The Determinants of
Commercial Property Market Performance

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CERTIFICATE

I certify that this thesis has not already been submitted for any degree and is not being submitted as part of candidature for any other degree.

I also certify that this thesis has been written by me and that any help that I have received in preparing this thesis, and all sources used, have been acknowledged in this thesis.

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ACKNOWLEDGEMENTS

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ABSTRACT

The purpose of this thesis is to critically evaluate the determinants for modelling and forecasting long-term performance in office, industrial and retail property markets and to suggest ways to improve commercial property forecasting. The research examined the three-year forecast accuracy of the most prominent property forecast model and associated determinants, and investigated the factors influencing current commercial property decisions in the rapidly changing economic environment with the major advances in globalisation, technological innovation and financial deregulation.

Forecasts are essential when making major commercial property decisions and have led to considerable emphasis being placed on formal property forecast models to determine future long-term property performance. Both the literature review and a survey of Australian property forecast organisations showed that explicit property forecasting is a relatively new predictive tool within the property industry. In addition, there appear to be insufficient theoretical considerations to present econometric theory and long-term forecast accuracy.

The information search revealed the preference in published studies for the single equation property forecast model. Accordingly, a single equation model was constructed for rents and yields in three prominent Australian property markets: Sydney CBD prime office, Sydney metropolitan prime industrial and New South Wales regional shopping centres. The property model forecasts started at December 1994, 1995 and 1996 and the forecast input determinants were an average of leading published macroeconomic forecasts from those periods. The accuracy of the property forecast model was measured by how close the three-year semi-annual forecast values were to the actual values Mean Absolute Percentage Error test (MAPE) and to the forecast values of a simple forecast model (Theil U value test).

The results showed that half the property forecast values were inaccurate when related to actual values and there was no consistency in the underlying relationship. The majority of property forecast values were also less accurate than the forecast values from the naïve forecast model. Significantly, the overall random pattern of error showed no evidence that historical time-series length and key statistical tests determined the predictive capacity of the property forecast model. The accuracy of the property forecast model process should be established on the out-of-sample analysis.

The success of the property forecast model thus appeared to depend on the forecasts of the selected macroeconomic determinants. These were then tested for forecast accuracy and revealed a consistently large forecast error over the three-year forecast periods used in this study, illustrating their limited capacity to foresee structural economic change.

Such economic changes, connected to advances in the modern economy, are reshaping business organisations, the fundamentals of space demand and, significantly, commercial property market performance. A survey of the same three markets - Sydney CBD prime office, Sydney metropolitan prime industrial and New South Wales regional shopping centres, showed that demand for space is more than a function of the macro economy, with each market involving distinct organisational, space and decision-making considerations. Market determinants such as the dominance of multi nationals, the impact of mergers and acquisitions in the office market and the relatively short time (generally less than six months) organisations spend searching for new space are absent in current property forecast research.

One procedure to determine an organisation's approach and requirement for space is to measure and benchmark the range and importance of property decision influences. The space selection process indicates the significance of diverse microeconomic characteristics, and the distinct impact of new technology on office space demand. Elsewhere the macroeconomic factors displayed some similarities across the office, industrial and retail markets.

This thesis demonstrates that structural economic change, and the influences on space demand, are important determinants when forecasting long-term commercial property market performance. It recommends that these should be included in future long-term property forecast systems, ensuring that property forecast models and selected determinants are based on post-evaluation analysis. Furthermore, and in a different medium, it suggests that structured market research must be used to identify contemporary factors and circumstances influencing the commercial property landscape. The patterns that emerge in this process are central to the property decision process and far more comprehensive than those identified in previous property forecast literature.

Chapter
One

INTRODUCTION

1.1 FOUNDATION FOR THE RESEARCH

The extraordinary financial losses and market disruptions in the late 1980s and early 1990s have overshadowed the last decade of the 20th Century. The issues were particularly severe in commercial property markets and called into question many earlier property decisions. As a consequence, the qualities of design and physical parameters for structured commercial property decisions were reviewed with new guidelines derived from financial and economic markets (Matysiak 1992).

Formal property forecasts are now used in major property decisions and form part of the cash flow analysis in property asset allocations, building valuations and development appraisals. Cash flow analysis has been well documented in many leading property textbooks (Cadman and Austin-Crowe 1994, Jaffe and Sirmans 1995, Brown and Matysiak 2000) and is now an adopted valuation method as detailed in the RICS (1995) Red Book and API (1999) Australian Professional Practice Manual.

Property forecasts are normally over two or more years, as commercial property is viewed on a long horizon. This is illustrated in Rowland and Kish's (2000) survey of Australian property fund managers, which showed 86 percent having a holding period for commercial property of five years or more. Equally, construction timelines for commercial property can extend into many years when adding together the development, planning and building stages (Darlow 1988).

There has been considerable emphasis on developing effective property forecast models, as forecasting has become a central part of commercial property decision analysis. Published research in this area is limited and primarily by academics; issues of sensitivity and confidentiality restrict property forecast organisations from publishing their forecast models since there is considerable economic value placed on providing commercial property forecasts (Ball *et al* 1998).

The processes used in many of the published property forecast models, while presumably acceptable at the time of publication, are now suspect with reference to current econometric theory (Ball *et al* 1998, Chaplin 1999). In addition, it appears that the input determinants for several property forecast models are aspects of macroeconomic activity, which historically have been shown to have a poor forecast track record (Ashley 1988 and Ash *et al* 1990).

There is a recent research on the accuracy of property forecast models. For example, Sivitanides (1998), Chaplin (1999), Thompson and Tsolacos (2000) have tested for short-term, out-of-sample forecast accuracy relative to their property forecast models. The mixed results highlighted that out-of-sample forecast accuracy tests should follow general forecasting theory (Makridakis *et al* 1998), and be based on the actual forecast requirements (commercial property characteristics require long-term forecasts). Property forecast model credentials should therefore be established by regular long-term forecast accuracy tests.

Furthermore, in trying to establish the integrity of commercial property models, it must be recognised that commercial property decisions are made in an environment of continual change and development (Mitchell and McNamara 1997). This is most evident in the demand for space (Guy and Harris 1997, Roulac 1996b), as organisations respond to new business opportunities and challenges presented by the emerging new world economy, including globalisation, financial deregulation and significant advances in communication and information technology.

Analysis of the complex dynamics of the demand market can demonstrate the influences and changes occurring across the commercial property landscape. There is little empirical evidence, apart from a few individual studies on specific markets (for example, Gerald Eve Research 1999, Lizieri *et al* 1997, Knight Frank Hooker 1995), that property researchers are systematically addressing these broad issues, and none appear to be translating the information into measurable determinants of commercial property market performance.

1.2   STATEMENT OF THE PROBLEM

Many commercial property decisions lead to major allocations of resources (land, labour and capital). It is therefore critical to determine long-term property performance. Formal modelling and forecasting has developed over the last 20 years and is now an essential part of the commercial property decision toolkit. As Ball *et al* (1998) and Chaplin (1999) explained, the drive in model building is to try to explain the past and predict the future with the aim of linking, at some stage, commercial property market performance with leading economic indicators.

A major concern with this approach is that the model assumptions are premised upon tomorrow replicating yesterday, allowing for no possibility of a different tomorrow. This is especially significant in the fast changing modern environment, portrayed by unprecedented shifts in society, economy and organisational change and the implications on office, industrial and retail markets.

No modelling in the commercial property market is without difficulties. There is now a requirement to establish the credentials of commercial property forecast determinants with regards to the property forecast models and the pace and nature of change affecting the various commercial property markets. This generates a number of challenging issues and suggests that property forecast research would be more successful with a focus on comprehending the probable future rather than an extrapolation of the past.

1.3   PURPOSE AND OBJECTIVES

The purpose of this thesis is to critically evaluate the determinants for modelling and forecasting long-term performance in commercial property markets. This can be achieved by establishing and then determining the long-term forecast accuracy of the most common property forecast model and selected determinants.

When evaluating the predictive capacity of the property forecast model, there is a requirement to investigate and examine the determinants influencing current property decisions as these are being shaped in an economic environment distinctly different from the past. Therefore in this thesis the research on the determinants of commercial property market performance is in two distinct areas:

(i)   **Property forecast model determinants** – those time series observations that provide a relationship, and which track historical commercial property market performance.

(ii)   **Property market determinants** – a profile of factors influencing current decisions in the commercial property markets including those driven by future expectations.

The objectives follow the two general areas of research on the determinants for modelling and forecasting the long-term performance in office, industrial and retail property markets:

Property forecast model determinants

(i) To examine and evaluate commercial property market forecast theory and models used in forecasting the long-term performance of the office, industrial and retail property markets.

(ii) To develop and test the most common property forecast model.

(iii) To analyses and discuss the forecast accuracy of the selected determinants driving the property forecast model.

Property market determinants

(i) To design a system for collecting data on the main factors influencing current commercial property markets and devise a technique to translate these into measured property market determinants.

(ii) To compare property market determinants in this study with those selected input determinants for the property forecast model.

(iii) To suggest ways for improving the accuracy of long-term commercial property market forecasts.

Combined the property forecast model and property market objectives will provide a platform to better understand determinants for modelling and forecasting long-term commercial property market performance. This, in turn will be an important property decision tool and provide a framework for a property forecast system to successfully operate in a rapidly changing economic and commercial property environment.

1.4   RESEARCH FRAMEWORK

In defining the purpose and objectives, the research framework details the stages, scope and limitations of the thesis. Figure 1. 1 illustrates the research framework:

Figure 1.1   **Flow Chart of the Research Framework**
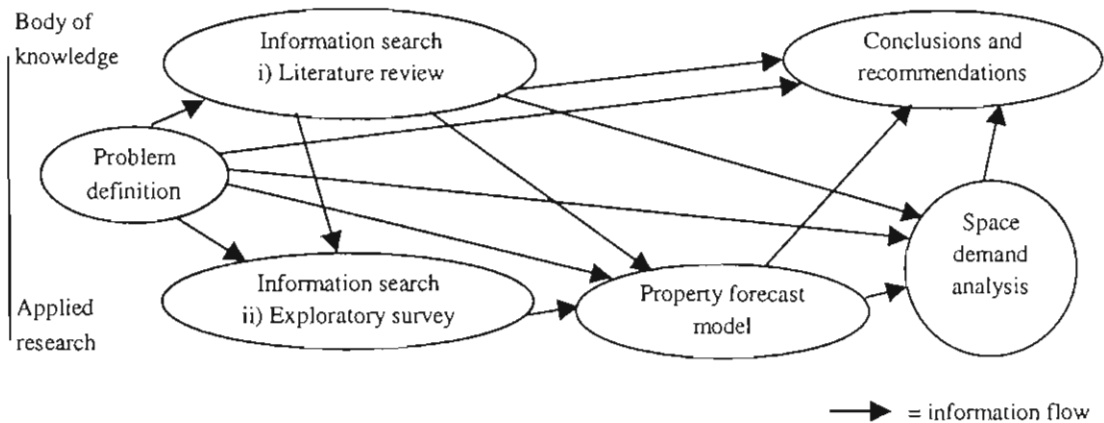
Figure 1.1 outlines the key stages in the research; each step represents different study areas with defined starting points. The thesis is built on grounded theory with observations sourced from case studies of three prominent office, industrial and retail markets. The main part of the thesis covers:

(i)   **Information search** - provides a comprehensive review of published work on commercial property modelling and forecasting. The literature survey also explores the background issues which impact on property forecasting, for example: property data issues and the theoretical bases of the property forecast models.

In the review of the development and application of property forecasts, a noticeable absentee is information from property forecast organisations. Their published work on forecasting is limited, mainly because their models as previously stated have commercial value. For a clear idea on property organisations' approach to forecasting, a survey on the industry participants refines the research issues.

(ii) **Property forecast model** - can be developed based on the most important considerations highlighted in the information search. The model and selected determinants can provide the forecast values. The accuracy of the forecast values can be compared to actual values and to the forecast of a simple forecast model. The results determine if the forecast values and property forecast model are accepted, modified or rejected.

(iii) **Space demand analysis** - can provide the market knowledge to the property forecast process. In a changing economic environment, analysis on the property sector most affected (space occupiers), can demonstrate significant contemporary circumstances affecting the property landscape and future property performance.

Applying structural analysis to organisations' space requirements can unravel the complexities of demand and establish the credentials of property forecast model determinants, highlighting new determinants driven by a rapidly changing world economy. Better knowledge of the underlying property changes is essential in arriving at models and forecasts that improve the contribution towards informed decision making.

1.4.1 Scope

At various stages of this thesis, detailed commercial property market information is required to establish the determinants of commercial property market performance. For consistency and comparison purposes, the data and material sources need to be from defined commercial property markets. The required information is as follows:

(i) Details of the organisations that provide forecasts for the leading commercial property markets.

(ii)   Availability of sound historical property data for forecast model purposes.

(iii)   Abundant and reliable property leasing details for a survey of organisations'
        space demands and associated decisions.

The required information narrowed the section to leading Australian property markets. Three
established property markets were identified: Sydney CBD prime office, Sydney
metropolitan prime industrial and New South Wales regional shopping centres. These
represented premier Australian property markets, being of sufficient size to continuously
attract major investors and space occupiers. As a rule these property markets received the
most attention from property consultants and commentators and so should have
comprehensive information.

A summary of the specific markets appears in Table 1.1 with further detailed information in
Appendix A.

Table 1.1   **Summary of Leading Australian Property Markets**
at December 1998

Property market characteristics	Sydney CBD prime office market	Sydney metropolitan prime industrial market	NSW regional shopping centres
Value (AU$)	9.1 billion	5.1 billion	4.8 billion
Floor space (sqm)	1.4 million	6.9 million	5.1 million
No. of buildings	58	Not known	27
Location	Defined	Dispersed	Geographically scattered
Status of research	Extensive	Limited	Specialised
Planning issues	Extensive local planning controls	Depends on locality and space use	Restricted to extensions and refurbishments
Development timeframes	Long term (2-5 years)	Short term (1-2 years)	N/A
Key features	Central location with good infrastructure	Changing market - both by location and type	More than 40% owned/managed by one company

Adapted: Higgins *et al* 2000

Table 1.1 illustrates the leading characteristics of the commercial property markets. Each one has distinctive location, building and construction features. In addition, the level of research differs extensively across these property markets. There is the comprehensive office market coverage with good disclosure and accurate documentation of performance, absorption and supply. In contrast, the retail market is characterised by restrictive information from a few specialised property research organisations. Industry market research is limited to specific locations covered by leading property research organisations and formal property definitions are still to be established. This further demonstrates the importance of property market research to establish performance determinants for the different commercial property markets.

1.4.2 Limitations

There are limitations associated with this study. These principally relate to the selected property forecast model and collection of survey data. The timeframe and the number of variables included in the property forecast model is necessarily limited. To test the forecast accuracy long-term (three years) and to compare them with actual figures, the commercial property forecast model start dates were prior to December 1996.

The model start dates restricted the macroeconomic forecast determinants to those available at the start of the forecast periods, the scope was therefore limited to the available forecast determinants. However, data sourced from public and property organisations' libraries presented sufficient forecast values on the selected determinants to avoid any bias in the data collected from individual organisations.

Finally, it is appreciated that there are research deficiencies with a survey procedure. In this instance, the two surveys forming part of this study were based on data collected from identified populations rather than samples and, prior to each survey, a pilot study was undertaken. However, it is acknowledged that there were time, administrative and financial constraints.

1.5   CONTRIBUTION TO KNOWLEDGE

This study investigates the determinants for modelling and forecasting long-term performance in commercial property markets. The proposed multidisciplinary approach to the study reflects the complexity of the commercial property markets, and the uncertainties fuelled by the emerging new economy. This thesis will therefore contribute to property forecast knowledge in two main areas: property forecast model building, and structured market demand analysis as a property forecasting tool.

The main contribution to knowledge is as follows:

(i)   Property forecast models are seldom tested out-of-sample. The study will develop tests to discover the regular long-term (three-year) forecast accuracy of the most common property forecast model in the office, industrial and retail property markets.

(ii)   It will determine the extent that long-term forecast values are based on the property forecast model input determinants.

(iii) Suggest improvements in property forecast modelling procedure to reduce forecast error.

(iv)   The uncertainties of the new economy are affecting space demand and property market performance. Structured market research will establish a process to better capture the underlying property changes and so improve the knowledge on the determinants driving the property markets, especially with the current uncertainties with loss making internet organisations.

(v)   Understanding the influences on organisations' space decision will provide valuable information on the relationship between business and buildings. For example it will benefit the property development industry indicating the past

mismatch between the design needs of the space occupiers and the space supplied.

Commercial property forecasting takes place in a climate characterised by the future, different from the past. It is important to combine the research on property forecast modelling and the property market sector (space demand) which is most significantly affected by organisations embracing the 'new world' driven by globalisation, technological advances and financial deregulation. This study provides a platform for a commercial property forecast system which will ultimately improve the quality of future commercial property investment and development decisions.

1.6   STRUCTURE OF THESIS

The thesis outline is presented in Figure 1.2; specific chapter descriptions follow.

Chapter One aims to provide the reader with an understanding of the reasons for the research and the context in which it can be applied. The research purpose and objectives provide reference points for the thesis. The scope and limitations of the study are explained along with the contribution to knowledge.

Chapter Two reviews the literature in order to understand the determinants of commercial property market performance. General forecasting fundamentals are reviewed in stages with reference to associated commercial property literature. The literature review on the commercial property markets is in three areas including the sources and concerns in measuring commercial property market performance, and a framework to identify commercial property market performance determinants. The final area details published office, industrial and retail property market models with a summary of the time series, statistical approach, select determinants and model outputs. Where provided, the forecast accuracy analyses were examined and reported on.

Chapter Three presents a study of the current status of property organisations forecasting the performance of Australian commercial property markets. Property organisations were surveyed and provided details of their structure and range of property forecasts, the selected forecast models and performance determinants. Also provided is information on their approach to evaluating property forecasts.

Chapter Four draws on the literature review and the industry survey to crystallise the research issues and to establish the methodology for constructing the property forecast model and selecting macroeconomic determinants.

Chapter Five details the property and macroeconomic data sources and constructs the property forecast model. The forecast values are compared with actual property performance and a simple forecast model. A similar exercise is performed on those selected forecast macroeconomic determinants from the property forecast model.

Chapter Six explains macroeconomic transformation forces and then tests the forecast macroeconomic determinants. These agents of change primarily affect the demand for commercial property. Information on organisations, the space occupied and decision influences can provide a platform to determine future commercial property market performance. Structural market research employs a survey to provide details on the demand for space.

Chapter Seven presents the causes and patterns of new space demand in Australian commercial property markets. The survey details a framework to understand the complex dynamics of space demand markets and details leading performance determinants in commercial property markets. Policy implications are explained relative to property forecast research.

Chapter Eight summarizes the research and states the conclusions with reference to the objectives. Recommendations are made for forecasting performance in the commercial property markets and stages in property forecast modelling. Areas for further research are made at the end of the chapter.

Figure 1.2   **Thesis Outline**

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                  ┌─────────────────────────────────────────┐
                  │               Chapter 1                  │
                  │           Define the problem.            │
                  │  Develop objectives and research framework│
                  └─────────────────────────────────────────┘
                                     │
                                     ▼
      ┌───────────────────────────────────────────────────────────────┐
      │                          Chapter 2                             │
      │                  Undertake literature review                   │
      └───────────────────────────────────────────────────────────────┘
              │                                      │
              ▼                                      ▼
   ┌──────────────────┐      ┌───────────────────────────────────────────────┐
   │ Identify forecast│      │ Evaluate information on commercial property    │
   │  fundamentals    │      │ markets:                                       │
   └──────────────────┘      │ (i) Data   (ii) Determinants  (iii) Models and │
              │              │ forecasts                                      │
              │              └───────────────────────────────────────────────┘
              ▼                    │            │              │
      ┌───────────────────────────────────────────────────────────────┐
      │                          Chapter 3                             │
      │        Survey of organisations providing property forecasts    │
      └───────────────────────────────────────────────────────────────┘
                                     │
                                     ▼
      ┌───────────────────────────────────────────────────────────────┐
      │                          Chapter 4                             │
      │ Detail the issues from the literature review and survey        │
      │ information.                                                    │
      │              Develop property forecast model                   │
      └───────────────────────────────────────────────────────────────┘
                                     │
                                     ▼
      ┌───────────────────────────────────────────────────────────────┐
      │                          Chapter 5                             │
      │           Test commercial property forecast model             │
      │       for statistical reliability and forecast accuracy        │
      └───────────────────────────────────────────────────────────────┘
                                     │
                                     ▼
      ┌───────────────────────────────────────────────────────────────┐
      │                          Chapter 6                             │
      │ Discuss research findings and propose structural market        │
      │ research study                                                 │
      └───────────────────────────────────────────────────────────────┘
                                     │
                                     ▼
      ┌───────────────────────────────────────────────────────────────┐
      │                          Chapter 7                             │
      │               Survey of new space demand.                     │
      │ Detailing organisations, operational issues and decision       │
      │ influences                                                     │
      └───────────────────────────────────────────────────────────────┘
                                     │
                                     ▼
      ┌───────────────────────────────────────────────────────────────┐
      │                          Chapter 8                             │
      │ Present summary, conclusion and recommendations for further    │
      │ research                                                       │
      └───────────────────────────────────────────────────────────────┘
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Chapter

Two

A REVIEW OF LITERATURE

PROPERTY FORECAST MODELS, DETERMINANTS AND FORECAST THEORY

2.1 INTRODUCTION

The objective of this chapter is to review literature on commercial property forecast models and the determinants. To study this, the literature review has been expanded to cover forecasting theory and commercial property data issues. In addition, the relationship of the determinants to commercial property performance is examined and a conceptual framework established for the analysis of the determinants.

To provide the basis to examine the commercial forecast model determinants, relevant literature on the office, industrial and retail markets were reviewed. These included models, which were not intended for use as forecasts, but did show the historical relationship between commercial property performance and the selected determinants. The information is primarily shown in table format, detailing the selected time-series data, statistical model, determinants and significance of the results. In addition, the research procedures were evaluated and where provided, the forecast accuracy assessed.

In the last two decades, commercial property market research has established its importance as property markets in many developed countries struggle with unprecedented periods of boom and subsequent slumps. Commercial property shortcomings are now better understood with in-depth research on what causes property cycles and the property market's complex relationship with the wider economy.

The continuous advancement in property market research has been made simpler with computers and associated software. Computers can now carry out complicated quantitative techniques and, with modern economic theory, previously accepted statistical procedures in property forecasting may have produced misleading or even erroneous findings. New and better property forecast model procedures need to be established.

Property forecast models and the forecasts can be affected by many factors. In this literature review they have been defined and separated into the forecasting process and commercial property market characteristics. This framework then permits a review of property forecast models and their determinants. The literature review covers these issues under four headings.

(i) **Fundamentals of forecasting** - presents forecasting principles and applications. It highlights the strengths and limitations with commercial property market forecasts.

(ii) **Commercial property markets data** - details the sources and concerns in measuring commercial property market performance.

(iii) **Commercial property market determinants** - identifies the determinants and relationship with modelling office, industrial and retail property market performance.

(iv) **Commercial property market models and forecasts** - details published office, industrial and retail property market models and summarises the selected time-series data, statistical model, determinants and significance of the results.

2.2 FUNDAMENTALS OF FORECASTING

According to DeLurgio (1998), forecasting forms an integral part of many decision making processes. It attempts to decrease the dependence on chance and provide some way to predict future events. For commercial property, the importance is magnified as the cost and timeframe to acquire and sell buildings is substantially more than similarly valued equities and bonds (MacGregor and Nanthakumaran 1992).

In identifying the importance in the decision process, it is necessary to understand that forecasts do make assumptions on historical and future events. Makridakis *et al* (1998) pointed to past irregular components, which represents substantial unexplained or unpredicted fluctuations. The ability to forecast accurately will be limited unless these observations are noted and modified. Similarly, forecasts based on past and current knowledge are limited, as any unexpected natural, economic and political event can provide unanticipated shocks and so restrict the relevance of past similarities.

Given an uncertain climate, it is necessary to consider the factors that can influence the forecasting process and to review standard modelling techniques.

2.2.1 Forecasting Steps

Forecasting situations can vary widely with diverse applications and forecast methodology. In recognising this, Makridakis *et al* (1998) explained that the key is in the planning and following a procedure which, depending on the situation can be relatively simple or complex. Figure 2.1 is a flow chart of seven forecasting steps, appropriate to forecasting commercial property market performance.

Figure 2.1   **Steps in the Forecasting Process**

(Step i)	Define objectives
(Step ii)	Source data
(Step iii)	Preliminary data analysis
(Step iv)	Model selection
(Step v)	Validate results
(Step vi)	Publish forecasts
(Step vii)	Updates and revisions
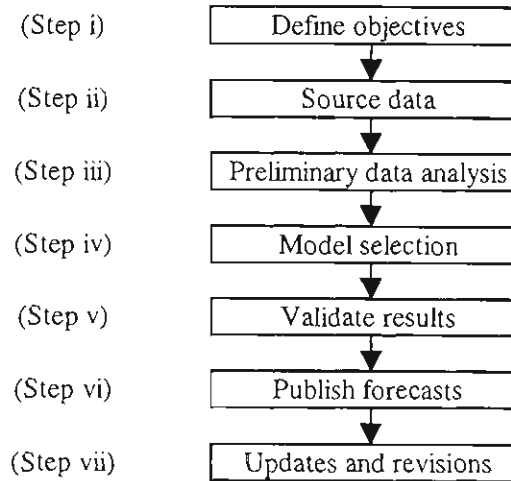
Adapted: DeLurgio 1998

A brief explanation of each step follows with remarks where appropriate regarding techniques and drawbacks to a commercial property application.

(i)   **Define objectives**

At the start of the forecasting process, Gaynor and Kirkpatrick (1994) emphasised the importance of determining precisely the forecasted value or values, forecast length and whether it is a single forecast or a forecast of regular predictive intervals. There is no universally accepted range for forecast periods, although DeLurgio (1998) and Makridakis *et al* (1998) provide a forecast timeframe range for short-term (up to three months), medium-term (four months to two years) to long-term (two or more years).

For property, Mitchell and McNamara (1997) observed that the relatively long transaction and holding periods mean that short-term property forecasts have limited value, with investors' requirements typically being forecasts over a five-year period.

In defining the objectives, DeLurgio (1998) makes the point that contrasting results can arise depending on the data source. This is evident in property as unique demand and supply circumstances may affect local property rents separating them from the returns for a national rental series. Ball and Grilli (1997) noted that national forecasts may obscure rather than

reveal true behavioural relationships in commercial property markets. It is important to determine the appropriateness of the data to the forecast requirements.

(ii) Source data

One of the most important steps in developing a forecast model is collecting valid and reliable data. Forecasts are no more accurate than the data used. A clear definition should accompany the data, with the method of collection and an explanation of the process and calculations for data publication. Any discretion over the selected time-series should be identified and consistency analysed (Gaynor and Kirkpatrick 1994).

Similarly according to Bowerman and O'Connell (1993), if several time-series are selected the basic pattern is to be identical, for example, separate data detailing trends and seasonal variations and any data in terms of real and nominal amounts.

The issues of commercial property data quality is extensive and is separately examined later in this chapter.

(iii) Preliminary data analysis

A visual analysis of data can illustrate potential problems with one or more data points that differ markedly from the other observations. Data quality and explanations of natural, economic and political events can exert considerable influence on quantitative models. Various techniques are available to deal with the potential problem, for example exponential smoothing, removing outliers and changing the data parameters (Pindyck and Rubinfeld 1991).

In addition, Harris (1995) explained that it is necessary to examine the underlying properties of the processes that generated the time-series variables. Failure to distinguish between stationary and non-stationary data can lead, in the long-term, to contemporaneous rather than meaningful results. A stationary variable occurs when the data fluctuates around a constant mean, independent of time. There have been several statistical processes developed to test for

stationarity. The Dickey-Fuller test is the most widely accepted unit root test (Makridakis *et al* 1998).

A non-stationary time series can, according to Bowerman and O'Connell (1993), be transformed into a stationary time series by taking, among others, the first difference of the original series: the change between each time series observation.

Property research literature shows limited preliminary data analysis. Matysiak and Wang (1995) and Chaplin (1999) reported that some leading academic property articles have done no formal preliminary data time-series testing for appropriate functional form and stationarity tests. The assumption that data transformation to first difference or taking logarithms without the benefit of formal test is an arbitrary, and possibly a misleading approach.

(iv)   Model selection

DeLurgio (1998) emphasised to generate accurate forecasts in defined limitations of time, data and costs, the forecasting technique selection can be as simple or complex depending on the situation. Model choice is to be consistent with both theoretical reasoning and empirical findings with selection to be supported by circumstantial evidence comparing alternative methods (Makridakis *et al* 1998). An overview of the three main forecasting techniques is provided later in this chapter.

(v)   Validate results

All forecasting situations involve some degree of uncertainty given the presence of irregular historical components and the application of suitable forecast variables. Tests can be performed on the historical data with statistical equation to determine the forecast model suitability although, according to DeLurgio (1998), model selection based on out-of-sample analysis is better than using an historical fit. Similarly, Makridakis *et al* (1998) considers forecast accuracy an overriding criterion in model selection.

Later sections of this chapter detail forecast accuracy, reviews property forecast models and, where available, the associated accuracy of the forecast values.

(vi) **Publish forecasts**

Published forecast data can vary substantially depending on specific markets. An important element is the ability of the forecast recipients to understand forecast fundamentals. A study by Winklhofer *et al* (1996) detailed forecast recipients' responses concerning various forecasting issues and concluded that there is a limited interrelationship between resources committed to forecasting and forecast performance. Winklhofer *et al* (1996) also recommended that forecasting be more useful and relevant to the end user.

Information by organisations providing property forecasts is limited as, according to Matysiak (1992), mainstream UK economic forecast organisations do not include "commercial property" as a component in their main economic models. However, the economic information does provide a platform for property organisations to forecast. These forecasts are produced regularly although model structure is seldom disclosed.

Similarly, RICS (1994) concedes property organisations' forecasts are commercially sensitive and, with models remaining confidential, limited knowledge is available. In this study the issue has been addressed by a survey of Australian organisations providing forecasts for three leading property markets. The information supplied is on the forecast range, technique and evaluation of processes employed. See Chapter Three for the research.

(vii) **Updates and revisions**

Beyond a forecast publication there is a requirement for continuous maintenance and process verification to ensure that the forecast model and theory remains valid and effective. As DeLurgio (1998) pointed out, forecasting is an ongoing process requiring discipline and objectivity to achieve a good forecasting system. For a comprehensive empirical study comparing *ex ante* period findings to determine accuracy of all major forecasting methods, see Fildes *et al* (1995).

Updates and revisions of forecast values and property forecast models are seldom reported in either academic or commercial research. Mitchell and McNamara (1997) illustrated forecast

downgrades by comparing the average of two forecasts of nominal shop rental growth between 1993 and 1995. The revisions were significant and indicated an opportunity to add value by anticipating property forecasters' continual errors. This is further examined later as part of this study.

The lack of updates on published property forecast models, and property organisations' non-disclosure of their commercially sensitive property forecast models, has restricted the property forecast researcher to a model which may provide limited regular long-term predictive ability. Chapter Five details the long-term forecast accuracy of an established commercial property forecast model.

2.2.2 Forecasting Techniques

The most common method of forecasting is based on past patterns, past relationships, or subjective predictions (DeLurgio 1998). These three ways to estimate the future can be used to classify forecasting methods as time-series analysis (using past patterns), causal analysis (past relationships between multiple variables), and qualitative analysis (subjective judgements). Figure 2.2 illustrates the main techniques and provides examples which can be applied to forecasting future commercial property market performance.

Figure 2.2   **Summary of Forecasting Techniques**

	High ◀——— Requirement for data ———▶ Low		
Primary focus	**Quantitative** (economy, financial, property)		**Qualitative** (marketing, human science)
Techniques	Time-series analysis (generating process)	Causal analysis (cause and effect relationship)	Judgement method (subjective)
Examples	Moving averages	Correlation analysis	Naïve extrapolation
	Time series decomposition	Regression models	Jury of experts
	Box-Jenkins (ARIMA)	Econometric models	Delphi techniques
	Vector auto regression analysis		Scenario analysis

Adapted: Gaynor and Kirkpatrick (1994)

As Makridakis *et al* (1998) explains, there is no single forecasting system that always provides the best all-purpose result. Individual circumstances require whichever method works best. An overview of the three main forecasting methods follows:

(i) **Judgmental method** - requires no in-depth statistical analysis. It is a product of intuitive thinking and accumulated knowledge on an individual and group basis to forecast future property market performances.

Combined opinions can be arranged into a rigid structure (Delphi technique) where by design and an expert's knowledge combine to generate consensus forecasts. Generally, the more sophisticated the approach, the more time it takes and so it neglects the major time advantage of the judgement process.

(ii) **Causal method** - assumes that future values exhibit a cause and effect relationship with one or more independent variables (determinants). The purpose of the causal model is to discover the form of the historical relationship and use it to forecast future property performance. To forecast, the causal method depends on the accuracy, uniformity and stability of past figures. Statistical tests can determine the appropriateness of the data and selected determinants. Computers can increasingly process the data to provide information about the suitability of the model and determinants.

(iii) **Time-series analysis** - assumes that property performances are based on their historical past. The methodology is to discover a pattern in historical data series and extrapolate that pattern into the future.

In examining the pattern in the time series data there are techniques to adjust and deconstruct the time series into individual components. This can show the underlying features of the time series, although it is recognised that relying on the projections of the past distinctly limits the anticipation of future turning points.

<div align="right">Adapted: Higgins 2000a, Rowland 1993</div>

There is extensive literature defining the three broad forecasting techniques and on advanced forecasting methods and applications (DeLurgio 1998, Granger *et al* 1986, Makridakis *et al* 1998, Pindyck and Rubinfeld 1991). However, it is beyond the scope of this research.

