	0.3518	0.3710	0.3464	0.3494	0.3440	0.3399	0.3314	0.3486	0.3321	0.3279	0.3664	0.3114	0.3320	0.3245	0.2751	0.3218	0.2027	0.2065	0.2083	0.1916	0.1966	0.1982	0.1787	0.1834	0.1445	0.2834
S20	0.4060	0.4099	0.4289	0.4082	0.4487	0.4100	0.4201	0.4525	0.4101	0.4041	0.4513	0.3934	0.4717	0.4553	0.3878	0.4423	0.3456	0.3059	0.2877	0.2433	0.2212	0.2783	0.3211	0.2925	0.2363	0.3733
S21	0.4365	0.5051	0.6352	0.5448	0.5180	0.6571	0.6972	0.6580	0.6960	0.6327	0.9029	0.2552	0.4487	0.4545	0.5272	0.5054	0.5534	0.5637	0.6850	0.7307	1.3885	1.8339	3.0613	3.5120	2.9856	0.9755
S22	0.1100	0.1441	0.1780	0.1610	0.1612	0.1621	0.1756	0.1945	0.2854	0.3105	0.3360	0.1301	0.5164	0.5046	0.4891	0.4485	0.5300	0.4490	0.4793	0.5660	1.2837	2.0298	3.0470	3.0115	2.8230	0.7410
S23	0.5876	0.6118	0.5984	0.7069	0.6073	0.6717	0.7913	0.9799	0.9697	0.7579	1.0590	0.4976	0.6612	0.7630	0.6856	0.5387	0.7675	0.8268	0.5727	0.5371	1.1600	1.4605	1.7548	1.9120	1.6743	0.8861
S24	0.2958	0.3832	0.4075	0.4327	0.4102	0.4743	0.5458	0.5701	0.5780	0.5635	0.8391	0.1636	0.4046	0.4057	0.4302	0.4388	0.5455	0.5106	0.6553	0.7486	1.6836	2.2488	3.2839	3.7331	3.1413	0.9558
S25	0.1146	0.2099	0.2221	0.2609	0.2175	0.2537	0.2981	0.3322	0.3578	0.3756	0.3584	0.1706	0.4600	0.4772	0.3863	0.4233	0.4607	0.4175	0.5366	0.5912	1.3492	1.8288	2.9328	3.2197	2.6672	0.7569
S26	0.0026	0.0071	0.0081	0.0094	0.0069	0.0063	0.0080	0.0091	0.0104	0.0073	0.0043	0.0057	0.0140	0.0126	0.0073	0.0051	0.0023	0.0018	0.0019	0.0017	0.0009	0.0012	0.0013	0.0011	0.0011	0.0055
S27	0.1402	0.1817	0.2159	0.2189	0.2340	0.2901	0.3537	0.3778	0.4292	0.4436	0.6426	0.1293	0.3339	0.2853	0.3654	0.3540	0.4674	0.4746	0.5519	0.6153	1.3595	2.0617	4.2709	4.8715	3.8906	0.9423
S28	0.2494	0.3096	0.2823	0.2440	0.2931	0.3327	0.3711	0.4067	0.4093	0.5013	0.5113	0.1833	0.2121	0.2586	0.3023	0.4454	0.4671	0.4473	0.2237	0.2352	0.4997	0.6568	0.5712	0.5893	0.6027	0.3842
S29	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
S30	0.1240	0.1473	0.1495	0.1383	0.1630	0.1703	0.1844	0.1193	0.1199	0.2398	0.3117	0.2079	0.2901	0.5041	0.3113	0.2229	0.2473	0.2354	0.3632	0.3772	0.4323	0.4327	0.4865	0.5240	0.4496	0.2781
S31	0.5133	0.5906	0.5674	0.5258	0.6562	0.5166	0.4711	0.2887	0.2742	0.5314	0.5432	0.8942	0.6248	0.5484	0.4445	0.3578	0.4555	0.2643	0.3616	0.4273	0.4720	0.4530	1.3260	0.6195	0.5235	0.5300
S32	0.1015	0.2463	0.2107	0.1978	0.1804	0.1620	0.1597	0.1285	0.0999	0.1592	0.3057	0.1947	0.2392	0.3145	0.3026	0.3922	0.4209	0.3683	0.5348	0.5563	0.5464	0.5029	0.6111	0.5931	0.5547	0.3233
S33	0.4287	0.4113	0.4026	0.3791	0.4327	0.4149	0.4284	0.4036	0.3669	0.4269	0.4559	0.4290	0.5291	0.5442	0.5194	0.5553	0.5594	0.5599	0.5343	0.5461	0.5570	0.5944	0.5865	0.5983	0.5892	0.4901
S34	0.2569	0.2679	0.2419	0.2497	0.2479	0.2633	0.2741	0.2942	0.3175	0.3785	0.2737	0.3637	0.4333	0.4397	0.4267	0.4298	0.4343	0.4342	0.3983	0.4192	0.4143	0.4327	0.4927	0.5112	0.4746	0.3668
S35	0.3093	0.3785	0.3474	0.3102	0.3349	0.2904	0.2937	0.2984	0.2818	0.3189	0.3806	0.3748	0.4148	0.4861	0.4094	0.4249	0.4118	0.4094	0.3653	0.3720	0.3964	0.4076	0.4712	0.4785	0.4635	0.3772
S36	0.2524	0.1990	0.1907	0.2148	0.2441	0.2575	0.2482	0.2534	0.2610	0.2388	0.2606	0.2291	0.3706	0.3649	0.3543	0.3616	0.3560	0.3667	0.3482	0.3382	0.3580	0.3676	0.3941	0.4021	0.3903	0.3049
S37	0.4125	0.3107	0.3192	0.2954	0.2906	0.2361	0.2572	0.3266	0.3447	0.5300	0.5412	0.4997	0.4122	0.4058	0.4207	0.4040	0.3946	0.3819	0.3406	0.3620	0.3893	0.3968	0.5746	0.5390	0.4968	0.3953
S38	0.1336	0.1893	0.1900	0.1888	0.2072	0.1660	0.1718	0.1949	0.1757	0.2129	0.2065	0.1872	0.1771	0.1724	0.1746	0.1725	0.1812	0.1696	0.1776	0.1816	0.2424	0.2463	0.2332	0.2479	0.2302	0.1932
S39	0.3013	0.3107	0.2786	0.3076	0.3181	0.3089	0.3181	0.4312	0.3623	0.4339	0.4629	0.3838	0.4448	0.4673	0.4385	0.4217	0.4134	0.4286	0.4029	0.4002	0.4288	0.4381	0.5442	0.5461	0.5003	0.4037

Source: Results obtained from the model developed in Chapter 4.

Table VIII.12: Elasticity of sectoral supply indices, 1975 to 2015

Sect Code	1978-75	1979-78	1980-79	1981-80	1982-81	1983-82	1984-83	1987-84	1990-87	1993-90	1994-93	1995-94	1997-95	1999-97	2002-99	2005-01	2006-05	2007-06	2008-07	2009-08	2010-09	2013-10	2014-13	2015-14
S01	1.21	-4.98	0.83	0.24	-1.78	-0.46	0.48	0.66	-3.92	-0.22	4.92	0.04	-0.30	-12.48	6.95	1.55	0.15	0.58	0.95	0.67	0.63	4.37	1.08	1.93
S02	1.00	-5.41	-78.94	0.46	-7.59	-0.25	-5.80	1.49	1.42	-0.16	7.49	-0.78	-1.50	2.82	1.21	0.03	6.62	1.07	7.94	0.58	-1.97	0.86	20.20	0.10
S03	3.29	0.08	-0.33	5.13	0.39	0.14	-0.64	0.19	-0.07	2.04	0.94	1.60	0.29	-8.20	0.32	0.29	1.74	6.55	-0.46	0.33	-2.19	40.28	0.25	0.61
S04	0.41	-4.51	3.41	3.08	-0.98	0.89	11.20	-3.56	1.98	-0.16	0.46	-1.33	-0.61	0.17	1.03	0.07	0.32	-0.89	-0.80	2.15	0.20	0.47	-0.87	0.43
S05	0.36	0.89	0.29	0.56	0.69	-0.87	-0.28	0.99	1.07	-0.45	1.02	0.52	0.73	-0.86	0.33	0.48	0.68	1.60	0.68	0.30	-0.32	1.06	1.58	-0.19
S06	0.00	-4.36	2.67	-0.88	-13.59	1.96	0.01	0.92	0.79	-1.34	-1.01	-13.70	0.02	0.44	0.17	0.95	1.45	1.21	-0.38	-0.40	0.73	0.43	2.89	0.82
S07	-1.42	0.84	14.60	-0.59	0.73	-1.74	-20.29	-7.88	3.18	-0.60	-0.14	11.63	-2.78	6.78	0.10	1.22	-4.82	-0.04	28.24	0.03	2.03	2.10	3.12	0.32
S08	-9.17	6.02	0.16	-2.92	-11.86	0.49	0.34	4.50	0.84	-0.73	-1.71	-0.78	3.48	-7.67	0.67	0.24	0.61	-0.03	5.62	-0.59	0.33	-0.19	-0.51	4.13
S09	-2.98	-7.98	0.55	-2.17	1.45	-0.68	-8.21	227.80	-0.71	0.65	2.86	-0.46	-0.74	1.13	-1.98	-0.59	-0.97	-2.36	-2.78	5.50	-0.11	0.57	0.27	-4.42
S10	3.50	-5.64	1.63	-1.03	-0.69	1.64	-0.43	2.85	1.45	-0.08	11.70	0.68	0.69	0.58	0.53	1.13	1.06	-0.58	1.67	0.00	0.89	0.63	0.03	0.58
S11	2.52	0.90	-0.53	0.39	2.16	-2.33	0.07	30.98	2.67	0.45	-0.10	0.38	1.11	1.56	0.20	3.78	0.89	3.30	0.80	-1.39	-5.09	0.89	0.33	0.86
S12	0.30	-0.41	0.88	2.20	-0.31	0.28	0.14	0.71	0.83	1.08	-0.16	0.62	-0.28	-1.34	0.59	1.28	1.47	0.96	1.36	0.37	0.70	-0.76	0.86	0.65
S13	-0.73	-0.95	0.72	-8.79	-0.02	0.06	-0.10	-1.61	0.31	0.80	-0.44	0.61	-0.23	0.27	0.91	-0.69	3.87	2.44	-26.26	-0.55	1.39	1.24	0.99	3.25
S14	2.68	25.07	2.00	0.05	-1.28	1.80	-1.31	8.02	-3.68	0.02	-0.29	0.60	0.31	-0.92	-0.11	2.35	0.78	-0.13	3.10	7.08	2.43	0.28	0.49	0.49
S15	0.26	4.21	1.30	0.60	1.06	1.72	0.67	0.78	1.36	0.10	-0.09	1.72	3.37	3.63	1.92	0.89	1.25	-1.87	-0.63	-0.86	0.35	0.25	0.82	0.42
S16	1.15	2.46	0.78	1.37	-3.51	0.95	0.52	0.28	0.73	1.29	0.55	2.93	2.71	2.71	2.35	1.46	0.61	0.59	1.11	2.51	1.14	0.52	0.82	0.61
S17	2.87	3.16	1.35	3.87	1.40	1.45	0.47	1.44	0.96	2.69	12.01	0.02	3.09	0.01	0.03	3.00	-1.27	2.14	2.43	2.37	0.84	3.19	1.09	-71.65
S18	-0.46	4.20	0.84	0.73	-6.51	1.00	-0.44	2.30	0.56	0.51	-2.42	1.17	-1.32	0.20	3.02	1.04	0.83	0.28	0.19	9.58	0.81	0.31	0.10	0.10
S19	3.30	-7.37	0.78	-0.41	0.44	0.43	-0.87	3.00	0.02	-1.91	14.29	1.28	2.93	7.92	0.09	2.86	-6.13	0.97	-1.89	-0.50	-0.10	0.03	-3.17	0.63
S20	-5.00	2.99	1.53	-0.91	-13.75	0.15	-3.95	3.98	-1.03	-0.54	7.90	11.84	-1.27	-2.52	-0.29	3.26	-0.11	1.24	0.24	0.83	0.04	0.31	0.52	23.76
S21	0.45	0.21	-2.92	-13.98	0.19	0.95	-1.42	0.92	-2.05	0.11	0.54	-0.01	-0.71	0.20	-0.53	0.50	-0.48	0.35	-0.29	0.27	0.66	1.17	0.01	1.08
S22	0.71	-0.86	9.69	3.38	1.61	0.90	0.60	-5.34	2.79	6.80	0.75	-0.06	-0.57	1.57	2.31	0.76	-19.05	2.07	-0.73	2.21	0.40	1.48	1.05	1.54
S23	0.33	-0.14	0.30	0.08	-0.27	0.33	0.11	-7.11	0.36	-0.11	0.80	-0.06	-0.90	1.18	-5.10	0.06	-0.24	-0.26	-1.22	0.49	0.98	16.36	1.34	4.90
S24	0.47	0.58	2.92	6.11	0.39	0.72	0.74	4.96	-6.33	0.02	0.45	-0.01	-0.53	0.89	6.06	0.11	0.78	0.13	0.19	2.86	0.52	1.14	0.42	1.15
S25	0.15	0.69	3.80	0.10	0.53	0.74	0.69	-2.69	-1.99	-3.22	1.00	0.04	-1.56	4.38	44.23	1.88	0.14	1.08	1.00	2.84	0.69	1.32	0.75	1.21
S26	-0.50	-5.47	2.11	-0.44	0.30	0.73	0.58	-2.92	-1.41	-0.08	5.85	0.00	-0.40	-0.52	0.60	0.35	0.27	0.92	-0.08	0.00	-1.53	0.57	0.00	7.85
S27	0.42	0.65	13.76	0.75	0.40	0.80	1.43	1.30	49.52	0.46	0.56	-0.01	-0.70	0.22	-1.99	0.43	-0.34	0.97	-0.16	4.08	0.68	1.42	0.37	1.36
S28	0.62	0.09	-8.66	0.40	0.71	0.57	1.57	1.85	0.63	7.00	0.17	-3.49	-0.58	3.36	-0.01	-0.74	-2.23	0.00	-6.00	-0.03	0.65	-1.54	0.84	-0.37
S29	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	-2.44	-0.37	-0.81	0.60	0.00
S30	0.58	-1.74	2.77	0.25	1.10	1.49	-0.04	5.83	0.84	0.21	-0.31	-1.69	-0.11	-0.61	9.76	0.65	1.05	0.08	0.26	-5.60	-13.02	-0.79	0.25	0.75
S31	0.45	0.51	1.14	-0.10	0.24	-3.48	-0.50	-2.82	0.50	1.16	-0.68	-0.02	0.21	30.13	-0.20	-0.32	-1.23	0.57	-1.08	12.47	-1.30	0.06	-0.85	2.58
S32	0.17	-0.52	1.79	-10.72	0.56	2.53	-1.48	-0.96	1.23	0.12	1.85	33.60	-0.83	-14.49	2.26	0.73	-0.74	0.17	-0.01	5.69	-0.96	0.48	1.94	0.85
S33	4.30	1.95	1.26	-0.03	6.67	-1.29	2.42	2.12	-1.19	0.07	3.52	11.89	0.59	0.94	-0.24	0.81	0.55	2.88	0.79	12.15	2.84	0.85	1.63	2.30
S34	3.02	41.09	6.37	14.62	-1.68	-0.99	-27.83	-0.19	-0.08	-1.14	-0.17	1.14	3.67	-3.79	0.92	0.63	-0.92	-6.22	-3.74	0.15	-0.14	1.20	-0.08	4.12
S35	0.48	3.28	-7.14	0.68	-0.45	1.18	0.57	0.82	1.13	-0.12	-0.25	1.65	0.27	1.71	0.98	0.83	2.10	-0.05	0.91	2.93	-0.31	0.92	2.21	0.54
S36	5.46	6.23	0.76	0.61	0.29	-3.64	0.88	0.95	1.98	0.63	-1.46	0.46	1.62	1.08	0.95	1.04	0.75	1.42	2.35	0.97	1.49	0.87	0.66	0.93
S37	1.34	-2.62	-37.72	0.56	-1.27	3.70	-0.13	0.50	2.55	-3.87	2.92	1.45	6.93	0.54	0.40	0.66	70.68	6.69	-0.35	1.13	1.06	8.42	1.50	2.84
S38	0.26	0.72	6.52	-0.30	-1.21	1.45	-1.79	-1.04	0.38	15.60	13.46	-14.55	-6.34	-0.51	3.72	0.13	-1.45	-2.99	1.40	0.26	-12.63	-0.08	-0.02	0.68
S39	3.36	1.77	6.54	1.55	1.39	2.41	-0.31	2.32	1.30	-0.62	-0.39	1.13	-0.99	2.54	24.94	1.33	1.26	21.77	0.54	-0.07	1.15	0.88	4.03	0.41

Source: Results obtained from the model developed in Chapter 4.

Table VIII.13: Elasticity of final demand-value added, 1975 to 2015

Sect Code	1978-75	1979-78	(1980-79)	1981-80	1982-81	1983-82	1984-83	1987-84	1990-87	1993-90	1994-93	1995-94	1997-95	1999-97	2002-99	2005-01	2006-05	2007-06	2008-07	2009-08	2010-09	2013-10	2014-13	2015-14
S01	0.83	1.55	0.72	0.90	-1.75	1.01	0.64	1.12	1.58	0.99	-11.72	-0.32	0.49	-0.16	1.69	0.98	7.36	1.10	1.22	0.46	0.44	0.33	-0.76	-3.38
S02	3.26	-0.06	-0.76	1.25	-0.18	0.19	0.09	0.71	1.28	0.62	89.18	-0.49	1.01	2.56	1.46	0.66	1.51	2.21	1.80	1.40	1.46	-0.17	7.50	-0.25
S03	0.28	4.12	-0.02	0.21	-0.63	0.00	0.08	0.05	3.81	1.07	1.11	0.15	1.74	0.54	1.01	0.34	14.89	0.08	0.50	0.48	-0.93	-0.33	1.72	3.04
S04	0.27	1.01	3.53	0.69	3.13	0.17	1.81	0.11	0.02	-0.16	0.77	1.99	-1.27	0.19	0.49	1.21	0.52	0.41	-0.48	2.48	1.12	0.57	-1.79	-2.06
S05	-3.45	0.04	-0.49	2.55	0.30	-0.66	-0.16	1.19	-2.04	-0.13	-2.14	0.25	0.59	0.10	8.93	0.38	0.25	0.48	0.72	-3.91	-3.86	0.45	-0.47	0.41
S06	12.84	-0.36	2.57	-3.17	-9.83	0.90	3.43	0.60	0.72	-1.90	-0.45	-0.94	-0.37	0.08	0.34	1.11	0.88	1.33	0.01	-0.03	0.16	0.71	0.82	1.18
S07	-1.13	-0.68	0.39	0.68	0.24	-1.27	0.76	0.49	1.52	0.60	3.95	-1.10	-0.13	-2.17	-0.11	1.48	0.20	0.19	-0.35	1.45	1.79	-0.23	1.80	-0.27
S08	-2.12	1.46	-10.87	-0.11	0.29	0.59	0.83	0.92	-12.89	0.57	0.90	0.37	1.22	0.15	1.51	-0.29	1.61	1.69	-0.96	2.88	-0.40	-17.35	1.68	0.47
S09	0.04	-0.08	-0.04	0.03	-0.11	0.10	0.00	-0.47	0.46	0.03	-0.29	-0.02	0.93	-1.37	-1.98	-0.02	-0.83	0.42	0.09	0.00	0.20	0.44	0.31	0.87
S10	0.04	0.06	-1.77	-0.01	0.47	1.53	0.05	0.13	-1.51	-4.02	0.29	5.72	0.11	0.03	0.24	0.83	-0.12	-0.03	-0.09	0.07	0.18	0.32	-0.86	0.05
S11	0.01	0.27	0.98	-0.23	-1.20	-2.27	-0.31	12.93	0.06	0.09	1.50	0.49	0.85	-0.28	0.12	0.76	0.91	0.79	-0.25	-0.59	-0.37	4.59	1.29	0.13
S12	0.23	-14.88	-0.15	2.42	94.75	-1.77	4.70	-0.37	-3.29	615.23	-15.45	5.03	0.56	0.64	0.14	1.77	1.33	-7.42	0.72	3.10	1.16	1.24	0.55	-0.76
S13	0.70	-0.82	-19.98	0.28	1.88	-0.14	0.44	1.71	-2.95	1.23	2.18	1.12	0.06	0.82	1.73	-131.31	0.95	-4.12	-0.13	-0.07	-0.29	0.29	0.74	0.34
S14	0.66	-0.01	-2.04	-1.08	-1.64	1.86	0.09	-0.02	0.58	-0.06	-0.53	0.00	1.73	-0.62	-0.14	0.14	-0.68	0.50	5.47	-0.62	1.13	2.54	1.33	0.28
S15	-0.32	-0.39	1.59	-0.55	0.59	0.69	0.45	0.23	0.88	20.95	-0.03	-0.79	-0.30	-0.65	-2.95	0.65	-0.02	0.00	0.04	-0.21	0.23	-0.01	-0.05	-0.03
S16	0.69	1.63	0.76	0.20	0.33	0.42	0.05	0.84	0.21	2.55	-0.08	1.48	5.38	8.29	0.46	0.29	1.30	0.62	-1.29	0.49	0.37	0.48	0.01	0.01
S17	1.01	-0.29	1.44	0.59	2.07	1.22	0.27	2.05	1.10	-3.53	4.76	0.50	3.24	-0.24	-2.03	2.05	0.00	2.42	2.72	5.53	0.30	9.87	-0.70	4.49
S18	0.68	-0.02	0.63	0.75	-0.19	1.18	0.20	0.19	0.44	0.41	-0.09	1.46	0.77	2.75	2.02	0.51	0.63	0.16	-0.11	-0.38	0.45	-0.17	-0.22	0.61
S19	-5.30	0.86	1.72	18.30	0.83	-0.10	-0.55	1.03	0.87	-6.21	133.87	2.94	0.53	-1.04	-15.38	0.16	-0.17	0.12	-0.08	1.47	8.32	0.51	0.99	-0.01
S20	-0.74	0.81	0.80	-0.28	3.45	0.77	0.61	0.49	1.03	-0.25	3.08	0.13	0.42	-0.79	-0.41	-0.07	0.38	1.50	0.26	13.08	-0.11	1.09	-6.43	3.69
S21	0.16	-3.37	2.93	2.23	-4.37	0.76	1.34	-0.55	27.36	0.01	0.30	0.00	0.07	0.13	-0.01	0.52	-1.05	1.67	-0.34	-2.52	0.23	-2.33	1.99	0.37
S22	-2.20	-0.10	-6.51	-0.52	2.18	1.02	0.35	0.58	-1.07	-1.78	1.16	-0.17	0.19	8.92	2.17	0.82	3.67	-1.56	-0.10	-0.69	-0.11	5.58	0.56	1.95
S23	-0.09	0.26	-1.78	1.55	-0.60	-1.24	-2.94	-13.61	-15.34	-6.05	0.60	-0.01	0.59	1.10	0.79	8.87	25.92	57.47	0.68	4.38	1.09	3.30	-0.86	-6.92
S24	0.67	0.56	0.08	1.24	0.43	1.86	0.44	-0.55	-0.92	0.00	0.27	-0.02	0.13	0.76	1.13	-0.27	0.52	1.02	5.04	-1.38	0.08	1.10	3.38	-2.53
S25	1.41	0.73	0.93	1.35	1.84	-0.24	0.47	0.77	0.36	1.17	1.06	0.19	0.60	-0.15	-5.86	1.75	2.15	0.71	1.09	-1.27	0.60	1.64	0.66	2.98
S26	1.03	0.58	1.12	1.06	1.07	1.13	0.76	0.99	1.05	0.98	1.03	0.97	0.94	1.02	0.96	1.03	1.01	1.19	0.99	0.98	0.99	0.99	1.00	1.01
S27	-0.06	0.37	7.67	0.71	-0.84	0.70	0.73	-0.30	-6.03	0.36	0.38	0.01	0.14	0.22	2.44	0.35	-0.62	0.70	-0.07	-1.44	0.36	2.37	3.95	-2.62
S28	1.65	-1.42	-6.05	-0.09	0.75	-0.17	5.71	-1.18	0.26	0.00	-0.46	-0.04	-1.67	0.02	-0.17	-0.02	-0.87	-0.43	-0.03	1.10	0.00	1.03	0.93	-0.06
S29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
S30	1.04	-4.50	2.00	0.86	1.51	1.97	20.90	0.74	0.25	0.17	0.03	8.49	-0.13	-1.52	4.27	1.31	0.88	2.41	0.36	-0.61	10.90	3.56	0.10	0.96
S31	0.03	0.31	0.93	-2.67	-82.67	27.58	58.86	0.16	0.28	0.58	0.01	-7.50	1.57	6.09	0.09	-1.36	40.21	25.98	-24.29	-0.21	-2.06	-1.65	101.42	-2.29
S32	0.34	1.26	1.50	1.47	1.30	1.91	1.63	0.95	0.07	-0.18	0.03	12.92	-0.04	0.44	0.69	0.86	17.20	5.89	-0.14	0.88	-6.04	5.07	5.10	0.74
S33	0.41	-0.44	0.51	0.15	1.99	0.81	7.09	0.82	-2.56	0.88	1.70	-2.15	2.21	0.54	-3.62	0.88	0.44	4.46	0.66	0.38	-0.15	0.71	3.19	-1.86
S34	1.12	0.21	-2.57	-7.49	-0.34	0.74	0.21	0.28	-0.30	-0.15	0.08	0.33	-1.67	0.20	0.40	1.84	-1.42	0.49	-0.92	-0.39	2.83	1.04	0.31	0.91
S35	-0.53	0.26	3.04	1.26	-0.55	-0.03	0.51	0.61	-1.71	0.07	-0.45	-0.78	0.33	0.19	0.16	0.94	-0.59	4.13	0.52	0.29	-2.60	1.78	-0.10	1.04
S36	1.91	1.14	0.03	0.98	0.43	1.11	-2.20	0.92	1.43	0.85	-2.28	0.31	1.31	1.12	0.93	1.28	1.33	-0.05	1.42	0.40	1.82	0.72	0.62	0.95
S37	-0.16	-0.49	3.44	0.74	-0.97	0.51	-1.56	0.63	-0.14	0.41	1.09	-0.41	2.04	0.28	2.27	1.18	3.05	1.82	-0.56	0.25	1.20	1.84	0.02	1.27
S38	0.75	1.12	1.02	0.70	-1.23	0.99	0.58	1.20	-6.29	1.32	1.62	-0.37	1.14	0.69	1.19	0.84	3.90	0.54	0.73	0.14	1.18	1.89	0.56	0.91
S39	1.66	1.27	1.48	0.92	1.16	1.47	3.57	1.37	0.15	0.51	-0.33	0.25	0.54	1.75	7.47	1.36	0.85	-1.14	-2.54	5.38	1.46	0.83	0.57	0.82