When considering the broad forecasting techniques, issues can be identified and considered regarding the applications to commercial property forecasts models. Flaherty (1996), Hetherington (1988), Higgins (1999a) and Matysiak (1992) research provides the basis to compare forecasting techniques relating to commercial property markets. See Table 2.1 for comparisons.

Table 2.1   **Comparison of Forecasting Methods**
Applying to Commercial Property Markets

Characteristics		Judgmental analysis	Time series analysis	Causal analysis
Forecast horizon	Short (1-3 months)		✓	✓
	Medium (4 months to 3 years)	✓	✓	✓
	Long (> 3 years)	✓		✓
Development cost	Low ($100s)		✓	
	Medium ($1,000s)	✓	✓	✓
	High ($10,000s)	✓		✓
Data period used	Weekly			
	Monthly		✓	
	Quarterly	✓	✓	✓
	Yearly	✓	✓	✓
Automation of development	Low	✓		
	Medium			✓
	High	✓		✓
Use of external data		Yes (subjective)	No	Yes (including dummies)
Pattern recognition ability	Trend	Depends on model design	✓	✓
	Seasonal		✓	✓
	Cyclical		✓	✓
	Explanatory			✓
Number of observations required	Low (<24)	✓		
	Medium (25-48)	✓	✓	✓
	High (>48)	✓	✓	✓

Adapted: DeLurgio 1998

Table 2.1 illustrates the importance of selecting a suitable forecast model, although it should be recognised that the process forms part of the overall forecasting system with the necessity for any forecast model to be monitored, maintained and developed, as conditions are never stationary (DeLurgio 1998, Makridakis *et al* 1998).

2.2.3 Accuracy Measurements

The accuracy of forecast models can be measured over two distinct periods, the *ex post* and the *ex ante* forecast period. According to Pindyck and Rubinfeld (1991), the *ex post* forecast period is defined as the period from the first observation after the end of the sample period to the most recent observation. Importantly it can illustrate the model's suitability relative to current observations. The *ex ante* period is the out-of-sample, future forecast of the model. It is this that determines forecast accuracy. Figure 2.3 shows the *ex post* and *ex ante* forecasting periods.

Figure 2.3   ***Ex Post*** **and** ***Ex Ante*** **Forecasting Periods**
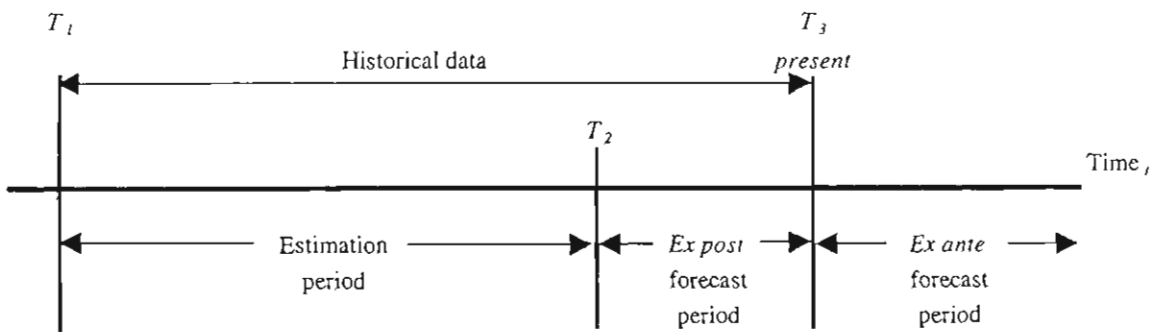
Source: Pindyck and Rubinfeld 1991

Granger and Newbold (1986) and Pindyck and Rubinfeld (1991) emphasised that the choice of whether to accept or reject a forecast model is to evaluate the accuracy on an *ex post* and *ex ante* basis. Statistical tests to judge the significance of the results and underlying model assumptions may assist, however it is the predictive capability that should determine forecast model selection.

The forecast accuracy in the *ex post* and *ex ante* forecasting periods can be assessed by various visual (graphical) and statistical analyses.

Gaynor and Kirkpatrick (1994) recommend an initial visual examination of forecast values to highlight obvious forecast error. Any patterns evident in the forecast values indicate flaws in the forecast. Furthermore, Bowerman and O'Connell (1993) remarked that by looking at forecast and actual values there is the ability to evaluate if the forecast values correctly predict actual data turning points. A plot of the forecast values can lead, lag or be coincident with the plot of the actual data pattern.

Selecting a statistical method to determine forecast accuracy depends on the data composition. Gaynor and Kirkpatrick (1994) explained the two similar basic processes, the squared error method, where errors are close in magnitude and if there are one or two large errors, an absolute error technique is recommended. The squared error method to determine forecast error and Theil's U value (comparing the accuracy of a forecast model to that of a simple 'naïve' model) is explained and illustrated further in Chapter Five, where the forecast values from a property forecast model are tested for accuracy.

In the past, the accuracy of commercial property forecasts has received limited attention with the emphasis on the forecast values and the identification of the determinants. As part of a wider range of issues, both Mitchell and McNamara (1997) and Harris and Cundell (1995) have expressed concern with the limited accountability of the theoretical and technical appropriateness underpinning property market forecasts. The systematic analysis of model prospects is neither widespread nor widely available.

Chaplin (1999) takes this a step further by analysing four leading papers on modelling UK office rents. The absence in the publications of various property model stages (preliminary data analysis, forecasting accuracy, and model structure) made it unclear whether the stages were ever carried out and so the reliability of the model's ability to forecast must be questioned.

Later in this chapter, as part of analysing the published papers on commercial property market models, those that provide tests on the data, model and forecasts will be examined and discussed.

2.3   PROPERTY MARKET DATA

Commercial property as compared to alternative asset classes is conspicuous by a low degree of information. MacGregor (1990) detailed infrequent trading (thin markets), no centralised marketplace, high transaction costs and the value of large individual buildings being generally indivisible. Added to these items are the limitations of short data series and the weaknesses in market knowledge (Fraser 1991, RICS 1993).

As there are a number of significant problems relating to commercial property market data, the review of literature is in two stages: firstly, data definition and classification and secondly, data adequacy and accuracy.

2.3.1 Definition and Classification

The commercial property asset class comprises a framework of sub-markets on which data is collected and used for research. The main sub-market categories represent the operational characteristics of the space.

(i)   **Office property** - organisations require space from which to conduct the logistics of business.

(ii)   **Industrial property** - broad space demand, ranging from storage facility (warehouse) to the requirements of production (factory).

(iii)   **Retail property** - retailers require property from which to sell products to their customers.

Source: London Economics (1998)

These property markets can be separated further and sub divided into specific locations and categories, as historically established by institutions and real estate organisations (see Appendix A for classification of three leading Australian property markets).

In defining the property markets and their use, London Economics (1998) recognised there are some substitutions with organisations operating in a different property environment, for example, an industrial warehouse converted to retail or office use. However, the grouping by primary function underpins many available data sets and accordingly, the focus is on the user category and location (Society of Property Researchers 1995).

In defining property categories, the structure of the property industry can illustrate the required data. The main property participants are occupiers, developers and investors with the data ranging from rents and yields for occupiers and developers, to comprehensive property data sets including income and capital returns for property investors (RICS 1993, Brown and Matysiak 2000). Other important 'data consumers' are various official bodies, such as government planning departments (Society of Property Researchers 1995).

Figure 2.4 shows the data requirements of the main property participants.

Figure 2.4   **Data Flow and Requirements of Main Property Participants**

Organisations	Principal requirements	Data
Property investors	Performance measures for property comparisons and asset allocation.	Income returns & Capital returns
Occupiers	For selection between properties and direct ownership.	Rents
Property developers	Provides feasibility data for development opportunities.	Yields
Government departments	Economic and urban planning and taxation purposes.	All data

Adapted: Society of Property Researchers 1995, Brown and Matysiak 2000

Given the diversity of interests in commercial property, analysis of commercial property data occurs at various spatial levels. National, regional and local property markets are studied and individual properties assessed within their locational context (Society of Property Researchers 1995).

In any property decision there is a requirement for precise knowledge of the property and market standard measurements (Baum and Mackmin 1986). Figure 2.5 represents the main performance measures of the commercial property markets.

Figure 2.5   **Measures of Commercial Property Performance**
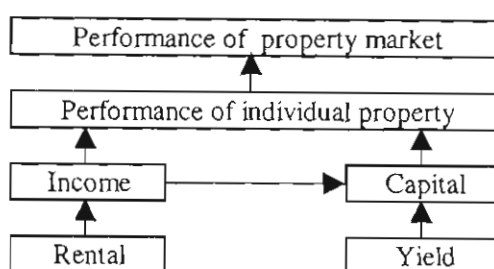
Adapted: Hargitay and Yu 1993

Reliable data and information is required to measure commercial property performance. Brown and Matysiak (2000) provide a comprehensive account of the various performance indicators. Commonplace is the equivalent yield measure, used for valuing commercial property and for analysing current transactions. Similarly, the effective rent measure overcomes the distortions in the face rents provided by landlord inducements. The RICS (1995) and Australian Property Institute (1999) provide valuation guidelines to interpret market information and provide a standard measurement process to compare property rents and yields.

In recognising property's heterogeneous nature and the irregular flow of property markets data, property organisations have fundamental difficulties in constructing property performance indices within an inefficient marketplace. RICS (1993) acknowledges that the statistical techniques used to analyse the data have come to be accepted among property researchers and their customers, although the shortcomings in the underlying data may be less clear.

In attempting to piece together groups of property data is it necessary to look at the information source. This can be presented at three broad categories:

(i)   Comprehensive data relating to the total commercial property market.

(ii)   Sample data relating to groups of properties.

(iii)   Specific data about a particular property.

<div align="right">Source: Hargitay and Yu 1993</div>

The ideal situation is a comprehensive data set, with all the information, which can be disaggregated to a required level. In practice, most available data sources fall into the sample category, due to logistics and limited availability of comprehensive data (Society of Property Researchers 1995).

2.3.2   Adequacy and Accuracy

The limitation in property performance measures provided an initial hurdle for commercial property market research. Reliable annual property performance data in the US, UK and Australia was typically available from the late 1960s. Higher frequency property market data was available from later dates with corresponding demand and supply data gradually being introduced (Mitchell and McNamara 1997, Higgins 1999b).

The individual nature of property and the irregular flow of property markets data created fundamental difficulties in constructing property performance indices. Property organisations supplement the information providing time-series indices with aggregated comparable data derived from appraisals (valuations) based on market evidence of individual property transactions (Dunse *et al* 1998, Morrell 1991). Figure 2.6 illustrates the difficulty at a local, regional and national level with appraisal-based performance time-series.

Figure 2.6   **Composition of Commercial Property Market Databases**
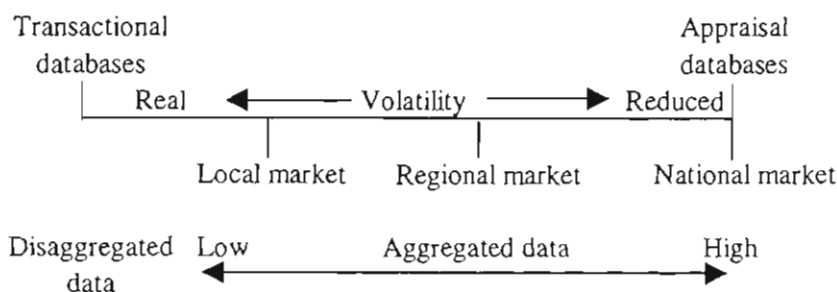
Source: Higgins 1999a

Figure 2.6 illustrates the volatility associated with the various commercial property market databases. Studies in this area have been considerably hampered by the lack of reliable data, nevertheless understanding the distribution characteristics of property returns play a key role in making investment decisions (Brown and Matysiak 2000).

According to Baum and MacGregor (1992) appraisal-based performance indices tend to lag behind the property market and understate the true volatility of property. These issues have been recognised by a substantial body of recent research (for example: Brown 1991, Gelter 1989, 1993, MacGregor and Nanthakumaran 1992). All highlight the issue of appraisal smoothing by:

(i)   Appraisal-based indices which report more regularly than the valuation of individual properties, which form the indices.

(ii)   Valuations which contribute to the appraisal-based indices based on infrequent market transactions, which may not be particularly up-to-date.

Source: Higgins and Wilson 2000

These shortcomings are evident in major appraisal (capital value weighted) based "benchmark" indices such as, the Property Council of Australia (PCA) investment performance index series, the NCREIF index in the US, and the Investment Property Databank (IPD) property index in the United Kingdom (Newell and MacFarlane 1994).

As property investment research relates to the risk and return of individual assets, McNamara (1990) suggests data be relevant in spatial scale to the market in which the property is located. Ball and Grilli (1997), Hekman (1985) and Pagliari and Webb (1992) recognise that many local factors exhibit dissimilar features (planning policies, market structures and time-specific imbalances) and any aggregation in data information may obscure, rather than reveal true behavioural performance. Local transactional databases are more likely to exhibit information in a timely manner and accurately capture the magnitude and direction in property markets compared with appraisal base indices.

Notwithstanding the problem with constructing performance measures, the collecting, analysing and reporting time series data is now central to an information-driven property industry (Society of Property Researchers 1995). The test for data adequacy can be established on Redmond (1995) criteria for securities property indices.

(i)   **Accuracy** - the data should accurately reflect changes in the performance of the underlying property market.

(ii)   **Flexibility** - the data should be flexible enough to accommodate a variety of user requirements.

(iii)   **Global standardisation** - the data should enable the user to compare the performance with national and international property markets.

(iv)   **Market Coverage** - the data should be representative of the defined market.

(v)   **Reliability** - the data should be consistent with acceptable industry standards.

(vi)   **Timeliness** - the data should be available on a regularly reported basis.

(vii)   **Transparency** - the rules of inclusion, exclusion, pricing and construction should be available publicly.

Adapted: Redmond 1995

Fundamental to the property decision-making process is the acknowledgement of a systematic process for data collection, analyse and dissemination. Significant progress has been made in the past and as the Society of Property Researchers (1995) acknowledges with the data deficiencies, it is a trade-off between what users may want and what is commercially practical. This situation will improve as more data information is systematically collected and processed to provide the prospects of better property forecast models based on longer time-series data (McNamara 1994).

2.4 PROPERTY MARKET DETERMINANTS

Commercial property markets are influenced by a myriad of complex factors being transmitted to property from the wider economy and arising directly from the property markets. To examine these determinants, firstly the structure of the property market and the participants must be identified and secondly, the quantifiable components modelled to provide a structure for analysing the empirical papers on performance determinants of the office, retail and industrial markets.

2.4.1 Property Market Structure

The structure of commercial property markets can be separated into three distinct operational groups: occupiers (users), investors and developers (RICS 1994). Keogh (1994) details a simple theoretical framework to capture the driving forces and adjustment dynamics of these activities, see Figure 2.7.

Figure 2.7   **Commercial Property Market Driving Forces and Adjustments**

```
        ┌─────────────────────┐
        │    User market      │◄╲
        │      Rents          │  ╲╲
        │   Expected rents    │    ╲╲
        └─────────────────────┘      ╲╲      New supply
                                       ╲╲     (long run)
  Repackage  ┊        │                  ╲╲
  property   ┊        │  Use values        ╲╲
  interests  ┊        │                      ╲╲
  (short run)┊        ▼                        ╲╲
             ▼  Use values                       ╲▼
        ┌─────────────────────┐              ┌─────────────────────┐
        │ Investment market   │──────────────►  Development market │
        │  Capital values     │ Capital values│    Land value       │
        │  Current yields     │◄··············│  Development activity│
        └─────────────────────┘              └─────────────────────┘
                  ▲              New supply
                  │              (long run)
                  │
           Required rate
            of return
  Key:
     ───────► Value information      ··········► Adjustment process
```
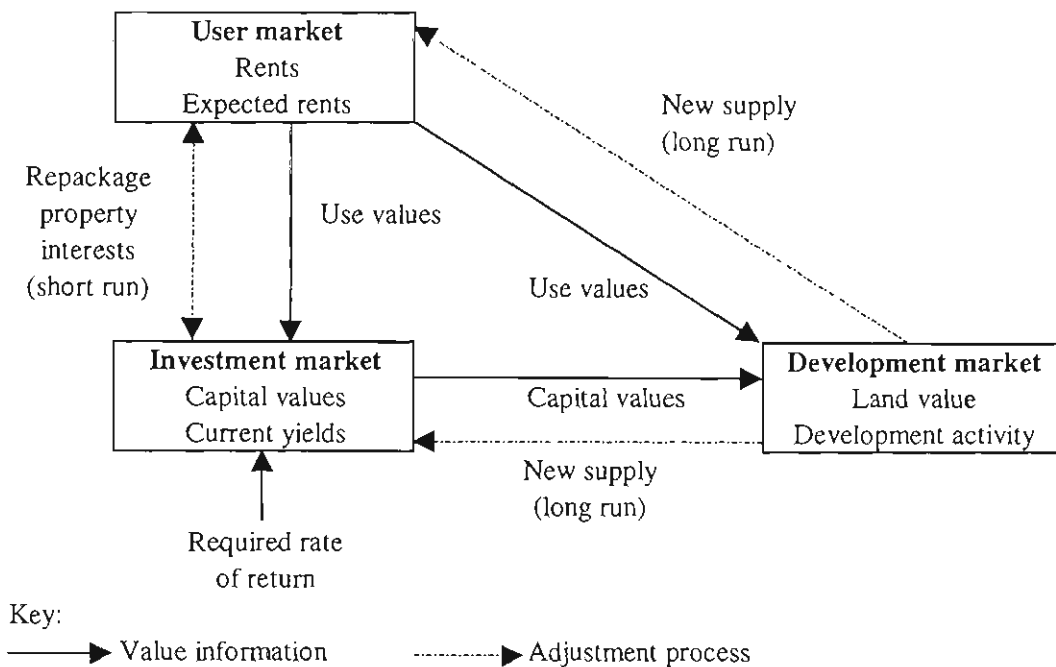
The property market model illustrates three separate operational components: user market, investment market, and development market. All have individual demand and supply features but are linked by the flow of information, permitting either a simple reassessment or changes in market activity. Empirical analysis of the theoretical framework by Tsolacos (1998), acknowledges the real economy drives the user property market and investment market trends, and can provide the property development catalyst. The speed of adjustment may vary between components and be influenced by alternative investment selections.

Whether the performances of the three principal elements of the property market are separate or linked together, it is the wider business environment, which will ultimately provide the decision framework in which property operates. RICS (1994) illustrates the main external reasons for individual property activities.

(i)   **Occupier** - an input to their production of goods and services.

(ii)   **Investor** - performance profile compared to alternative investments.

(iii) **Developer** - an output with the level of production set by expected profits.

<div align="right">Source: RICS (1994)</div>

2.4.2 Conceptual Model of Property Market Determinants

The changes in commercial property market performance can be quantified by the market's internal momentum and the external parameters within which property decision are made. Analysing commercial property market structure presents a formidable challenge with Cororan (1987), Fisher *et al* (1993) and DiPasquale and Wheaton (1992) suggesting a two-market diagrammatic model, linking space and capital markets in both short and long run settings. Despite the two-market rational approach, Viezer (1999) detailed shortcomings, primarily relating to lack of adjustment process and not being able to compare one market with another.

Archer and Ling (1997) suggested the potential benefits of expanding to a three-market model, retaining the space market element of the two-market model and separating specific property risk components from the general capital market. Figure 2.8 shows the relationship of space, capital and property markets.

Figure 2.8   **The Relationship of Space, Capital and Commercial Property Markets**
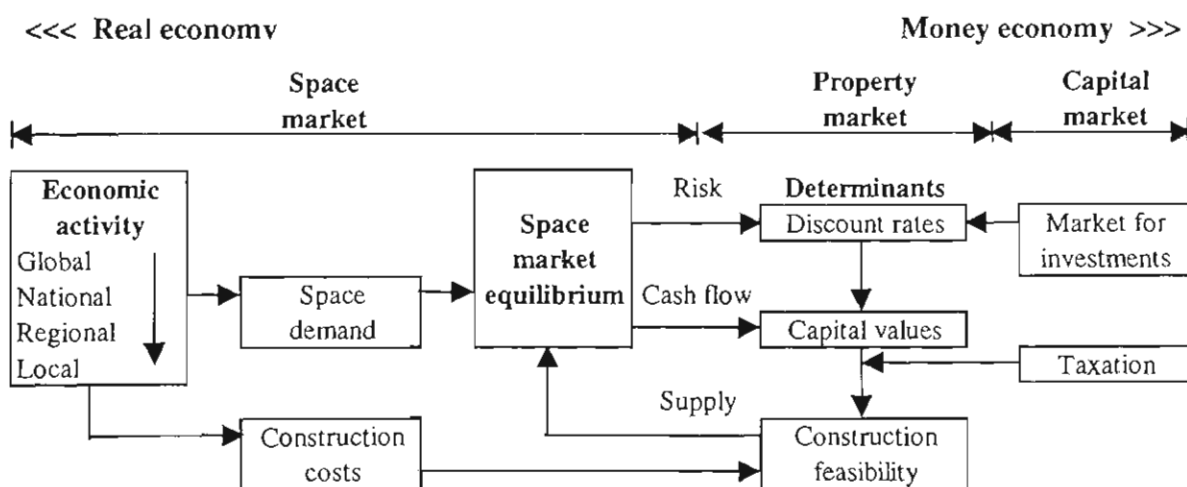
<div align="right">Source: Archer and Ling 1997</div>

Analysing space, capital and property markets can provide a platform for understanding performance dynamics in published commercial property market models and forecasts. The art is to link the asset-specific elements (income stream and risk of the income stream) that arise from the space market with capital market forces (interest rates and investor aversion) by assessing property specific risk (Giliberto 1998).

A feature of the three-market model is the distinction of the property, space and property elements. These can be separated and the individual characteristics examined.

(i)   Space market

The demand for space can be both unpredictable and complex as it may relate to particular economic activity, locality and timeframe. Far from static, space demand in varying degrees and forms mirrors economic activity, such as employment characteristics, production and income levels (Archer and Ling 1997, DiPasquale and Wheaton 1992).

Giliberto (1998) considers the space market as an arena in which local demand and supply interact to determine rent and occupancy levels and this is where significant short-term divergences can occur. A feature of demand is flexibility against the existing supply of space. Any long-term distortion in the demand and supply equilibrium changes the rental values and provides construction opportunities (Fisher *et al* 1993).

(ii)   Capital market

The capital market is where funds are raised and where property competes with all other assets for a place in an investor's portfolio. Capital markets in general serve a variety of related functions, including:

- Assess the risk of investments.

- Establishing required returns on investments.

- Allocating scarce capital amongst competing uses.

Source: Giliberto 1998

On the basis of efficient diversification, modern portfolio theory suggests a selection of investments relative to expected returns and risk. The risk free return is established in the capital markets with the appropriate property-specific premium be determined by information in the commercial property markets (Archer and Ling 1997).

(iii) Property market

A key element, according to Giliberto (1998), of the three-market model is its recognition that property is a product separate from capital and space markets. As a specific property discount rate is determined by the interaction of the risk-free rate, investor risk premium requirements and the risk profile of the specific property. A property value and capitalisation rate can be determined with reference to the discount rate and expected space market cash flow.

Current property values combined with construction cost knowledge can provide one of the main determinants to the feasibility of new construction. Long-term property asset market price relative to replacement costs should equate, although in the short-term the two may diverge significantly because of lags and delays inherent in the construction process (Archer and Ling 1997, DiPasquale and Wheaton 1992).

The Archer and Ling's (1997) conceptual model linking space, property and capital markets can be taken a step further to illustrate the operation of building cycle in relationship to time and the macro-economy. Barras (1994) tested the underlying dynamics of property to external factors with reference to UK commercial property activity. The building boom concept is explained as a changeable interaction of the business cycle in the real economy (space market), the credit cycle in the money economy (capital market) and the long cycle of development in the property market.

Figure 2.9 details the building cycle characteristics in a space, property and capital market framework.

Figure 2.9   **Characteristics of a Dynamic Building Cycle**

Real economy	Property market	Money economy

Economic upturn ⟵   ⟶ Credit expansion
                   ⟶ Increased property demand ⟵
                              ↓
                      Supply shortages
                              ↓
                   Rising rents/falling yields
                              ↓
Economic boom ⟷   Building boom ⟷   Credit boom
                              ↓
                      Increased supply
                              +
                     Slackening demand
Economic downturn ⟶   ⟵ Rising interest rates
                              ↓
                   Falling rents/rising yields
                              ↓
Recession ⟷   Property slump ⟷   Credit squeeze
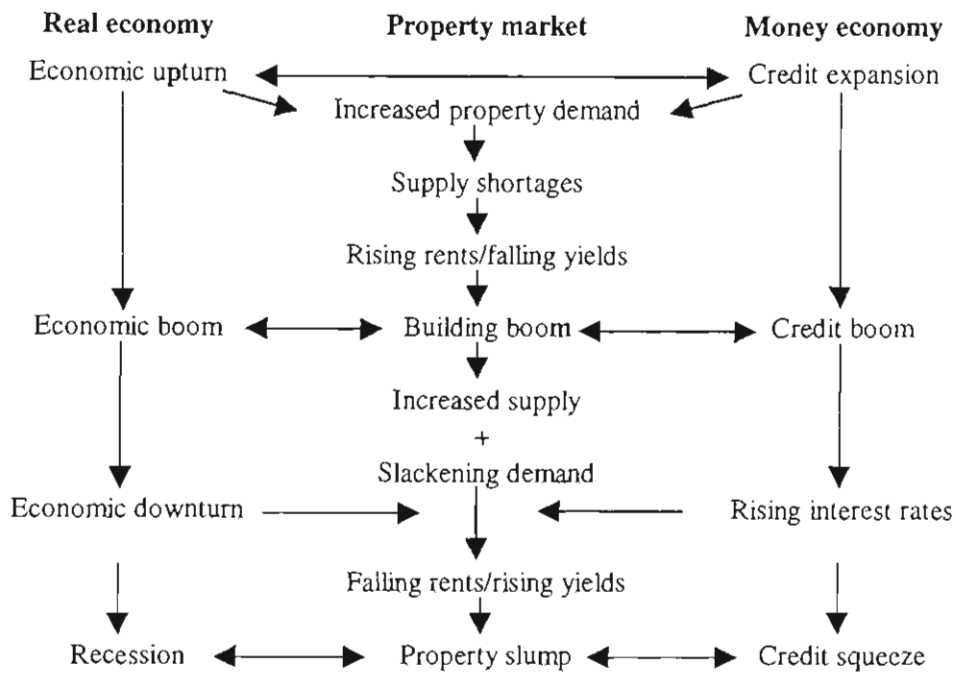
Source: Barras (1994)

The model explains cyclical forces and implications for commercial property market performance. Also it should be noted that Barras (1994) warned of concerns in applying the mechanics of an application of past chronological events to future projections.

More recently, RICS (2000) simultaneously released a report and a computer model on forecasting office supply and demand. The model was developed using the City of London as a case study. Figure 2.10 shows a flowchart of the multi-equation office model.

Figure 2.10   **Office Market Model Flow Chart**
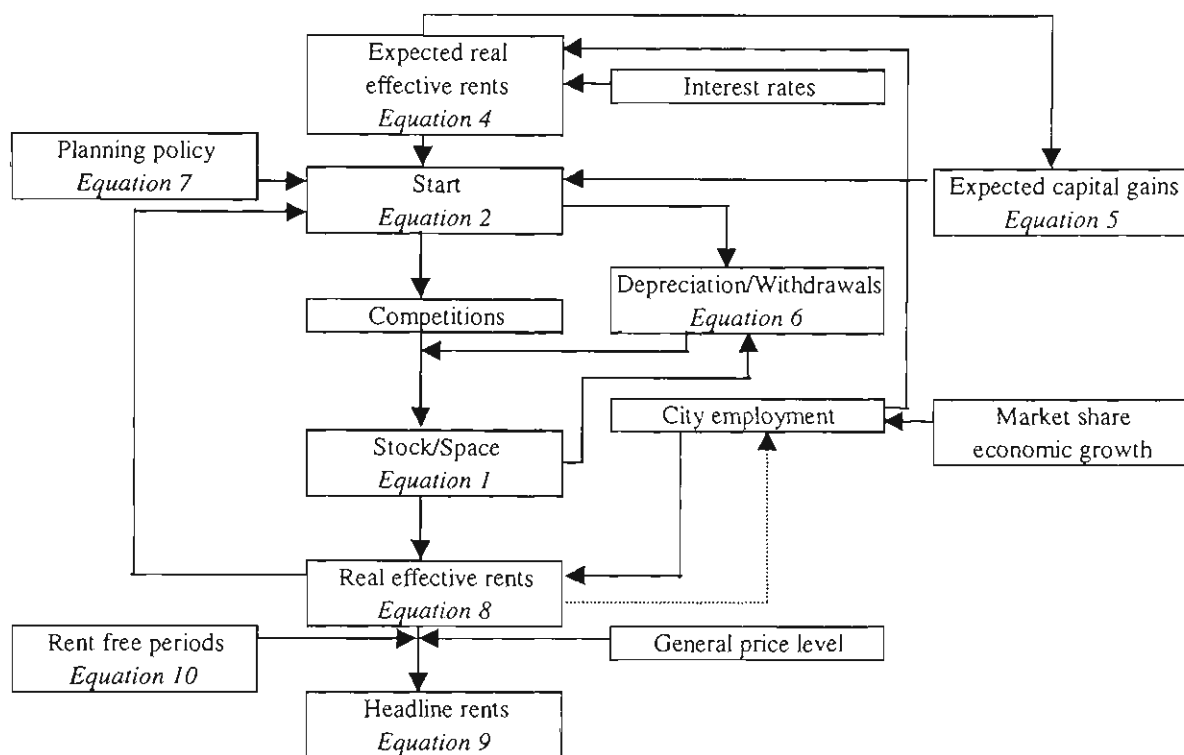
The model contains 10 regression equations with the supply and demand components separated to provide a chain of office market information. The three external drivers are interest rates, inflation and economic growth represented by a measure of employment. These determinants conformed to the Archer and Ling's (1997) space and capital market section of their three-market model.

The extent of the essential property data for the RICS (2000) model may restrict its use. If data is available, the individual market circumstances may differ from those of Central London with its defined location and focus as a global financial centre. Also as the Fildes *et al* (1995) study points out, the out-of-sample accuracy of simple methods is, on average, at least as good as that of complex or statistically sophisticated ones. The RICS (2000) model seems to overlooks the requirement to test the forecast accuracy out-of-sample.

To understand future commercial property markets, as both Cadman and Austin-Crowe (1994) and Roulac (1996b) pointed out, depends on an acceptance that external forces can

directly affect the property markets and indirectly affect it through influences on the economy and associated links. An examination of commercial property models can detail the leading performance determinants.

2.5   PROPERTY MARKET MODELS AND FORECASTS

The objective of this section is to review published office, industrial and retail market models. Journal articles by academics form the main part of the study, as commercial sensitivity and confidential issues surround many organisations' commercial property market models. Most of the models surveyed consider just the historical standpoint, but still highlight the determinants. Any property models with forecasts were examined for methodology and reported accuracy.

In analysing the published commercial property market models, a central feature is that the determinants can vary in importance, impact and timing. A simple framework based on Archer and Ling's (1997) model (see Figure 2.8), can classify the determinants into the space, capital and property markets. Figure 2.11 illustrates the simplified model.

Figure 2.11   **Commercial Property Model:**
Space, Property and Capital Market Determinants
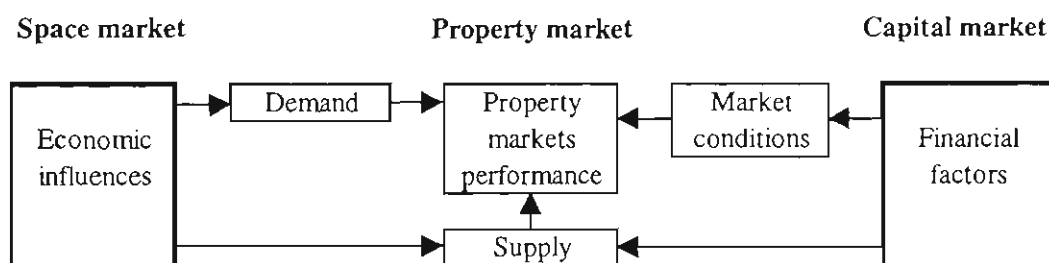
Determinants of property market performance may vary due to different locations in time, spatial considerations, model construction and the quality and form of selected data series. These issues will be addressed in the office, industrial and retail literature review with summary tables for rent, income returns, yields, capital and total return models. The tables report the time series, forecast methodology, external determinants and a summary of the

results. In detailing the determinants, some models do include aspects of previous (dependent) internal information. For example, RICS (1994) determinants for specific property sector yields were based on the gap to the all-property yields, which is itself primarily influenced by the previous year's property yield.

2.5.1 Office Models

In the past, commercial property market forecasts were focused on office markets, as over the long term office investments have dominated institutional property portfolios. In addition, when compared with alternative property classes, office market data is more comprehensive, with increased transactions over a relatively longer time-frame, and more frequently in well-defined geographical locations (Gardiner and Henneberry 1988).

The office market exhibits distinct characteristics. Jones (1995) reports on the low supply elasticity traced to prime office buildings in distinct localities and long development timeframes incorporating both public sector interventions through planning and building construction issues. On the contrary, office demand exhibits long-term continuity, especially as nations transform to service-oriented societies (Pyhrr et al 1989).

The literature on office market models has been divided into three sections: local office market rents, aggregated national and regional office income, and office capital performance including yields, capital values and total returns. A definition and explanation of property performance measures is provided at the beginning of this chapter.

Empirical studies of US office markets have primarily focused on office rent determinants at metropolitan and city levels. The approach has been two-fold.

(i)   Identification, analysis and quantification of the characteristics that contribute to changes in local office rents.

(ii)   To establish office market rents linked to vacancy rates and the macro economy.