Source: Results obtained from the model developed in Chapter 4.

Table VIII.14: Elasticity of final demand-value added by category for IOI, 1975-2015

Sectors	Sec. Code	e \ yr	1978-75	1979-78	1980-79	1981-80	1982-81	1983-82	1984-83	1987-84	1990-87	1993-90	1994-93	1995-94	1997-95	1999-97	2002-99	2005-01	2006-05	2007-06	2008-07	2009-08	2010-09	2013-10	2014-13	2015-14
Coal Mining	S02	eV	3.26	-0.06	-0.76	1.25	-0.18	0.19	0.09	0.71	1.28	0.62	89.18	-0.49	1.01	2.56	1.46	0.66	1.51	2.21	1.80	1.40	1.46	-0.17	7.50	-0.25
		eW	5.56	-0.09	-0.69	4.27	-0.06	0.38	0.33	0.25	1.16	-0.27	0.34	11.55	0.71	-1.35	-0.74	0.70	0.43	-0.44	2.81	0.04	0.02	0.41	4.96	0.93
		eP	2.41	-0.04	-0.80	0.07	-0.25	0.07	-0.12	0.94	1.10	0.94	80.82	-83.75	1.30	5.93	2.53	0.63	1.85	2.77	1.44	1.92	1.63	245.90	9.72	-2.05
		eT	13.74	-0.36	-0.23	9.42	0.64	0.73	1.67	0.60	8.51	-0.35	230.82	-123.79	-5.41	0.00	2.47	3.25	0.46	0.27	3.11	0.84	0.00	-125.00	-0.37	11.12
Crude Oil (incl. condensate)	S03	eV	0.28	4.12	-0.02	0.21	-0.63	0.00	0.08	0.05	3.81	1.07	1.11	0.15	1.74	0.54	1.01	0.34	14.89	0.08	0.50	0.48	-0.93	-0.33	1.72	3.04
		eW	0.11	3.23	-0.02	-0.02	-0.74	0.00	0.06	-0.07	3.91	-0.04	0.98	-1.14	1.36	0.12	0.28	0.43	29.81	-1.54	0.96	0.21	0.89	0.69	2.93	1.41
		eP	0.34	4.54	-0.01	0.30	-0.56	0.00	0.10	0.11	4.12	1.49	1.15	0.57	1.77	0.60	1.10	0.33	13.75	0.24	0.48	0.50	-1.16	-0.65	1.54	3.29
		eT	-0.36	4.04	-0.03	-0.23	-1.88	0.00	-0.06	0.08	-6.49	1.73	0.15	1.77	2.47	-0.92	0.33	0.14	4.29	-0.39	-1.32	0.44	6.75	12.68	-0.06	6.81
Gas (incl. Nat Gas, LPG and CSG)	S04	eV	0.27	1.01	3.53	0.69	3.13	0.17	1.81	0.11	0.02	-0.16	0.77	1.99	-1.27	0.19	0.49	1.21	0.52	0.41	-0.48	2.48	1.12	0.57	-1.79	-2.06
		eW	0.53	1.04	3.42	0.93	2.80	-0.21	1.70	0.37	0.02	-0.11	0.51	-0.55	-1.84	-1.87	0.19	1.07	1.02	0.11	-5.47	3.20	-1.42	1.04	-0.18	-5.66
		eP	0.20	1.00	3.62	0.63	3.31	0.32	1.91	0.01	0.01	-0.18	0.83	2.59	-1.22	0.33	0.52	1.21	0.49	0.43	-0.18	2.43	1.32	0.51	-2.03	-1.44
		eT	0.71	1.03	1.21	1.01	0.37	0.06	0.71	0.36	0.31	-0.09	-0.47	4.03	-2.48	-2.12	-0.14	2.96	0.00	0.00	0.00	0.00	0.00	9.17	-3.38	7.77
Exploration and Mining Support Services	S05	eV	-3.45	0.04	-0.49	2.55	0.30	-0.66	-0.16	1.19	-2.04	-0.13	-2.14	0.25	0.59	0.10	8.93	0.38	0.25	0.48	0.72	-3.91	-3.86	0.45	-0.47	0.41
		eW	-2.73	0.03	-0.49	2.74	0.14	-0.64	0.33	1.17	-6.60	-0.04	-2.06	0.05	1.26	-0.58	-2.04	0.35	2.77	0.22	-0.12	4.92	1.31	0.83	0.47	0.15
		eP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.36	6.58	0.00	0.00	17.20	-0.08	0.96	34.19	0.40	-2.11	0.94	1.74	-11.44	-17.11	-0.04	-1.80	0.74
		eT	-17.72	0.14	-0.52	0.14	13.26	-0.83	0.30	0.68	5.62	-0.43	-2.19	0.07	1.63	-0.42	3.34	0.34	0.50	-0.04	0.29	20.28	2.42	1.79	-0.12	-0.11
Other Mining	S06	eV	12.84	-0.36	2.57	-3.17	-9.83	0.90	3.43	0.60	0.72	-1.90	-0.45	-0.94	-0.37	0.08	0.34	1.11	0.88	1.33	0.01	-0.03	0.16	0.71	0.82	1.18
		eW	-2.46	0.86	1.49	0.63	3.76	-0.41	0.19	0.07	0.85	-2.54	-1.14	-0.32	1.23	3.15	1.09	0.27	0.21	0.94	1.47	0.18	19.06	1.49	-0.04	0.16
		eP	20.50	-0.93	3.26	-4.87	-17.42	1.91	4.33	0.89	0.78	-1.61	-0.18	-1.16	-0.99	-16.93	0.07	1.42	1.08	1.41	-0.25	-0.09	54.71	0.55	1.06	1.42
		eT	-71.53	-1.82	-2.53	7.90	7.04	0.50	17.60	1.08	-1.62	-2.21	1.71	-2.37	3.76	-39.44	-0.24	0.53	-0.19	0.42	0.64	0.86	14.28	0.60	0.22	-0.92
Petroleum Products Manufacturing	S12	eV	0.23	-14.88	-0.15	2.42	94.75	-1.77	4.70	-0.37	-3.29	615.23	-15.45	5.03	0.56	0.64	0.14	1.77	1.33	-7.42	0.72	3.10	1.16	1.24	0.55	-0.76
		eW	0.41	-7.90	-0.05	-13.35	-50.33	-1.71	1.28	-1.06	0.49	304.04	1.11	-1.62	0.07	-1.90	0.59	0.04	-0.18	-2.38	0.51	2.56	0.31	0.47	0.31	0.30
		eP	0.02	-16.39	0.05	16.83	466.85	-9.80	18.56	10.50	-18.94	780.49	-22.99	6.18	1.51	4.05	-0.67	3.70	1.98	-8.78	0.77	3.15	1.33	1.56	0.62	-0.77
		eT	0.83	-68.16	-1.45	16.11	-386.00	28.39	6.35	-1.36	2.91	870.85	-1.82	3.65	0.32	-16.86	2.24	0.67	0.26	-0.55	0.28	6.37	1.19	-20.56	4.03	35.74
Coal Products Manufacturing	S13	eV	0.70	-0.82	-19.98	0.28	1.88	-0.14	0.44	1.71	-2.95	1.23	2.18	1.12	0.06	0.82	1.73	-131.31	0.95	-4.12	-0.13	-0.07	-0.29	0.29	0.74	0.34
		eW	0.61	-0.10	-13.73	0.57	1.18	-0.13	0.66	1.81	-0.29	0.76	-0.19	0.26	0.01	0.76	1.51	-18.00	0.12	-2.25	-0.05	-0.06	-0.55	0.24	0.77	0.43
		eP	0.80	-0.97	-7.53	0.02	3.69	-1.94	-0.44	0.11	-13.99	1.48	3.27	1.27	0.16	0.89	2.11	-257.75	1.30	-4.62	-0.14	-0.07	-0.24	0.31	0.73	0.34
		eT	0.41	-6.28	-102.63	0.03	-17.94	6.62	0.33	1.86	1.42	1.62	0.23	0.94	0.03	0.45	0.00	-59.60	0.36	-1.57	0.03	-0.11	0.00	0.00	0.34	0.00
Electricity Generation by Coal	S21	eV	0.16	-3.37	2.93	2.23	-4.37	0.76	1.34	-0.55	27.36	0.01	0.30	0.00	0.07	0.13	-0.01	0.52	-1.05	1.67	-0.34	-2.52	0.23	-2.33	1.99	0.37
		eW	-0.42	-3.57	1.72	1.41	4.00	0.83	0.57	1.17	16.63	-0.61	0.29	-0.04	0.12	-0.28	-2.86	0.81	1.61	0.15	0.05	-0.67	0.79	5.15	1.19	1.81
		eP	0.91	-3.64	4.31	2.48	-9.88	0.72	2.47	-1.60	42.06	0.34	0.31	0.02	0.06	0.20	1.27	0.43	-1.91	2.28	-0.67	-3.56	-0.14	4.13	1.83	4.45
		eT	-2.93	3.21	-2.00	8.20	3.50	0.43	-2.89	-7.58	-107.35	0.00	0.00	0.00	0.00	18.17	-15.42	0.28	-4.23	3.05	2.42	-4.19	1.80	-132.90	3.02	-9.96
Electricity Generation by Oil Products	S22	eV	-2.20	-0.10	-6.51	-0.52	2.18	1.02	0.35	0.58	-1.07	-1.78	1.16	-0.17	0.19	8.92	2.17	0.82	3.67	-1.56	-0.10	-0.69	-0.11	5.58	0.56	1.95
		eW	-0.65	-26.82	-2.56	-1.01	6.11	1.14	-2.88	0.70	-2.28	-0.44	1.15	-0.19	0.23	14.90	2.90	1.04	5.16	-2.93	-0.01	0.16	-18.85	2.68	0.83	1.49
		eP	-4.18	-27.59	-11.02	-0.37	-0.41	0.96	5.05	0.50	0.59	-2.49	1.16	-0.16	0.19	7.85	1.84	0.75	3.18	-1.02	-0.18	-1.17	-47.57	3.08	0.62	0.64
		eT	5.96	48.96	9.57	3.07	5.88	0.50	-17.29	0.08	-16.28	0.00	0.00	0.00	0.00	0.00	6.10	0.64	1.87	-0.32	0.55	-1.46	12.17	56.11	0.21	5.26