Studies of local office rent variations within a defined a set of buildings can identify and quantify significant contributions from different attributes. The hedonic regression process (cross sectional analysis) in broad terms detailed physical building characteristics, location and vacancy rates as determinants that can affect local US office rents (Frew and Jud 1988, Glascock, *et al* 1990, Wheaton and Torto 1995b). Based on US methodology, a recent UK study (Dunse and Jones 1998) emphasised the importance of age and location as a principal determinant of rent. However, the conclusion highlighted the limitations of hedonic analysis, as the values of variables may contrast across different building localities and grades.

The second body of US research literature involves office market models incorporating demand, supply and rental price equations. Particular emphasis is focused on office employment and variations in vacancy rates (Hekman 1985, Pollakowski *et al* 1992, Rosen 1984 and Wheaton and Torto 1988). The gap between actual and natural vacancy rates (long-term equilibrium) has been a key variable in US office rent determinants. Clapp (1993), Grenadier (1995) and Voith and Crone (1988) illustrated that vacancy rates are predominantly determined by local, rather than national factors. Similarly, Pyhrr *et al* (1989) proposed that the nature of the local economic base is a good indication of current and future needs for office space.

Outside the US the rent and vacancy rate equilibrium concept has been tested on both the Sydney and London office markets (Hendershott 1995 and Hendershott *et al* 1998). The models linked office rent variations to the gap between natural and actual vacancy rates. The Central London office model appears superior, consistently tracking actual rental values. For the Sydney market, the initial flaws in the equation were overcome by relating the percentage change in real effective rents to gaps between both the natural and actual vacancy rates.

RICS (2000) developed a multi-equation model (see Figure 2.10) for the City of London office market. Demand, developments and rental changes were modelled in a framework of 10 regression equations with external employment, interest rates and construction cost determinants. Vacancy rates were excluded preferring to include an employment and stock

level equation. The analysis of the model overlooked tests on preliminary data and forecast accuracy. Table 2.2 provides a summary of office rent models.

Table 2.2   **Office Rent Models**

Author (s) (Year)	Data	Time period and methodology	Determinants	Summary of results
BIS Shrapnel (1998)	Colliers Jardine Sydney CBD prime office rental series	1973-1997 (annual) Multi equation regression model	(p) Vacancy rate	Significant R^2 of 0.92, with occupied space equation determining the vacancy rate.
Brennan, Cannaday and Colwell (1984)	Leasing agents survey, 29 obser. on Chicago CBD office market.	1980-1983 Hedonic equation regression model	(p) Lease details (p) Vacancy rate (p) Building char. (p) Location	Significant R^2 of 0.93, log linear model identified CBD location and lease term as an important consideration.
Clack and Dannis (1992)	Swearingen Co. Dallas office rental and vacancy rates	1981-1991 (six monthly) Equilibrium of structural markets	(s) Office employment (p) Land values (p) Construction costs	An analytical model is developed based on varying supply, demand and occupancy conditions to defined market equilibrium.
Dunse and Jones (1998)	477 asking rents Glasgow office suites. Scottish Pro. Network data	1994-1995 Hedonic equation regression model	(p) Physical building characteristics (p) Age (p) Location	Adj. R^2 of 0.61, emphasises the importance of age and location as principal determinants of rent.
Frew and Jud (1988)	Survey of 66 office buildings in North Carolina.	1984 Hedonic equation regression model	(p) Vacancy rate (p) Location (p) Building char.	R^2 range 0.50-0.58 confirms vacancy rate to be included in determining office rental price.
Glascock, Jahanian and Sirmans (1990)	675 observations on the Baton Rouge, Louisiana office market	1984-1988 (annual) Single equation regression model	(p) Building class (p) Location (p) Overall market cond.	R^2 range 0.72 - 0.85 suggests rentals vary systematically across building class, location and market conditions.
Hekman (1985)	BOMA real market rents and vacancy rates for 14 USA Cities	1979-1983 Single equation regression model	(s) GDP (s) Employment rate (s) Unemployment rate (p) Vacancy rate	R^2 range 0.36 - 0.60. Model illustrates the rents adjust to local and national economic conditions.
Hendershott (1995)	JLW Sydney effective real rents and vacancy rates	1970-1992 (annual) Single equation regression model	(p) Vacancy rate (p) Replacement cost (p) Building depreciation rate	R^2 of 0.68, evaluations of natural 6.8% vacancy rate. Implication on replacement construction costs.
Hendershott, Lizieri and Matysiak (1998)	DTZ Debenham Thorpe new prime City of London office rents (real)	1976-1996 (annual) Multi equation regression model	(s) Office employment (p) Vacancy rate (p) Supply rate (c) Interest rates	Adj. R^2 of 0.69, based on an equilibrium vacancy model.
RICS (2000)	Henderson Invest. City of London Effective office rent	1981-1996 (six monthly) Multi equation regression model	(s) Employment (p) Construction costs (c) Interest rates	Significant R^2 of 0.99 demonstrates variability of selected variables in multi equation model.
Rosen (1984)	Office rents, San Francisco Office Space Inventory, Uni. of California	1961-1983 (annual) Single equation regression model	(s) Office employment (p) Optimal and actual vacancy rate (p) Office space supply	R^2 of 0.55. shows changes in office rents are inversely related to deviations of actual vacancy rates from optimal vacancy rates.
Wheaton and Torto (1995b)	TW office rent index of five USA markets	1979-1991 (annual and six monthly) Multi equation regression model	(p) Lease terms (p) Building char. (p) Location (p) Vacancy rate (p) Net absorption	R^2 range 0.39 - 0.57 for hedonic measure of office rent and R^2 range 0.36 - 0.75 for office rent relationship with vacancy rate and net absorption.
Wheaton and Torto (1988)	TW office rent index of five USA markets	1968-1986 (annual) Regression model	(p) Structural and natural vacancy rate	R^2 0.73 supports fit of structural vacancy rate. Provided six-year forecasts on vacancy-rental equ.
Wheaton, Torto and Evans (1997)	DTZ Debenham Thorpe new prime City of London office rents	1974-1994 (annual) Multi equation regression model	(s) Office employment (p) Construction costs (c) Interest rates	R^2 of 0.88, based on an equilibrium vacancy model. The model suffers from omission of three years of financial data.

Determinants: (s) =space market, (p) = property market and (c) = capital market

Forecasting methodology and application in the UK has centered primarily on aggregated regional and national income returns. Past studies have employed a similar range of variables to capture office space performance with gross domestic product (GDP) measures being most prominent (Gardiner and Henneberry 1988 and 1991, Giussani *et al* 1993, RICS 1994). Significantly, the studies illustrate the absence of office employment as a variable in determining market income performance. A study by Dobson and Goddard (1992) linked interest rates and a house price index to office rental income and noted that banking, insurance and finance employment appeared to have no effect on their study of four UK geographic areas.

More recently, Tsolacos *et al* (1998) did identify changes in office employment trends as a determinant in UK office rental income changes, although the equation included the same employment determinant lagged one, two and three years. The inherent limitations of a repeated independent determinant may have restricted the equation fit to the actual values as demonstrated by the statistical analysis.

Within the Australian property market, Higgins and Wilson (2000) noted that income changes in four regional office markets were linked to lagged regional economic variations (GDP, inflation and population) rather than office employment. BIS Scrapnel (1998) offered a multi-equation model based on office employment and average workspace ratios to forecast occupied space leading to vacancy rates and rental levels. More recently, Murray (2000) detailed one of JLL Advisory quantitative models used to forecast Sydney office rents. The two equation regression model, connects effective rents with vacancy rates, additional supply and employment growth.

For an alternative to econometric modelling technique, McGough and Tsolacos (1995) time-series analysis applied the ARIMA modelling process to aggregated UK office rent income to provide short-term predictions. It illustrated that past shocks in office rental income affects present and future trends. A shortcoming of this study is that the model deals in second differences in rental income.

Literature on US office market rent income (in contrast to the UK research) links changes in vacancy rates and office employment to appraisal-based office rental income indices.

Sivitanides (1998) and Wurtzebach *et al* (1991) examined the national office market and Shilling *et al* (1987) analysed 17 USA cities. The results strongly suggest that a lagged-vacancy rate is a powerful predictor of office market income returns.

Table 2.3 summarises studies on the determinants of office market rental income.

Table 2.3　　**Office Rental Income Models**

Author (s) (Year)	Data	Time period and methodology	Determinants	Summary of results
D'Arcy, McGough andTsolacos (1999)	Hamilton Osborne King, Dublin office rental values	1970-1997 (annual) Single equation regression model	(s) Irish real GDP (s) Office employment (p) Office floor stock	A R^2 0.49 resulted from swings in rental values in certain years due to small market size. An ex post forecast accuracy was less than 4%.
Dobson and Goddard (1992)	Investor Chronicle/ Hillier Parker office rent index	1972-1987 (annual) Single equation regression model	(p) House price index (c) Interest rates	Significant R^2 of 0.94 although restricted by limited data points and no tests for data stationarity.
Gardiner and Henneberry (1988)	Hillier Parker eight regional office rent index	1977-1984 Single equation regression model	(s) Regional GDP (s) Service sector empl. (s) Unemployment (p) Office floor stock	A R^2 range 0.40 - 0.98 indicates general influence of regional GDP on office rents. One year forecast on 3 regional growth office markets provided 3% forecast error.
Gardiner and Henneberry (1991)	Hillier Parker four regional office rent index	1977-1984 Habit persistence regression models	(s) Regional GDP	New models applied to declining economic regions provide a R^2 range 0.77 - 0.98. Highlighted two-stage approach to office forecasting.
Giussani, Hsia and Tsolacos (1993)	Hillier Parker Int. Prop. Bulletin, 10 Euro. capital cities rent series	1983-1991 (annual) Single equation regression model	(s) GDP (s) Unemployment (s) Service sector empl. (c) Interest rates	A R^2 range 0.31 - 0.87, result suggests office rents can be explained by same demand-side variables, particularly GDP.
McGough and Tsolacos (1995)	JLW Property Index, office rental values	1977-1993 (quarterly) ARIMA (0,2,1) model	(p) Past rental values	Result illustrated past shocks, affects present and future changes in rental values. Satisfactory one year forecast error of 3%.
RICS (1994, 1996)	IPD, CIG, MGL Office rental values (appraisal-based)	1967-1995 (annual) Single equation regression model	(s) GDP (p) Floor space Stock (p) Construction Orders	Significant R^2 of 0.96 for 1996 update with equation including a negative and positive dependant rent component lagged year 1 and 2.
Sivitanides (1998)	NCREIF Nat. income returns, Torto Wheaton vacancy rates	1978-1996 (annual) Single equation regression model	(s) Office Employment (p) Vacancy rate	Significant Adj. R^2 of 0.91, lagged vacancy rate can account for 80% of variations in office rent. Accepted *ex post* test for mean absolute error 1990-96.
Shilling, Sirmans and Corgel (1987)	BOMA 17 USA cities property market series	1960-1975 (annual) Multi equation regression model	(p) Vacancy rate (p) Operating expenses (s) Non-manu. Employ. (s) Population	R^2 range 0.66 - 0.95. Estimated normal vacancy rate a function of non-manu. employment, population.
Tsolacos, Keogh and McGough (1998)	JLW Index of office rental values	1980-1995 (quarterly) Single equation regression model	(s) GDP (s) Office employment (p) New const. activity (c) Interest rates	Adj. R^2 of 0.59, Highlights importance of office employment with lags up to two years.
Wurtzebach, Muller and Machi (1991)	Russell -NCREIF Office Index (appraisal-based)	1978-1990 (quarterly) Regression model	(s) Inflation (s) Expected and unexpected inflation (p) Vacancy rate	R^2 range 0.51-0.53 suggests if supply and demand equation in balance, office sector can provide an effective inflation hedge.

Determinants: (s) =space market, (p) = property market and (c) = capital market

As part of a wider study, Chaplin (1998) surveyed UK property practitioners and academics for a definitive office rent income model. For reasons of commercial sensitivity, the composition and structure of the individual models were not disclosed. However, a consensus model was formulated on the information provided. The selected determinants for modelling national office rental income were lagged dependent variables, output of the financial and business service sector and new office orders.

There is comparatively limited research on the determinants of total and capital office market values. For the UK national office market Ball and Grilli (1997), Dobson and Goddard (1992), Tsolacos *et al* (1998), linked funding arrangements, types of interest rates and rent components (sometimes substituted by economic factors) as significant determinants of total and capital office values. Equivalent Australian studies have been conducted with Jones Lang Wootton (1992) identifying inflation, interest rate differentials and stock market dividend yields as key economic factors for Sydney prime office yields. Newell and Higgins (1996) showed Australian total office returns primarily fed directly from Australian and international economic influences.

For an alternative approach, Schofield (1997) identified that office total returns were sensitive to unanticipated inflation at various UK office cycle stages. The synopsis was based on future cash-flow analysis and varying forms of shocks which provide the variation between required and delivered real returns.

Tables 2.4 details office yield, capital and total return models.

Table 2.4   **Office Yield, Capital and Total Return Models**

Author (s) (Year)	Data	Time period and methodology	Determinants	Summary of results
Ball and Grilli (1997)	IPD national total return series (appraisal based)	1970-1995 (annual) VAR model	(s) GDP (s) Commercial output (p) Property value (c) Interest rates	An adj. R^2 of 0.56 highlighted the relationship between selected model variables. Authors expressed concerns on model forecast ability.
BIS Shrapnel (1998)	Colliers Jardine Sydney CBD prime office yield series	1973-1997 (annual) Single equation regression model	(p) Property value (p) Rental levels	Significant R^2 of 0.93, based on expected capital gains.
Dobson and Goddard (1992)	Inv.Chronicle/ Hillier Parker office capital value index.	1972-1987 (annual) Single equation regression model	(s) Office employment (p) House price index (c) Interest rates	Significant R^2 of 0.88, although restricted by limited data points and no tests for stationarity data.
JLW Advisory (1992)	JLW Sydney Prime Office Yield	1976-1991 (six monthly) Single equation regression model	(p) Rental levels (e) Interest rates (c) Local inflation	Significant R^2 of 0.93 with lagged variables, although no reported preliminary data analysis.
Newell and Higgins (1996)	PCA property investment index Australian office total returns	1984-1994 (six monthly) Single equation regression model	(s) OECD GDP (s) Industrial GDP (s) ASX indices (s) Commodity indices	Significant R^2 of 0.97 with a high 7.5% forecast error over 6 months on the appraisal-based index.
Schofield (1997)	IPD national total return series (appraisal-based)	1980-1994 (annual) Sensitivity analysis	(c) Interest rates (actual, expected and unexpected)	In specific market conditions the sensitivity of real return to unanticipated inflation is significant.
Tsolacos, Keogh and McGough (1998)	JLW Index of office capital values	1980-1995 (quarterly) Multi equation regression model	(p) Rental levels (c) Interest rates	Adj. R^2 of 0.35, illustrates that capital values respond to rents lagged in the short-term.

Determinants: (s) =space market, (p) = property market and (c) = capital market

The models discussed in the office literature review indicate a general similarity in the techniques employed. The methodology frequently applied either a multi-equation model or a single equation model with both typically using the regression procedure. The selected determinants for the equations were commonly lagged to explain the relationship with the dependant time-series. Although different authors used different variables and new adaptations of the regression models, preference has often been given to forming a model with high 'R^2', low autocorrelation of the residual, and high 't' readings (Ball *et al* 1998).

A concern in many studies is the failure to include results on the suitability of the time series data, structural composition of the determinants and the predictive failure of regression equations (RICS 1993). It is sometimes possible to obtain high 'R^2' and a good fit with historical data, but if preliminary analysis is overlooked for stationarity, it may lead to inappropriate data selection.

Similarly, Chaplin (1998, 1999) remarked that forecast office models with an acceptable equation error may have poor predictive powers. Frequently predictive capacity is not tested over any significant time horizon, although this may of be due to data constraints and a wider report agenda (Newell and Higgins 1996 and McGough and Tsolacos 1995).

Forecast accuracy can be partitioned into the *ex ante* and *ex post* periods. For example, Sivitanides (1998) analysed two econometric models for the lowest Mean Absolute Error (MAE) over the *ex post* forecast period (comprising the last seven years of a 19-year time series). An out-of-sample, *ex ante* forecast by Gardiner and Henneberry (1991) tested a habit-persistence and a linear regression model to forecast rental income in four UK region office markets for 1985-1989. The absolute forecast error details a wide annual range, between two and 25 percent over the reported five years. The viability would have been restricted by what appears to be only seven years of historical data.

Notwithstanding the different regression techniques and available time series data, a common pattern emerges in all office categories and locations; rent is linked to vacancy rates or aggregate demand/supply proxies. Income and rental indices directly feed off the economy, although it is subject to several economic elements. Capital values and office yields respond to changes in rent and instruments of the financial markets.

2.5.2   Industrial Models

Modelling the industrial property market remains a relatively under-researched area of property market analysis. The lack of empirical work compared to the office and retail markets can be partially attributed to unique industrial market features such as:

(i)   Industrial properties can accommodate a wide range of activities that involve production, assembly, storage and distribution (Thompson and Tsolacos 2000).

(ii)   A contrast is evident in the overall industrial marketplace structure, as industrial buildings are historically owner-occupied and a majority of those rented have a single long-term tenant (Wheaton and Torto 1990).

(iii)   Construction time horizons are generally shorter for industrial properties and so provide a closer relationship to business cycles (Kling and McCue 1991).

(iv)   Research on industrial properties is limited due the availability of historical data (Buttimer *et al* 1997).

Past empirical research on the industrial property market has focused primarily on market behaviour relative to price and income characteristics, and factors influencing industrial property development. This literature examines demand and supply flows within the industrial markets and the interaction with the wider economy. Quantitative studies at the local, regional and national levels provided evidence of the key relationships in industrial markets.

Table 2.5 summarises the studies on the determinants of industrial property market rent and income performance.

Table 2.5   **Industrial Rent and Income Models**

Author (s) (Year)	Data	Time period and methodology	Determinants	Summary of results
BIS Shrapnel (1997b)	Sydney Prime Industrial (real) rents.	1983-1997 (annual) Multi equation regression model	(s) Sydney industrial demand index (c) Long-term bonds	Significant R^2 of 0.92, econometric analysis analysed by omitting lagged variables.
Buttimer, Rutherford and Witten (1997)	Rent data from 848 build. in the Dallas/Fort Worth area.	1989-1993 (quarterly) Single equation regression model	(s) Net employment (p) Building char.	Adj. R^2 of 0.38, comprehensive data identifies physical and economic influences on rental rates.
Dobson and Goddard (1992)	Inv. Chronicle/ Hillier Parker industrial rent index.	1972-1987 (annual) Multi equation regression model	(s) Industrial employment (p) House price index (c) Interest rates	Significant R^2 of 0.98 although restricted by limited data points and no tests for data stationarity.
McGough and Tsolacos (1995)	JLW Property Index, industrial rental values	1977-1993 (quarterly) ARIMA (3,2,0) model	(p) Past rental values	Result illustrated past long-term performance affects present and future changes in rental values. Satisfactory one year forecast error of 3%.

Author (s) (Year)	Data	Time period and methodology	Determinants	Summary of results
Nanthakumaran, O'Roarty and Orr (1996)	Hillier Parker. industrial rent index.	1967-1996 (annual) Single equation regression model	(s) Industrial production outputs (p) Construction orders	Adj. R^2 of 0.78, utilising a dummy variable for an outlier. Acceptable 3-year visual predictive capability.
RICS (1994, 1996)	IPD, CIG, MGL industrial rental values (appr. based).	1965-1995 (annual) Single equation regression model	(s) GDP (s) Manufacturing output (p) Construction orders	Significant R^2 of 0.98 for 1996 update with equation including dependant rent component lagged years 1 and 2.
Stone (1999)	TW industrial rent index for San Jose R&D market.	1983-1998 (six monthly) Multi equation regression model	(s) Technology employment (s) Output per worker (p) Supply of space	Acceptable R^2 of 0.72. Concerns expressed as to variation of R&D to TW industrial forecasts.
Thompson and Tsolacos (1999)	JLW and CB Hillier Parker indust. rent index	1977-1997 (quarterly) Single equation regression model	(s) GDP (s) Manu. employment (p) Industrial floorspace vacancy	The two different methodologies provide Adj. R^2 of 0.47,and 0.66 with ex-post 2 year forecast error of annual 3.2% and 4.6%.
Thompson and Tsolacos (2000)	CB Hillier Parker real industrial index	1977-1998 (annual) Multi equation regression model	(s) GDP (p) Value of contractors (p) Output for industrial projects	Adj. R^2 of 0.57, rent *ex- post* forecast evaluation measures (RMSE and Theil-U value) provided contradictory results.

Determinants: (s) =space market, (p) = property market and (c) = capital market

Empirical rental analyses on local industrial property markets are based on disaggregated transactional data and on open market estimates. The result indicated apart from the physical building characteristics, that the variation in rent can be explained by primarily lagged sector specific employment (Buttimer *et al* 1997) and lagged local economic factors (BIS Shrapnel 1997b).

Studies on regional and national industrial property markets revealed that rental income is influenced by supply determinants relating to construction orders. The demand determinants include macroeconomic and industrial sector trends such as, gross domestic product, manufacturing employment, manufacturing output (Nanthakumaran *et al* 1996, RICS 1994, Thompson and Tsolacos 1999, 2000).

For industrial property values, hedonic analysis of variations in individual building prices recognised regional economic influences (employment rate, income and gross domestic product) and monetary variables (Atteberry and Rutherford 1993, Lockwood and Rutherford 1996). The studies feature relatively short time frames and a non-linear relationship among the variables to determine local industrial property market performance.

The determinants for national and regional industrial property prices and yields were leading macroeconomic and monetary factors (BIS Shrapnel 1997b, Dobson and Goddard 1992). The

macroeconomic influences are those for industrial rents with the monetary factors including variations in interest rates and inflation which are unique to determining property value. For industrial property market total returns, Newell and Higgins (1996) illustrated the degree to which near-term macroeconomic determinants can explain performance. Primarily, the factors that lead the Australian industrial property market performance by six months were gross domestic (non-farm) product, national account final consumption and the total employed labour force. A summary of the industrial yield, capital and total return models is exhibited in Table 2.6.

Table 2.6   Industrial Yield, Capital and Total Return Models

Author (s) (Year)	Data	Time period and methodology	Determinants	Summary of results
Atteberry and Rutherford (1993)	764 industrial property sales from Dallas/ Fort Worth	1983-1991 (monthly) Single equation regression model	(s) Equity Indices (p) Industrial construct. (c) Corporate bonds (c) Long-term bonds	Adj. R^2 of 0.51, sales data indicates a relationship between current and past property prices, monetary and industrial construction indices
BIS Shrapnel (1997b)	Sydney Prime Industrial (real) yields	1980-1997 (annual) Single equation regression model	(p) Real industrial rents (c) Bond rates	Significant R^2 of 0.76, equation suggests yields are interest rate sensitive.
Dobson and Goddard (1992)	Investor Chro./ Hillier Parker indust. capital value index	1972-1987 (annual) Single equation regression model	(s) Industrial empl. (c) Interest rates (p) House price index	Significant R^2 of 0.98, although restricted by limited data points and no tests for data stationarity.
Lockwood and Rutherford (1996)	Sales data from 308 buildings in the Dallas/Fort Worth area	1987-1991 Multivariate factor-analytic technique	(p) Physical char. (p) Regional influences (p) Location factors	A factor-analytic linear structural relation's model examines local market determinants.
Newell and Higgins (1996)	PCA property invest. index East Australian total returns	1984-1994 (six monthly) Single equation regression model	(s) Retail labour force (s) GDP (non farm) (s) Retail sales (p) Total build. activity	Significant R^2 of 0.92 with a low 2.2% forecast error over 6 months on the appraisal based index.

Determinants: (s) =space market, (p) = property market and (c) = capital market

The demand and supply drivers for the industrial property market performance were the same as new industrial developments. The demand variables included macroeconomic and financial variables, such as gross domestic product, manufacturing output, employment, interest rates and capital funding (Giussani and Tsolacos 1994, Kling and McCue 1991, Tsolacos 1995a and Wheaton and Torto 1990,).

The industrial property models were dominated by single-equation regression models with many including past dependent values as current independent determinants. An alternative is the multi-equation regression model employed by BIS Shrapnel (1997b), Thompson and Tsolacos (2000).

Similar to research on the office markets, tests on the preliminary data were noticeably absent or not reported. If not addressed, non-stationary data may provide erroneous rather than meaningful results. In addition, although probably outside the primary scope of the authors' research, was a noticeable lack of forecast analysis. To validate calculated regression equation for total Australian industrial returns, Newell and Higgins (1996) compared forecast to actual percentage variation. For more comprehensive empirical studies, McGough and Tsolacos (1995) and Thompson and Tsolacos (1999,2000) forecast rents both *ex post* and *ex ante* with a broad range of forecast error techniques. The forecast accuracy was for periods of less than two years and generally provided inconclusive evidence as to the predictive capacity of industrial property forecast models.

2.5.3   Retail Models

Over the last half century, just as retailing has changed dramatically, so has the environment in which retailing occurs (Roulac 1996c). Shopping centres have emerged and now offer a complete shopping and leisure experience, which in the past was usually confined to town centres. The evolution provided opportunities for investors to participate in the development and growth of shopping centres. As demand and supply fundamentals change in the retail sector, a number of studies have focused on the major determinants of shopping centre performance. These have developed in two broad parallel directions.

(i)   The determinants of shopping centre returns, considering both shopping centre dynamics for specific shop rents, and the broad economic forces and trends affecting retail property markets.

(ii)   Establishing the relative importance of economic and property market variables to explain retail development patterns.

The contribution of retail tenant mix to shopping centre success has increasingly been emphasised by occupiers, investors and professional advisors (Pyhrr *et al* 1989, Torto

Wheaton Research 1998). A study by Sirman and Guidry (1993) examined variations in retail rent across shopping centres in the United States, identifying four main determinants: customer drawing power, centre design, location and market conditions. Gerbich (1998) and Tay *et al* (1999) studies support the empirical hedonic model and confirms the importance of space allocation theory to shopping centre base rent determinants.

Coupled to research on location-specific information, is the requirement to understand the aggregate data on the conditions of different retail markets and the regional trends that will impact on shopping centre performance. Empirical studies on retail performance determinants have focused primarily on shopping centre specialty shop rents and the centre's total income. Unlike alternative property sectors, the retail market exhibits continuing change (food halls and cinema complexes), customers base and demand determinants. Hetherington (1988) recognised retail market divergence by locality and type with the requirement of separate time series analysis of the various retail markets.

The aggregate retail rent is dependent on both aggregate demand and supply conditions. The demand factors often lag in the short to medium term both macroeconomic and retail specific determinants. The macroeconomic determinants for example include aspects of gross domestic product, population and employment (Dobson and Goddard 1992, Torto Wheaton Research 1998, Tsolacos 1995b, 1998). While retail specific variables embrace retail sales, consumer expenditure and sentiment (Benjamin *et al* 1988, BIS Shrapnel 1997a, Hetherington 1988, RICS 1994).

The supply side (RICS 1994, Torto Wheaton Research 1998 and Tsolacos 1995b,) included total retail supply or retail construction output. The importance of the supply influence may be limited at a national aggregated level with local specific factors underpinning demand and supply variables (Tsolacos 1995b).

McGough and Tsolacos' (1995) time-series analysis supports the inclusion of past changes in retail rent to convey information about current and future trends. This convention is explicitly recognised in other empirical retail models with past values of retail rents being included as an independent determinant.

Table 2.7 provides a summary of empirical studies on retail rent and income models.

Table 2.7   **Retail Rent and Income Models**

Author (s) (Year)	Data	Time period and methodology	Determinants	Summary of results
Benjamin, Jud, and Winkler (1988)	160 retail observations from 19 metropolitan statistical areas	1986-1995 (monthly) Multiple equation regression model	(s) Retail sales (p) Supply of retail space	R^2 of 0.99, by a simultaneous natural logarithm rental model incorporating vacancy rates from retail space demand and supply variables.
BIS Shrapnel (1997a)	Sydney regional shopping centre specialty shop rents (real)	1981-1997 (annual) Multiple equation regression model	(s) Cons. senti. index (s) Retail turn per capita (p) Supply of retail space.	R^2 of 0.94, analysis restricted to limited time series. Near term influences relate to consumer sentiment and completions.
Dobson and Goddard (1992)	Investor Chronicle/ Hillier Parker retail rent index.	1972-1987 (annual) Single equation regression model	(s) Retail employment (p) House price index (c) Interest rates	Significant R^2 of 0.88, although restricted by limited data points and no tests for data stationarity.
Hetherington (1988)	Hillier Parker retail rent index (real)	1965-1987 Correlation analysis	(s) Retail sales volume (s) Store Profits	Correlation coefficient of 0.93, although separation of national data suggested significance depends on size of town.
Hillier Parker (1985)	Hillier Parker retail rent index (real)	1977-1985 (six monthly) Single equation regression model	(s) Disposable Income (s) Retail profit	Significant R^2 of 0.88-0.95 for the series of annual reports. Forecast accuracy represented previous year's forecast to actual results.
McGough and Tsolacos (1995)	JLW Property Index, retail rental values	1977-1993 (quarterly) ARIMA (1,2,0) model	(p) Past rental values	Past rents influence current and future changes, with a one year forecast accuracy of 3%.
RICS (1994, 1996)	IPD,CIG, MGL retail rental values (appraisal- based)	1966-1995 Single equation regression model	(s) Cons. expenditure (p) Floorspace stock (p) Construction orders (c) Interest rates	Significant R^2 of 0.96 for 1996 update and incorporating natural logarithm for rent and constant prices for monetary variables.
Silver and Goode (1990)	Investor Chronicle/ Hillier Parker shop rent index	1977-1988 (six monthly) Single equation regression model	(s) Retail price index (s) Cons. expenditure (p) Index of cons. wages (c) Interest rates (c) Stockmarket indices.	Significant R^2 above 0.98 for the various statistical models, although authors expressed concern as to multi collinearity instability.
Sirmans and Guidry (1993)	Survey of shopping centres Baton Rouge, Louisiana, USA	1989-1991 (six monthly) Single equation regression model	(s) Cust. drawing power (s) Market conditions (p) Design of centre (p) Location	An R^2 of 0.85 indicates shopping centre rents can in part be explained by inter-shopping centre features.
Tay, Lau and Leung (1999)	405 retail shops in 9 prime Hong Kong shopping centres	1991-1994 (monthly) Single equation regression model	(p) Lease provision (p) Size of shop. centre (p) Locality in shop. centres	A satisfactory R^2 of 0.78 links the monthly rental determinant (logged) to a variety of independent variables.
Torto Wheaton Research (1998)	Torto Wheaton retail rent index	1981-1995 (annual) Multiple equation regression model	(s) Total employment (s) Population (s) Personal income (p) Supply of ret. space	Explanation restricted to data and methodology. Chicago metropolitan shopping centre rents illustrated with an R^2 of 0.85.
Tsolacos (1995b)	Jones Lang Wootton index of retail rents	1977-1994 (quarterly) ARIMA (3,0,1) model	(s) Consumer expenditure (s) GDP (p) Retail build. output	A moderate R^2 of 0.56 explains changes of real rents. Comparison of four quarter forecast to actual provided a low 1.4% forecast error.
Tsolacos (1998)	Hillier Parker real retail rent index	1985-1997 (quarterly) Regression model VAR system	(s) Real consumer expenditure (p) New retail building orders	An adjusted R^2 of 0.71 explains changes of determinants for new retail developments although is limited by forecast accuracy.

Determinants: (s) =space market, (p) = property market and (c) = capital market

Empirical research on retail property values, capital returns and yields are limited. Studies suggest similar economic factors to retail rent models with an additional monetary factor as an independent determinant (BIS Shrapnel 1997a, Dobson and Goddard 1992), see Table 2.8. Newell and Higgins (1996) is the exception with total retail return model displaying exclusively macroeconomic factors with an explanation to the strong relationship of retail income to total returns. Higgins and Wilson (2000) substantiated income return variations accounted for over 70 percent of total return variations in Australian regional retail markets.

Table 2.8   **Retail Yield, Capital and Total Return Models**

Author (s) (Year)	Data	Time period and methodology	Determinants	Summary of results
BIS Shrapnel (1997a)	Sydney regional shopping centre yields	1981-1997 (annual) Single equation regression model	(p) Real retail rents (c) Long-term bonds	Significant R^2 of 0.89, with emphasis on interpretation of the long-term equilibrium yield.
Dobson and Goddard (1992)	Investor Chronicle/ Hillier Parker retail capital value index	1972-1987 (annual) Single equation regression model	(s) Retail employment (s) House price index (c) Interest rates	Significant R^2 of 0.98 although restricted by limited data points and no tests for data stationarity.
Newell and Higgins (1996)	PCA property investment index Australian retail total returns	1984-1994 (six monthly) Single equation regression model	(s) Man. gross product (s) Indust. gross product (s) Government deficit (s) Retail trade	Significant R^2 of 0.96 with a low 3 5% forecast error over 6 months on the appraisal based index.

Determinants: (s) =space market, (p) = property market and (c) = capital market

The process of analysing retail demand and sales has become sophisticated, because constructing new or expanding existing shopping centres requires large amounts of capital and long development timeframes. Several researchers have published empirical studies on shopping centre supply (for example: Benjamin *et al* 1988, RICS 1994, Tsolacos 1998). A common feature in explaining past development patterns is associated retail market performance, selection includes shopping centre capital values, rents and vacancy rate variables.

Econometric analysis to investigate the determinants of retail market performance and new development were generally in the form of single-equation regression models. These often included natural logarithms, a lagged dependent variable and two or more aspects of demand, comprising macroeconomic and retail specific factors. Many of the authors appeared to accept high coefficients of determination 'R^2' to validate their model with a supplementary test to check for independence of the random error term.

Silver and Goode (1990) expressed concern if the selection of econometric models were based on historical good fit to the actual data series. Empirical tests were recommended on the selected time series data for stationarity and, where applicable, forecasting accuracy. Tsolacos (1995b) applied unit root tests on the variables and *ex post* (in sample) and *ex ante* (out-of-sample) forecast tests. The *ex ante* forecast error of less than two percent on a one-year rent prediction was exemplary although the author noted it is based on aggregated national data.

2.6 SUMMARY

This chapter presented a literature review of commercial property market determinants and the associated forecasting theory. As the forecasting process is a series of identified steps, the application and the limitations of commercial property were systematically examined. The study revealed that in past publications, many of the procedures that were accepted at that time now require more in-depth econometric analysis. Most evident were the lack of preliminary data analysis and, where applicable, forecast accuracy measurements to determine the appropriateness of the selected model and associated determinants.

A further issue with commercial property research is the historical availability and the collection of valid and reliable data. The concern relates to a low degree of information with limited transactions, no central trading place and the unique characteristics of largely indivisible building assets. In recognising the infrequency of the raw data and an inefficient marketplace, local transactional databases are more likely to reveal true behavioural performance than alternative national and valuation-based indices. The trade-off is balancing what is commercially practical with what is ideally required.

The commercial property market structure can be separated into distinct operational groups, with occupiers, investors and developers linked together by the wider business environment. Their decision making processes are influenced by a myriad of complex factors from the wider economy and arising directly from property markets. These commercial market

determinants can be placed into a framework based on Archer and Ling's (1997) three-market model of the space, capital and property markets.

A review of the published office, industrial and retail market models demonstrated two broad forecast approaches being the multi-equation models and single equation models. Typically, both used the regression procedure to determine the relationship overtime of the dependant variables to explanatory variables (determinants). The review of literature shows more published studies which take the single equation approach.

In the survey of both published historical and forecasting models, a pattern emerged with the selected determinants. For rent (including income return) models in all property sectors, the main space market determinant was the gross domestic product (GDP) measure. In addition, office rent determinants included office employment, while industrial rent determinants covered additional components of GDP and industrial employment. Retail rents provided a broad coverage of retail specific determinants like retail sales and consumer expenditure.

There are limited published property yields, capital and total return models. The literature review revealed that most had capital market determinants being represented by a range of interest rate charges, such as 90-day bank bills. Generally, the remaining determinants were completely from the space or property markets. The space determinants represented aspects of GDP and employment, and the property determinants were primarily forms of rent.

A common approach in most models was to accept the regression equation based on a good fit being determined by the coefficient of determination (R^2) and tests for serial and autocorrelations. In many models, conspicuous by its absence, were forecast accuracy tests, particularly in out-of-sample tests. Recent articles, such as (Chaplin 1998, Sivitanides 1998 and Thompson and Tsolacos 1999) have provided short-term, out-of-sample tests. All acknowledge that a good fit with historical data may have limited predictive powers.

The literature review serves to highlight a number of issues surrounding commercial property forecasts. A summary of the property forecasting models, structure and determinants provide the platform for a survey in the next chapter of Australian organisations that provide commercial property forecasts.

CURRENT STATUS OF PROPERTY FORECASTING

A STUDY OF PROPERTY ORGANISATIONS' APPROACH TO PROPERTY FORECASTING

3.1 INTRODUCTION

The main objective of this chapter is to investigate the current approach by Australian organisations to forecasting the long-term performance of leading property markets. The research examines the property forecasting extent, data sources, model structures, selected determinants and property forecast evaluation techniques. Higgins (2000a) details published research associated with this chapter. See Appendix C for a copy.

As property forecasting research has been developed extensively by organisations for business opportunities and much of the property forecast information is regarded as commercially sensitive and would not be made available to a third party for research purposes. Therefore, the research was in two stages, firstly a telephone survey to identify organisations who provided regular long-term forecasts on the leading New South Wales office, industrial and retail property markets. Secondly, these organisations were contacted and sent a questionnaire centered on forecast processes and components rather than their

forecast model equations. All organisations which agreed to participate, completed the survey.

This chapter has been divided into two main sections. The first section details the introduction and research design with commentary on questionnaire structure and information on those surveyed. The second section contains the questionnaire responses, with a profile of the survey respondents, their forecast techniques, components and evaluation process. A summary statement concludes the chapter.

3.2 RESEARCH DESIGN

The survey research was designed to source information from organisations, which regularly publish long-term forecasts on the performance of the three leading NSW commercial property markets: Sydney CBD prime office, Sydney metropolitan prime industrial and New South Wales regional shopping centres. To do this a telephone survey of 30 financial and business organisations determined those organisations that provide regular forecasts for publication and those which produced research for the organisation's internal use. Sixteen leading property organisations were identified. They were approached to participate and 15 agreed to complete the detailed questionnaire.

As there was a limited number of survey participants, a pilot questionnaire was sent to three past property researchers who worked for property forecast organisations and were known to the author. After receiving comments and making amendments, the questionnaire was sent in November 1998 to the 15 property organisations predominately addressed to the research manager.

The five-page questionnaire was designed to be completed in a short time and included primarily 12 detailed multi choice questions in three sections: firstly, information on the property organisation and the range of forecasts, secondly, the forecast process and associated determinants and thirdly, property forecasts and evaluation techniques. See Appendix B for a copy of the final version of the questionnaire.

All information collected from the survey is reported in a condensed format and no information on individual organisations is disclosed.

3.3   SURVEY RESULTS AND DISCUSSION

The initial telephone survey revealed that organisations which forecast the commercial property market performance could be divided into three categories. Firstly, property consultants with access to market knowledge and raw data from their leasing and sales teams. Secondly, property equity organisations and their association with the securitised property market (listed property trusts), and thirdly, major building owners, who can be both direct owners and securitised property trust managers. The property equity organisations and the building owners' historical data is almost entirely supplied by the property consultants.

The questionnaire was sent out to 15 property organisations and with follow-up phone calls and meetings. All respondents returned a completed questionnaire. An initial examination indicated that the property organisations had provided detailed information on their forecast approach, however many were less forthcoming in providing historical forecast values. Notwithstanding this, the completed questionnaires provided extensive information on the property organisations' approach to long term forecasting for commercial property market performance.

3.3.1 Property Organisations and Range of Forecasts

The survey examined four aspects of the property forecast organisations, being the respondents' industry classifications, the number of property professionals employed and the years and range of forecasts. The industry classifications of the property forecast organisations are shown in Table 3.1.

Table 3.1   **Property Forecast Organisations and the Industry Categories**

Organisation categories	No.	%		
Property consultants	6	40%		
Property equity analysts	4	27%		
Building owners	5	33%		
Total	15	100%		

The survey illustrated the range of property organisations providing regular long-term forecasts. All were major property operators in their particular industry category and 10 formed part of a multi-national organisation. This demonstrates how limited is the number of property organisations that provide forecasts in the define industry categories, especially as the estimated institutional investment in the NSW property market (covered in this survey) is valued in excess of $20 billion as at December 1998.

Property forecasting is a specialist area with 12 (80 percent) of the surveyed organisations employing less than five property professionals to forecast the performance of NSW property markets. Organisations employing more than five property professionals were in each property organisation category.

Table 3.2   **Property Organisations and the Years Forecasting**

Years of forecasting	Office		Industrial		Retail	
	No.	%	No.	%	No.	%
0-5 years	11	73%	14	100%	10	91%
6-10 years	3	20%	0	0%	1	9%
11-15 years	1	7%	0	0%	0	0%
Total	15	100%	14	100%	11	100%

Table 3.2 illustrates the relatively short period of time organisations have been forecasting the NSW property markets. Generally, those now employing more than five property professionals have provided forecasts for more than five years, although the extent of coverage varies across the specific property classes. All those surveyed provide office forecasts with one organisation providing forecasts intermittently for over 10 years. Coverage of both industrial and retail markets were less, with 93 percent and 80 percent of the organisations providing forecasts in the respective areas. All the industrial and retail forecasts

started in the last five years except for one organisation's retail forecasts, which started between five and 10 years ago.

Table 3.3 shows the frequency of property forecasts provided by the property organisations.

Table 3.3   **Property Organisations and the Frequency of Forecasts**

Frequency of forecast	Office		Industrial		Retail	
	No.	%	No.	%	No.	%
Quarterly	5	33%	5	36%	5	45%
Six monthly	8	53%	5	36%	2	18%
Annually	0	0%	1	7%	1	9%
As required	2	13%	3	21%	3	27%
Total	15	100%	14	100%	11	100%

Property forecasts are predominantly prepared on either a quarterly or six-monthly basis. When combined, the organisations forecasting at least semi-annually ranged from office at 86 percent, industrial, 72 percent and retail, 63 percent. Over 20 percent of industrial and retail forecasts are prepared as needed, mainly by property equity organisations.

In each property class, there can be several forecast categories. Table 3.4 highlights these and the percentage of property organisations providing forecasts in each category. In addition, some individual organisations forecast specific categories, for example: gross rent, building outgoings, construction costs and workspace ratios.

Table 3.4   **Property Organisations and the Range of Property Forecasts**

Forecast categories	Office		Industrial		Retail	
	No.	%	No.	%	No.	%
Rents	15	100%	13	87%	9	60%
Yields	13	87%	12	80%	9	60%
Income returns	8	53%	7	47%	6	40%
Capital returns	8	53%	8	53%	6	40%
Demand (employment)	10	67%	2	13%	2	13%
Supply	12	80%	3	20%	4	27%
Vacancy rates	14	93%	1	7%	1	7%

Most evident from the survey results was the property organisations' comprehensive coverage of all the office forecast categories and the high importance of rent and yield categories compared with the industrial and retail markets. The diversity between the property markets in demand and supply categories, highlights the difficulty of retail and industrial market research. For example, industrial vacancy rates are very difficult to substantiate due to the physical size of the industrial market and the relatively short construction timeframes.

The forecast categories are itemised by time period in Table 3.5.

Table 3.5   **Range of Property Forecasts by Time Periods**

Forecast categories	Office			Industrial			Retail		
	1-3 yrs	4-10 yrs	>10yrs	1-3 yrs	4-10 yrs	>10yrs	1-3 yrs	4-10 yrs	>10yrs
Rents	1	7	5	3	6	3	1	5	2
Yields	1	6	4	2	6	3	0	6	3
Income returns	0	5	3	0	4	3	0	4	3
Capital returns	0	5	3	0	5	2	0	5	2
Demand (Employment)	0	6	4	0	2	0	0	2	0
Supply	0	5	3	0	1	0	0	2	0
Vacancy rates	1	9	4	0	1	0	1	1	0

Table 3.5 shows that property markets forecasts are generally for a period of more than three years, as forecasts are predominately for asset valuations that commonly use a 5 to 10 year cashflow analysis. Short-term forecasts of less than three years are most evident in the industrial sector, being still a relatively low 11 percent of the total.

3.3.2 Property Forecasting Techniques

The property organisations were asked to list the processes used in their five-year forecasts. They were provided with a choice of time series analysis (trends, moving averages), causal analysis (economic modelling), questionnaires (related to market conditions), judgment (based on market knowledge) and a space to specify any other approach.

Figure 3.1 illustrates the property organisations' principal techniques with the percentage of respondents in brackets.

Figure 3.1 **Property Organisations' Forecast Techniques – Five-Year Forecasts**
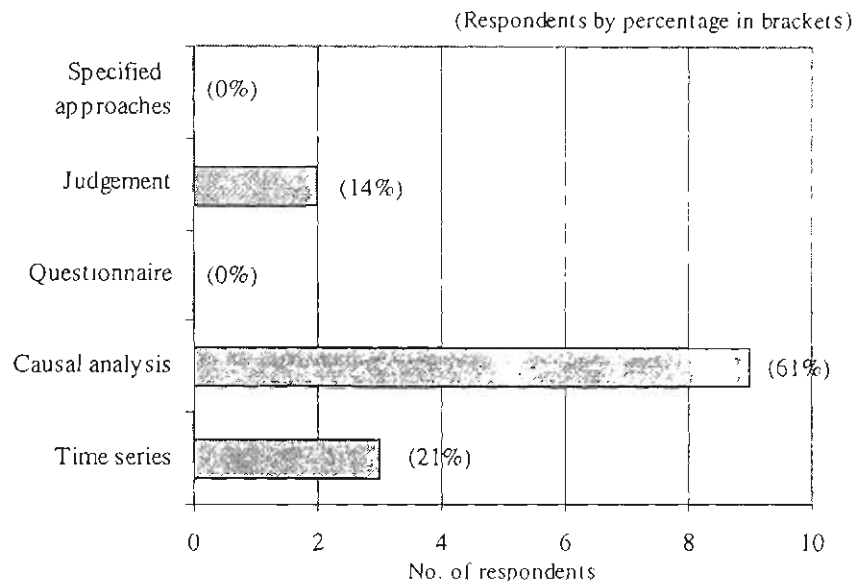
Most property organisations selected casual analysis (econometric modelling) as the principal technique for five-year property performance forecasts. The processes selected were essentially: building owners - causal method, property consultants - causal and time series analysis, and property equity organisations - equally across the range.

In ranking the forecast techniques, a trend was evident in the property organisations' selection; as nine placed causal analysis first, six placed time series second, six placed judgmental third and seven placed questionnaire fourth. The similarity in ranking highlighted the general selection process and all except one property organisation had the causal method as either the first or second choice.

Even with the property organisations having various forecasting techniques, they do generally forecast the same comprehensive range of performance categories, pre-eminently rents and yields.

3.3.3 Selected Property Market Determinants

When detailing the forecasting process, property organisations listed the main determinants in their five-year forecasts as net effective rents and equivalent yields. Tables 3.6 and 3.7 recorded the determinants selected and the frequency respectively. For confidentiality and clarity, the determinants are in broad terms and grouped under three main headings: Property, Space and Capital. As discussed in Chapter Two, Literature Review, these form the conceptual framework for property market determinants.

Table 3.6   **Property Organisations' Principal Determinants For Net Effective Rent Forecasts**

Property market determinants	Office Selections by Property organisations		Industrial Selections by Property organisations		Retail (Speciality Shops) Selections by Property organisations	
Property	Historical rents	2	Historical rents	3	Historical rents	2
	Construction activity	10	Construction activity	3	Construction activity	4
	Construction costs	1	Construction costs	1	Occupancy costs	1
	Vacancy rates	8				
	Workspace ratio	5				
	Lease incentives	1				
Space	GDP	4	GDP	10	GDP	2
	Office employment	9	Employed persons	3	Employment	1
	ASX - indices	1	- Manufacturing/Wholesale		Retail turnover	7
	Job adverts	1	Estimated utilisation	1	including per capita	
			capacity		Population	2
					Private disposable income	1
					Consumer sentiment index	4
Capital	Interest rates	1	Interest rates	2	Inflation	1
			Inflation	2		

Table 3.6 reveals a wide range of property and space determinants used to forecast long-term rents. The many space determinants in the retail market represented varied influences on consumer confidence and income. The most common is retail turnover, which is closely linked to private consumption and household expenditure.

Several property determinants in the office market indicate that additional variables such as vacancy rates and workspace ratios form a second tier approach to forecasting office net effective rents, i.e. initially forecast the vacancy rate and from there determine future rents. It

would appear that industrial and retail rent forecasts are formed using selected determinants in a one-step process.

For the commercial property rents, the main space determinants portray different economic characteristics with office employment for office rents, economic activity (GDP) for industrial rents, and retail turnover for retail rents. These individual elements do form part of overall economic activity, although they do perform, to some extent, separately.

Table 3.7   **Property Organisations' Principal Determinants**
                                For Equivalent Yields Forecasts

Property market determinants	Office Selections by Property organisations		Industrial Selections by Property organisations		Retail (Speciality Shops) Selections by Property organisations	
Property	Historical yields	4	Historical yields	4	Historical yields	4
	Rents	7	Rents	5	Rents	3
	Sales eevidence (trend)	1	Sales evidence (trend)	1	Capital growth	1
	Vacancy rates	2				
Space			Consumer sentiment index	1	Consumer sentiment index	1
					GDP	1
					Retail turnover	1
Capital	Interest rates	6	Interest rates	4	Interest rates	6
	Inflation	2	Inflation	1	Inflation	2

The property organisations surveyed selected a narrow band of property and capital determinants to forecast property yields, with space (demand) variables largely absent. To some extent this is understandable, with the linkage between space and property determinants in forecast rental analysis. This is shown by rents being the most selected independent property determinants apart from historical yields.

When comparing the principal rent and yield determinants, a feature is the broad selection of space determinants that influence rental performance compared with the similar property and capital determinants for property yields. This indicates the importance of understanding rental determinants and sources of future space demand.

Having established the principal determinants to forecast property markets, Figure 3.2 details if the property organisations have kept the same determinants over the past five years. The percentage of respondents is shown in the brackets.

Figure 3.2   **Property Organisations' Selection of Principal Property Forecast Determinants for the Past Five Years**
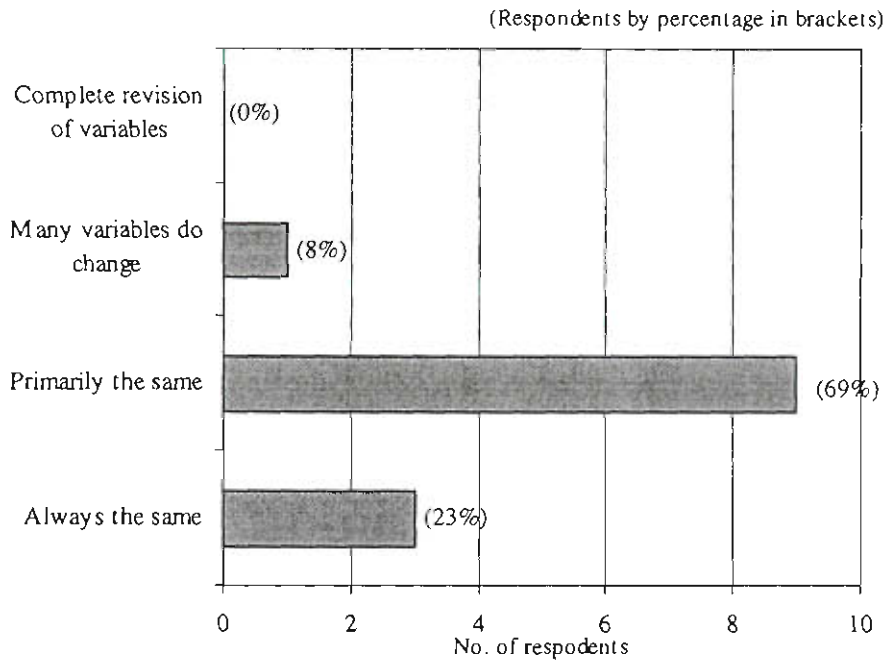
Generally, the property organisations said that the principal property forecast determinants have remained the same over the past five-years, with 92 percent using the same, or primarily the same, determinants in their forecasts. This continuity highlights the influences of leading determinants on property market forecasts and the need to establish their forecast credentials.

Macroeconomic forecast data

As illustrated in Tables 3.6 and 3.7, an important consideration in forecasting commercial property performance is the future performance of the macro economy. For property organisations there are three principal sources of forecast economic data: independent, in-house, and government organisations.

Table 3.8 details the source of economic projections and the frequency of use by the surveyed property organisations.

Table 3.8   **Property Organisations' Source of Economic Projections**

Frequency	Economic organisations					
	Independent		In-house		Government	
	No.	%	No.	%	No.	%
Always	6	46%	4	50%	0	0%
Often	5	38%	2	25%	1	13%
Sometimes	2	15%	0	0%	6	75%
Rarely	0	0%	0	0%	0	0%
Never	0	0%	2	25%	1	13%
Total	13	100%	8	100%	8	100%

Table 3.8 shows that 11 (73 percent) of the property organisations surveyed often to always use forecasts provided by independent economists, with six property organisations (40 percent) often to always used the services of in-house economist. There was a mixed response by the property organisations to the government economic forecasts, as six (40 percent) sometimes referred to the government information, with 7 percent often and 7 percent never using the government forecast data.

The surveyed property organisations' confidence in the principal economic forecast is illustrated by the extent to which survey respondents amend, and/or qualify the economic forecast data.

Figure 3.3 show the property organisations that amend/qualify economic forecast data with the respondents' percentage in brackets.

Figure3.3   **Property Organisations' That Amend/Qualify
Economic Forecast Data**

(Respondents by percentage in brackets)
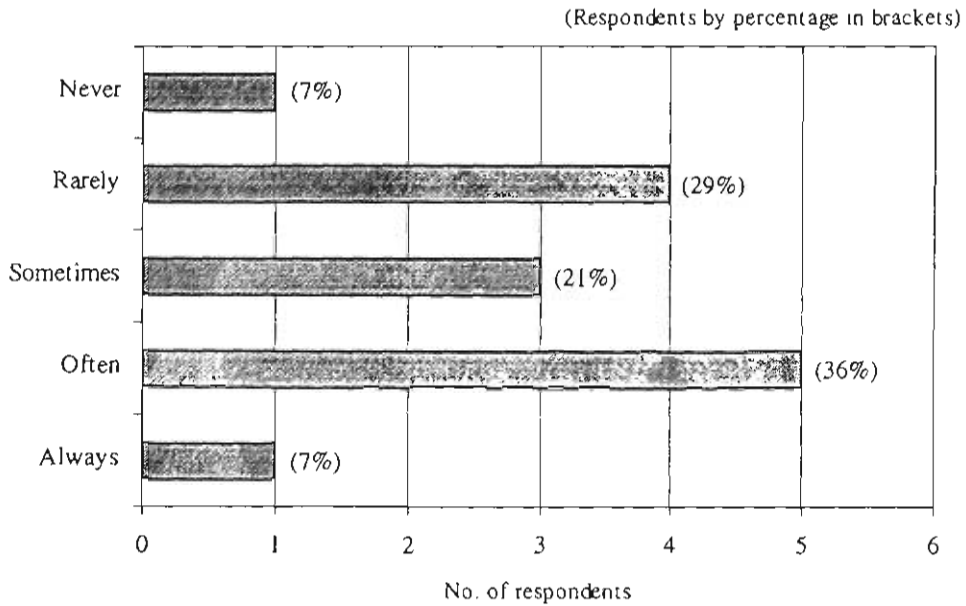
The wide response range provides inconclusive evidence as to property organisations' approach to modifying forecast economic data. However two points were evident, firstly, those using in-house economists amended economic forecasts rarely to never. This could be because the property organisations are consulted during the data preparation. Secondly, the limited confidence property organisations have in the published economic forecasts, with 43 percent regularly amend/qualify the data. They may do so for various reasons including: unrelated volatility between the economic and property markets, pre-selection of economic forecasts to achieve the desired property forecasts, and combining economic forecasts to provide a consensus approach.

3.3.4 Evaluation of Property Forecasts

An integral part of property forecasting is the evaluation stage. Here property forecasts can be compared with other current forecasts measuring the same property market performance, and by retrospectively examining past forecasts. The property organisations' approach to analysing other property organisations' forecasts is illustrated in Figure 3.4 with respondents' percentage in brackets.

Figure 3.4 **Property Organisations' Examination of Competitors' Forecasts**
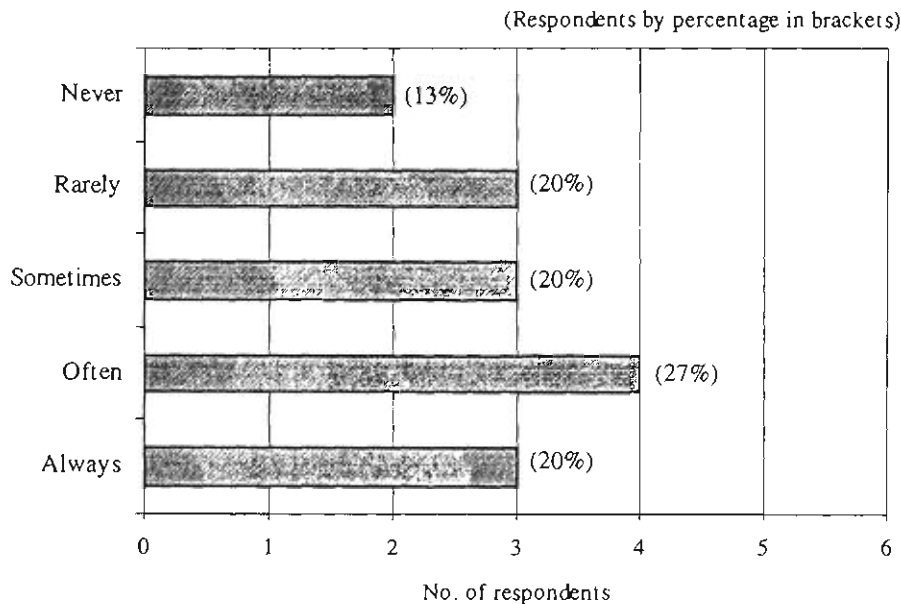
(Respondents by percentage in brackets)

No. of respondents

The response to the survey question again initially appears unclear, with a mixed response across all categories. On further analysis, building owners predominantly analyse other property organisations' forecasts. Cost restraints and confidentiality may restrict property equity organisations and property consultants reviewing competitors' forecasts.

Retrospective examination generally forms a key part of the property organisations' evaluation process, with 10 organisations (77 percent) of the respondents confirming they undertook some form of historical analysis. However, the property organisations' response to the nature of the review appears to be random and short-term, commonly being either of no set format or an analysis of forecast to actual performance over the previous period.

One prevailing difficulty for property organisations in measuring their forecasting ability is the limited track record. Most organisations have been forecasting for a relatively short time (less than 5 years). Further, the application of statistical methods to measure forecast accuracy appears to be under-utilised when compared to general forecasts procedures with recognised forecast accuracy tests and benchmarks.

3.4 SUMMARY

Forecasting the future performance of commercial property markets is now an integral part of the property development and investment decision making process. Sixteen property organisations forecast the performance of the $20 billion Sydney CBD prime office, NSW regional shopping centres and Sydney prime industrial markets. The majority of those surveyed provided rent and yield forecasts on either a quarterly or six monthly basis.

For five-year property forecasts, property organisations principally use the causal (econometric modelling) process. The main space (demand) determinant for forecasting office, industrial and retail rents is different characteristics of the economy. This compares to predominantly the same property and capital variables used for all five-year equivalent yield forecasts, with space (demand) determinants typically absent. Generally, those surveyed forecast the same office, retail and industrial performance categories and included office demand, supply and vacancy rates.

In forecasting commercial property market performance, the property organisations identified the macro economy as an important determinant. A problem is that some property organisations regularly amend/qualify the data. There can be various reasons for this, although the inconsistency is a concern as there is a need to standardise an organisation's property forecasting approach.

Theoretical and technical evaluation of forecasting techniques is still at an early stage in Australia. Retrospective analysis of property market forecasts by survey respondents appears to be on a random and short-term basis. In part, this may be due to a limited track record, as the majority of organisations started forecasting in the last five years and there is an absence of a standard approach to accurately measure forecast error.

Property forecast considerations are further discussed in the next chapter and a property forecast model is developed on the information in this chapter and the previous chapter literature review.

Chapter Four

PROPERTY FORECASTING DESIGN
KEY ISSUES AND DEVELOPMENT OF THE PROPERTY FORECAST MODEL

4.1 INTRODUCTION

This chapter presents a property forecast model of rents and yields for the office, industrial and retail markets. To establish the model structure and to understand the specific considerations with commercial property forecasts, information was derived and combined from the previous chapters, being the literature review and the survey of property organisations' approach to property forecasting. The preferred property data source, selected model determinants and methods to measure forecast accuracy were also clarified.

Developing the property forecast model for the office, industrial and retail markets will establish the most frequently selected space, property and capital market determinants. The practical issues in the approach and application will be detailed through selecting the property forecast model and determinants.

The remainder of this chapter has been divided into two sections. Firstly, identifying the issues in property forecast model application and secondly, developing a property forecast model and selected determinants. A summary concludes the chapter.

4.2 ISSUES IN THE APPLICATION OF A COMMERCIAL PROPERY FORECAST MODEL

The literature review identifies key steps in the forecast process (see Chapter 2.2.1). An explanation of these factors can highlight the issues in the application of a commercial property forecast model with reference to the literature review and survey of property organisations' approach to property forecasting.

Table 4.1 **Summary of Considerations in Property Forecasting**

Forecasting factors	Explanation of factors	Commercial property considerations
Selection of property forecast data	Determine objectives including the theoretical problem of data aggregation and hierarchical forecast implications.	Preference to forecast local property market data, which can then establish aggregated regional and national property market forecasts.
Time horizons	Forecast term - determine length of forecast: short, medium or long duration. Quantity - single or regular interval forecasts.	Historically commercial property is considered as a long-term investment and for valuation (cash flow) purposes require forecasts at regular intervals.
Cost *versus* value constraints	Development costs and ongoing value may stipulate the forecast approach.	Limited costs occur generally at the development and installation stages to major ongoing labour costs associated with property data collection.
Property data source	Availability - time-series data examined for length, relevance and representation. Pattern - selected time series data to be of similar configuration. Consistency - recognised and publicised time series data.	Restricted historical time-series as property organisations have only recently systematically collated property information. Property terminology and methodology can vary between property organisations. Restricted by no central marketplace, infrequent market transactions and many confidentiality agreements, which can affect data consistency over time, location and class.
Preliminary data analysis	Analyse underlying fundamentals generating the time-series. Transform inconsistent data and non-stationary time series.	Often overlooked the preliminary data analysis to include visual and statistical tests including the unit root test for non-stationarity.
Model selection	Forecast model to generate accurate forecasts in defined limitations of data, time and costs.	The most frequently employed technique is causal (econometric) modelling based on single and multi equations using regression analysis.
Validation of results	Historical analysis - evaluation of complete data series to test statistical significance. *Ex post* forecast - can confirm historical suitability of selected model variables. *Ex ante* forecast - based on the out-of-sample observations, it determines the forecast accuracy and property forecast model selection.	Validation of results generally restricted to key statistical tests to confirm historical validity of the property-forecast model and associated determinants. Most property organisations publish forecasts with limited information on process, statistical tests and forecast accuracy. In published research papers, the *ex-ante* forecasts are short-term and do not match model long-term forecast requirements.

Forecasting factors	Explanation of factors	Commercial property considerations
Forecast accuracy	Various statistical tests can determine forecast accuracy.	Under utilised with no recognised benchmarks to determine the accuracy of commercial property market forecasts.
Presentation of forecasts	Forecast information is only as good as the decision-makers knowledge of the applied forecast process and techniques.	Property decision-makers' knowledge is limited, as application can be a part of a broad range of considerations for development, investment and valuation processes.
Updates and revisions	Provides verification of forecast model and the selection of time-series variables.	Restricted due to property organisations' commercial sensitivity and limited track record. Unpublished internal assessment may exist.

In providing a summary of property forecast considerations, it should be noted that explicit property forecasting is a relatively new area of property research. This is demonstrated in the property organisation survey with the majority of organisations starting their forecasting in the past five years. These organisations have recognised the opportunity and need to capitalise on the growing awareness of the importance of formal modelling and forecasting the commercial property markets.

Whether by choice or coincidence the property organisations' approach and selection of determinants appeared similar to that outlined in the literature review. It confirmed that the preference is for econometric models which make use of plentiful historical macroeconomic data to explain the performance in the office, industrial and retail property markets.

Also property organisations forecast on local market data providing primarily forecast rents and yields. It is evident from the literature review that in recognising the infrequency of raw data and the inefficient marketplace, these can reveal more of the local market dynamics than national and appraisal databases, which can obscure and smooth market behaviour. It is, however, important when modelling at the local level to identify specific market features.

It became clear while selecting the commercial property market models and determinants, that the criteria appear to be controlled by the historical data movement. An acceptance that the determinants' past relationship to commercial property market performance will provide the basis of the future association is commonplace in the literature review. These assumptions need to be proven to substantiate the determinants especially as in the survey of property organisations there appears limited confidence in published economic forecasts. The key is to test out-of-sample the model determinants and see if the relationship remains sound.

4.3 DEVELOPMENT OF THE PROPERTY FORECAST MODEL

In the literature review, the survey of leading historical and property forecast models provided an extensive list of determinants that can be linked to commercial property performance. These were grouped into space, property and capital market factors. The property organisation survey also detailed the principal determinants for property forecasts. Combining the information and selecting the main determinants produced a rent and yield model for the office, industrial and retail markets. See Figure 4.1 to Figure 4.4 for the models detailing the determinants of commercial property market performance.

(i)   **Office rent models** - have been the focus of past property forecast research due to good data availability and easily defined property locality and class. The surveys highlighted the prime determinants as aspects of employment and GDP in the space market and, to lesser extent, capital market interest rates. The property market determinants provide a measure of supply and construction costs. In addition, many office rent models have a vacancy rate determinant (see Figure 4.1).

Figure 4.1   **Model of Office Rent Determinants**
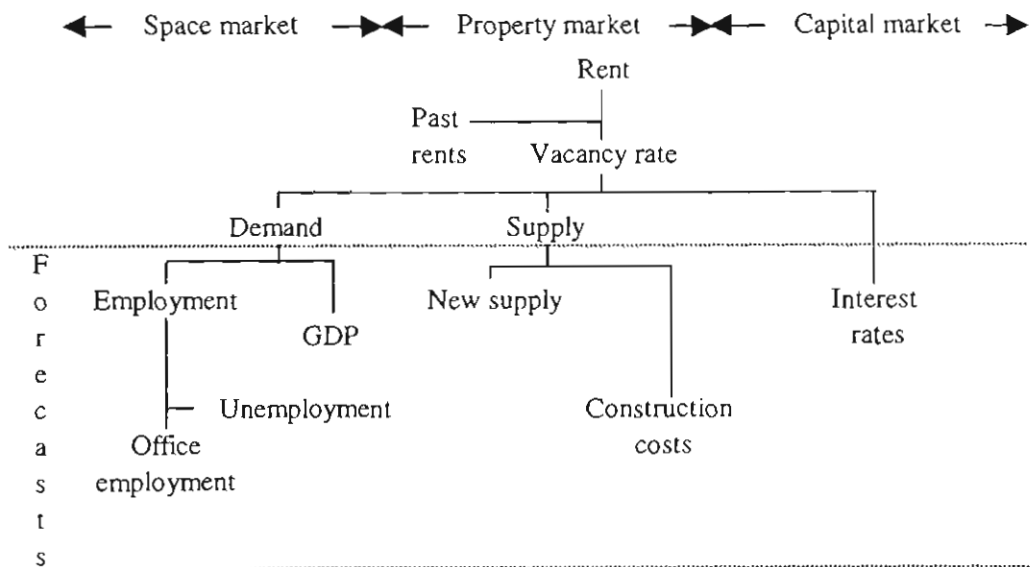
(ii)   **Industrial rent models** - primarily feature the same leading space and capital market determinants as for the office rent models, although the space market emphasis is more on GDP output characteristics. Property market determinants appear limited, being represented by construction orders, a component of new supply (see Figure 4.2).