Source: Results obtained from the model developed in Chapter 4.

Table VIII.14 (con'd)

Sectors		e \ yr	1978-75	1979-78	1980-79	1981-80	1982-81	1983-82	1984-83	1987-84	1990-87	1993-90	1994-93	1995-94	1997-95	1999-97	2002-99	2005-01	2006-05	2007-06	2008-07	2009-08	2010-09	2013-10	2014-13	2015-14
Electricity Generation by Natural Gas	S23	eV	-0.09	0.26	-1.78	1.55	-0.60	-1.24	-2.94	-13.61	-15.34	-6.05	0.60	-0.01	0.59	1.10	0.79	8.87	25.92	57.47	0.68	4.38	1.09	3.30	-0.86	-6.92
		eW	-0.14	0.19	-2.40	1.37	2.78	-1.16	-3.01	-10.93	-13.56	-11.63	0.59	-0.04	0.62	0.74	1.05	8.61	24.98	67.69	0.94	5.30	1.55	2.05	-7.77	-2.41
		eP	-0.02	0.16	-1.07	1.61	-2.83	-1.29	-2.83	-15.25	-17.79	-3.07	0.60	0.00	0.59	1.16	0.67	8.95	26.22	53.39	0.46	3.87	0.80	2.22	-2.26	5.93
		eT	-0.35	2.74	-4.31	2.86	2.58	-1.62	-3.35	-24.59	7.07	0.00	0.00	0.00	0.00	16.90	2.22	9.07	27.04	48.16	2.53	3.55	2.36	25.11	8.08	-39.50
Electricity Generation by Hydro	S24	eV	0.67	0.56	0.08	1.24	0.43	1.86	0.44	-0.55	-0.92	0.00	0.27	-0.02	0.13	0.76	1.13	-0.27	0.52	1.02	5.04	-1.38	0.08	1.10	3.38	-2.53
		eW	0.85	0.46	0.71	0.77	-10.24	2.46	-0.91	0.28	-0.23	-0.45	0.26	-0.07	0.17	-0.04	-0.01	0.10	2.81	0.28	2.80	-0.28	0.28	0.39	0.12	0.95
		eP	0.43	0.42	-0.63	1.37	7.48	1.55	2.40	-1.06	-1.86	0.25	0.28	-0.01	0.12	0.90	1.64	-0.39	-0.22	1.31	6.92	-1.99	-0.06	0.48	2.72	7.39
		eT	1.66	3.80	2.64	4.61	-9.60	-0.79	-6.93	-3.95	7.71	0.00	0.00	0.00	0.00	36.10	-5.05	-0.57	-2.24	1.69	-10.81	-2.36	0.64	13.43	7.59	-27.70
Electricity Generation by Renewables	S25	eV	1.41	0.73	0.93	1.35	1.84	-0.24	0.47	0.77	0.36	1.17	1.06	0.19	0.60	-0.15	-5.86	1.75	2.15	0.71	1.09	-1.27	0.60	1.64	0.66	2.98
		eW	1.56	0.63	1.48	0.88	-13.96	0.40	-0.86	1.44	1.03	0.48	1.05	0.13	0.64	-0.77	-8.89	2.06	3.48	-0.47	1.80	-0.10	0.81	0.79	1.39	1.52
		eP	1.20	0.60	0.30	1.49	12.25	-0.58	2.41	0.36	-0.55	1.54	1.07	0.22	0.59	-0.04	-4.50	1.66	1.72	1.19	0.50	-1.93	0.46	0.91	0.81	-1.18
		eT	2.24	4.10	3.18	4.79	-13.01	-3.09	-6.81	-1.96	8.76	0.00	0.00	0.00	0.00	27.30	-22.23	1.51	0.55	1.79	6.08	-2.33	1.19	16.53	-0.28	13.55
Electricity Generation by Other Fuel	S26	eV	1.03	0.58	1.12	1.06	1.07	1.13	0.76	0.99	1.05	0.98	1.03	0.97	0.94	1.02	0.96	1.03	1.01	1.19	0.99	0.98	0.99	0.99	1.00	1.01
		eW	1.12	0.26	2.31	0.36	2.34	0.86	-0.22	1.47	0.72	-1.25	1.01	0.87	0.99	0.57	1.33	1.14	1.61	4.81	1.23	2.33	1.25	0.31	1.34	0.41
		eP	0.91	0.15	-0.25	1.26	0.23	1.27	2.18	0.70	1.49	2.17	1.03	1.02	0.93	1.10	0.79	1.00	0.81	-0.26	0.80	0.22	0.82	0.41	1.07	-0.69
		eT	1.52	10.92	5.98	6.09	2.26	2.33	-4.59	-0.95	-2.99	0.00	0.00	0.00	0.00	0.00	2.97	0.95	0.29	-2.12	2.63	-0.24	1.72	12.89	0.57	5.33
Electricity Transmission and Distribution	S27	eV	-0.06	0.37	7.67	0.71	-0.84	0.70	0.73	-0.30	-6.03	0.36	0.38	0.01	0.14	0.22	2.44	0.35	-0.62	0.70	-0.07	-1.44	0.36	2.37	3.95	-2.62
		eW	27.35	0.20	2.82	0.21	10.43	0.80	-0.03	0.75	-2.71	-0.36	0.37	-0.04	0.18	-0.21	10.41	0.66	1.89	-1.65	0.31	0.15	0.80	0.12	-0.23	1.38
		eP	4.18	0.15	13.21	0.86	-8.27	0.65	1.84	-0.94	-10.59	0.74	0.39	0.02	0.13	0.30	-1.12	0.25	-1.44	1.64	-0.38	-2.33	0.07	0.43	3.10	8.77
		eT	70.82	5.65	-12.11	4.33	9.75	0.27	-3.44	-4.58	0.00	0.00	0.00	0.00	0.00	19.31	45.46	0.09	-3.64	2.85	2.59	-2.87	1.59	41.57	9.35	-31.53
Gas Supply	S28	eV	1.65	-1.42	-6.05	-0.09	0.75	-0.17	5.71	-1.18	0.26	0.00	-0.46	-0.04	-1.67	0.02	-0.17	-0.02	-0.87	-0.43	-0.03	1.10	0.00	1.03	0.93	-0.06
		eW	3.08	-0.84	-2.30	0.44	0.86	3.83	-2.93	0.38	2.55	-0.05	0.17	-0.06	-2.32	0.54	-0.04	-1.32	-1.47	-0.86	-0.01	-0.23	0.07	0.55	-1.26	-0.08
		eP	-0.35	-1.22	-10.58	-0.78	0.63	-3.76	19.03	-2.42	-0.48	0.04	-0.92	-0.03	-1.63	-0.14	-0.21	0.30	-0.82	-0.45	-0.04	1.26	0.20	0.94	1.57	-0.04
		eT	6.23	-10.05	4.06	3.77	1.08	1.88	-10.99	-0.73	0.00	0.00	0.00	0.00	0.00	-3.27	0.29	-0.06	-1.07	0.48	0.31	0.04	-2.06	6.32	-0.25	-0.24
Water Supply UPSTREAM	S29	eV	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		eW	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		eP	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		eT	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Supply, Urban	S30	eV	1.04	-4.50	2.00	0.86	1.51	1.97	20.90	0.74	0.25	0.17	0.03	8.49	-0.13	-1.52	4.27	1.31	0.88	2.41	0.36	-0.61	10.90	3.56	0.10	0.96
		eW	0.89	-15.31	-1.21	1.16	0.15	2.34	69.07	-0.80	0.24	0.21	0.00	5.84	-0.33	-1.48	4.68	4.70	-5.97	-1.56	0.44	-0.81	-14.43	1.51	-0.30	26.94
		eP	1.12	-1.62	2.68	-0.29	2.21	1.96	13.93	1.57	0.22	0.15	0.04	9.04	-0.08	-1.51	4.12	0.82	3.13	3.01	0.17	-0.68	19.49	3.95	0.08	-2.56
		eT	-0.41	46.71	17.45	28.30	-4.79	0.69	-79.90	-2.87	1.11	0.00	0.00	0.00	0.00	0.00	29.07	-21.32	18.60	-9.13	-3.38	-11.29	-30.58	18.17	12.46	-44.97
Water Supply, Rural	S31	eV	0.03	0.31	0.93	-2.67	-82.67	27.58	58.86	0.16	0.28	0.58	0.01	-7.50	1.57	6.09	0.09	-1.36	40.21	25.98	-24.29	-0.21	-2.06	-1.65	101.42	-2.29
		eW	0.03	0.16	0.22	-2.66	-109.86	29.45	83.57	-0.80	0.27	0.61	-0.02	-6.81	1.12	5.97	0.03	0.91	16.40	114.39	-22.88	-0.31	2.81	-1.75	98.64	-4.21
		eP	0.03	0.36	1.08	-2.74	-68.58	27.57	55.29	0.68	0.25	0.57	0.01	-7.64	1.69	6.06	0.12	-1.69	48.02	12.54	-27.97	-0.25	-3.71	-1.63	101.28	-2.03
		eT	0.01	1.03	4.32	-1.12	-209.17	21.28	7.16	-2.10	1.12	0.00	0.00	0.00	0.00	0.00	-3.70	-16.50	101.79	282.95	-95.03	-5.62	5.92	-0.93	186.29	1.11
Water Services (Sewerage & Drainage)	S32	eV	0.34	1.26	1.50	1.47	1.30	1.91	1.63	0.95	0.07	-0.18	0.03	12.92	-0.04	0.44	0.69	0.86	17.20	5.89	-0.14	0.88	-6.04	5.07	5.10	0.74
		eW	0.37	0.78	0.41	1.49	0.01	2.19	2.82	0.51	0.01	-0.10	0.01	9.25	-0.23	0.40	0.61	1.43	0.76	2.55	-0.34	0.70	-1.73	1.12	4.62	0.81
		eP	0.32	1.72	2.43	0.99	4.06	1.65	0.77	1.95	0.04	-0.31	0.06	16.79	0.21	0.57	0.86	0.81	47.89	8.03	-0.82	0.56	-14.18	8.12	3.41	0.95
		eT	-0.10	6.60	11.48	6.96	-9.83	1.36	-2.10	-0.70	1.13	0.00	0.00	0.00	0.00	0.00	-6.09	-11.61	150.57	-6.00	-4.15	-7.46	4.89	101.03	47.97	-2.33

Source: Results obtained from the model developed in Chapter 4.