Figure 4.2   **Model of Industrial Rent Determinants**
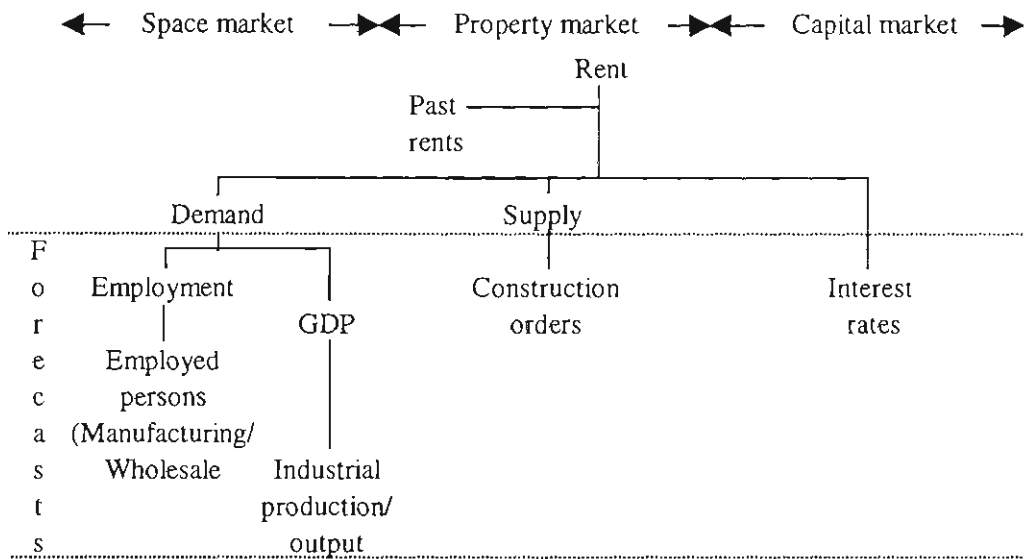
(iii)   **Retail rent models** - exhibited distinct determinants associated with retailing, mainly retail sales and retail turnover. Beneath this are the leading space, property and capital market determinants and additional space market determinants, including population demographics and private consumption. These appeared independent from the office and industrial property market models (see Figure 4.3).

Figure 4.3   **Model of Retail Rent Determinants**

← Space market →►◄— Property market →►◄— Capital market →

Rent

Past ———— rents

Demand/Retail turnover   Supply

F
o   Consumer   GDP   New supply   Interest
r   sentiment   rates
e
c   Private
a   consumption
s   Population
t   demographics
s

Employment
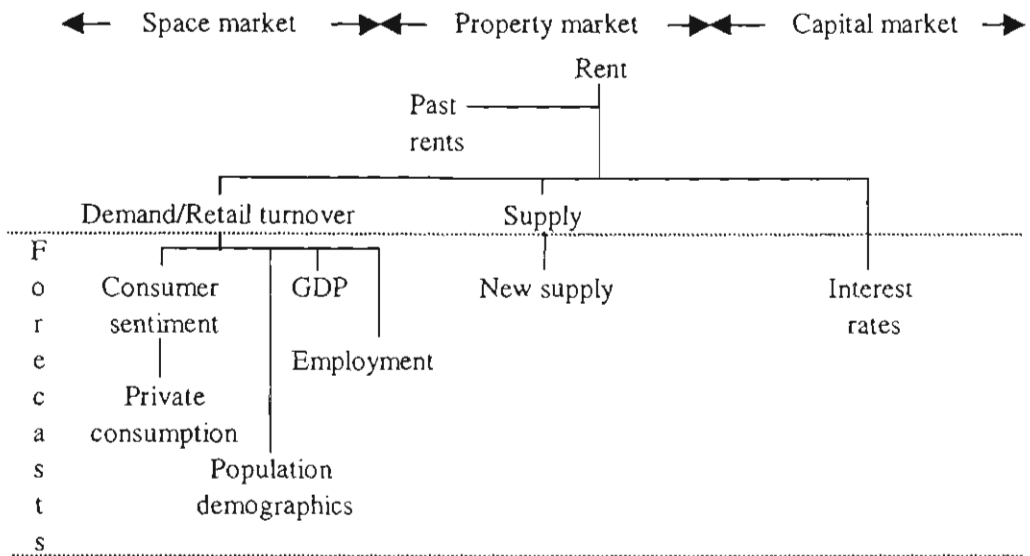
(iv)   **Commercial property yield models** - were primarily represented in the literature review by capital and total return models due to the scarcity of past research. The individual commercial property markets have similar limited determinants, which appeared in two groups, those of the capital market characterised by interest rates changes, and property rent determinants. To complement and as an alternative to the property rent determinants is GDP and employment space market determinants (see Figure 4.4).

Figure 4.4   **Model of Commercial Property Yield Determinants**

← Space market →►◄— Property market →►◄— Capital market →

Yield

├— Past yields

Demand

F
o   Rents   Interest
r   Employment   rates
e
c   GDP   Short term bills
a
s   Long term bonds
t
s
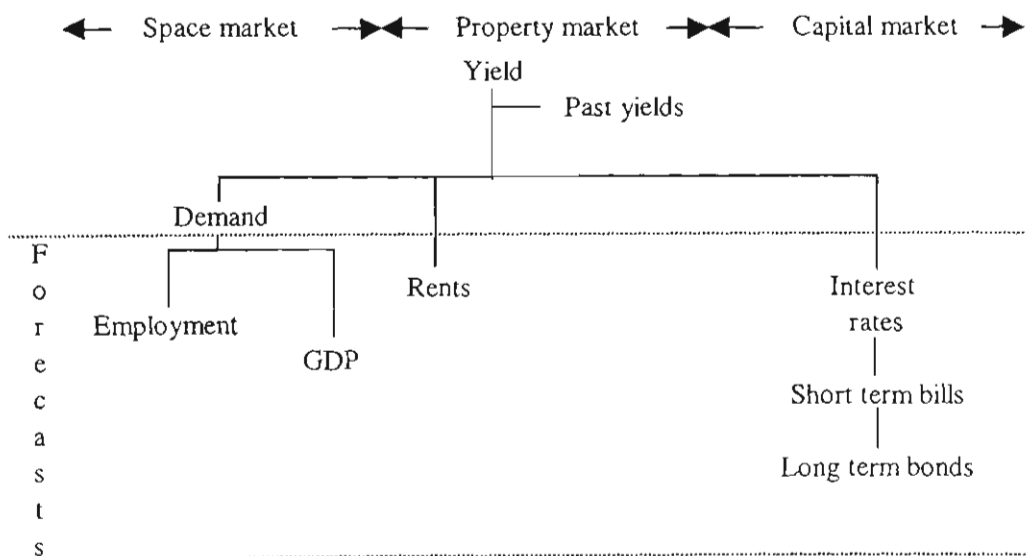
Common features in models were lagged determinants, and current and recent property performance measures selected as future determinants. In addition, the models exhibited similarities in the selection of some determinants. The space market determinants for the rent models provided distinct measures of economic activity. The capital market determinants were more defined as evident in all commercial property market models.

In selecting the property forecast model, the forecasts can either be a single econometric equation or part of a system of econometric equations to determine property market features which include property market performance. In each approach, there are external determinants which drive the models, and it is these that are to be tested to explain the appropriateness of the property forecast model. For this thesis, the single equation model is used as it is straightforward and there are also more published articles on this approach.

The issues in approach and application of the property forecast model can be separated into three main stages:

(i)   **Property model data analysis** - provides confirmation on the selection of the property data and determinants with reference to the qualities of the underlying data.

(ii) **Property model tests** - applies standard statistical tests to confirm the model's adequacy and ability to link property performance measures with the selected determinants.

(iii) **Forecast accuracy** - highlights the quality of the forecast values and the property forecast models with out-of-sample tests comparing the forecast values with actual values and those from the simplest of forecast models.

4.4 SUMMARY

There are several practical issues confronting commercial property forecasting when compared with identified general forecasting steps. Many are still to be addressed, however this can be explained in part because the majority of property organisations started forecasting in the past five years to meet market driven demand and there are no recognised property forecasting guidelines.

To forecast commercial property market performance, the literature review and property organisation survey highlighted the popularity of econometric models which make use of historical macroeconomic data to explain properly market performance. Due to the infrequency of raw data and the inefficient marketplace, property forecasts appear to be at the local level and primarily detail future rents and yields.

In grouping into space, property and capital factors, the property forecast model determinants can be established from the literature review and the property organisations' survey. The main commercial property rent determinants were aspects of the space and property markets, with commercial property yield determinants being primarily associated with the capital markets. A common feature in the models was lagged determinants and current and recent property performance measures selected as future determinants.

The criteria for selected determinants in the literature review and the property organisations' survey seemed to overlook the mechanics to determine if the historical relationships could contend with the nature and magnitude of the continuous changes in the economic environment. This is considered in the next chapter, with the approach and application of a property forecast model. Three areas are examined: analysis of input data, statistical tests on the property forecast model, and accuracy of the forecast values.

THE PROPERTY FORECAST MODEL
AN EVALUATION OF LONG-TERM FORECAST VALUES

5.1   INTRODUCTION

The main objective of this chapter is to assess the long-term forecast accuracy of the selected property forecast model and determinants. A review of literature and survey of property organisations suggests that a single equation approach is the principal econometric forecast model to determine future commercial property market performance.

The literature review and property organisation survey highlighted the main determinants to forecast commercial property rent and yields. These predominantly represented features of demand for a single equation model as there is limited commercial property supply data and what is available can be affected by unexpected building withdrawals for refurbishment and demolition. In addition, knowledge of projected demand should form the basis of future supply models. Leading macroeconomic indicators generally form the demand determinants with their historical time series and availability of published long-term forecasts.

This chapter tests the selected forecast methodology on the three leading New South Wales commercial property markets. Rent and yield models were constructed to provide semi-annual, three-year forecast values started at December 1994, December 1995 and December 1996. All models were tested for statistical reliability and visually examined to compare the historical relationship between predicted and actual property performance. The accuracy over the six forecast periods was compared with actual property performance and the forecast values from a simple forecast model. A similar exercise was performed on the selected macroeconomic determinants used in the property forecast model.

Evaluating the commercial property market forecast model is divided into five sections. These include: introduction, sources of property and economic data, methodology for the single equation model, empirical results, validation of the forecasts, and a summary statement.

5.2 DATA

To forecast commercial property market performance, the model depends on the availability and quality of macroeconomic forecasts, and the historical property and macroeconomic time series data. The data is presented on a sixth-monthly basis, as this was the main time period presented in the published macroeconomic forecasts from 1994 to 1996.

A recognised benchmark for measuring New South Wales commercial property market performance is the Colliers Jardine Sydney CBD prime office and Sydney prime industrial time series. Similarly, CB Richard Ellis provided the leading NSW regional shopping centres time series. Information for the databases is gathered by monitoring specific buildings in the designated property markets and from their own leasing agents' deals, and other published information. This raw data is analysed and the property market performance is calculated on an aggregated basis. The time series are transactional based with the net effective rent and equivalent yield measurements starting in December 1977 for Sydney CBD prime office and Sydney prime industrial market and December 1982 for the NSW regional shopping centres.

The main criteria applied in selecting the macroeconomic indicators, were their widespread recognition and the availability of the corresponding macroeconomic forecasts. The Australian Bureau of Statistics (ABS) collects and publishes Australian macroeconomic data and was ranked second in a world league of countries with the most reliable statistics (Economist 1993).

The macroeconomic forecast data were sourced from public and property organisation libraries and represented published macroeconomic projections for more than one year by leading independent economic forecast organisations and the NSW state government. The forecasts were all from the second half of 1994, 1995 and 1996 and as they had different forecast time durations, the average was taken for the semi annual forecasts. For example, the Australian Gross Domestic Product forecast for December 1994 is shown in Table 5.1

Table 5.1   **Gross Domestic Product Forecasts as at December 1994**

Economic forecasts	1 Jun-95	2 Dec-95	3 Jun-96	4 Dec-96	5 Jun-97	6 Dec-97
Organisation 1	4.1	3.7	3.3	2.9		
Organisation 2		4.3		3.2		0.9
Organisation 3	4.6		3.3		2.6	
Organisation 4	4.8		3.5		3.0	
Organisation 5	5.3	4.1	4.0	3.3	2.8	1.8
Average	4.7	4.0	3.5	3.1	2.8	1.4

The projections were restricted to the main national macroeconomic indicators as dictated by the published Australian macroeconomic forecasts during the 1994 to 1996 period. To avoid forecast bias from an individual organisation, there was a requirement for at least two separate independent sources for each forecast. The selected national macroeconomic indicators were: employment, gross domestic product, inflation, private consumption, 90-day bank bills, and 10-year bonds.

The national macroeconomic indicators show a strong link with New South Wales economic activity, as it represents over a third of the Australian economy (ABS 1999). Table 5.2 compares the past co-movement of the Australian and the New South Wales economy for the twenty years to 1994.

Table 5.2   **Correlation of Australian and New South Wales Macroeconomic Activity: 1974-1994**

Economic indicators	Correlation coefficient
Employment	0.82
Gross domestic product	0.85
Inflation	0.97
Private consumption	0.64

As part of the preliminary analysis, specific property and local economic activity were also examined; industry category employment, property vacancy rates and workspace ratios, can influence commercial property market performance. These factors have been historically measured, particularly in the office market, although forecasts are rarely published and in this instance needed multiple equations to forecast the commercial property market performance. The literature review therefore suggests the preference and adoption of a single equation model with selected macroeconomic determinants to forecast commercial property market performance.

5.3   RESEARCH METHODOLOGY

In a single regression equation, the model predicts future rents and yields by modelling the past relationship between independent property and macroeconomic determinants. As changes in macroeconomic activity may take time to affect commercial property market performance, the independent determinants have been lagged to one year. Similarly, dependent rent and yields variables were lagged six months and a year for inclusion as an integral independent forecast component. The one-year lag provides sufficient time for the assumed property and macroeconomic activity to flow on to commercial property performance.

The single regression equation to forecast commercial property market rents and yields can be expressed as:

(i) $RENT_t = f(EMP_{t,\,t-2},\ GDP_{t,\,t-2},\ CPI_{t,\,t-2},\ PRI_{t,\,t-2},\ BONDS_{t,\,t-2},\ BILLS_{t,\,t-2},\ RENT_{t1,\,t-2})$

(ii) $YIELD_t = f(EMP_{t,\,t-2},\ GDP_{t,\,t-2},\ CPI_{t,\,t-2},\ PRI_{t,\,t-2},\ BONDS_{t,\,t-2},\ BILLS_{t1,\,t-2},\ RENT_{t,\,t-2},\ YIELD_{t1,\,t-2})$

Where: *RENT* is property market net effective rents; *YIELD* is property market equivalent yields; *EMP* is employment; *GDP* is Gross Domestic Product; *CPI* is inflation; *PRI* is private consumption; *BONDS* is 10-year bank bonds; and *BILLS* is 90-day bank bills. The subscripts denote time and *t...t-2* are the lags applied to the respective determinants.

The review of literature revealed three key statistical tests to confirm the validity of the commercial property forecast model:

(i)   **Coefficient of determination (R^2)** - an indication of how close a fit the regression equation is to the dependent time series.

(ii)   **Statistical test for bias (t-test)** - a measure to determine if there is no bias and the errors are normally, or nearly normally, distributed.

(iii)   **Durban Watson statistics (DW)** - a test to detect patterns in a series of errors.

The main statistical package for the analysis was the BMDP Statistical Software. More specifically, the subprogram 'Multiple regression: stepwise forward model' was used to provide an acceptable regression equation to predict future commercial property performance.

A significance level of 0.05 with a non-zero intercept was chosen as the model parameter. The visual examination and DW test make use of Microsoft Excel 97 with the PHStat supplement. The E-views software provided the Augmented Dickey-Fuller unit root test.

5.4 RESULTS

Before regression analysis, the Augmented Dickey-Fuller (ADF) test is performed to examine if the property and macroeconomic data is stationary. The ADF test is carried out on the first differences of all data series for the time period December 77 to June 94 except for the retail data, which commenced in December 1982. The first difference between each observation is shown by the Δ designation. The results are reported in Table 5.3.

Table 5.3   **Tests for Data Stationarity**

	Variable	Computed ADF statistic		Variable	Computed ADF statistic
Δ	EMP	-3.11	Δ	OFFICE RENT	-4.36
Δ	GDP	-5.04	Δ	OFFICE YIELD	-4.04
Δ	CPI	-3.50	Δ	INDUSTRIAL RENT	-3.83
Δ	PRI	-5.85	Δ	INDUSTRIAL YIELD	-3.09
Δ	BONDS	-5.81	Δ	RETAIL RENT	-1.67
Δ	BILLS	-6.70	Δ	RETAIL YIELD	-3.01

Critical values at 5%: -2.94 and at 10%: -2.61 for sample period Dec 77 to Jun 94 for all variable except Δ RETAIL RENT and Δ RETAIL YIELDS with critical values at 5%: -1.95 and at 10%: -1.62 for sample period Dec 82 to Jun 94

All time series appear to be stationary at 5 percent level of significance except the retail rent series which is stationary at the 10 percent level. Therefore, all variables in the property forecast model is at first differences.

A stepwise multiple regression analysis illustrated the preferred inter-relationship of the independent variables (determinants) to the dependent variable (rents and yields) with statistical validation. The BMDP software permits the time series data to be analysed and fashioned to provide acceptable outcomes, for example adjusting for moving averages, logarithms and exponential smoothing. The industrial and retail yield models both required data transformation to achieve satisfactory results.

The empirical results for the stepwise regression analysis is presented in Tables 5.4 and 5.5. They detail the rent and yield equations for each property sector with the statistical tests to confirm the validity of the single equation regression model.

Table 5.4   **Single Equation Regression Model for Commercial Property Rents**

	Dec-94 Dependent variable		Dec-95 Dependent variable		Dec-96 Dependent variable	
	Coefficient	t-test	Coefficient	t-test	Coefficient	t-test
Office rents						
ΔGDP_t					1.04	2.2
ΔCPI_t	1.69	2.6	1.21	2.1	1.23	2.6
$\Delta BILLS_t$	0.14	3.8	0.12	3.4	0.11	3.4
$\Delta RENT_{t-1}$	0.50	3.6	0.63	5.5	0.64	6.8
R^2	0.80		0.79		0.82	
Observations	32		34		36	
DW statistic	1.72		1.82		1.88	
Industrial rents						
ΔEMP_{t-1}	3.71	6.8	3.41	6.4	1.91	2.6
ΔGDP_{t-1}	1.25	2.9	1.35	3.1	1.31	2.7
$\Delta RENT_{t-1}$					0.35	2.5
R^2	0.84		0.81		0.77	
Observations	22		24		26	
DW statistic	2.61		2.22		2.09	
Retail rents						
ΔEMP_{t-1}			2.21	3.6	1.74	3.1
ΔGDP_{t-1}	1.22	3.0				
ΔCPI	1.44	4.0				
ΔPRI_{t-2}	-1.27	-2.6	-3.09	-3.9	-1.90	-3.4
$\Delta BILLS_{t-1}$			-0.11	-3.4	-0.12	-3.4
$\Delta BILLS_{t-2}$	-0.18	-4.6				
$\Delta RENT_{t-1}$	0.48	4.1	0.66	5.0	0.73	5.5
R^2	0.83		0.75		0.72	
Observations	22		24		26	
DW statistic	2.28		1.96		1.80	

All commercial property rent equations were tested for statistical reliability. The R^2 range of 0.72 to 0.84 indicated an acceptably close fit and the t-test (with degrees of freedom adjusted to the number of independent variables) and DW test exceeded requirements. To achieve a satisfactory result for the industrial rent model, the time series had to be shortened by six years. Initially, transformation of the data and dummy variables were examined over the complete time series. Unfortunately the equations did not produce any meaningful results with statistical validation tests being unacceptably low.

For the commercial property markets, the selected independent macroeconomic determinants were generally the same for the three forecast start dates and agreed with those selected in the literature review and property organisations' survey. The independent macroeconomic determinants for the office rent model represented economic activity and financial markets. The employment time series appeared too broad an economic indicator to capture the changes in office market demand and rental performance. The retail model consisted of a broad selection of independent macroeconomic determinants, with private consumption being evident in the model for each year. This appears to agree with the literature review with the range of macroeconomic determinants and retail specific determinants such as retail sales, consumer expenditure and sentiment, which are all similar in nature to the private consumption measure.

The predicted rents from the model were compared to the actual rents. Figure 5.1 shows the December 1994 office rent model predictions and the actual rents for December 1978 to December 1994.

Figure 5.1   **Comparison of Property Forecast Model**
Predicted to Actual Office Rents

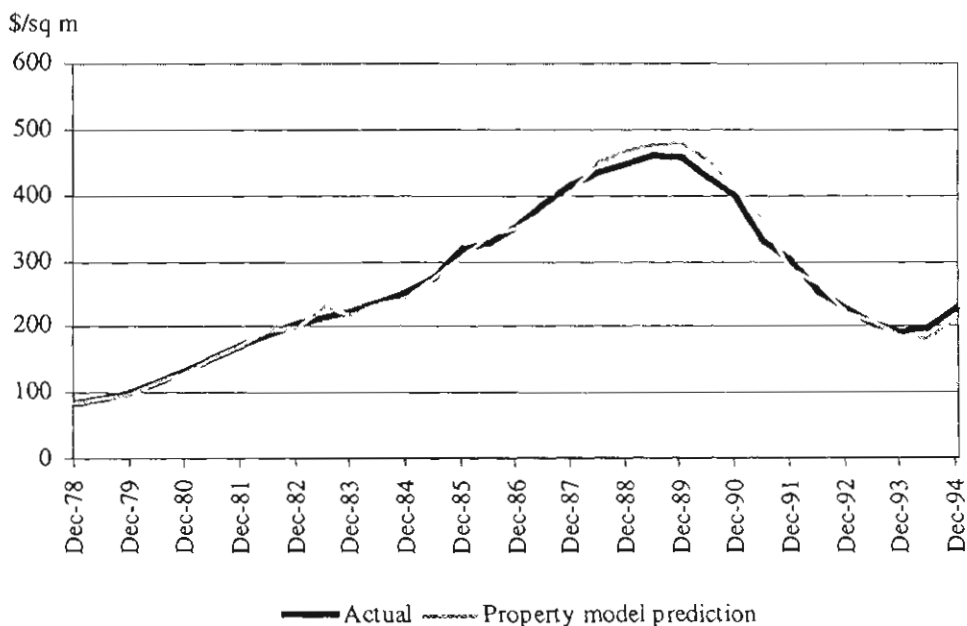
━━Actual ⎯⎯ Property model prediction

Figure 5.1 demonstrates a close fit between the property model predicted and actual office rents for the December 1994 model. The predicted and actual office rent performance is nearly identical with minor variations most noticeable at the turning points. Graphs were

prepared on all commercial property rent equations and provided similarly satisfactory results.

The statistical validation and independent variables for the commercial property yield model is shown in Table 5.5.

Table 5.5 **Single Equation Regression Model for Commercial Property Yields**

	Dec-94		Dec-95		Dec-96	
	Dependent variable		Dependent variable		Dependent variable	
	Coefficient	t test	Coefficient	t test	Coefficient	t test
Office yields						
ΔEMP	-4.09	-5.3	-4.00	-5.2		
ΔEMP_{t-1}					-3.39	-3.3
$\Delta BILLS_{t-1}$	0.39	4.8	0.36	4.7		
$\Delta BILLS_{t-2}$					0.30	3.9
$\Delta BONDS_{t-1}$					0.46	4.3
$\Delta RENT$					-0.64	-5.2
$\Delta RENT_{t-1}$	-0.35	-3.3	-0.36	-3.4		
$\Delta YIELD_{t-1}$					-0.42	-2.2
R^2	0.59		0.59		0.61	
Observations	31		33		35	
DW statistic	1.99		2.65		2.80	
Industrial yields						
ΔEMP	-1.45	-2.3	-1.40	-2.4	-1.44	-2.6
ΔGDP_{t-2}	-0.77	-2.5	-0.77	-2.6	-0.76	-2.7
ΔCPI	0.83	2.4	0.85	2.6	0.86	2.8
$\Delta BILLS_{t-1}$	0.09	2.3	0.09	2.8	0.08	2.9
$\Delta YIELD_{t-1}$	0.33	2.3	0.34	2.5	0.33	2.5
R^2	0.77		0.77		0.77	
Observations	21		23		25	
DW statistic	1.94		2.01		2.05	
Retail yields						
ΔGDP	-0.68	-2.6	-0.73	-2.6	-0.68	-2.6
ΔCPI_{t-2}	0.68	3.5	0.73	3.6	0.72	3.6
$\Delta BILLS$	0.06	3.1	0.06	3.0	0.06	3.0
$\Delta RENT_{t-1}$	-0.54	-6.1	-0.51	-5.5	-0.51	-5.7
$\Delta YIELD_{t-1}$	0.33	2.5	0.35	2.5	0.33	2.5
R^2	0.79		0.75		0.74	
Observations	22		24		26	
DW statistic	1.94		2.15		2.26	

Table 5.5 shows the commercial property yield equations and the associated statistical tests. The office and industrial yield independent determinants were smoothed (moving average) with the low office R^2 reading being offset by the sound t-test and DW test. Furthermore, for the results to be statistically significant the industrial yield equations omitted the December 1990 data, as in this period there was a sharp rise in the industrial yield.

The selected independent determinants for the commercial property yield equations were similar over time and across the commercial property markets with employment, gross domestic product and 90-day bank bills regularly featured. This matched the literature review and the selection from the property organisations' survey.

The predicted commercial property yields from the single equation model were compared to actual yields. Figure 5.2 shows the December 1994 office yields model predictions and the actual yields from December 1979 to December 1994.

Figure 5.2   **Comparison of Property Forecast Model**
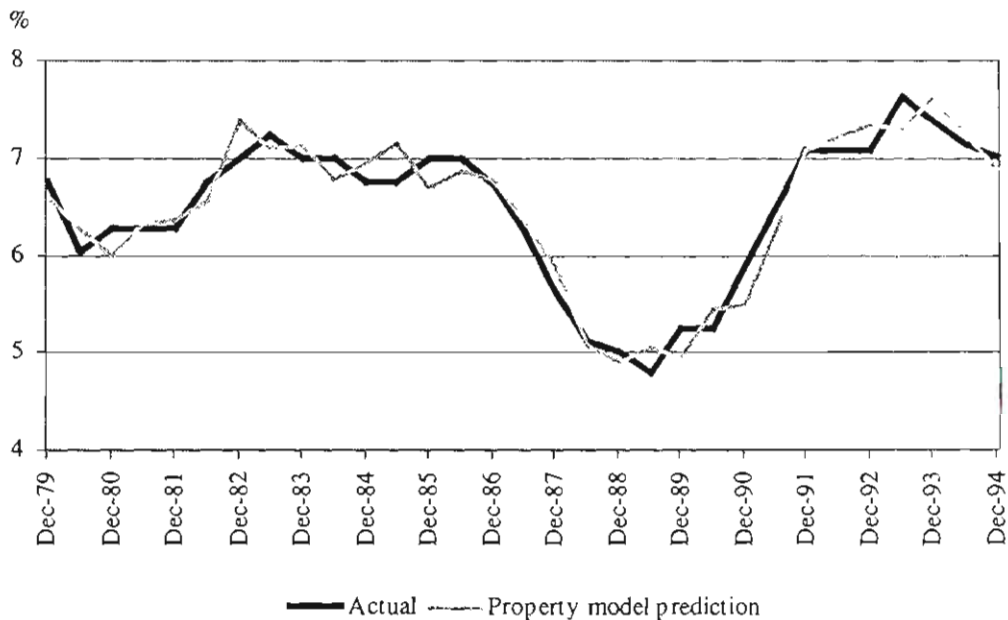**Predicted to Actual Office Yields**

Figure 5.2 illustrates the ability of the predicted office yields to follow the movement in actual data, which, during the late 1980s experienced the property boom with considerably lower yields followed by a slump in property values and associated increased yields. The trends is clearly evident with distinguishable similarity of the predicted to actual office yield.

The rent and yield single equation model on statistical evidence and by visual examination appeared to provide a sound platform to forecast commercial property performance. The accuracy of the model process can be demonstrated by comparing the property model forecast values to actual values and those forecast values from a simple naïve forecast model.

5.5   ANALYSIS OF PROPERY FORECAST VALUES

The accuracy of a forecasting model can be measured by how close the forecast values are to actual values and to the forecast values of a simple forecast model. The methods to measure the forecast accuracy generally embody either the absolute values of the error or the square of the errors, as this prevents positive and negative forecast errors from cancelling each other out. To evaluate the accuracy of the property performance forecasts, both systems were applied in the Mean Absolute Percentage Error (MAPE) and Theil U value tests.

The MAPE measures the mean of the sum of all of the percentage errors without regards to positive and negative errors. It therefore provides a meaningful measure of the forecasts to actual data in terms of an average absolute percentage error. The statistical equations are as follows:

(I)   The mean of the absolute percentage error

$$MAPE = \frac{\sum\limits_{t=1}^{n} \frac{|e_t|}{Y_t}}{n}$$

Where: e_t is the forecast error in time period t;

Y$_t$ is the actual value in time t;

n is the number of observations in the forecast period.

The Theil's U inequality coefficient (Theil, 1966) compares the accuracy of the forecast values from the forecast model with that from a naïve model. The statistical approach is to calculate the root mean square error (standard error) from the model-forecast values and relate it to the standard error from naïve model values. The naïve model is based on the minimum amount of effort and data manipulation. In this instance it is the most recent observation available prior to the forecast period. For example, Sydney CBD prime office rents increased by 15.9 percent from the June to December 1994 and so the December 1994 naïve rent model showed rents increasing at 15.9 percent every six months for the three-year forecasting period. The statistical equations is as follows:

(I)   The root mean square error (standard error)

$$RMSE = \sqrt{\frac{\sum_{t=1}^{n} e^2_t}{n}}$$

(II)   The Theil's U is

$$U = \frac{RMSE \text{ of the forecasting model}}{RMSE \text{ of the naïve model}}$$

Where: e_t is the forecast error in time period t;

n is the number of observations in the forecast period.

On comparing the RMSE (standard error) of the forecast model values to naïve model values, the Theil's equation provides a U value, which can be summarised as follows:

(i) $U = 1$ the naïve model is as good as the forecast model.

(ii) $U < 1$ the forecast model is better than the naïve model.

(iii) $U > 1$ the naïve model is better than the forecast model.

The MAPE and Theil U value provides a straightforward statistical application, which can be easily interpreted to provide a good indication of the forecast model accuracy.

5.5.1 Accuracy of the Property Forecast Values

The single equation model provides a formula to determine future property performance. The forecast values from the macroeconomic determinants were used in the model to provide the three-year semi-annual property forecasts. The commercial property rent forecast values for the six forecast periods are compared to the actual performance in Table 5.6.

Table 5.6   **Comparison of Forecast to Actual Commercial Property Rents**

		Dec-94			Dec-95			Dec-96		
		Actual	Forecast	Error	Actual	Forecast	Error	Actual	Forecast	Error
Office rents										
Forecast period	1	269	243	26	337	331	6	372	367	4
	2	303	256	46	355	353	2	400	375	25
	3	337	267	70	372	362	9	417	387	30
	4	355	275	80	400	373	27	419	394	25
	5	372	275	97	417	369	48	424	406	17
	6	400	275	125	419	364	55	452	419	33
Mean absolute error (MAE)				74			24			22
Mean absolute percentage error (MAPE)				21%			6%			5%
Industrial rents										
Forecast period	1	102	103	-1	110	105	5	122	122	0
	2	104	106	-2	118	108	10	128	123	5
	3	110	113	-3	122	106	16	130	125	5
	4	118	113	5	128	105	23	130	128	2
	5	122	119	3	130	102	28	130	132	-2
	6	128	115	13	130	103	27	138	135	3
Mean absolute error (MAE)				4			18			3
Mean absolute percentage error (MAPE)				4%			14%			2%
Retail rents										
Forecast period	1	935	884	51	965	941	24	965	954	11
	2	965	834	131	965	949	16	965	957	8
	3	965	819	146	965	961	4	992	939	53
	4	965	764	201	965	995	-30	1,055	951	104
	5	965	754	211	992	1,034	-42	1,093	959	134
	6	965	730	235	1,055	1,114	-59	1,000	967	33
Mean absolute error (MAE)				162			29			57
Mean absolute percentage error (MAPE)				17%			3%			5%

The accuracy of commercial rent forecasts appears to be random; the length of the time series, property market sector and forecast start dates having no effect on the results. For example, the three-year office rent forecasts in December 1994 details an unacceptable forecast percentage error (MAPE) of 21 percent. This compares with the three-year office rent MAPE for December 1995 and December 1996 of 6 percent and 5 percent respectively. The variation in forecast error between the different periods is considerable, especially as the model for 1994 and 1995 have the same independent determinants and the 1996 model has just one additional independent determinant.

Table 5.6 also exhibited the forecast value, actual commercial property rent and the error for each forecast period. In four of the forecast commercial property rent equations (office rent Dec 94 and Dec 95, industrial rent Dec 95 and retail rent Dec 94), there is a defined pattern in the series of errors. The forecasts nearly continuously track in the wrong direction, so compounding the forecast error. Figure 5.3 illustrates the forecast values and actual office rents.

Figure 5.3   **Office Rent Model Forecasts at December 1994, 1995, 1996**
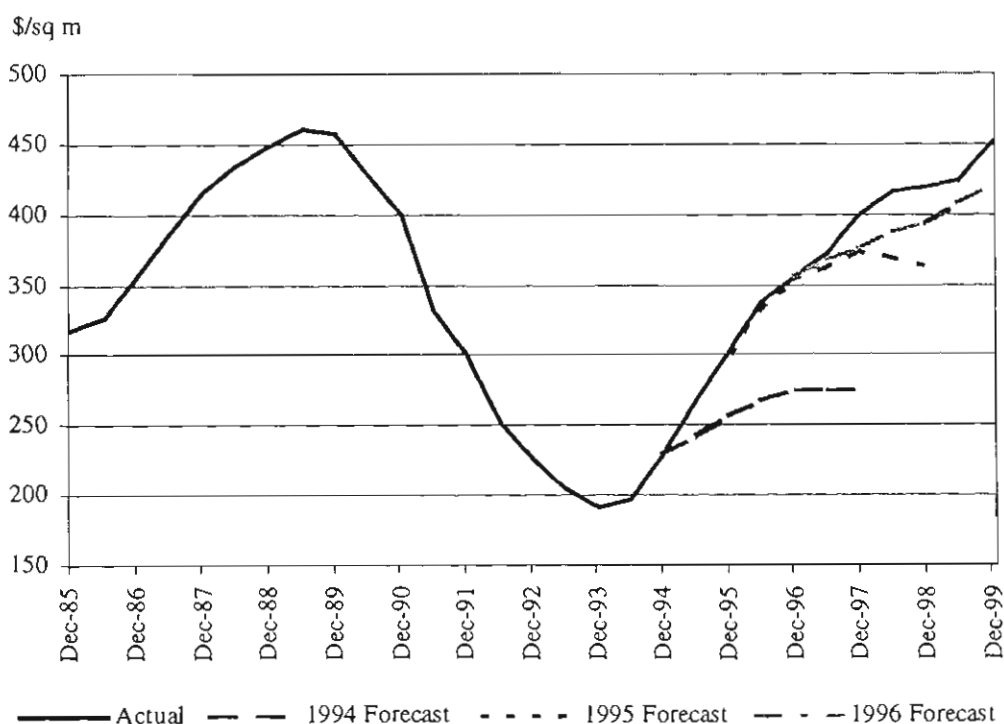
Figure 5.3 shows the actual office rents for the past 15 years and the three forecasts in December 1994, 1995 and 1996. On each occasion the forecast undervalued the rental growth with the December 1994 forecast seriously underestimating the revival in the Sydney prime CBD office market. The December 1995 forecast closely tracked the actual performance for 18 months before predicting a downtown that did not eventuate.

After measuring the forecasts in terms of percent error (MAPE), the next step is to compare commercial property rent forecast values with the naïve forecast model values. Table 5.7 shows the stages required to determine the Theil's U value for December 1994 office rent forecast.

Table 5.7   **Computation of Theil's U Value**
Three Year Office Rent Forecast at December 1994

Forecast periods	Naïve model				Forecast model			
	Actual	Predicted	Error	Error^2	Actual	Forecast	Error	Error^2
Jun-95	17.9	15.9	2.0	4.1	17.9	6.5	11.5	131.2
Dec-95	12.4	15.9	-3.6	12.7	12.4	5.3	7.0	49.4
Jun-96	11.3	15.9	-4.6	21.6	11.3	4.1	7.2	51.6
Dec-96	5.4	15.9	-10.5	109.7	5.4	3.3	2.1	4.6
Jun-97	4.7	15.9	-11.3	126.8	4.7	-0.2	4.8	23.1
Dec-97	7.6	15.9	-8.3	68.6	7.6	0.1	7.5	56.4
Mean square error (MSE)				57.3				52.7
Root mean standard error 'standard error' (RMSE)				7.6				7.3
Theil's U Value								1.0

Table 5.7 shows the method to determine the Theil's U value to compare the December 1994 office rent forecast model with the naïve model, representing the continuous 15.9 percent predicted forecast. The Theil's U value of 1.0 shows that the naïve model is as good as the forecast model. The limitation of the forecast office rent model agrees with the MAPE forecast error of 21 percent. This equates to a substantial annual absolute error of 42 percent. The Theil's U values for all commercial property rent forecasts are detailed in Table 5.8. For a comparison, the forecast model MAPE is also shown.

Table 5.8   **Commercial Property Rent Forecast Model - Forecast Accuracy**

Forecast model	Office		Industrial		Retail	
	Theil's U value	MAPE	Theil's U value	MAPE	Theil's U value	MAPE
Dec-94	1.0	21%	2.0	6%	4.1	5%
Dec-95	0.4	4%	1.5	14%	0.7	2%
Dec-96	1.0	17%	0.6	3%	1.0	5%
Average	0.8	14%	1.4	8%	1.9	4%

Table 5.8 shows that only three forecast models had a Theil's U value less than one and so were better than the naïve forecast model. The six forecast models that were the same or worse than the naïve model represented 66 percent of the forecast equations tested.

Those forecast model which were better than the naïve model had a less than 5 percent MAPE reading. However the relationship appears limited, as the forecast retail model December 1994 has a low MAPE of 5 percent and a high Theil's U value of 4.1.

The tests to determine forecast accuracy have shown limitations with the forecast rent models. An examination of the yield forecast model could establish if this is isolated or a feature of the forecast approach. The comparison of the model forecasts to actual property yields is shown in Table 5.9.

*Table 5.9*   **Comparison of Forecast to Actual Commercial Property Yields**

		Dec-94			Dec-95			Dec-96		
		Actual	Forecast	Error	Actual	Forecast	Error	Actual	Forecast	Error
Office yields										
Forecast period	1	7.0	7.3	-0.4	6.5	6.3	0.2	6.3	6.5	-0.1
	2	6.7	7.7	-1.0	6.4	6.2	0.2	6.3	6.2	0.1
	3	6.5	7.7	-1.1	6.3	6.4	-0.1	5.8	6.5	-0.6
	4	6.4	7.9	-1.5	6.3	6.5	-0.2	6.0	6.6	-0.6
	5	6.3	8.2	-1.8	5.8	6.5	-0.7	6.2	6.8	-0.7
	6	6.3	8.5	-2.2	6.0	6.7	-0.7	6.3	7.0	-0.7
Mean absolute error (MAE)				1.3			0.4			0.5
Mean absolute percentage error (MAPE)				21%			6%			8%
Industrial yields										
Forecast period	1	10.1	10.2	-0.1	10.0	9.9	0.1	9.5	9.7	-0.2
	2	10.0	10.1	-0.1	9.9	9.8	0.1	9.4	9.4	0.0
	3	10.0	10.0	0.0	9.5	9.8	-0.3	8.9	9.3	-0.4
	4	9.9	10.0	-0.1	9.4	9.8	-0.5	9.0	9.1	-0.1
	5	9.5	10.0	-0.5	8.9	9.8	-0.9	9.0	9.0	0.0
	6	9.4	10.1	-0.7	9.0	9.8	-0.8	9.0	8.9	0.1
Mean absolute error (MAE)				0.3			0.5			0.1
Mean absolute percentage error (MAPE)				3%			5%			1%
Retail yields										
Forecast period	1	8.0	8.1	-0.1	7.6	7.9	-0.3	7.8	7.7	0.1
	2	7.8	8.4	-0.6	7.6	8.1	-0.4	7.8	7.7	0.0
	3	7.6	8.8	-1.2	7.8	8.2	-0.4	7.8	7.8	-0.1
	4	7.6	9.2	-1.6	7.8	8.2	-0.4	7.8	7.9	-0.2
	5	7.8	9.7	-2.0	7.8	8.0	-0.2	7.6	8.0	-0.4
	6	7.8	10.3	-2.5	7.8	7.8	0.0	7.1	7.9	-0.8
Mean absolute error (MAE)				1.3			0.3			0.3
Mean absolute percentage error (MAPE)				17%			4%			3%

The forecast accuracy of the property yield model appeared random, although it is consistently better than the property rent model. The property yield equations for December 1995 and 1996 provided a MAPE (forecast error) range of 1 percent to 8 percent and in contrast, the forecast office and retail yield equation for December 1994 provided a MAPE of unacceptability high 21 percent and 17 percent forecast error respectively. The high MAPE forecast errors match those of the office and retail rent equations for the same period and, on further investigation, they have common independent macroeconomic determinants.

The pattern of error in the forecast periods continues to highlight the general trend of the forecast yield values tracking in the wrong direction. This is evident by the gradual growth in error over the forecast period.

The performance of the office yield model can be established by comparing the forecast yields with actual yields as shown in Figure 5.4.

Figure 5.4   **Office Yield Model Forecasts at December 1994, 1995, 1996**
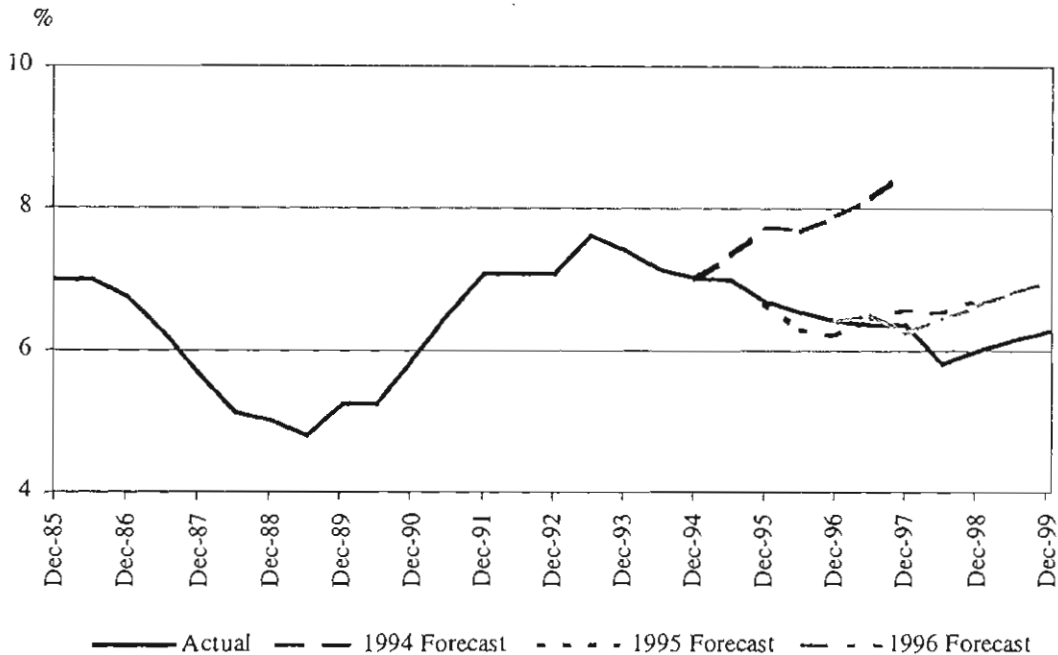
The forecast values for the commercial property yield model seemed to miss the long-term decline in the actual yields. This is most noticeable with the forecast equation for December 1994 where forecast values went in the wrong direction from the first forecast period. The forecast values for the office forecast model December 1995 and December 1996 appeared initially to follow the actual yields and then changed direction with the forecast yield values increasing in years two and three.

The accuracy of the office yield forecast model can be further measured by comparing the forecast values with those from a naive forecast model. An example of the Theil's U value approach is shown in Table 5.10 for the office yield forecast at December 1994. The naïve forecast represents the June to December 1994 yield movement of −1.9 percent.

Table 5.10   **Computation of Theil's U Value**
Three Year Office Yield Forecast at December 1994

Forecast periods	Naïve model				Forecast model			
	Actual	Predicted	Error	Error^2	Actual	Forecast	Error	Error^2
Jun-95	-0.3	-1.9	1.5	2.3	-0.3	4.7	-5.0	25.0
Dec-95	-4.2	-1.9	-2.3	5.4	-4.2	5.4	-9.6	91.9
Jun-96	-2.3	-1.9	-0.5	0.2	-2.3	-0.7	-1.6	2.7
Dec-96	-1.9	-1.9	0.0	0.0	-1.9	2.8	-4.7	22.4
Jun-97	-1.0	-1.9	0.8	0.6	-1.0	3.4	-4.4	19.8
Dec-97	0.0	-1.9	1.9	3.4	0.0	4.7	-4.7	22.0
Mean square error (MSE)				2.0				30.6
Root mean standard error 'standard error' (RMSE)				1.4				5.5
Theil's U Value								3.9

The 3.9 Theil's U value shows the naïve model is considerably better than the forecast model. The rejection of the office yield model for December 1994 is understandable as the forecast generally predicted yield values would increase rather than the actual continuous decline. The Theil's U value test for all office yields are shown with the associated MAPE forecast error in Table 5.11.

Table 5.11 **Commercial Property Yield Forecast Model - Forecast Accuracy**

Forecast model	Office		Industrial		Retail	
	Theil's U value	MAPE	Theil's U value	MAPE	Theil's U value	MAPE
Dec-94	3.9	21%	0.8	3%	3.2	17%
Dec-95	1.0	6%	1.1	5%	0.7	4%
Dec-96	1.2	8%	0.9	1%	0.9	3%
Average	2.0	12%	0.9	3%	1.6	8%

The Theil's U value identified four forecast yield equations (44 percent) that were better than using a naïve forecast model process. These were in the industrial and retail sector with all office forecasts being worse than from the naïve forecast model. Those with the largest Theil's U value were the office and retail yield equations in December 1994.

The forecast yield model demonstrated an exceedingly loose relationship between the MAPE and Theil's U value tests for forecast accuracy. All those forecast yield equations with a Theil's U value below one had corresponding MAPE of less than 5 percent forecast error. The connection is also evident when comparing the forecast accuracy of the commercial property rent and yields model. For example, the forecast property rent and yield equation for industrial Dec 1996 and retail Dec 1995 passes the forecast accuracy tests with similar Theil's U values and MAPE forecast error results.

The similarities in the commercial property rent and yield model result, indicate a requirement to examine the forecasts of the selected macroeconomic determinants, as this may represent the main reason of the forecast error in the commercial property performance model.

5.5.2 Accuracy of the Macroeconomic Forecast Values

The commercial property forecast models were based on selected macroeconomic forecast inputs which represented the average forecast values published by leading forecast organisations. On a visual examination, most forecast values for each period appeared to be grouped together and with the general closeness in the year three forecasts, it suggest similarities in forecasts and approach by the leading forecast organisations.

The limitations in the commercial property forecast model indicated that the selected macroeconomic determinants also required testing to determine their forecast accuracy.

Table 5.12 compares the macroeconomic forecasts to recorded macroeconomic activity.

*Table 5.12*   **Comparison of Forecast to Actual Macroeconomic Indicators**

		Dec-94			Dec-95			Dec-96		
		Actual	Forecast	Error	Actual	Forecast	Error	Actual	Forecast	Error
10 Year bonds										
Forecast period	1	9.2	9.8	-0.6	8.9	8.7	0.1	7.1	7.8	-0.8
	2	8.2	9.7	-1.5	7 4	9.2	-1.8	6.1	8 5	-2.5
	3	8.9	9.9	-1.0	7.1	8.3	-1.2	5.6	8.5	-3.0
	4	7.4	10.9	-3.5	6.1	8.5	-2.5	5.0	9.7	-4.6
	5	7.1	9.3	-2.2	5.6	7.9	-2.4	6.3	9.0	-2.8
	6	6.1	8.9	-2.8	5.0	7.5	-2.5	7.0	9.7	-2.7
Mean absolute error (MAE)			1.9			1.7			2.7	
Mean absolute percentage error (MAPE)			27%			29%			47%	
90 Day bank bills										
Forecast period	1	7.6	7.6	-0.1	7.6	7.9	-0.3	5.4	6.4	-1 1
	2	7.4	8.8	-1.4	6.1	8.7	-2.6	5.1	6.8	-1.8
	3	7.6	9.8	-2.2	5.4	7.7	-2.4	5.3	7.6	-2.3
	4	6.1	10.7	-4.6	5.1	8.0	-2.9	4.8	8.3	-3.4
	5	5.4	9.8	-4.4	5.3	7.3	-1.9	4.9	8.5	-3.5
	6	5.1	9.1	-4.0	4.8	6 5	-1.6	5.7	8.9	-3.2
Mean absolute error (MAE)			2.8			2.0			2.5	
Mean absolute percentage error (MAPE)			48%			36%			50%	
Inflation										
Forecast period	1	4.5	3.2	1.3	3.1	4.6	-1.5	0.3	2.3	-1.9
	2	5.1	4.0	1.1	1.5	4.4	-2.9	-0.2	2.4	-2.7
	3	3.1	4.4	-1.3	0.3	3.4	-3.1	0.7	2.9	-2.3
	4	1.5	4.5	-3.0	-0.2	4.5	-4.7	1.6	2.7	-1.1
	5	0.3	4.2	-3.9	0.7	3.3	-2.6	1.1	3.6	-2.6
	6	-0.2	5.0	-5.2	1.6	3.0	-1.4	1.8	4.6	-2.7
Mean absolute error (MAE)			2.6			2.7			2.2	
Mean absolute percentage error (MAPE)			590%			590%			407%	
Gross domestic product										
Forecast period	1	4.0	4.7	-0.7	3.9	3.1	0.8	4.6	3.3	1.4
	2	4.2	4.0	0.1	3.9	3.1	0.9	4.9	3 4	1.5
	3	3.9	3.5	0.4	4.6	2.7	1.9	4.6	4.0	0.6
	4	3.9	3.1	0.8	4.9	1.3	3.6	4.7	4.0	0.8
	5	4.6	2.8	1.8	4.6	2.3	2.3	4.1	3.8	0.3
	6	4.9	1 4	3.5	4.7	1.6	3.2	4.3	4.4	-0.1
Mean absolute error (MAE)			1.2			2.1			0.8	
Mean absolute percentage error (MAPE)			27%			46%			16%	
Private consumption										
Forecast period	1	6.0	4.8	1.2	3.9	3.1	0.8	2.8	2.6	0.1
	2	4.8	4.5	0.3	2.4	2.7	-0.3	5.6	2.3	3.3
	3	3.9	4.0	-0.1	2.8	1.6	1.2	4.5	2.6	1.9
	4	2.4	4.7	-2.3	5.6	1.4	4.2	3.8	3.6	0.2
	5	2.8	3.0	-0.2	4.5	1.4	3.1	4.9	2.9	2.0
	6	5.6	1.5	4.1	3.8	1.9	1.9	4.7	3.5	1.3
Mean absolute error (MAE)			1.4			1.9			1.5	
Mean absolute percentage error (MAPE)			34%			45%			30%	
Employment										
Forecast period	1	4.8	3.3	1.5	0.9	2.6	-1.7	0.7	1.4	-0.7
	2	3.4	3.6	-0.2	0.5	1.8	-1.3	1.4	1.7	-0.3
	3	0.9	3.0	-2.1	0.7	0.8	-0.1	2.4	2.3	0.1
	4	0.5	3.0	-2.4	1.4	1.0	0.4	2.0	3.1	-1.0
	5	0.7	2.2	-1.4	2.4	1.4	1.0	2.1	2.5	-0.3
	6	1.4	0.3	1.1	2.0	0.8	1.3	2.9	2.8	0.1
Mean absolute error (MAE)			1.5			1.0			0.4	
Mean absolute percentage error (MAPE)			164%			95%			31%	

The accuracy of the macroeconomic forecasts is unsatisfactory. For example, the MAPE forecast error of 16 percent to 590 percent with an average 128 per cent compares with the commercial property rent and yield MAPE forecast error of 1 percent to 21 percent with an average 8 per cent.

The macroeconomic forecasts appeared to misinterpret the mechanics operating in the economy with eight forecasts (44 percent) continuously tracking in the wrong direction and so creating the large forecast error. This is particularly evident with inflation, as the forecasts continuously moved to an annual 4 percent inflation rate, whilst actual inflation was in decline and remained below 2 percent.

The pattern of error in the leading macroeconomic forecasts is illustrated in Figures 5.5 and 5.6.

Figure 5.5   **Gross Domestic Product Forecasts at December 1994, 1995, 1996**
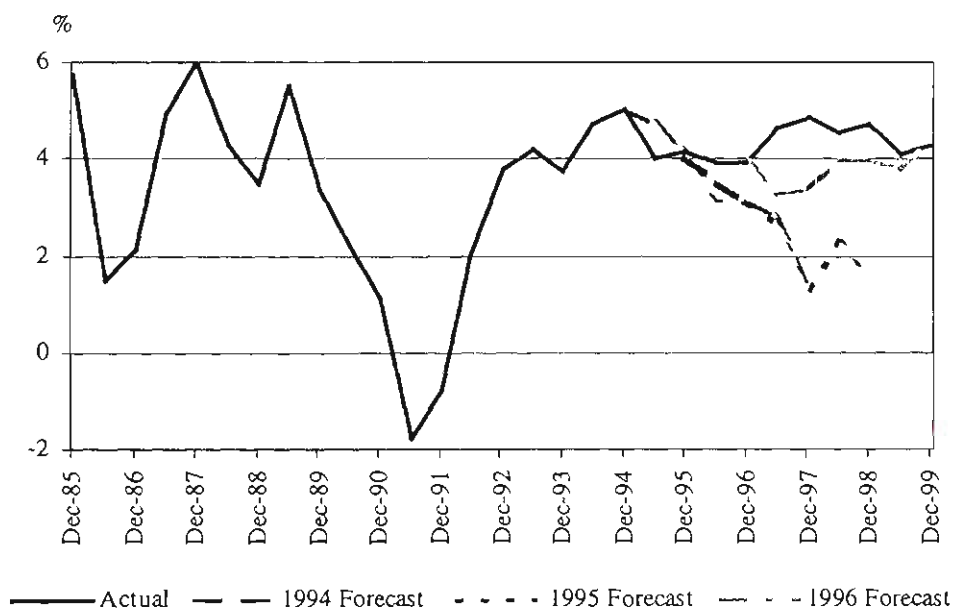
The GDP forecasts show a decline in economic activity compared with the actual stable performance. This forecast trend may in some way be influenced by past volatility, which ranged in the previous 10 years from 6 percent to -1.9 percent. The GDP December 1994 and 1995 forecasts certainly indicated that economic activity would slow down.

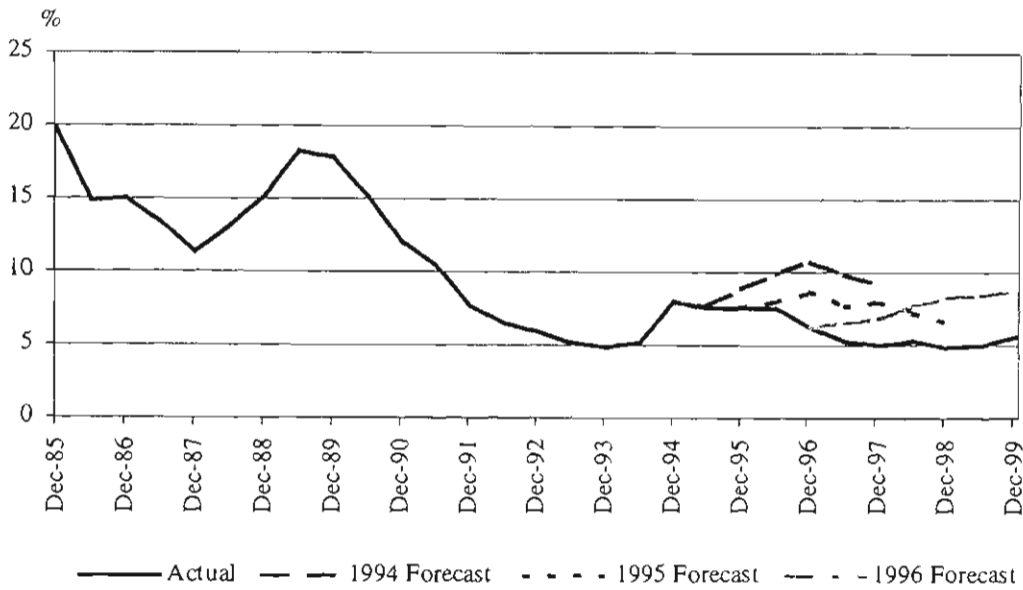*Figure 5.6*   **90-Day Bank Bill Forecasts at December 1994, 1995, 1996**

Figure 5.6 shows the 90-day bank bill rate for the last 15 years. The forecasts all predicted that interest rates would increase in the short-term. The opposite appeared to have occurred with interest rates either remaining stable or declining.

The concerns with the macroeconomic forecasts can further be established by comparing the forecasts with those of a naïve forecast. The Theil's U value and MAPE results are shown in Table 5.13.

Table 5.13   **Forecast Accuracy of Macroeconomic Forecasts**

Forecast model	10 year bonds		90 day bank bills		CPI	
	Theil's U value	MAPE	Theil's U value	MAPE	Theil's U value	MAPE
Dec-94	0.9	27%	1.8	48%	1.5	590%
Dec-95	1.0	29%	1.1	36%	0.7	590%
Dec-96	2.0	47%	2.8	50%	2.4	407%
Average	1.3	34%	1.9	45%	1.5	529%

Forecast model	GDP		Private consumption		Employment	
	Theil's U value	MAPE	Theil's U value	MAPE	Theil's U value	MAPE
Dec-94	2.0	27%	1.4	34%	0.7	164%
Dec-95	5.0	46%	1.6	45%	0.5	95%
Dec-96	1.4	16%	0.8	30%	0.3	31%
Average	2.8	30%	1.3	36%	0.5	97%

The Theil's U value test shows that overall the macroeconomic forecasts were worse than the naïve forecast model with only the employment forecast delivering the better model. However, even in this instance the overall MAPE forecast error is at 97 percent per period.

When examining the individual forecasts, the Theil's U value reveals that the naïve model is better on 12 instances (66 percent) than the macroeconomic forecasts. Apart from the employment forecast, where all three macroeconomic forecasts performed better than the naïve model, the remaining three satisfactory macroeconomic forecasts appeared both random over time and across the macroeconomic indicators (10 year bonds Dec 94, CPI Dec 95, private consumption Dec 96).

The extent of the differences between the macroeconomic forecasts and actual events is disturbing and can limit the usefulness of the commercial property forecast model. It is, however, worth noting that 10 (56 percent) of the rent and yield forecast models had an acceptable forecast accuracy (MAPE) of 5 percent and below. This could be due to the significance in the single regression equation of lagged independent yield and rent determinants, and that some of the equations contained positive and negative coefficients that may combine to limit the error from the independent forecast macroeconomic determinants.

5.6 SUMMARY

Based on the literature review and survey of property organisations, a single equation model was formed to forecast rent and yield values for three leading New South Wales commercial property markets. The model predicted future performance values based on the historical relationship of the property and macroeconomic activity. The regression equations were tested for statistical reliability and visually examined for predicted to actual performance. The independent macroeconomic forecast determinants were an average of published macroeconomic forecasts.

The commercial property rent and yield models were constructed to provide semi-annual forecast values starting at December 1994, 1995 and 1996. The accuracy of the property forecast model was measured by how close the forecast values were to actual values, the forecast error was determined by the Mean Absolute Percentage Error (MAPE). In addition, the forecast values were compared with those from a naïve-forecast model by the Theil's U value test.

The forecast accuracy results for the commercial property market performance model was mixed with 10 (56 percent) of the forecast equations providing a 5 percent and below MAPE forecast error. In addition seven (39 percent) of the forecast equations provided a Theil's U value below one, so performing better than the naïve forecast model.

Generally, there seemed a decidedly loose relationship between the methods to determine forecast accuracy with the link between the MAPE and Theil's U value which became more distant as the error increased. The pattern of error in the commercial property forecasts appeared to be random over time and across commercial property markets. There was no evidence of historical time-series length and key statistical tests affecting the out-of-sample accuracy of the commercial property market forecasts.

The success of the commercial property model can depend on the selected macroeconomic forecast determinants. Like the property model forecasts, they were also tested for their forecast accuracy. The results showed very high (MAPE) forecast error and the Theil U value showed 12 (67 percent) macroeconomic forecasts were worse than from a naïve forecast model.

The extent of the large differences between the forecasts and the actual macroeconomic activity would have affected the accuracy of the forecast values from the property forecast model. In some instances, this may be limited with the momentum from the inclusion of property performance determinants and that some property forecast equations contained macroeconomic determinants with positive and negative coefficients and so cancelling out their forecast errors.

The data analysis and presentation of the results from the property forecast model shows the shortcomings in the selection of macroeconomic input determinants. The next chapter will explain and discuss the limitations with macroeconomic forecasts, and propose a new framework to document the determinants of commercial property market performance.

ANALYSIS AND DISCUSSION
THE PROPERTY FORECAST MODEL, DETERMINANTS AND THE AGENTS OF CHANGE

6.1 INTRODUCTION

The objective of this chapter is to examine the macroeconomic forecast determinants that severely restricted the forecast accuracy of the property forecast model in the previous chapter. The reasons for the macroeconomic forecast limitations need to be defined and the impact on the office, industrial and retail property markets discussed. A method of capturing and measuring the property market changes is by structural demand analysis. As space demand is intrinsically linked to commercial property market performance, the determinants can be compared with those of the property forecast model and can lead to new commercial property forecast guidelines.

This chapter has been divided into three main sections. The first section outlines and determines the transformation forces, which can affect the macroeconomic forecasts. The second section details the new agents of economic change affecting the commercial property

markets, and the third section presents a framework to record, measure and benchmark the determinants for an organisation's new space demand. A summary concludes the chapter.

6.2 FACTORS INFLUENCING MACROECONOMIC FORECASTS

Forecasting macroeconomic activity requires an understanding of the interplay between the method of measurement, economic theory and fundamental changes beneath the economic surface. These fundamental changes can originate as short-term economic shocks or long-term structural change (Abelson and Joyeux 2000, Brunhild and Burton 1974). It is possible to identify some of the major sources of economic shocks and structural economic changes and the implication on the macroeconomic forecasts.

6.2.1 Economic Shocks

All forecasting situations involve some degree of uncertainty, and although the boundaries are not easy to define, the presence of unpredictable events must be expected. These are often not only unforecasted, but also unforecastable. It is the large and extraordinary events such as wars, strikes, earthquakes and political turmoil, which can have a profound impact on a nation's economic performance (Brunhild and Burton 1974, McTaggart *et al* 1999).

Unforeseen economic circumstances can be demonstrated by major events, which were not evident at the commencement of the respective year, but emerged unexpectedly to have a dramatic effect on a nation's business and investment conditions. Table 6.1 is a list of major unpredictable events which, according to Stammer (1997), significantly altered Australian economic activity in the 12 years to 1997.

Table 6.1   **Unexpected Economic Shocks on the Australian Economy**

Year	Events
1986	Keating's "Banana Republic" comments
1987	Black Monday on the Sharemarket
1988	Boom in world economy despite black Monday
1989	Iron curtail breaks down
1990	Iraq's invasion of Kuwait
1991	Collapse of the Soviet Union
1992	Souring of the vision of Europe
1993	Huge improvement in Australia's competitiveness
1994	Sharp increase in bond yields
1995	Powerful rally in US financial markets
1996	Liquidity boom from Japan
1997	Collapse of Asian financial markets

Source: Stammer 1997

There is an extensive range of unpredicted global and national events that can impact on Australian macroeconomic forecasts and depends on circumstances, timing and magnitude. Nevertheless, long-term economic fundamentals can prevail as government fiscal and monetary policy's can act to stabilize and place the economy back into equilibrium (Brunhild and Burton 1974, Blanchard 1997). The underlying aggregated characteristics of the economy have provided the platform for standard economic equilibrium theory and macroeconomic forecast models (Economist 2000).

6.2.2 Structural Changes

Changes in the economy are progressive and can relate to modifications within the existing framework and to different economic states and structural conditions. The emphasis here refers to major restructuring of market economies and business activities which although can co-exist alongside pre-existing structures, is a break with the past, providing new social, economic and geographic patterns. Identifying structural changes is a matter of opinion and of degree (Brunhild and Burton 1974).

A way of explaining structural changes, according to Laing (1993) and Gibson and Lizieri (1998) is to examine the emergence of Fordism and post-Fordism.

Drucker (1988) identified three major structural changes of the last century. Firstly, at the beginning of the century, management effectively separated from ownership with new organisational structures. Secondly, by 1925 Henry Ford had developed the command and control model of organisation at his automobile plants. Fordism established clear hierarchies to enable complex large-scale operations of mass production with standardisation and separate functional specialisation of departments and management skills. Thirdly, since the end of the long post-war economic boom, post-Fordism shifted to more highly flexible and diverse systems with the growth of information based organisations. Table 6.2 reviews key Fordism and post-Fordism characteristics.

Table 6.2   **Characteristics of Fordism and Post-Fordism**

Fordist	Post Fordist	Fordist	Post Fordist
Production		**Organisation**	
Industry	Service	Hierarchy	Participation
Work on objects	Work with people	Command	Initiative
Mass	Customisation	Control	Learning
Rigid	Flexible	Expansive	Downsized
Employment		**Information technology**	
Core	Core/periphery	Automate	Informative
Full time	Variables times	Data	Knowledge
In-house	Outworkers	Routine	Creative
Blue/white collar	Open collar	Centralisation	Integration and
Job specialisation	No job demarcation		decentralisation
Location		**Patterns of work**	
Places	Networks	Layers of management	Task teams
Central	Dispersed	Single task	Multiple tasks
Transport	Communication	Status	Contribution

Source: Laing 1993

Central to the transformation of organisations and economies is the information revolution, which is affecting the way people think, communicate and act. The nature of this new flexibility is reflected in behavioural relationships and the major restructuring of market economies and business activities. As in economic history, with no precedence to these events, the conventional structured economic equilibrium theory may fail adequately to capture and forecast the changes (Diebold 1997 and Roulac 1996a).