Table VIII.15: Elasticity of final demand-value added indices, 1975-2015

Sector		e \ y	1978-75	1979-78	(1980-79)	1981-80	1982-81	1983-82	1984-83	1987-84	1990-87	1993-90	1994-93	1995-94	1997-95	1999-97	2002-99	2005-01	2006-05	2007-06	2008-07	2009-08	2010-09	2013-10	2014-13	2015-14
Agriculture, Forestry and Fishing	S01	e_V	0.83	1.55	0.72	0.90	-1.75	1.01	0.64	1.12	1.58	0.99	-11.72	-0.32	0.49	-0.16	1.69	0.98	7.36	1.10	1.22	0.46	0.44	0.33	-0.76	-3.38
		e_W	0.35	-0.05	0.19	-0.80	-0.54	0.20	0.06	-0.69	1.07	0.59	-10.81	0.29	0.28	-0.43	0.08	0.24	-0.06	-0.18	0.02	0.02	0.85	-0.01	-5.09	-2.14
		e_P	0.91	2.11	1.12	1.36	-2.52	1.28	0.98	1.55	2.09	1.11	-12.01	-0.54	0.55	-0.03	2.27	1.22	5.36	1.50	1.82	0.87	0.28	0.42	0.40	-3.66
		e_T	1.26	0.44	-5.56	-3.62	6.92	0.06	-0.37	0.27	-2.96	0.28	-11.82	2.04	1.34	-2.13	2.57	-0.74	-4.50	0.72	-0.94	-5.02	0.99	0.91	-0.02	-6.36
Other Mining	S02	e_V	3.26	-0.06	-0.76	1.25	-0.18	0.19	0.09	0.71	1.28	0.62	89.18	-0.49	1.01	2.56	1.46	0.66	1.51	2.21	1.80	1.40	1.46	-0.17	7.50	-0.25
		e_W	5.56	-0.09	-0.69	4.27	-0.06	0.38	0.33	0.25	1.16	-0.27	0.34	11.55	0.71	-1.35	-0.74	0.70	0.43	-0.44	2.81	0.04	0.02	0.41	4.96	0.93
		e_P	2.41	-0.04	-0.80	0.07	-0.25	0.07	-0.12	0.94	1.10	0.94	80.82	-83.75	1.30	5.93	2.53	0.63	1.85	2.77	1.44	1.92	1.63	245.90	9.72	-2.05
		e_T	13.74	-0.36	-0.23	9.42	0.64	0.73	1.67	0.60	8.51	-0.35	230.82	-123.79	-5.41	0.00	2.47	3.25	0.46	0.27	3.11	0.84	0.00	-1894.99	-0.37	11.12
Crude Oil (incl. condensate)	S03	e_V	0.28	4.12	-0.02	0.21	-0.63	0.00	0.08	0.05	3.81	1.07	1.11	0.15	1.74	0.54	1.01	0.34	14.89	0.08	0.50	0.48	-0.93	-0.33	1.72	3.04
		e_W	0.11	3.23	-0.02	-0.02	-0.74	0.00	0.06	-0.07	3.91	-0.04	0.98	-1.14	1.36	0.12	0.28	0.43	29.81	-1.54	0.96	0.21	0.89	0.69	2.93	1.41
		e_P	0.34	4.54	-0.01	0.30	-0.56	0.00	0.10	0.11	4.12	1.49	1.15	0.57	1.77	0.60	1.10	0.33	13.75	0.24	0.48	0.50	-1.16	-0.65	1.54	3.29
		e_T	-0.36	4.04	-0.03	-0.23	-1.88	0.00	-0.06	0.08	-6.49	1.73	0.15	1.77	2.47	-0.92	0.33	0.14	4.29	-0.39	-1.32	0.44	6.75	12.68	-0.06	6.81
Gas (incl. Nat Gas, LPG and CSG)	S04	e_V	0.27	1.01	3.53	0.69	3.13	0.17	1.81	0.11	0.02	-0.16	0.77	1.99	-1.27	0.19	0.49	1.21	0.52	0.41	-0.48	2.48	1.12	0.57	-1.79	-2.06
		e_W	0.53	1.04	3.42	0.93	2.80	-0.21	1.70	0.37	0.02	-0.11	0.51	-0.55	-1.84	-1.87	0.19	1.07	1.02	0.11	-5.47	3.20	-1.42	1.04	-0.18	-5.66
		e_P	0.20	1.00	3.62	0.63	3.31	0.32	1.91	0.01	0.01	-0.18	0.83	2.59	-1.22	0.33	0.52	1.21	0.49	0.43	-0.18	2.43	1.32	0.51	-2.03	-1.44
		e_T	0.71	1.03	1.21	1.01	0.37	0.06	0.71	0.36	0.31	-0.09	-0.47	4.03	-2.48	-2.12	-0.14	2.96	0.00	0.00	0.00	0.00	0.00	9.17	-3.38	7.77
Exploration and Mining Support Services	S05	e_V	-3.45	0.04	-0.49	2.55	0.30	-0.66	-0.16	1.19	-2.04	-0.13	-2.14	0.25	0.59	0.10	8.93	0.38	0.25	0.48	0.72	-3.91	-3.86	0.45	-0.47	0.41
		e_W	-2.73	0.03	-0.49	2.74	0.14	-0.64	0.33	1.17	-6.60	-0.04	-2.06	0.05	1.26	-0.58	-2.04	0.35	2.77	0.22	-0.12	4.92	1.31	0.83	0.47	0.15
		e_P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.36	6.58	0.00	0.00	17.20	-0.08	0.96	34.19	0.40	-2.11	0.94	1.74	-11.44	-17.11	-0.04	-1.80	0.74
		e_T	-17.72	0.14	-0.52	0.14	13.26	-0.83	0.30	0.68	5.62	-0.43	-2.19	0.07	1.63	-0.42	3.34	0.34	0.50	-0.04	0.29	20.28	2.42	1.79	-0.12	-0.11
Other Mining	S06	e_V	12.84	-0.36	2.57	-3.17	-9.83	0.90	3.43	0.60	0.72	-1.90	-0.45	-0.94	-0.37	0.08	0.34	1.11	0.88	1.33	0.01	-0.03	0.16	0.71	0.82	1.18
		e_W	-2.46	0.86	1.49	0.63	3.76	-0.41	0.19	0.07	0.85	-2.54	-1.14	-0.32	1.23	3.15	1.09	0.27	0.21	0.94	1.47	0.18	19.06	1.49	-0.04	0.16
		e_P	20.50	-0.93	3.26	-4.87	-17.42	1.91	4.33	0.89	0.78	-1.61	-0.18	-1.16	-0.99	-16.93	0.07	1.42	1.08	1.41	-0.25	-0.09	54.71	0.55	1.06	1.42
		e_T	-71.53	-1.82	-2.53	7.90	7.04	0.50	17.60	1.08	-1.62	-2.21	1.71	-2.37	3.76	-39.44	-0.24	0.53	-0.19	0.42	0.64	0.86	14.28	0.60	0.22	-0.92
Food, Beverage and Tobacco	S07	e_V	-1.13	-0.68	0.39	0.68	0.24	-1.27	0.76	0.49	1.52	0.60	3.95	-1.10	-0.13	-2.17	-0.11	1.48	0.20	0.19	-0.35	1.45	1.79	-0.23	1.80	-0.27
		e_W	-1.77	-0.44	2.51	0.64	-0.49	0.34	0.86	1.09	1.21	0.63	1.12	-0.04	0.59	-0.82	0.66	0.22	0.92	1.37	-0.51	2.13	-2.17	-0.05	-0.02	0.38
		e_P	-2.01	-1.47	-6.87	0.53	1.75	-2.69	0.98	-0.52	3.38	0.54	8.31	-2.51	-1.06	-4.02	-1.00	2.80	-0.66	-1.20	-0.10	-7.63	8.22	-0.56	4.23	-1.13
		e_T	22.20	1.54	15.79	3.25	-3.44	-10.80	-1.51	0.81	-12.59	1.96	-19.48	-2.13	1.59	-1.41	0.18	7.93	-0.73	0.82	-0.57	81.58	-6.64	1.58	1.67	0.69

Source: Results obtained from the model developed in Chapter 4.

Table VIII.15 (cont'd)

		e \ y	1978-75	1979-78	1980-79	1981-80	1982-81	1983-82	1984-83	1987-84	1990-87	1993-90	1994-93	1995-94	1997-95	1999-97	2002-99	2005-01	2006-05	2007-06	2008-07	2009-08	2010-09	2013-10	2014-13	2015-14
Textile, clothing, footwear and leather	S08	e_V	-2.12	1.46	-10.87	-0.11	0.29	0.59	0.83	0.92	-12.89	0.57	0.90	0.37	1.22	0.15	1.51	-0.29	1.61	1.69	-0.96	2.88	-0.40	-17.35	1.68	0.47
		e_W	-3.39	0.88	-3.06	-109.01	1.26	0.93	0.72	1.25	1.04	0.57	1.14	0.42	-0.08	0.59	1.01	-1.14	0.18	1.05	3.38	0.19	1.74	-4.76	1.43	-0.11
		e_P	5.35	5.76	-83.20	-181.77	-4.71	-2.16	1.65	-0.24	-25.10	0.58	0.24	0.23	4.51	-0.95	2.57	2.05	3.98	3.75	-13.58	10.75	-3.07	-27.87	2.27	1.51
		e_T	8.19	-0.87	16.35	172.54	4.16	0.96	-0.13	0.81	-166.40	0.62	-0.26	0.64	-5.06	-0.55	-0.13	0.37	-0.64	-1.60	-1.07	-6.20	2.88	-5.58	-0.42	1.77
Pulp, Paper and Paperboard Manufacturing	S09	e_V	0.04	-0.08	-0.04	0.03	-0.11	0.10	0.00	-0.47	0.46	0.03	-0.29	-0.02	0.93	-1.37	-1.98	-0.02	-0.83	0.42	0.09	0.00	0.20	0.44	0.31	0.87
		e_W	0.05	0.28	-0.32	-0.15	-0.15	-0.03	0.00	0.05	0.10	-0.12	0.16	-0.15	0.82	0.04	-26.07	-0.01	-0.93	-0.04	-0.10	-0.29	-0.33	0.14	0.05	-0.07
		e_P	-0.06	-3.30	0.25	0.28	-0.12	0.36	0.00	-1.64	0.79	0.23	-0.57	0.08	0.95	-3.02	-0.11	-0.07	-0.79	0.99	0.37	0.67	0.74	0.77	0.72	2.07
		e_T	0.41	-0.03	1.36	4.11	0.89	0.05	0.00	0.39	-0.45	-0.16	-2.19	-0.10	0.66	-0.01	-3.07	-0.01	0.32	0.58	0.55	-1.63	0.34	1.35	0.71	-0.55
Wood Products	S10	e_V	0.04	0.06	-1.77	-0.01	0.47	1.53	0.05	0.13	-1.51	-4.02	0.29	5.72	0.11	0.03	0.24	0.83	-0.12	-0.03	-0.09	0.07	0.18	0.32	-0.86	0.05
		e_W	-0.03	0.12	-1.79	-0.12	1.31	1.10	-0.04	-0.14	-2.32	-4.13	-0.65	1.85	-1.35	0.13	0.22	0.76	0.05	0.05	-0.02	0.40	-0.15	0.19	1.40	0.11
		e_P	0.15	-0.06	-2.45	0.13	-2.34	2.25	0.27	0.44	-0.65	-3.33	2.26	15.19	1.95	-0.10	0.26	0.89	-0.33	-0.15	-0.22	-0.49	0.65	0.56	-6.10	-0.07
		e_T	0.62	-0.02	4.40	0.71	23.13	1.41	-0.21	0.93	5.87	-15.14	-5.05	11.67	4.69	0.51	0.17	1.45	-0.19	0.06	-0.05	0.48	-0.48	0.04	-1.32	0.10
Printing, publishing other than music and Internet	S11	e_V	0.01	0.27	0.98	-0.23	-1.20	-2.27	-0.31	12.93	0.06	0.09	1.50	0.49	0.85	-0.28	0.12	0.76	0.91	0.79	-0.25	-0.59	-0.37	4.59	1.29	0.13
		e_W	0.61	0.22	1.42	-0.53	-0.91	-0.45	-0.58	11.19	0.49	-0.52	1.66	0.99	0.17	-0.92	-0.66	0.05	-0.13	-0.63	-0.14	-0.19	-0.51	2.29	0.57	0.04
		e_P	-1.62	0.30	0.51	-0.23	-1.53	-6.52	0.55	17.22	-0.43	1.60	1.02	-0.48	2.51	0.95	1.92	1.75	2.43	2.93	-0.37	-1.19	-0.23	6.63	2.21	0.13
		e_T	-1.76	0.83	-2.16	5.33	-3.27	-0.89	-1.32	6.59	-2.54	-2.30	13.35	3.10	1.13	-1.02	-0.41	2.09	-1.14	0.66	-0.27	2.57	-0.61	4.45	-0.93	2.67
Petroleum Products Manufacturing	S12	e_V	0.23	-14.88	-0.15	2.42	94.75	-1.77	4.70	-0.37	-3.29	615.23	-15.45	5.03	0.56	0.64	0.14	1.77	1.33	-7.42	0.72	3.10	1.16	1.24	0.55	-0.76
		e_W	0.41	-7.90	-0.05	-13.35	-50.33	-1.71	1.28	-1.06	0.49	304.04	1.11	-1.62	0.07	-1.90	0.59	0.04	-0.18	-2.38	0.51	2.56	0.31	0.47	0.31	0.30
		e_P	0.02	-16.39	0.05	16.83	466.85	-9.80	18.56	10.50	-18.94	780.49	-22.99	6.18	1.51	4.05	-0.67	3.70	1.98	-8.78	0.77	3.15	1.33	1.56	0.62	-0.77
		e_T	0.83	-68.16	-1.45	16.11	-3985.45	28.39	6.35	-1.36	2.91	870.85	-1.82	3.65	0.32	-16.86	2.24	0.67	0.26	-0.55	0.28	6.37	1.19	-20.56	4.03	35.74
Coal Products Manufacturing	S13	e_V	0.70	-0.82	-19.98	0.28	1.88	-0.14	0.44	1.71	-2.95	1.23	2.18	1.12	0.06	0.82	1.73	-131.31	0.95	-4.12	-0.13	-0.07	-0.29	0.29	0.74	0.34
		e_W	0.61	-0.10	-13.73	0.57	1.18	-0.13	0.66	1.81	-0.29	0.76	-0.19	0.26	0.01	0.76	1.51	-18.00	0.12	-2.25	-0.05	-0.06	-0.55	0.24	0.77	0.43
		e_P	0.80	-0.97	-7.53	0.02	3.69	-1.94	-0.44	0.11	-13.99	1.48	3.27	1.27	0.16	0.89	2.11	-257.75	1.30	-4.62	-0.14	-0.07	-0.24	0.31	0.73	0.34
		e_T	0.41	-6.28	-102.63	0.03	-17.94	6.62	0.33	1.86	1.42	1.62	0.23	0.94	0.03	0.45	0.00	-59.60	0.36	-1.57	0.03	-0.11	0.00	0.00	0.34	0.00
Chemical Products	S14	e_V	0.66	-0.01	-2.04	-1.08	-1.64	1.86	0.09	-0.02	0.58	-0.06	-0.53	0.00	1.73	-0.62	-0.14	0.14	-0.68	0.50	5.47	-0.62	1.13	2.54	1.33	0.28
		e_W	-0.78	0.01	-4.59	-5.70	6.58	0.69	-0.04	-0.21	-0.37	-0.14	-0.87	-0.33	0.85	-0.82	0.30	0.02	-0.29	0.22	-0.08	-0.33	0.81	0.55	-1.00	-0.62
		e_P	7.07	0.15	-0.59	3.84	-9.48	6.17	0.62	0.35	4.29	0.09	-0.10	0.18	2.89	-0.32	-0.68	0.30	-1.33	0.89	12.76	-0.71	1.53	4.80	4.52	1.28
		e_T	4.03	-0.84	8.35	23.70	-21.35	-6.74	-0.10	-0.04	-4.10	-0.69	-2.58	7.28	0.98	-1.74	0.22	0.39	1.21	0.40	2.64	-3.65	0.63	1.23	3.16	2.01

Source: Results obtained from the model developed in Chapter 4.

Table VIII.15 (cont'd)

Sector		e \ y	1978-75	1979-78	1980-79	1981-80	1982-81	1983-82	1984-83	1987-84	1990-87	1993-90	1994-93	1995-94	1997-95	1999-97	2002-99	2005-01	2006-05	2007-06	2008-07	2009-08	2010-09	2013-10	2014-13	2015-14
Non-Metallic and Mineral Products	S15	e_V	-0.32	-0.39	1.59	-0.55	0.59	0.69	0.45	0.23	0.88	20.95	-0.03	-0.79	-0.30	-0.65	-2.95	0.65	-0.02	0.00	0.04	-0.21	0.23	-0.01	-0.05	-0.03
		e_W	-0.97	-1.20	0.56	-0.15	0.39	0.41	1.94	0.27	0.68	21.04	0.52	-0.34	0.04	-0.18	-1.60	1.30	-0.03	-0.01	0.36	-0.08	0.05	0.01	-0.06	-0.04
		e_P	0.72	-1.32	3.96	-3.46	0.87	1.09	-2.85	0.00	1.56	20.73	-0.84	-1.33	-0.68	-1.32	-4.48	-0.22	0.01	0.01	-0.46	-0.42	0.44	-0.05	-0.01	-0.01
		e_T	3.06	18.86	-2.33	24.65	0.51	0.41	5.94	2.02	-2.04	24.54	5.29	-1.42	0.32	-0.49	-0.50	1.05	-0.07	0.02	0.06	0.20	0.07	0.00	-0.33	-0.05
Iron and Steel Manufacturing	S16	e_V	0.69	1.63	0.76	0.20	0.33	0.42	0.05	0.84	0.21	2.55	-0.08	1.48	5.38	8.29	0.46	0.29	1.30	0.62	-1.29	0.49	0.37	0.48	0.01	0.01
		e_W	0.40	0.26	1.00	-0.33	-0.12	0.31	0.00	0.19	0.08	2.49	0.05	-2.28	4.87	6.44	-0.60	0.14	0.64	2.63	-1.40	0.34	0.32	0.12	0.00	-0.02
		e_P	1.36	5.77	0.63	1.81	1.55	0.00	0.00	1.98	0.96	2.95	-0.15	8.50	5.76	10.72	1.26	0.60	2.30	-2.57	-1.07	0.53	0.43	0.99	0.04	0.27
		e_T	0.00	5.66	-1.04	-2.32	0.56	0.35	0.12	0.84	-0.88	-1.48	-1.50	-4.05	0.66	0.31	-3.99	0.14	-0.73	0.87	-2.52	2.54	0.37	-0.03	0.01	0.06
Basic Non-Ferrous Metal Manufacturing	S17	e_V	1.01	-0.29	1.44	0.59	2.07	1.22	0.27	2.05	1.10	-3.53	4.76	0.50	3.24	-0.24	-2.03	2.05	0.00	2.42	2.72	5.53	0.30	9.87	-0.70	4.49
		e_W	0.77	-0.80	0.50	-0.08	-0.60	0.59	-0.41	0.77	-0.22	2.58	-0.78	0.29	6.43	-0.37	-3.72	-1.03	0.61	-0.05	-4.27	1.73	-0.56	-0.46	0.24	-2.14
		e_P	0.98	0.31	2.65	0.96	4.10	2.37	0.54	4.73	2.30	-6.62	14.45	0.70	1.23	-0.09	-0.55	3.36	-0.41	4.65	4.80	6.84	0.74	14.14	-177.73	36.11
		e_T	6.58	0.01	1.54	2.97	0.00	0.00	0.00	-1.25	3.02	-6.24	-32.23	-0.11	3.84	-1.25	-3.26	-1.84	0.23	0.23	-0.49	7.52	-0.16	105.07	0.87	-18.77
Metal Products, Other	S18	e_V	0.68	-0.02	0.63	0.75	-0.19	1.18	0.20	0.19	0.44	0.41	-0.09	1.46	0.77	2.75	2.02	0.51	0.63	0.16	-0.11	-0.38	0.45	-0.17	-0.22	0.61
		e_W	3.67	0.06	0.67	0.55	-0.68	1.04	-0.03	0.25	0.42	0.74	-0.30	1.26	0.81	1.78	1.01	0.44	-1.28	-0.12	-0.26	0.01	0.19	0.05	0.08	0.95
		e_P	-11.72	-0.15	0.79	0.67	2.41	1.65	1.35	-0.10	0.80	-0.22	0.36	2.02	0.61	6.02	30.02	0.67	5.15	1.59	0.21	-1.26	0.89	-0.50	-0.89	-0.06
		e_T	-6.83	-0.47	-1.05	5.90	-10.22	0.88	-1.52	0.93	-1.89	-3.53	-1.91	0.90	1.12	-0.16	0.04	0.53	-0.55	0.10	-0.08	0.11	0.14	-0.98	0.87	-1.07
Machinery, Transport and Machinery Products	S19	e_V	-5.30	0.86	1.72	18.30	0.83	-0.10	-0.55	1.03	0.87	-6.21	133.87	2.94	0.53	-1.04	-15.38	0.16	-0.17	0.12	-0.08	1.47	8.32	0.51	0.99	-0.01
		e_W	-6.50	0.68	1.01	11.17	0.69	0.62	-0.79	1.43	0.31	-4.11	-6.39	-3.21	0.79	-1.04	-8.79	0.13	-0.01	0.35	-0.05	1.30	-17.33	-0.59	0.36	-0.35
		e_P	2.35	2.73	11.39	74.08	-0.92	-7.45	1.54	0.17	3.55	-10.72	471.81	13.61	-0.09	-0.54	-31.92	0.22	-0.71	-0.42	-0.16	1.24	71.91	2.51	2.53	0.85
		e_T	8.67	-0.19	-4.83	-32.89	8.69	0.67	-3.86	-2.93	-2.38	7.13	335.49	-25.70	1.28	-6.31	-2.63	0.20	0.94	-0.07	0.19	6.13	-29.28	-1.18	-0.19	1.25
Manufacturing, Other	S20	e_V	-0.74	0.81	0.80	-0.28	3.45	0.77	0.61	0.49	1.03	-0.25	3.08	0.13	0.42	-0.79	-0.41	-0.07	0.38	1.50	0.26	13.08	-0.11	1.09	-6.43	3.69
		e_W	3.66	-0.26	0.82	-0.05	2.52	1.40	0.33	0.69	1.61	-0.17	1.67	-0.22	0.24	-0.19	-0.38	-0.20	0.70	1.10	-0.97	13.06	-160.28	1.59	2.03	3.67
		e_P	-15.93	3.25	1.73	-1.31	2.75	-2.18	1.94	0.38	0.17	-0.63	7.27	0.95	1.10	-2.46	-0.50	0.17	-0.26	2.29	4.27	18.60	-360.81	0.34	-18.84	3.73
		e_T	-9.33	-1.02	-4.40	2.78	27.92	3.72	-1.17	-2.39	-5.11	2.72	17.66	1.00	0.49	-0.88	-0.12	0.80	-0.33	0.03	-0.04	-39.63	-267.18	0.23	1.50	3.55
Electricity Generation by Coal	S21	e_V	0.16	-3.37	2.93	2.23	-4.37	0.76	1.34	-0.55	27.36	0.01	0.30	0.00	0.07	0.13	-0.01	0.52	-1.05	1.67	-0.34	-2.52	0.23	-2.33	1.99	0.37
		e_W	-0.42	-3.57	1.72	1.41	4.00	0.83	0.57	1.17	16.63	-0.61	0.29	-0.04	0.12	-0.28	-2.86	0.81	1.61	0.15	0.05	-0.67	0.79	5.15	1.19	1.81
		e_P	0.91	-3.64	4.31	2.48	-9.88	0.72	2.47	-1.60	42.06	0.34	0.31	0.02	0.06	0.20	1.27	0.43	-1.91	2.28	-0.67	-3.56	-0.14	4.13	1.83	4.45
		e_T	-2.93	3.21	-2.00	8.20	3.50	0.43	-2.89	-7.58	-107.35	0.00	0.00	0.00	0.00	18.17	-15.42	0.28	-4.23	3.05	2.42	-4.19	1.80	-132.90	3.02	-9.96