6.2.3 Analysis of Macroeconomic Forecast Error

In the previous chapter, the determinants of the commercial property forecast model were three-year semi-annual macroeconomic forecasts starting in December 1994, December 1995 and December 1996. A way to evaluate the macroeconomic forecasts is to separate them into first, second and third year forecasts and then compare the forecast values with those from the corresponding actual values and the forecast values from a naïve forecast model. The forecast accuracy tests are reported in Chapter 5.5.

Table 6.3 details the Theil's U value and MAPE results for the macroeconomic forecasts in years one, two and three.

Table 6.3 **Accuracy of Macroeconomic Forecasts in Year 1, Year 2 and Year 3**

Forecast period	10 year bonds		90 day bank bills		CPI	
	Theil's U value	MAPE	Theil's U value	MAPE	Theil's U value	MAPE
Year one	1.3	17%	1.8	20%	0.9	497%
Year two	1.5	44%	1.9	54%	1.0	578%
Year three	1.0	42%	1.5	60%	1.2	515%
Average	1.3	34%	1.7	45%	1.0	530%

Forecast period	GDP		Private consumption		Employment	
	Theil's U value	MAPE	Theil's U value	MAPE	Theil's U value	MAPE
Year one	1.3	20%	0.8	21%	0.7	95%
Year two	2.1	29%	1.3	44%	0.6	129%
Year three	6.3	40%	1.5	44%	0.5	66%
Average	3.2	30%	1.2	36%	0.6	97%

Generally, the forecast accuracy of the macroeconomic determinants appear to be consistently poor over the three years, with the Theil U value and MAPE forecast error remaining the same or gradually deteriorating over time. This would indicate the forecast error comes primarily from structural changes to the economy rather than economic shocks, which would have translated into a sudden significant error for any one or more years.

The forecasts were so inaccurate, that in three (50 percent) of the macroeconomic forecast determinants, the naïve forecast values were superior from year one, For year two onwards, all the naïve model forecast values were better, except for the employment forecasts.

The MAPE forecast error is evident in all forecast periods. In year one, (even excluding the extremely high CPI and employment figures) the MAPE forecast error was approximately 20 percent for each six-month forecast. This large error would severely restrict even the short-term commercial property forecasts.

The accuracy of the individual forecast values can be examined with the MAPE test. Generally, the forecast accuracy deteriorated over time from year one to year two, with year three being approximately the same as year two or slightly better. There is no obvious improvement in forecast accuracy between the December 1996 year one, two and three forecasts and those previously started in December 1994 and December 1995.

The weak track record of the macroeconomic forecasts highlights the continuing structural changes in the economy. The characteristics of the modern economy are difficult to model on historical information. The impact of these agents of change can be explored directly on the office, industrial and retail markets.

6.3   THE AGENTS OF CHANGE

In the latter part of the 20th century the nature and pace of economic process changed, with the more rapid spread of globalisation, technological innovation and financial deregulation. These building blocks of the new economy are altering the conventional economic marketplace and are providing new global opportunities and threats. The nature of these transformational forces and structural changes impact differently across the industry categories and on individual organisations (Drucker 1993, Roulac 1996b, Watzlawicket *at al* 1997).

The contemporary features of globalisation, technological innovation and financial deregulation can illuminate the impact on the changes to business patterns.

(i)   **Globalisation** - incorporates the free market ideas (deregulation and policy liberalisation) which governments around the world are embracing as they compete to attract organisations and the associated wealth and employment. The emerging dynamics of the integration of world economies is contributing to the phenomenal growth of multi national corporations. As cross border barriers are removed, these organisations initially overlay and gradually replace geographic-based structures with specialised units reflecting the multiple stages of the organisation's operations (Allen and Pantalis 1996, Barnwell and Pratt 1996).

(ii)   **Technological innovation** - plays a critical role in creating and enabling new market structures, business organisations and work practices. By breaking down the spatial barriers, technology provides organisations the key to improving planning, co-ordination and monitoring operations in diverse markets. The flexibility is at low cost to the organisation and the individual, relative to where work takes place and even affects the way in which activities are undertaken (D'Arcy 2000, Gibson and Lizieri 1998, Miller N 1996, Wheaton 1996).

(iii)   **Financial deregulation** - has provided the catalyst for the increased mobility of capital. The emerging global financial markets are using modern technology to provide a worldwide network to source investments and opportunities. As increased flows of capital look for premium returns, the open and sophisticated capital markets are shaping modern economies and place an increased emphasis on a nation's productivity and performance (Coakley 1994, Sassen 1991).

The major restructuring of market economies and business activities has led organisations away from the conventional modes of operation to much more highly adaptable and diverse systems (Lizieri *et al* 1997). Corporate management strategy, according to Arthur Andersen (1993), O'Mara (1999), Porter (1985) now promotes flexibility and efficiency, linked to better meeting customer demand. New operational processes and working practices are the
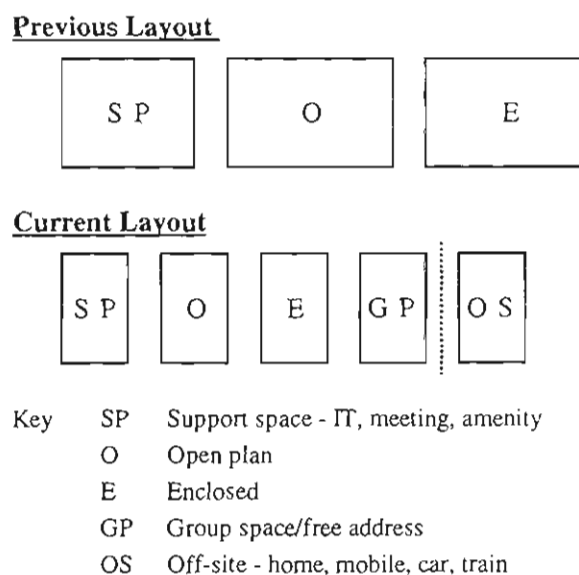
implications of business reorganisation and are altering the pattern and demand for space in the property markets (Becker and Joroff 1995, Nourse and Roulac 1993).

6.3.1 Office Market

In this changing environment, organisations' focus according to Gibson and Lizieri (1999) is on core activities with project teams in a dynamic working environment of information and interactive workspace. The impact of the new business structures and working practices are changing the traditional office layout to one with greater flexibility and diversity.

Information technology facilitates new working practices in the office environment. Computers and communication technology has changed office work and can effectively permit some operations to take place from a variety of different locations (Gerald Eve Research 1999, Gibson and Lizieri 1998). These work practices have been defined, for example: hotelling, teleworking, and desksharing. Figure 6.1 demonstrates changes in office space use.

Figure 6.1   **The Changes in Office Space Layout**

Previous Layout

S P	O	E

Current Layout

S P	O	E	G P	O S

Key	SP	Support space - IT, meeting, amenity
	O	Open plan
	E	Enclosed
	GP	Group space/free address
	OS	Off-site - home, mobile, car, train

Source: Gerald Eve Research 1999

Figure 6.1 shows the advances in new technology and that it can facilitate a decline in office space, with off-site work activities and a reduced requirement for support space (computer rooms, meeting rooms etc). Balanced against this, is that new technology creates office space demand with improving economic prosperity, and the space requirement to provide and service the new technology (Harris 1999).

In the changing business environment, productivity and operating efficiency are important aspects of an organisation's strategy. New corporate management strategies and technology advances are providing a looser and more dynamic relationship between the work place and office space (Roulac 1996a and Laing 1993). Knowledge of the changing market demand structure is central to determining future office market performance.

6.3.2 Industrial Market

Industrial properties can accommodate a broad range of industry categories. For example, the storage and distribution facilities (warehouses) and the requirements of production (factories). As new technology is changing the nature of work, it is also changing the parameters of manufacturing and distribution. For example, Roulac (1999) detailed how the multiple layers of real estate used for production and the delivery of goods to the retailer and consumer is being replaced using new information technology to provide streamline, logistics solutions. The re-engineering of the supply chain can be demonstrated by past changes in the distribution layout.

Figure 6.2 shows the traditional distribution process and the 'just in time' approach providing savings in space and cost.

Figure 6.2   **Industrial Property's and the Retail Supply Chain**

Key   W = Warehouse
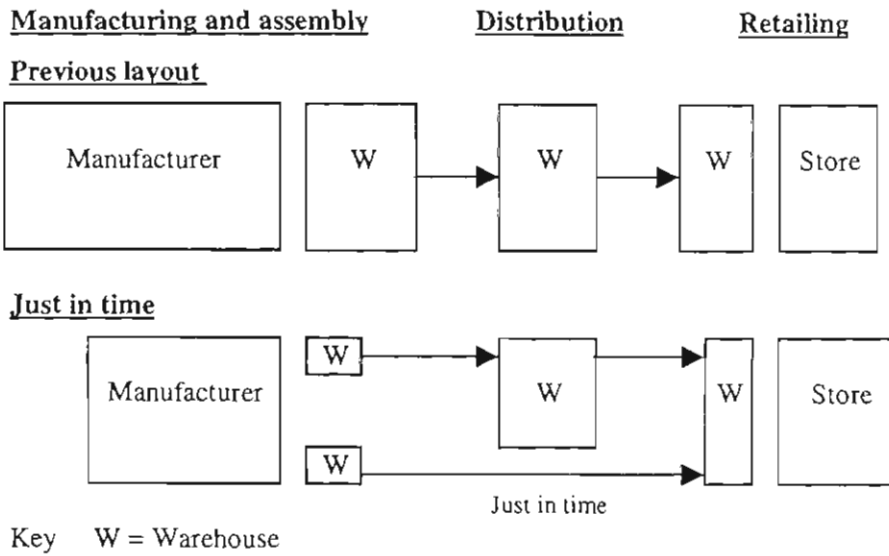
Source: Normura Global Real Estate Research 1994

New technology and communication advances can permit goods to move directly from the manufacturer to the store and, with electronic shopping, from the manufacturer to the consumer. The supply logistics to provide efficiency gains from the growing electronic connectivity between manufacturing, assembly, storage, sales and delivery are creating a new geography and style of industrial building (Fisher 1997).

The e-commerce revolution is also providing a new range of occupiers in the industrial markets. An industrial location can now attract industrial, office and retail occupiers and so creating a new class of industrial demand with the location parameters of good access, flexibility and security (Harley 2000a, Thompson 1998). Requirements for prime industrial space can range from hi-tech facilities, national distribution centres and stand alone large box retailing.

As the demand side of the industrial market changes, there is a requirement to better understand the industrial space, occupier's structure, demand philosophy and operational requirements. This will become even more evident with non-traditional industrial organisations and the implications on future industrial market performance.

6.3.3 Retail Market

Globally, retail markets differ in configuration and operation (Roulac 1996c). In New South Wales, according to the Shopping Centre Council of Australia (2000), shopping centres account for nearly half of all retail turnover with the remaining sales by city retailers, stand-alone stores and traditional shopping strips. Shopping centres are the institutions' main exposure to the retail market.

To draw more customers to shopping centres and improve retail sales, new themes have been introduced. These have evolved with shopping centres becoming the centre of community and social activity (Roulac 1996c). Table 6.4 shows the evolution of themes in US shopping centres, which has similarly occurred in Australia, although at different times.

Table 6.4   **Shopping Centre Demand Generation Themes**

Decade	Demand generation themes
1950 and 1960	Concentration of major department stores and satellite stores
1970	Restaurants and movie theaters
1980	City centre services: post office, library and daycare centres
1990	Entertainment and amusement

Source: Roulac 1996c

As shopping centres expand and broaden their appeal, globalisation and technological advances are creating new retailers and methods of operation (Roulac 1996c). For example, telecommunication stores selling mobile phones are now commonplace and there are a growing number of big name international manufacturers who are opening stores to showcase and promote brand awareness (Baen 2000).

There are several articles for example: Baen (2000), Borsuk (1999), McKellar (2000), Miller (2000), Roulac (1996c) that look at new technology, particularly the Internet and its competition to traditional shopping methods. For example, online buying provides the retailers and manufacturers a low risk and low cost alternative to retail store costs.

Booth (2000) concedes the business-to-customer relationship over the Internet is still to be completely understood, although retail facilities in a shopping centre can provide many customer benefits. The changes in the shopping centre landscape will relate to the cost and the delivery of the product (Baen 2000). The retail outlets may require less space for display and storage with the retailers and manufacturers distribution centres providing the delivery of items at the required time and date to the customer's residence.

The retail culture and environment is shifting and the future performance of shopping centres will depend on the type of retail operation and how they capture and retain patronage and retail sales. The aim is to better understand the individual retail operations and their space determinants.

6.4   STRUCTURAL MARKET RESEARCH

The demand for space is changing due to new business activities and organisations' strategies to manage continuing unprecedented globalisation, technological innovations and financial deregulation. The range and impact on the office, industrial and retail market is very difficult to comprehend, although as Harris and Cundell (1995) and Roulac (1995) stressed, property values are directly linked to the benefits the space holds for current and prospective occupiers.

In order to understand the shifting nature of demand, Guy and Harris (1997) outlined how structural market research can provide a systematic approach to understanding the complex dynamics of property demand and so guide and complement the established forms of commercial property market analysis.

Structured appraisal of space demand, can be achieved by analysing and translating the operational characteristics of the occupational market, specifically by examining those organisations that committed to new space over a specific time period. Collected in a survey,

the structural market research can examine the demand for space by analysing the organisation, the space occupied and decision influences.

Table 6.5 details the areas of structural market research that can form the basis of a survey. The questionnaire structure can apply equally to multi national organisations and to single stand-alone operations.

Table 6.5   **Components of Structured Space Demand Research**

Organisation	Space	Decision influences
Industrial category	Time looking for space	Macroeconomic influences
Business cycle location	Lease length	Microeconomic influences
Organisation structure	Primary activity for space	
Location of decision	Distance from relocation/expansion	
Recent merger/acquisition	New and previous space size	
Business and space plan		

Identifying the individual components forming the structural market research can lead to establishing a chain of decision factors for a specific class of organisation, for example: by industry category, floor size and locality. The matrix of organisation, space and decision data can translate into defined operational characteristics for the organisation's space demand. This information can profile demand patterns and suggest future property market directions.

The identified factors that influence the property decision-making process can be delineated into macroeconomic and microeconomic influences. The macroeconomic influences represent a broad range of property criteria that can be associated with the level of business activity. The microeconomic category is more location-specific and can be limited to a particular property and surrounding vicinity. In several areas these categories can overlap (Maginn and Tuttle, 1990).

Figure 6.3 on the next page shows the decision framework for influences on space demand.

Figure 6.3

Influences on Organisations' New Space Decision

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                    ┌─────────────────────────────────┐
                    │   Decision framework for         │
                    │   influences on space demand     │
                    └─────────────────────────────────┘
```