Source: Results obtained from the model developed in Chapter 4.

Table VIII.15 (cont'd)

		e \ y	1978-75	1979-78	1980-79	1981-80	1982-81	1983-82	1984-83	1987-84	1990-87	1993-90	1994-93	1995-94	1997-95	1999-97	2002-99	2005-01	2006-05	2007-06	2008-07	2009-08	2010-09	2013-10	2014-13	2015-14
Electricity Generation by Oil Products	S22	e_V	-2.20	-0.10	-6.51	-0.52	2.18	1.02	0.35	0.58	-1.07	-1.78	1.16	-0.17	0.19	8.92	2.17	0.82	3.67	-1.56	-0.10	-0.69	-0.11	5.58	0.56	1.95
		e_W	-0.65	-26.82	-2.56	-1.01	6.11	1.14	-2.88	0.70	-2.28	-0.44	1.15	-0.19	0.23	14.90	2.90	1.04	5.16	-2.93	-0.01	0.16	-18.85	2.68	0.83	1.49
		e_P	-4.18	-27.59	-11.02	-0.37	-0.41	0.96	5.05	0.50	0.59	-2.49	1.16	-0.16	0.19	7.85	1.84	0.75	3.18	-1.02	-0.18	-1.17	-47.57	3.08	0.62	0.64
		e_T	5.96	48.96	9.57	3.07	5.88	0.50	-17.29	0.08	-16.28	0.00	0.00	0.00	0.00	0.00	6.10	0.64	1.87	-0.32	0.55	-1.46	12.17	56.11	0.21	5.26
Electricity Generation by Natural Gas	S23	e_V	-0.09	0.26	-1.78	1.55	-0.60	-1.24	-2.94	-13.61	-15.34	-6.05	0.60	-0.01	0.59	1.10	0.79	8.87	25.92	57.47	0.68	4.38	1.09	3.30	-0.86	-6.92
		e_W	-0.14	0.19	-2.40	1.37	2.78	-1.16	-3.01	-10.93	-13.56	-11.63	0.59	-0.04	0.62	0.74	1.05	8.61	24.98	67.69	0.94	5.30	1.55	2.05	-7.77	-2.41
		e_P	-0.02	0.16	-1.07	1.61	-2.83	-1.29	-2.83	-15.25	-17.79	-3.07	0.60	0.00	0.59	1.16	0.67	8.95	26.22	53.39	0.46	3.87	0.80	2.22	-2.26	5.93
		e_T	-0.35	2.74	-4.31	2.86	2.58	-1.62	-3.35	-24.59	7.07	0.00	0.00	0.00	0.00	16.90	2.22	9.07	27.04	48.16	2.53	3.55	2.36	25.11	8.08	-39.50
Electricity Generation by Hydro	S24	e_V	0.67	0.56	0.08	1.24	0.43	1.86	0.44	-0.55	-0.92	0.00	0.27	-0.02	0.13	0.76	1.13	-0.27	0.52	1.02	5.04	-1.38	0.08	1.10	3.38	-2.53
		e_W	0.85	0.46	0.71	0.77	-10.24	2.46	-0.91	0.28	-0.23	-0.45	0.26	-0.07	0.17	-0.04	-0.01	0.10	2.81	0.28	2.80	-0.28	0.28	0.39	0.12	0.95
		e_P	0.43	0.42	-0.63	1.37	7.48	1.55	2.40	-1.06	-1.86	0.25	0.28	-0.01	0.12	0.90	1.64	-0.39	-0.22	1.31	6.92	-1.99	-0.06	0.48	2.72	7.39
		e_T	1.66	3.80	2.64	4.61	-9.60	-0.79	-6.93	-3.95	7.71	0.00	0.00	0.00	0.00	36.10	-5.05	-0.57	-2.24	1.69	-10.81	-2.36	0.64	13.43	7.59	-27.70
Electricity Generation by Renewables	S25	e_V	1.41	0.73	0.93	1.35	1.84	-0.24	0.47	0.77	0.36	1.17	1.06	0.19	0.60	-0.15	-5.86	1.75	2.15	0.71	1.09	-1.27	0.60	1.64	0.66	2.98
		e_W	1.56	0.63	1.48	0.88	-13.96	0.40	-0.86	1.44	1.03	0.48	1.05	0.13	0.64	-0.77	-8.89	2.06	3.48	-0.47	1.80	-0.10	0.81	0.79	1.39	1.52
		e_P	1.20	0.60	0.30	1.49	12.25	-0.58	2.41	0.36	-0.55	1.54	1.07	0.22	0.59	-0.04	-4.50	1.66	1.72	1.19	0.50	-1.93	0.46	0.91	0.81	-1.18
		e_T	2.24	4.10	3.18	4.79	-13.01	-3.09	-6.81	-1.96	8.76	0.00	0.00	0.00	0.00	27.30	-22.23	1.51	0.55	1.79	6.08	-2.33	1.19	16.53	-0.28	13.55
Electricity Generation by Other Fuel	S26	e_V	1.03	0.58	1.12	1.06	1.07	1.13	0.76	0.99	1.05	0.98	1.03	0.97	0.94	1.02	0.96	1.03	1.01	1.19	0.99	0.98	0.99	0.99	1.00	1.01
		e_W	1.12	0.26	2.31	0.36	2.34	0.86	-0.22	1.47	0.72	-1.25	1.01	0.87	0.99	0.57	1.33	1.14	1.61	4.81	1.23	2.33	1.25	0.31	1.34	0.41
		e_P	0.91	0.15	-0.25	1.26	0.23	1.27	2.18	0.70	1.49	2.17	1.03	1.02	0.93	1.10	0.79	1.00	0.81	-0.26	0.80	0.22	0.82	0.41	1.07	-0.69
		e_T	1.52	10.92	5.98	6.09	2.26	2.33	-4.59	-0.95	-2.99	0.00	0.00	0.00	0.00	0.00	2.97	0.95	0.29	-2.12	2.63	-0.24	1.72	12.89	0.57	5.33
Electricity Transmission and Distribution	S27	e_V	-0.06	0.37	7.67	0.71	-0.84	0.70	0.73	-0.30	-6.03	0.36	0.38	0.01	0.14	0.22	2.44	0.35	-0.62	0.70	-0.07	-1.44	0.36	2.37	3.95	-2.62
		e_W	27.35	0.20	2.82	0.21	10.43	0.80	-0.03	0.75	-2.71	-0.36	0.37	-0.04	0.18	-0.21	10.41	0.66	1.89	-1.65	0.31	0.15	0.80	0.12	-0.23	1.38
		e_P	4.18	0.15	13.21	0.86	-8.27	0.65	1.84	-0.94	-10.59	0.74	0.39	0.02	0.13	0.30	-1.12	0.25	-1.44	1.64	-0.38	-2.33	0.07	0.43	3.10	8.77
		e_T	70.82	5.65	-12.11	4.33	9.75	0.27	-3.44	-4.58	0.00	0.00	0.00	0.00	0.00	19.31	45.46	0.09	-3.64	2.85	2.59	-2.87	1.59	41.57	9.35	-31.53
Gas Supply	S28	e_V	1.65	-1.42	-6.05	-0.09	0.75	-0.17	5.71	-1.18	0.26	0.00	-0.46	-0.04	-1.67	0.02	-0.17	-0.02	-0.87	-0.43	-0.03	1.10	0.00	1.03	0.93	-0.06
		e_W	3.08	-0.84	-2.30	0.44	0.86	3.83	-2.93	0.38	2.55	-0.05	0.17	-0.06	-2.32	0.54	-0.04	-1.32	-1.47	-0.86	-0.01	-0.23	0.07	0.55	-1.26	-0.08
		e_P	-0.35	-1.22	-10.58	-0.78	0.63	-3.76	19.03	-2.42	-0.48	0.04	-0.92	-0.03	-1.63	-0.14	-0.21	0.30	-0.82	-0.45	-0.04	1.26	0.20	0.94	1.57	-0.04
		e_T	6.23	-10.05	4.06	3.77	1.08	1.88	-10.99	-0.73	0.00	0.00	0.00	0.00	0.00	-3.27	0.29	-0.06	-1.07	0.48	0.31	0.04	-2.06	6.32	-0.25	-0.24

Source: Results obtained from the model developed in Chapter 4.

Table VIII.15 (cont'd)

Sector	Code	e \ y	1978-75	1979-78	1980-79	1981-80	1982-81	1983-82	1984-83	1987-84	1990-87	1993-90	1994-93	1995-94	1997-95	1999-97	2002-99	2005-01	2006-05	2007-06	2008-07	2009-08	2010-09	2013-10	2014-13	2015-14
Water Supply UPSTREAM	S29	e_V	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		e_W	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		e_P	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		e_T	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Water Supply, Urban	S30	e_V	1.04	-4.50	2.00	0.86	1.51	1.97	20.90	0.74	0.25	0.17	0.03	8.49	-0.13	-1.52	4.27	1.31	0.88	2.41	0.36	-0.61	10.90	3.56	0.10	0.96
		e_W	0.89	-15.31	-1.21	1.16	0.15	2.34	69.07	-0.80	0.24	0.21	0.00	5.84	-0.33	-1.48	4.68	4.70	-5.97	-1.56	0.44	-0.81	-14.43	1.51	-0.30	26.94
		e_P	1.12	-1.62	2.68	-0.29	2.21	1.96	13.93	1.57	0.22	0.15	0.04	9.04	-0.08	-1.51	4.12	0.82	3.13	3.01	0.17	-0.68	19.49	3.95	0.08	-2.56
		e_T	-0.41	46.71	17.45	28.30	-4.79	0.69	-79.90	-2.87	1.11	0.00	0.00	0.00	0.00	0.00	29.07	-21.32	18.60	-9.13	-3.38	-11.29	-30.58	18.17	12.46	-44.97
Water Supply, Rural	S31	e_V	0.03	0.31	0.93	-2.67	-82.67	27.58	58.86	0.16	0.28	0.58	0.01	-7.50	1.57	6.09	0.09	-1.36	40.21	25.98	-24.29	-0.21	-2.06	-1.65	101.42	-2.29
		e_W	0.03	0.16	0.22	-2.66	-109.86	29.45	83.57	-0.80	0.27	0.61	-0.02	-6.81	1.12	5.97	0.03	0.91	16.40	114.39	-22.88	-0.31	2.81	-1.75	98.64	-4.21
		e_P	0.03	0.36	1.08	-2.74	-68.58	27.57	55.29	0.68	0.25	0.57	0.01	-7.64	1.69	6.06	0.12	-1.69	48.02	12.54	-27.97	-0.25	-3.71	-1.63	101.28	-2.03
		e_T	0.01	1.03	4.32	-1.12	-209.17	21.28	7.16	-2.10	1.12	0.00	0.00	0.00	0.00	0.00	-3.70	-16.50	101.79	282.95	-95.03	-5.62	5.92	-0.93	186.29	1.11
Water Services (Sewerage & Drainage)	S32	e_V	0.34	1.26	1.50	1.47	1.30	1.91	1.63	0.95	0.07	-0.18	0.03	12.92	-0.04	0.44	0.69	0.86	17.20	5.89	-0.14	0.88	-6.04	5.07	5.10	0.74
		e_W	0.37	0.78	0.41	1.49	0.01	2.19	2.82	0.51	0.01	-0.10	0.01	9.25	-0.23	0.40	0.61	1.43	0.76	2.55	-0.34	0.70	-1.73	1.12	4.62	0.81
		e_P	0.32	1.72	2.43	0.99	4.06	1.65	0.77	1.95	0.04	-0.31	0.06	16.79	0.21	0.57	0.86	0.81	47.89	8.03	-0.82	0.56	-14.18	8.12	3.41	0.95
		e_T	-0.10	6.60	11.48	6.96	-9.83	1.36	-2.10	-0.70	1.13	0.00	0.00	0.00	0.00	0.00	-6.09	-11.61	150.57	-6.00	-4.15	-7.46	4.89	101.03	47.97	-2.33
Construction	S33	e_V	0.41	-0.44	0.51	0.15	1.99	0.81	7.09	0.82	-2.56	0.88	1.70	-2.15	2.21	0.54	-3.62	0.88	0.44	4.46	0.66	0.38	-0.15	0.71	3.19	-1.86
		e_W	28.51	-1.87	-0.18	0.21	-0.69	-0.04	-1.05	1.24	-2.85	0.77	1.15	-1.62	0.83	0.44	-8.66	0.62	0.49	8.31	0.93	0.58	206.29	1.02	6.53	-0.83
		e_P	-35.48	3.46	5.46	-0.10	6.17	2.11	21.88	0.49	-1.54	1.01	2.16	-2.75	3.53	0.63	0.76	1.15	0.40	1.21	0.26	1.24	-54.34	0.34	-1.02	-3.24
		e_T	-363.96	-4.08	-23.61	1.66	7.23	-1.02	-15.62	-0.27	-13.00	0.46	6.08	-0.96	4.20	0.54	-0.10	0.38	0.49	4.83	0.37	-28.69	209.66	1.21	3.69	-1.61
Wholesale and Retail Trade	S34	e_V	1.12	0.21	-2.57	-7.49	-0.34	0.74	0.21	0.28	-0.30	-0.15	0.08	0.33	-1.67	0.20	0.40	1.84	-1.42	0.49	-0.92	-0.39	2.83	1.04	0.31	0.91
		e_W	1.22	0.08	-2.10	-6.04	0.49	0.19	0.31	0.23	0.84	-0.17	0.06	0.25	-2.39	0.22	0.64	1.18	-1.57	1.07	-1.62	0.01	0.97	1.01	0.38	1.33
		e_P	0.69	0.32	-2.86	-8.66	-2.09	1.67	0.05	0.43	-1.60	-0.14	0.09	0.41	-0.39	0.14	-0.06	3.09	-1.73	-0.73	0.75	-2.25	6.79	1.00	-0.03	-0.19
		e_T	3.33	0.90	-5.14	-16.16	4.22	0.26	0.16	-0.03	-2.04	0.20	0.35	0.85	-1.80	0.26	0.22	3.45	2.82	0.76	-1.37	4.66	2.19	2.07	2.08	3.16

Source: Results obtained from the model developed in Chapter 4.

Table VIII.15 (cont'd)

Sector	Code	e \ y	1978-75	1979-78	1980-79	1981-80	1982-81	1983-82	1984-83	1987-84	1990-87	1993-90	1994-93	1995-94	1997-95	1999-97	2002-99	2005-01	2006-05	2007-06	2008-07	2009-08	2010-09	2013-10	2014-13	2015-14
Transport and Storage Services	S35	e_V	-0.53	0.26	3.04	1.26	-0.55	-0.03	0.51	0.61	-1.71	0.07	-0.45	-0.78	0.33	0.19	0.16	0.94	-0.59	4.13	0.52	0.29	-2.60	1.78	-0.10	1.04
		e_W	-0.79	0.03	3.98	1.05	0.07	0.30	0.41	0.31	0.28	0.03	-4.88	-0.44	1.44	-0.05	0.65	0.73	-4.45	-2.24	1.30	0.86	6.39	1.96	-0.52	0.89
		e_P	-0.62	0.46	4.47	0.68	-2.32	-26.29	1.18	0.99	-4.98	0.12	3.11	-1.01	-1.08	0.52	-0.46	1.22	4.40	12.95	-0.16	0.00	-10.23	1.35	0.11	1.11
		e_T	2.93	1.60	-9.44	7.25	1.22	7.72	-2.27	1.79	2.65	-0.11	23.68	-3.84	1.56	0.29	0.41	0.99	-3.80	-0.40	0.36	-2.75	-24.23	5.65	3.20	2.23
Communication, Finance, Property and Business Services	S36	e_V	1.91	1.14	0.03	0.98	0.43	1.11	-2.20	0.92	1.43	0.85	-2.28	0.31	1.31	1.12	0.93	1.28	1.33	-0.05	1.42	0.40	1.82	0.72	0.62	0.95
		e_W	2.28	-0.58	-22.95	0.61	1.41	1.65	4.67	0.64	2.70	0.38	-2.47	0.77	1.54	1.49	0.70	1.24	4.12	-0.07	1.72	1.85	2.56	0.11	0.92	0.57
		e_P	1.51	1.54	-314.55	0.33	-0.61	1.00	-14.91	1.23	1.21	1.28	-1.83	0.09	1.16	0.87	1.13	1.27	-0.74	-0.02	1.21	-0.28	1.31	1.15	0.40	1.19
		e_T	4.26	5.23	872.04	8.44	4.01	0.10	40.88	0.11	-1.45	-0.59	-7.58	-0.74	1.30	1.08	0.46	2.14	3.43	-0.29	1.16	-6.11	1.94	0.73	0.97	0.97
Government Administration, Defence, Public Order and Safety	S37	e_V	-0.16	-0.49	3.44	0.74	-0.97	0.51	-1.56	0.63	-0.14	0.41	1.09	-0.41	2.04	0.28	2.27	1.18	3.05	1.82	-0.56	0.25	1.20	1.84	0.02	1.27
		e_W	-0.03	-0.58	0.95	0.84	-0.94	0.50	-1.42	0.68	-0.55	0.37	2.67	-0.14	2.19	0.24	2.31	1.33	3.49	1.44	-0.86	-0.13	1.51	2.14	-8.25	1.01
		e_P	0.00	0.00	0.00	0.00	0.00	0.33	-1.41	0.18	2.29	0.81	3.82	-0.45	0.00	0.54	2.22	0.37	1.27	4.55	-0.97	2.33	-0.04	0.69	-1.62	3.15
		e_T	-7.60	2.46	73.69	-0.05	14.97	10.30	-32.86	0.00	0.00	-0.10	-77.63	-251.82	12.18	0.01	1.35	0.59	-2.69	0.76	16.46	-2.29	0.91	0.69	3.48	-2.94
Education, Health and Community Services	S38	e_V	0.75	1.12	1.02	0.70	-1.23	0.99	0.58	1.20	-6.29	1.32	1.62	-0.37	1.14	0.69	1.19	0.84	3.90	0.54	0.73	0.14	1.18	1.89	0.56	0.91
		e_W	0.82	1.10	1.24	0.75	0.79	1.06	0.68	1.21	-6.04	1.27	1.29	-0.16	1.31	0.66	1.18	0.81	4.07	0.42	0.92	0.00	1.24	2.08	0.68	0.90
		e_P	0.29	0.91	-0.56	-0.49	-20.50	0.51	0.70	0.31	-12.39	1.94	2.82	-1.58	-0.25	0.69	1.36	0.89	3.42	1.46	-1.03	1.76	0.73	0.87	-0.18	1.15
		e_T	0.27	4.06	-1.20	7.37	-15.83	1.33	-5.60	17.76	34.69	-0.65	11.28	-2.36	3.17	1.90	0.63	1.57	0.10	-0.12	3.72	-3.03	2.28	0.79	0.32	-0.70
Other Commercial Services including Waste Management	S39	e_V	1.66	1.27	1.48	0.92	1.16	1.47	3.57	1.37	0.15	0.51	-0.33	0.25	0.54	1.75	7.47	1.36	0.85	-1.14	-2.54	5.38	1.46	0.83	0.57	0.82
		e_W	5.01	1.69	1.80	0.06	0.89	2.59	4.07	2.26	2.16	0.54	-0.28	0.30	1.08	0.95	6.53	0.72	-0.59	0.88	0.40	3.59	0.74	1.26	1.53	0.28
		e_P	-0.35	0.27	0.63	-0.60	1.79	-2.17	1.23	0.02	-2.38	0.44	-0.40	-0.08	-2.02	6.62	13.32	4.18	5.68	-7.66	-5.51	11.05	2.87	0.13	-1.21	1.72
		e_T	-7.78	1.10	1.09	12.31	1.37	4.38	6.20	0.17	-11.39	-0.05	-1.75	1.33	1.67	3.08	1.10	1.44	0.33	-0.07	-22.73	-48.46	-0.08	0.81	1.50	2.37

Source: Results obtained from the model developed in Chapter 4.

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