```
        ┌──────────────────────┐                    ┌──────────────────────┐
        │   Macroeconomic      │                    │   Microeconomic      │
        │   influences         │                    │   influences         │
        └──────────────────────┘                    └──────────────────────┘
```

Property Market dynamics	Technical change	Economic influences	Political factors
a Current property market	a New technology	a Organisation specific	a Federal government
b Available supply	b Future technological advance	b Industry-wide	i) Monetary policies
c Forecast supply		c Australian economy	ii) Fiscal policies
d Forecast rental projections		d Global economy	iii) Political policies
		e Economic forecasts	d State government
			e Local government

Building locality	Business profile	Cost implication	Lease arrangements	Occupiable space
a Accessibility	a Image	a Total occupancy costs	a Previous lease expiry	a Space flexibility
b Public transport	b Vicinity to clients	b Unit cost of space	b New lease length	b Employee working environment
c Vehicle access/parking	c Locality associated	c Fit out costs	c Rent review structure	c Standard of building services
d Surrounding amenities	with business category		d Flexible lease terms	and finishes
	d Organisational structure			

6.4.1   Macroeconomic Influences

The macroeconomic influences affecting the organisation's space decisions are wide ranging and include issues of the 'new economy' and determinants at an aggregated local, nation and global level. These factors can be grouped into property market dynamics, technical change, economic influences and political factors.

(i)   **Property market dynamics** - characterise the disequilibrium of the property markets, with continuous adjustment for new demand and long-term supply conditions. This can be represented in the short-term by the widely reported commercial property market sentiment and the availability of space to meet specific demand patterns. On a longer term, the space occupier needs to consider future supply and prospective costs.

(ii)   **Technical change** - plays a critical role in the nature of business activity and demand for space. The diversity in technological advances can affect industry categories over time and intensity. The progress of change can be shown by the emphasis organisations place on current and projected technical change in their space demand decisions.

(iii)   **Economic influences** - are the effect of economy behaviour at various levels on an organisation's decision for space. These can radiate from specific organisational issues to national and global economic factors. In addition, future economic performance must be considered.

(iv)   **Political factors** - stem from three layers of Australian government: Federal (national), State and Local Government. The intervention in the property markets can take an indirect and direct form. Table 6.6 shows the tiers of government and policy issues.

Table 6.6   **Political Factors on Organisations' Space Decisions**

Government	Policies	Examples
Federal	Monetary	Money supply and financial market controls etc.
	Fiscal	Taxation etc.
	Political	Superannuation, deregulation and privatisation laws etc.
State		Local taxes and infrastructure services etc.
Local		Planning laws and community services etc.

6.4.2   Microeconomic Influences

Microeconomic influences form an important component in an organisation's space decision framework. The study on the operation of individual economic agents is distinct, especially as the aspects of space and locality are unique and so limit any form of direct replication. Microeconomic influences have two broad connecting themes: cost and the features of space.

(i)   Cost and space influences are essential in organisation's space decisions. Cost implications can be reported in terms of total occupancy cost and as a unit cost of space. These is also a recent additional cost consideration of building owners' large incentives, as a way to repackage the rental stream, with the most common representing fitout contributions.

The lease is the legal contract between the building owner and occupier, and controls their relationship throughout the agreement period. A primary interest is the lease length, rent review structure and flexibility of the lease terms.

(ii)   Space and its locality are critical in an organisation's space decision. Flexibility in the working environment and the standard of services and finishes in the occupied space, needs to be considered, alongside the geographic issues such as surrounding amenities and the accessibility to public transport and vehicle access. Another set of locality issues represents the organisation's profile characterised by image, vicinity to clients and the

clustering of similar industry category organisations. Finally, the space and locality itself may be the catalyst to facilitate new organisational structures.

6.5   SUMMARY

The nature and pace of economic structural change is fuelled by the rapid spread of globalisation, technological innovations and financial deregulation. Unfortunately, the examined macroeconomic forecasts were unable to read and foresee structural economic shifts. This limited the value of the property forecast model and reiterates the requirement for post-evaluation analysis on the property forecast model and selected determinants.

Structural changes in the economy can seriously affect an organisation's operations, their space demand and commercial property market performance. This is evident in the office market, with the focus on occupied space to provide greater flexibility with the diversity in work practices. Similarly, in re-engineering the supply chain, new distribution models and associated space requirements are emerging in the industrial and retail markets. Knowledge of the changing demand structure is central to determining the prospective performance of commercial property markets.

As demand is central in commercial property market economics, the emphasis will be on translating an organisation's space decisions and associated operational characteristics into a structured appraised format. This can then form part of a property forecast framework to guide the property forecast model and illustrate new property forecast determinants.

Structural market research can analyse the demand for space by examining the organisation, space occupied and decision influences. The information in these categories can be collected and on analysing the data, provide a matrix of behavioural theory and operational characteristics of the occupational markets. The next chapter details the structural market research on the office, industrial and retail property markets, with the aim to identify demand patterns and to suggest future property market directions.

Chapter
Seven

STRUCTURAL MARKET RESEARCH
DETERMINANTS OF SPACE DEMAND
AND EXPLANATION OF POLICY IMPLICATIONS

7.1   INTRODUCTION

The main objective of this chapter is to examine organisations' new space decisions, and to illustrate the determinants for office, industrial and retail property markets. The tabulated information will be a valuable tool in property decision making and forecasting commercial property market performance. Higgins (2000b) and Higgins *et al* (2000) details published research associated with this chapter. See Appendix C for a copy.

The previous chapters highlighted the limitations of forecast macroeconomic determinants and the transformation changes affecting the demand for space. For this to be examined, it is important to translate organisations' space decisions and operational characteristics into a structural appraisal of commercial property market demand. Policy implications for property forecast research can then be established.

The chapter reports on organisations that in the past two years committed to new space in the three markets - Sydney CBD prime office, Sydney metropolitan prime industrial and New South Wales regional shopping centres. This structured market research is questionnaire based and identifies the categories of new space occupier, their motives and rationale for the new space and the macroeconomic and microeconomic influences in their new space decision.

This chapter has been divided into four main sections. The first section includes the introduction and research design with commentary on questionnaire structure and information on those surveyed. The second section profiles the survey respondents as to the space and organisations characteristics, and the third section provides a degree of importance index for space demand. The fourth section details the study implications for property forecast research. A summery statement concludes the chapter.

7.2   RESEARCH DESIGN

The survey research was designed to obtain information on organisations' space demand and decision influences for the three commercial property markets. To define the survey sample, the questionnaire is focused on organisations committing to new space outside their current location, as there was available market information and factors such as current leases and fitouts may have affected the responses from organisations that stayed and expanded in their current premises.

For the information to be current, the new space demand survey covered the period July 1997 to June 1999 and the questionnaire was directed at senior executives who had knowledge of the relevant space decision.

For the purpose of the study, five leading property organisations provided published information and their own new leasing deals. This provided comprehensive coverage of the studied office, industrial and retail property markets. The data was examined and as the

industrial information was broad, prime industrial space was classified as a recognised Sydney metropolitan industrial location and recorded rental above $100,000 a year.

Similarly, the retail data excluded kiosks, food courts and stand-alone retail operations due to the small floor space occupied and difficulty in sourcing contact names and addresses respectively.

After confirming by phone the organisation and the space leased, the questionnaire was addressed where possible to the individual responsible for the space decision. The questionnaire was initially sent out to 15 organisations, which the author knew and were of various sizes and industry categories. After amendments, 437 new space occupiers were sent the questionnaire in September and October 1999.

The four page questionnaire was designed to be completed in a short time and could accommodate the array of new space occupiers, ranging by size and industry category. The 54 predominately multiple choice questions were in two sections. Firstly, for information on the new space and organisation and secondly, to identify factors that influenced the organisation's decision to occupy the new space. See Appendix B for a copy of the new space demand questionnaire.

All information collected from the survey is reported in a consensus format and no information on any individual organisation is disclosed.

7.3   SURVEY RESULTS AND DISCUSSION OF ISSUES

The questionnaire was sent to 437 new space occupiers, and with follow-up telephone calls, 167 responded providing an overall 38 percent response rate. The level of response by number and floor area for the property markets is shown in Table 7.1.

Table 7.1   **Summary of Survey Respondents**

Respondents' profile	Office		Industrial		Retail	
	Frequency	Floor area sqm	Frequency	Floor area sqm	Frequency	Floor area sqm
Questionnaire sent out	124	363,274	146	1,050,131	167	
Responses	42	219,528	57	370,655	68	39,684
Percentage	34%	60%	39%	35%	41%	

An initial examination of the response rate indicates a satisfactory coverage of the property markets. Retail sector information was limited as the property organisations' provided just occupiers and address details.

The distribution of respondents was measured according to floor size and industry category, see Tables 7.2 and 7.3 respectively.

Table 7.2   **Profile of Respondents by Floor Area**

Floor areas (sqm)	Office			Industrial			Retail		
	sqm	Rate	No.	sqm	Rate	No.	sqm	Rate	No.
0 - 500	2,019	15%	7				9,784		60
501 - 1,000	5,971	29%	8	4,342	61%	5	1,226		2
1,001 - 1,500	4,772	33%	4	4,701	31%	4			
1,501 - 2,000	13,993	73%	8	6,820	36%	4			
> 2,000	192,770	65%	15	354,792	35%	44	28,674		6
Total	219,525	60%	42	370,655	35%	57	39,684		68

Organisation's responses based on floor area in the office and industrial market were satisfactory as they represented the percentage of responses to questionnaires sent out. There is no information on the overall retail space demand, although the response rate conformed to regional shopping centre configuration, with predominately small specialty shops, large department stores and supermarkets.

The respondents' total floor area can be compared with the approximate total floor areas at December 1998, which was outlined in Chapter One. The new occupiers' percentage of the total market represented: office 16 percent, industrial 7 percent and retail 4 percent. The high office content relates to approximately 110,000 sqm of pre-committed space to be completed in 1999 and 2000 representing five new developments.

Table 7.3   **Profile of Respondents by Industry Category**

Industry category	Office			Industrial			Retail		
	sqm	Rate	No.	sqm	Rate	No.	sqm	Rate	No.
Manufacturing, construction & mining	) 6,614	44%	4	46,270	29%	9			
Government & utilities	) 12,632	30%	3		0%	0	1,473	88%	7
Wholesale trade, transport & storage	)			197,935	37%	27			
Retail trade & recreational services	)	0%	0	59,200	55%	12	35,901	35%	44
Communication, finance & business services	) 200,279	34%	35	67,250	47%	9	2,310	49%	17
Total	219,525	34%	42	370,655	39%	57	39,684	42%	68

Table 7.3 detailed the respondents' industry classification for their primary operation. The industry response rate represents the percentage of replies to the questionnaire sent out based on floor area. For the property markets, the frequency distribution for the main industry categories was satisfactory, with those zero responses in the office and industrial market relating to one retail operator and a government organisation respectively.

Having examined the overall responses to the survey, the frequency distribution across floor areas and industry categories appeared exemplary, showing no consistent tendency to deviate in one direction from the true value of the population parameter. To endorse the data coverage, the information was analysed and reported primarily by frequency and with reference to the dominant occupiers, being large space users, which in the survey represented respondents with new space above 2,000 sqm.

7.3.1 Profile of the New Space Occupiers

The survey examined three aspects of the new space occupiers: the respondent industry classification and the size of space occupied, the type of organisations, and if a merger or acquisition formed part of the decision to occupy the new space.

Table 7.4 and 7.5 presents the organisations' structure by floor area and industry category based on the information from the survey respondents.

Table 7.4   **Organisations' Structure by Floor Area**

Floor areas (sqm)	Office		Industrial		Retail	
	No.	%	No.	%	No.	%
0 - 500	7	17%	0	0%	60	88%
501 - 1,000	8	19%	5	9%	2	3%
1,001 - 1,500	4	10%	4	7%	0	0%
1,501 - 2,000	8	19%	4	7%	0	0%
> 2,000	15	36%	44	77%	6	9%
Total	42	100%	57	35%	68	100%

Organisations' space criteria appeared to range in size for the office market compared to the defined requirements of the retail and industrial market. Specialty shops with floor areas of less than 500 sqm, the average size being 163 sqm, dominate the retail market. New space occupiers in the industrial market were primarily above 2,000 sqm with the average size being 8,063 sqm. For each property market, the new space above 2,000 sqm represented over 70 percent of the total floor area surveyed.

Table 7.5   **Organisations' Structure by Industry Category**

Industry category		Office		Industrial		Retail	
		No.	Rate	No.	Rate	No.	Rate
Manufacturing, construction & mining	))	4	10%	9	16%	0	0%
Government & utilities	))	3	7%	0	0%	7	10%
Wholesale trade, transport & storage	))	0	0%	27	47%	0	0%
Retail trade & recreational services	))	0	0%	12	21%	44	65%
Communication, finance & business services	))	35	83%	9	16%	17	25%
Total		42	100%	57	100%	68	100%

Table 7.5 shows the respondents' industry classification and the significance on the selected property markets. On a floor area basis, the new space occupiers in the property categories were essentially: office market – finance and business services (71 percent), industrial market – transport, wholesale and retail trade (65 percent), and retail market – retail trade (63 percent). Communication organisations occupied approximately 10 percent by industry category in all three commercial property markets.

For space demand above 2,000 sqm, the industry category for office and retail markets was more defined, with financial services representing 60 percent and retail trade 83 percent respectively. There was no single industry category dominating the industrial market with transport, wholesale and retail trade organisations being the large space occupiers.

The information on the size and industry category shows the importance of large space organisations and the defined industry category. In areas, the distinction between property markets is blurred, as communication organisations straddle the three markets and retail operations now operate in the industrial markets. This would suggest overall market demand and performance is principally triggered by the requirements of large space occupiers. There is also some convergence of the commercial property market drivers with the opportunity for organisations to operate successfully across the surveyed property markets.

In addition to the industry category and floor size, the respondents provided information on the structure and where the organisations perceived themselves on the business cycle (see Table 7.6).

Table 7.6   **Organisations' Operational Structure**

Organisation structure	Office		Industrial		Retail	
	No.	%	No.	%	No.	%
Local operations	5	12%	8	14%	4	6%
Regional	1	2%	2	4%	1	1%
National	8	19%	22	39%	47	69%
Multi national	28	67%	24	43%	16	24%
Total	42	100%	56	100%	68	100%

Organisations' operational structures varied in the selected property markets and were essentially: office market – multi national organisations, retail market – national organisations, and industrial market – a range of multi national and national organisations. The diversity in organisations' structure is a further consideration that can affect the response to local economic conditions, as these instabilities are easier to manage for multi national organisations with their operating flexibility, economies of scale and vast access to capital. Furthermore, large organisations' emphasis is on operational performance (shareholder value) and could translate to occupational strategies realigned more with their wider business objectives and less with local economic conditions.

The contrast in organisations' operational structure is most evident between the office market, with a concentration of global organisations, and the prominence of national organisations in the retail market.

Having examined multi national organisations, the ultimate decision to occupy the new space was generally made (57 percent) at a national level. The final decisions for the new space made overseas ranged from office (20 percent), industrial (7 percent) and retail (3 percent). For multi national organisations, the final property decision undertaken overseas, represented office (29 percent), industrial (17 percent) and retail (12 percent). This was surprising as it exhibited less than a 10 percent increase on all surveyed organisations.

The operational structure of multi national organisations' and the associated location of the final decision would suggest a level of autonomy for Australian corporate real estate operations. Nevertheless, it appears the spread of globalisation is driving space demand, although the majority of Australian space decisions are still made here in Australia.

A further indication as to the type of organisation occupying the new space is to understand where the organisation is on the business cycle.

Table 7.7   **Organisations' Stage in the Business Cycle**

Business cycle stages	Office		Industrial		Retail	
	No.	%	No.	%	No.	%
Start - up	1	2%	4	7%	3	5%
Infant	3	7%	4	7%	4	7%
Youthful	10	24%	11	20%	10	17%
Mature	28	67%	37	66%	43	72%
Total	42	100%	56	100%	60	100%

Table 7.7 illustrates the strong presence in the property markets of mature organisations. This is confirmed by organisations' with a space demand above 2,000 sqm were those mature organisations represented: office (88 percent), industrial (70 percent) and retail (100 percent). The information seems to complement Table 7.6 with new space demand dominated by established multi national and national organisations with large space requirements.

The concentration of established international and national organisations committing to new space indicates the environment may be less influenced by the local economy. The quality of new space occupiers can change the risk profile, creating on one hand stability and opportunity for growth, and on the other significant new space demand determinants; for example the questionnaire asked if the demand for space was part of a merger or acquisition.

Table 7.8   **Spaces Demand by Organisations' as part of a Recent Merger or Acquisition**

Merger/ Acquisition	Office		Industrial		Retail	
	No.	%	No.	%	No.	%
No	25	60%	42	74%	58	85%
Yes	17	40%	15	26%	10	15%
Total	42	100%	57	100%	68	100%

Table 7.8 illustrates if a recent merger or acquisition formed part of the organisation's decision to occupy the new space. The 40 percent of office respondents whose decision was in part caused by a recent merger or acquisition represent approximately 57,000 sqm of space, being 26 percent of respondents' total floor area. This percentage increases if precommitted space is excluded (two large organisation merged and took precommitted to space) to 41 percent of the respondents' total floor area. Primarily, in the office market,

mergers and acquisitions involved national finance and insurance organisations. The retail market comprises international retail trade organisations, and the industrial market represented international and national transport and wholesale organisations.

Collectively, the 43 respondents in the three property markets affected by a merger or acquisition advised that it was internationally (42 percent), nationally (49 percent) and locally (9 percent) based. This suggests that mergers and acquisitions are both a global and national phenomenon. This is supported by Thomson Financial Services (2000) article with mergers and acquisitions worldwide rising to a record $US 3.4 trillion in 1999, spurred by a wave of cross-border transactions. This was a 36 percent increase over 1998, at $US 2.5 trillion. For 1999, Australian mergers and acquisitions were $A 60 billion, an increase of 10 percent over 1998.

In terms of deal number, Australia ranked fourth, on worldwide basis in 1998 and 11th position in the national breakup of worldwide merger and acquisition transactions for 1999 (Thomson Financial Services 1999, 2000).

Figure 7.1 shows the growth of Australian merger and acquisition activity.

Figure 7.1   **Australian Mergers and Acquisitions**
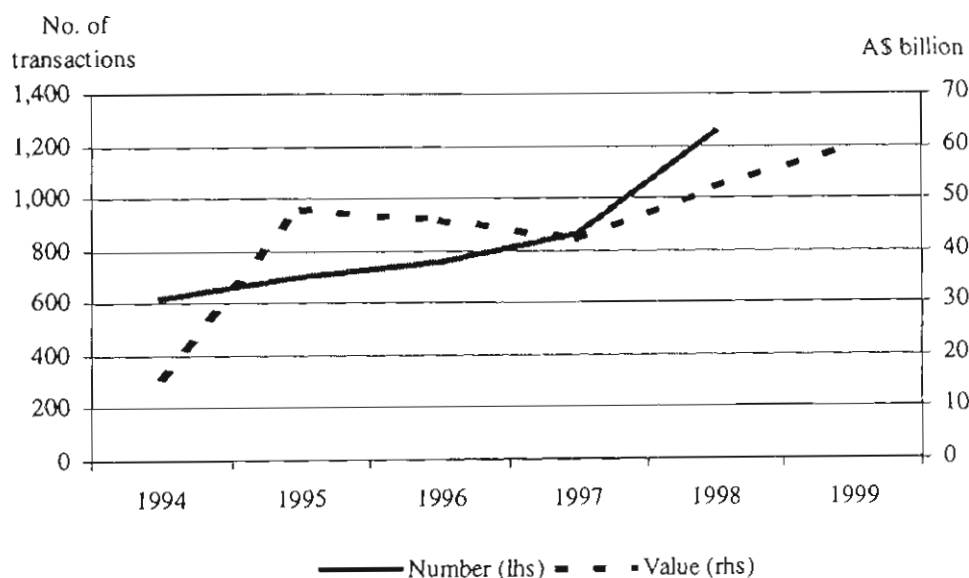
Source: Thomson Financial Securities Data (1999, 2000)

On the available information, Australian merger and acquisition activity for the four years to 1998 grew at an annual average, by value of $9 billion (18 percent) and by 158 transactions (15 percent). If these trends continue, property market dynamics will be increasingly influenced by merger and acquisition activity. The level of research does not match the importance of mergers and acquisitions. Information on post merger strategies and even the level of property related mergers and acquisitions would be a useful tool in determining future space demand.

7.3.2 Aspects of the New Occupied Space

The survey examined three aspects of the new occupied space: the rationale for the new space as part of the organisation's primary activity, the time spent searching for the new space and the lease period excluding renewals.

Table 7.9 details the respondent's prime requirement for the new space.

Table 7.9   **Space Demand by Principal Activity**

New space requirement	Office No.	Office %	Industrial No.	Industrial %	Retail No.	Retail %
Relocation	21	53%	20	35%	24	36%
Expansion	18	45%	32	56%	29	43%
New business activity	1	3%	5	9%	14	21%
Total	40	100%	57	100%	67	100%

Most respondents' required the new space for relocation and expansion purposes with office (98 percent) industrial (91 percent) and retail (79 percent). New business activity was primarily restricted to new retail space. This suggests organisations place established operations above new ventures in the selected prime property markets and would support Table 7.7 findings that new space occupiers in the business cycle were primarily mature organisations.

Table 7.10 illustrates the distance from the principal place of the organisations' relocation or existing business location.

Table 7.10   **Space Demand Relative to Distance from Relocation or Existing Space**

Distances	Office		Industrial		Retail	
	No.	%	No.	%	No.	%
Local	31	82%	17	37%	31	61%
Metropolitan	6	16%	25	54%	6	12%
Regional	0	0%	4	9%	4	8%
National	0	0%	0	0%	9	18%
Overseas	1	3%	0	0%	1	2%
Total	38	100%	46	100%	51	100%

The new space demand in the office and retail markets is generally from organisations in the local vicinity. Industrial occupiers appeared more flexible in relocating or expanding to surrounding areas. The attraction of the space to relocating or expanding national and overseas organisations appears limited to the retail market (20 percent) and all with a floor area below 500 sqm.

The information in Tables 7.9 and 7.10 illustrates the appeal of locality in the organisations' space decision, with most new occupiers being established and from the vicinity of the new space. This supports the cluster analysis theory provided by many leading economists. The new business activity in the retail market was primarily from national retail business (66 percent).

Table 7.11   **Time Spent Searching for New Space**

Searching time	Office		Industrial		Retail	
	No.	%	No.	%	No.	%
0-6 months	32	76%	29	52%	23	48%
7-12 months	7	17%	17	30%	15	31%
13-18 months	1	2%	3	5%	0	0%
19-24 months	0	0%	6	11%	8	17%
>24 months	2	5%	1	2%	2	4%
Total	42	100%	56	100%	48	100%

Table 7.11 shows the time respondents took to look for new space. Overall 58 percent of the organisations took less than 6 months to decide and commit to new space. Those that took less than one year were the majority in all property markets, representing office 93 percent, industrial 82 percent and retail 79 percent.

The flexibility by organisations in their space demand suggests they respond and adapt to the rapidly changing business environment and a limited appetite to a long-term pre-commitment for new developments. The major floor space occupiers represented the organisations that took more than 24 months to search for space.

An analysis of those 32 organisations in the office market that took less than six months to search for space showed that 71 percent were multi nationals, and separately 34 percent had a space requirement over 2,000 sqm. Furthermore, of the 18 new office occupiers which took space as part of a merger and acquisition, 17 took less than six months to decide and commit to the new space.

The short period organisations spend searching for new space demonstrates the fluid nature of the commercial property markets. There are several reasons for this, which can relate to supply and demand features, as well as part of the mechanics of an organisations' business strategy.

Table 7.12 details the length of the respondents' new leases excluding any lease renewal options.

Table 7.12   **Length of New Space Leases (excluding renewals)**

Lease term	Office		Industrial		Retail	
	No.	%	No.	%	No.	%
0-6 years	25	60%	30	55%	51	82%
7-12 years	14	33%	24	44%	4	6%
13-18 years	3	7%	1	2%	0	0%
19-24 years	0	0%	0	0%	1	2%
>24 years	0	0%	0	0%	6	10%
Total	42	100%	55	100%	62	100%

The lease terms across the property markets appear similar with the majority of respondents preferring short-term leases. The average new lease term for an organisation with less than 2,000 sqm was 5.7 years for office and 5.8 years for retail space. For industrial space to 10,000 sqm, the average new lease term was 6.4 years.

The major space occupiers committed to leases greater that 12 years, with the long leases in the retail market representing organisations associated with major shopping centre anchor tenants and may relate more to stopping further competition than the prospects of operational efficiency.

The respondents' information on time searching and length of lease can provide a key in determining the timing and nature of future space demand. Figure 7.2 shows a scattergram of the time searching and length of lease relationship.

Figure 7.2   **Scattergram of Time Searching by Lease Terms**
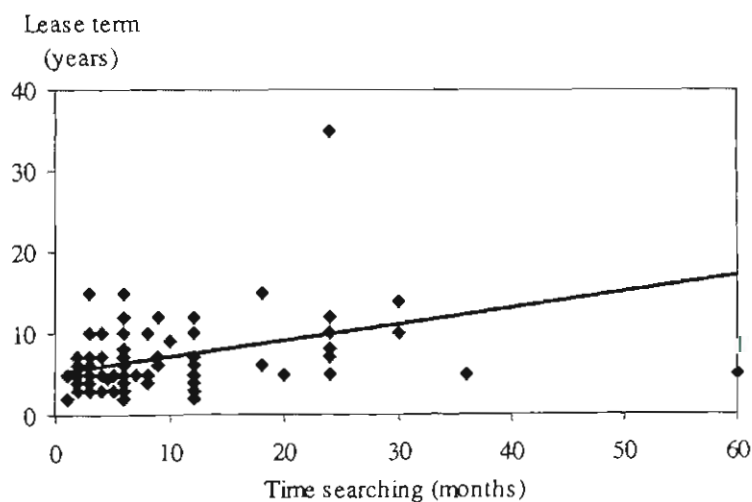
The scattergram illustrates a concentration of points at the convergence of the horizontal and vertical axis with the slope of the points moving upwards from left to right providing a positive association. However, a correlation co-efficient of 0.3 indicates an overall moderate to weak relationship. On removing the two outliers there is only a slight improvement. A linear correlation co-efficient of 0.4 to 0.5 for the three property markets suggests only moderate to positive relationship of time searching and length of lease.

The scattergram information is inconclusive, although it shows the limited time organisations spend in searching for new space and would suggest further research is required to understand the dynamics and behavioural aspects of the commercial property leasing market.

7.4   NEW SPACE DEMAND – DEGREE OF IMPORTANCE INDEX

The second part of the questionnaire contained 34 multiple choice questions on identified factors that influenced the organisations' decision for the new space. The decision framework for the influences on space demand is as detailed in Chapter six. The questions were structured so they were applicable to all new space occupiers from multi national organisations to a local single operation. Each factor was rated by the organisations' on a Likert scale from 1 (nil) to 7 (extremely high) in relation to the degree of importance in their decision to occupy the new space.

The responses for each factor on the Likert scale was recorded and totalled. An initial examination confirmed the same satisfactory response level as for the first part of the questionnaire. For the data to be analysed, the selected degree of importance index placed a weighted significance on the frequency of responses and is as follows:

(i)   Importance index $= \sum (\alpha X) * \dfrac{100}{f}$

Where:

α = the constant expressing the weighting given to each response

$X = \dfrac{\text{frequency of the responses}}{\text{total number of responses}}$

f = range of permitted responses

The method provides an appropriate process to identify a pattern of influences on organisations' decision for new space, as it measures the frequency of the responses to the total responses, and so the response weighting relates to the influences rather than any respondent's bias. The results are shown in two parts, firstly, the macroeconomic influences and secondly, the microeconomic influences.

7.4.1 Macroeconomic Influences

The macroeconomic influences on organisations' new space decisions are ranked by category and individual factors. Table 7.13 shows the degree on importance index of macroeconomic categories.

Table 7.13   **Influence of Macroeconomic Categories on Organisations' Decision for New Space**

Macroeconomic categories	Office		Industrial		Retail	
	Importance index	Rank	Importance index	Rank	Importance index	Rank
Property market dynamics	70	1	68	1	63	1
Economic influences	60	3	59	2	58	2
Technical change	65	2	53	3	49	3
Political factors	41	4	41	4	38	4

The degree of importance index illustrates the significance of understanding property market behaviour. In providing the highest ranking in all property markets, the interaction of the many different aspects of property market supply and demand needs to be recognised and measured. In the selected commercial property markets it is recognised that the level of information varies considerably due to a range of practical issues and market characteristics.

Similarly, the technical change category demonstrates the impact of new technology on organisations' new space decision. The office market technical change ranking it above economic influences, and highlights the acceptance in the office market of advances in information and communication technology offering new activities and greater flexibility in work practices, for example, hotelling and telecommuting.

The benefits of new technology are still being refined in the industrial and retail property market, with business-to-business Internet facilities and electronics shopping in their infancy.

The macroeconomic categories were loosely grouped together apart from the low index score for political factors. Marking political factors low contrasts to the many government direct and indirect controls on social and economic issues and the planning restraints on the location and patterns of development.

Table 7.14 shows the degree of importance index for all macroeconomic factors.

Table 7.14   **Influence of Macroeconomic Factors on**
                      Organisations' Decision for New Space

Macroeconomic factors	Office Importance index	Rank	Industrial Importance index	Rank	Retail Importance index	Rank
Property market dynamics						
a) Current property market	60	8	48	10	49	10
b) Available supply	80	1	85	1	84	1
c) Future supply	76	3	78	3	61	4
d) Forecast rentals projections	65	4	61	5	57	5
Economic factors						
a) Organisation specific	77	2	81	2	74	2
b) Industry-wide	61	7	64	4	64	3
c) Australian economy	57	9	56	6	52	7
d) Global economy	51	11	44	12	45	11
e) Economic forecasts	55	10	52	9	57	5
Technical changes						
a) New technology	65	4	53	8	49	9
b) Future technological advances	65	4	54	7	50	8
Political factors						
a) Federal government:						
i) - Monetary policies	42	12	42	13	39	13
ii) - Fiscal policies	42	13	39	15	38	14
iii) - Political policies	40	14	36	16	37	15
b) State government	40	14	41	14	36	16
c) Local government	40	14	45	11	41	12

In the property classes, the degree of importance index displayed similar scores for individual influences in the categories of technical changes and political factors. This compared with a range of scores for specific influences in property market dynamics and economic factor categories. The highest ranked influences related to defined supply and economic characteristics affecting organisations' space decisions. Political factors recorded the lowest ranking.

The degree of importance index exhibited a similar span in the property classes, although on further investigation the emphasis differed with the top-five-ranked industrial and retail influences accounting for nearly 50 percent of the range. The office market appeared more constant with relatively equal distribution of marks and would suggest a broader approach to examining the influences on the space demand decision.

The leading macroeconomic influences were similar apart from the distinct variation in emphasis placed on economic forecasts by occupiers of new retail space when compared with the importance placed on aspects of technical change by new office occupiers. This suggests retail space decisions link future consumer spending to economic conditions and the effects of technological advances differed in the selected property markets.

In all property sectors, future projections were fundamental in the decision to take space. Property market dynamics and its long-term nature provides a requirement for space occupiers to consider the implications of their commitment to the occupier space. This is both by consideration of the relatively available information on future property supply and forecast rental projections, which also forms an integral part of property investment analysis.

7.4.2   Microeconomic Influences

The microeconomic influences on organisations' new space decisions are shown by category and individual factors. Table 7.15 displays the degree of importance of microeconomic categories.

Table 7.15   **Influence of Microeconomic Categories on Organisations' Decision for New Space**

Microeconomic categories	Office		Industrial		Retail	
	Importance index	Rank	Importance index	Rank	Importance index	Rank
Occupiable space	80	1	76	1	71	4
Cost implications	76	2	72	2	82	1
Building locality	75	3	67	4	78	2
Business profile	72	4	62	5	67	5
Lease arrangements	71	5	71	3	78	2

The degree of importance index for the microeconomic categories was in a relatively narrow band compared with the macroeconomic categories. Furthermore, the office and retail microeconomic categories recorded degree of importance scores above all corresponding macroeconomic categories. A similar result would have been achieved in the industrial market but for the exception of the high score from property market dynamics category.

Ranking the degree of importance for microeconomic categories illustrated the different requirements for new space occupiers. The office and industrial respondents marked occupiable space aspects first, compared with cost implications on the retail index. Business profile received the lowest index score from the industrial and retail categories with lease arrangements ranked from second to fifth (last for office market) in the selected property classes.

Categorising and then indexing the degree of influences provides the framework on organisations' decision for new space. Identifying individual factors can highlight specific considerations.

Table 7.16   **Influence of Microeconomic Factors on**
                      Organisations' Decision for New Space

Microeconomic factors	Office Importance index	Rank	Industrial Importance index	Rank	Retail Importance index	Rank
Occupied space						
a) Space flexibility	79	5	79	3	74	11
b) Employee working environment	81	1	75	5	63	17
c) Standard of building finishes and service	80	3	74	7	76	10
Cost implications						
a) Total occupancy costs	81	1	80	2	89	1
b) Unit cost of space	71	13	65	12	77	9
c) Fitout costs	76	8	70	9	81	4
Building locality						
a) Pedestrian accessibility	74	10	55	18	85	2
b) Public transport	80	3	61	14	73	13
c) Vehicle access/parking	68	16	84	1	83	3
d) Surrounding amenities	78	7	67	11	72	15
Business profile						
a) Image	79	5	68	10	80	6
b) Vicinity to clients	71	13	65	12	70	16
c) Locality associated with business catego	65	17	58	16	73	13
d) Organisational structure	71	13	59	15	46	18
Lease arrangements						
a) Previous lease expiry	63	18	58	17	74	11
b) New lease length	73	11	77	4	78	8
c) Rent review structure	75	9	75	5	81	4
d) Flexible lease terms	72	12	72	8	80	6

Table 7.16 shows the degree of importance index for the microeconomic influences. The scores for the individual factors were associated with the organisations' operational features in the selected property markets. Generally, microeconomic factors for new space occupiers appear driven by total costs and then separately: office - organisational issues, industrial - building flexibility and access, and retail - customer needs. Equally significant are those least important microeconomic factors, which were principally associated with the business profile category.

The differences in the property sectors can be illustrated further:

(i)   **Office market** - The degree of important index is in a narrow 18-point band, with the top five influences covered by two points. These represented: total

occupancy costs: employee working environment, public transport, building images, and standard of finishes and services. The least important were previous lease expiry and locality associated with business category.

The narrow range for the influences may explain the low ranking for locality associated with business category. It was evident in Tables 7.3 and 7.9 that the organisations that took space in the surveyed property markets were relatively defined and expanded/relocated from the local vicinity.

(ii) **Industrial market** - the 29-point span in the degree of importance index exhibited a consistent spread of influences. The top influences were: vehicle access/parking, total occupancy costs, space flexibility, new lease length and rent review structure. The least important was the same as the office market plus pedestrian accessibility.

The spread of influences and the importance of vehicle access/parking can illustrate that even with the various industry categories (primarily transport, wholesale, retail trade and communications) that occupied the space as detailed in Table 7.5, the underlying factors considered in the space decision were similar.

(iii) **Retail market** - A wide 43-point range in the degree of importance index with the bottom three influences spanning 22 points representing operational issues. The top influences were: total occupancy costs, pedestrian accessibility, vehicle access/parking, fit out costs and rent review structure. Employee working environment, organisational structure and vicinity to clients were the least important.

The uneven distribution of marks in the importance index demonstrates both the retail organisations' customer orientations and the various considerations associated with the cost of space. Similarly, the general low ranking of the occupied space and business profile is a feature of the working environment.

7.5   POLICY IMPLICATIONS OF STRUCTURAL MARKET RESEARCH

The empirical study presented in this chapter gives a detailed insight into the operational and decision influences of organisations taking space in the Sydney CBD prime office, Sydney metropolitan prime industrial and New South Wales regional shopping centres. A direct consequence of identifying these influences is that they vary between the property markets and that many are contemporary issues separated from past macroeconomic activity. These need to be identified, recorded and used in future property forecast research.

Research on space demand has been consistently under examined as part of the property forecasting process. Structural market research provides the mechanics for establishing the changing requirements of occupiers and the overall property market characteristics. This information is important in property forecasting given the impact of the modern economy on the business environment.

7.5.1 Property Forecast Determinants

The research presented in Chapter Five showed the forecast accuracy of the property forecast model is linked to the selected macroeconomic forecast determinants. This highlights the following issues in property forecasting determinants:

(i)   The input determinants for property forecast models should historically have a good forecast track record. Out-of-sample analysis of the determinants should be disclosed alongside the property forecast values.

(ii)   The selection of property forecast determinants appeared to depend on their traditional long-term links to property market performance. In an environment of economic change, this underlying relationship needs to be substantiated rather than taken for granted.

(iii)   The occupier market is affected by significant structural changes in the economy. The implications on space demand will affect property market performance. These determinants need to be understood and incorporated in the property forecast process.

As commercial property forecasts assume a greater importance in the decision process, there is a requirement for a strategy to integrate the demand factors influencing the property environment into the property forecasting process. Figure 7.3 suggests the place and role structural market research has in determining future commercial property performance.

Figure 7.3   **Proposed Commercial Property Forecast System**
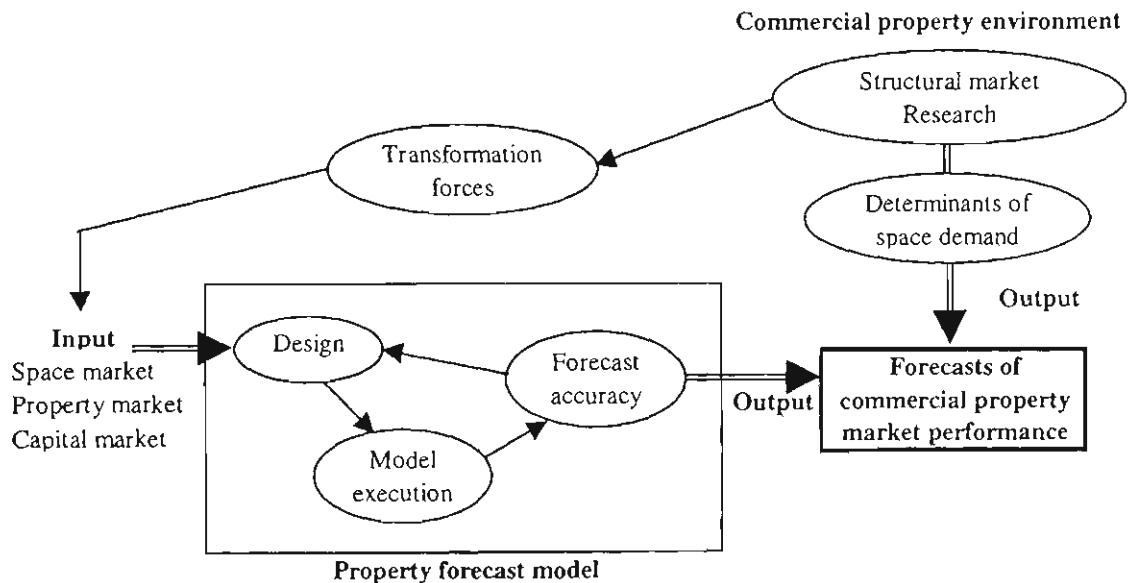
The proposed commercial property forecast system is in two stages:

(i)   **Property forecast model** - follows those forecasting steps identified in Chapter 2.2.1, with the forecast accuracy assessed long-term by continuous post-evaluation analysis. The structural market research link, allows for new property forecast model input determinants. On the evidence of this study, these could be the performance of global markets with the penetration of multi

national organisations, and in the office market the growth of merger and acquisition activity.

(ii) **Structural market research** - provides the tool to better understand the impact on the commercial property environment from the continual process of economic change. The demand analysis framework has an important function in identifying and measuring the key property influences, in particular those that result from the fast-changing demand profile across the office, industrial and retail property markets. For example organisations' operational structures, time searching for space and the advances in new technology.

7.5.2 Applications for Structural Market Research

The property industry is making increased use of property forecast information as an aid to decision making. Structural market research is a technique to reduce uncertainty in the property forecast process as it seeks to evaluate the dynamics of the market sector most open to change- organisations and their space demand. This study provides the framework to better understand the property market both now and in the future.

The systematic examination of space demand can highlight specific influences affecting the analysed office, industrial and retail property markets.

Table 7.17 summarises the leading features of organisations' space demand

Table 7.17 **Summary of the Leading Features of Organisations' Space Demand**

Leading features	Office profile	Industrial profile	Retail profile
Floor areas	Range of sizes	Generally above 2,000 sqm	Generally below 500 sqm
Industry category	Communication, finance & business services	Wholesale trade, transport & storage	Retail trade & Recreational services
Operational structure	Multi national	National and multi national	National
Stage in the business cycle	Mature	Mature	Mature
Mergers and acquisitions	Medium activity	Low activity	Low activity
Principal activity	Relocation	Expansion	Relocation/Expansion
Distance from previous premises etc.	Local	Metropolitan	Local

Table 7.17 illustrates the different space demand characteristics in the surveyed property markets. Even with this overall picture, there are clear implications for property investors and developers; research on property demand can improve long-term returns. This will become more significant as organisations have to succeed in the uncertainties of the new economy with flexibility being a key space requirement. Structured demand research will provide this knowledge as a value driver and risk-reward basis for commercial property.

The importance of the study can be demonstrated by the space demand research paper receiving the Australian Property Institute - New Researchers Award at the Pacific Rim Real Estate Conference, Sydney, 23-27 January 2000. In addition, articles based on the research have been published in national Australian newspapers. Australian Financial Review (Harley 2000b) reported on the impact of mergers and acquisitions on the property markets. Similarly, The Australian newspaper (Ivory Tower 2000) detailed how large multi national space occupiers drive the Sydney CBD prime office market.

The degree of important index emphasised the significance of microeconomic influences across the property markets. As part of the analysis the most and least important influences are shown in Table 7.18.

Table 7.18 **Leading Microeconomic Influences on Organisations' Decision for New Space**

Degree of importance	Office	Industrial	Retail

Highest
↑
⎮
⎮
⎮
↓
Lowest
	Total occupancy costs
	Employee working environment
	Public transport
	
	Vehicle access/parking
	Locality associated with
	  business category
	Previous lease expiry
		Vehicle access/parking
		Total occupancy costs
		Space flexibility
		
		Locality associated with
		  business category
		Previous lease expiry
		Pedestrian accessibility
			Total occupancy costs
			Pedestrian accessibility
			Vehicle access/parking
			
			Vicinity to clients
			Employee working
			  environment
			Organisational structure

A common factor in organisations' decision for new space was the high degree of importance placed on total occupancy costs. Other major influences on space decisions include aspects of the occupied space for the office and industrial markets, and customer needs for the retail market. These differences highlight the heterogeneity across property markets and demonstrates the role structural market research has in urban planning and property development.

Furthermore, comparing those top and bottom ranked items show that space is still viewed by many survey respondents as primarily a large single expenditure item. Current corporate real estate strategy suggests space should primarily be considered as part of organisations' strategic demand requirement for a competitive advantage. Structural market research can therefore provide a tool in educating corporate real estate managers. This is especially significant as organisations are challenged by the continual process of managing the structural changes and transformations in their surrounding business environment.

7.6 SUMMARY

The commercial property market landscape is changing to accommodate the requirements of organisations as they respond to new business environments. Survey information about new space occupiers identifies demand is more than a function of the local economy as illustrated with the diversity in industry categories, organisation structures and space requirements across the office, industrial and retail markets. The leading space demand influences are:

(i) **Large space occupiers** - primarily drive the commercial property markets, with the questionnaire identifying mature organisations with established products and recognised track record. The new space occupiers were dominated by multi national and national organisations.

(ii) **Mergers and acquisitions** - form part of recent decisions by organisations' to occupy the new space; representing a significant 40 percent of office market respondents and, to a lessor extent, retail (26 percent) and industrial (15 percent). On a continuing level of growth, mergers and acquisitions will have a major impact on commercial property markets. Monitoring and reporting on mergers and acquisitions by property class and industry category is still to be established in Australia.

(iii) **New business activity** - space demand was all but restricted to the retail market. Generally, new office and retail space demand was from organisations in the local vicinity with industrial occupiers more flexible in relocating or expanding to surrounding areas.

(iv) **Average lease term** - for the new space was approximately six years in all property markets with leases greater than 24 year associated with the major retail operators. In addition, the relationship to time searching was inconclusive with organisations' searched for new space being predominantly less than six months.

The questionnaire included a section on the degree of importance of identified influences relative to organisations' space decision. A weighted index illustrated the distinct premium organisations place on microeconomic influences. The leading influences range from customer needs in the retail markets and organisational issues for office and industrial markets. The least important influences were previous lease expiry and locality aspects for office and industrial markets to organisation and workforce issues in the retail market. The diversity in the microeconomic influences indicates the unique aspects of the selected

property markets. These different fundamentals need to be understood and incorporated to assess future space demand and market performance.

The macroeconomic influences in the degree of importance index display similarities in the property markets with the highest ranked factors related to defined supply and economic characteristics affecting organisations' space decisions. A distinct variation is the emphasis placed on economic forecasts by new retail space occupiers compared with the importance of technical change by new office occupiers. This reflects the nature of retail operations and influences of new technology in the office workplace compared with alternative property classes.

Knowledge on the rapid changes in the business environment is now a requirement to comprehend the performance of the commercial property markets. A structural market analysis can form the process with the causes and patterns of new space demand providing the framework for understanding the complex dynamics of the space demand market and the backbone to complement current research on the determinants of commercial property market performance.

Chapter

Eight

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

8.1   INTRODUCTION

This chapter presents a summary of the study. It embraces the findings from the literature review, property organisations' survey, the developed property forecast model and structural market research. The conclusion links and integrates the research findings, and the recommendations provide suggestions on the research application within the commercial property industry.

The thesis critically analyses the forecast determinants that drive performance in the office, industrial and retail markets; investigates the property forecasting process; and the conventional property performance relationship with economic activity. In acknowledging this passive interaction, the long-term performance of commercial property markets will be fashioned by the continual change in the environment surrounding commercial property markets. This is explored by determining and measuring the current determinants on

organisations' decisions for new space. These characteristics form an important component in forecasting commercial property market performance.

The remainder of this chapter has been divided into four sections. It comprises a summary of the research, conclusions, recommendations arising from this study, and areas for further research.

8.2   SUMMARY OF RESEARCH

In the late 1980s and early 1990s property markets around the world experienced a severe downturn with a widespread collapse in rental and capital values. As a consequence, major investors moved to embrace quantitative methods that provided a tool to assess future long-term prospects of commercial property market performance. Explicit forecasts are now part of the decision-making process for major property developments, valuations and asset allocations.

No modelling in the commercial property market is without difficulty. Property markets cannot be forecasted with complete certainty, however it is important that property forecast procedure follows general forecasting principles and applications, and to ensure the forecast errors are minimised and show no systematic bias.

The approach of most property forecast models is strongly influenced by the historical availability, collection and reliability of property data. In recognising the infrequency of raw property data and an inefficient marketplace, local transactional databases (depending on market size) are more likely to reveal true behavioural performance than alternative national and valuation-based indices. The trade-off in commercial property research is to recognise what is commercially practical as opposed to what is ideally required.

In order to examine the commercial property market forecast models, the literature review surveyed in the main, articles published in academic journal and compared the approach to a series of identified steps in general forecasting theory. The study revealed limited property

forecast research outside the office and retail rental markets and in many examined articles an absence of tests to determine the suitability of selected determinants and long-term accuracy of the forecast values.

Developments in econometric theory now show limitations in past property research that linked commercial property performance to commercial property market characteristics and the wider economy. There is a requirement for preliminary analysis on the data time series to remove spurious correlations with tests for functional form and stationarity.

Similarly, those publications that provided forecasts need to examine the accuracy of their forecast values. The forecast accuracy tests should be out-of-sample and correspond with the forecast requirements, which due to property investment horizons and development timeframes is long-term. While this may be beyond the scope and objectives of published journal articles, there is a fundamental requirement for verification of both the property forecast model itself and the associated determinants to ensure that they are valid and effective long-term.

As the published work was primarily theoretical and by academics, a survey of property organisations provided an insight into current commercial methods to forecast property performance in Sydney CBD prime office, Sydney metropolitan prime industrial and New South Wales regional shopping centres. A limited number provided forecasts and primarily started forecasting in the past five years. Notwithstanding the commercial sensitivity issue, the survey identified the causal (econometric model) and selected determinants to forecast the office, industrial and retail markets. Generally, the forecast approach matched that identified in the literature review.

The literature review and property organisation survey indicated the preference for a single equation property forecast model. On this information, rent and yield equations for same three Australian property markets were constructed to provide forecasts at December 1994, December 1995 and December 1996. To verify the model, the equations were statistically tested and the predicted to actual values examined visually. To provide the semi-annual, three-year forecast values, the property forecast model determinants were an average of leading published macroeconomic forecasts from these periods.

The three-year forecast accuracy of the rent and yield model was poor when measured against how close the forecast values were to actual values and to the values of a naïve forecast model. The results showed:

(i)   Eight forecast equations (44 percent) provided an unacceptable (above 5 percent in six months) MAPE forecast error to actual values.

(ii)   Eleven forecast equations (61 percent) had a Theil's U value above one and so were less accurate than the naïve forecast model.

(iii)   The pattern of error in the commercial property forecasts appeared to be random over time and across commercial property markets.

(iv)   There was no evidence of the historical time-series length and key statistical (goodness-of-fit) tests affecting the accuracy of the commercial property market forecasts.

The success of the rent and yield model appeared to depend on the selected three-year macroeconomic forecast determinants. Like the property model forecasts they were also tested for their accuracy. The results showed:

(i)   Large differences between forecast values and actual macroeconomic activity with eight macroeconomic forecasts (44 percent) continuously tracking in the wrong direction.

(ii)   None of the macroeconomic forecasts provided a 5 percent and below MAPE forecast error.

(iii)   Thirteen macroeconomic forecast determinants (72 percent) had a Theil's U value above one, thus making them less accurate than the naïve forecast model.

The impact on the rent and yield model of the high macroeconomic forecast error may be reduced with the inclusion of historical property performance determinants. In addition some equations contained positive and negative coefficients and so cancelling out the large forecast error from the macroeconomic determinants.

To determine the shortcomings of the macroeconomic determinants the first, second and third year forecasts were separated and the forecast accuracy again tested. The results showed:

(i)   The macroeconomic determinants appeared to be consistently inadequate over the three years of forecasts, with high MAPE forecast error and all the Theil U values were above one (excluding employment) and so being worse than the naïve forecast model.

(ii)   The forecast error remained the same or gradually deteriorated in years two and three. This would indicate that forecast error comes primarily from the structural changes to the economy rather than from economic shocks.

A better understanding of structural change is central to determining prospective commercial property market performance. This can be achieved by examining the property factors most affected by economic transformation from globalisation, technological innovations and deregulation. Foremost is the demand for space, as organisations reconfigure and restructure to take advantage of business opportunities and remain competitive in the rapidly shifting economic environment. Structural market research provides the tool to evaluate and translate organisations' space decisions and associated operational characteristics into determinants of commercial property market performance.

Information on space demand was collected by a survey of new space occupiers from the same three Australian office, industrial and retail markets. The questionnaire gathered information on the organisations, their new space characteristics, and the property decision influences.

The survey illustrated that space demand is more than a function of the macro economy, with distinct organisational, space and decision-making characteristics. The main organisational and space features are as follows:

(i) Large space occupiers primarily drive the surveyed commercial property markets, representing mature organisations with established products and recognised track records.

(ii) A recent merger or acquisition affected an organisations' decisions to occupy new space, with 40 percent of office market respondents advising that this was a direct factor. The figures were considerably lower for retail organisations (26 percent) and industrial organisations (15 percent).

(iii) Locality forms part of an organisation's space decision-making with most office and retail space occupiers being already established in the vicinity of the new space. Industrial occupiers were more flexible in relocating or expanding to surrounding areas.

(iv) Demand for space by a new business activity was mainly restricted to the retail market.

(v) The average lease term for new space were approximately six years in all property markets, with leases greater than 24 years associated with major retail operators.

(vi) Organisations predominantly spend less than six months searching for new space and there is no evidence that there is a relationship between time searching and the length of the new lease.

The second stage of the survey was on what influenced organisations' space decisions. A 'weighted degree of importance' index illustrated the distinct premium place by organisations on microeconomic influences. The leading influences include customer needs in the retail markets, to organisational issues for the office and industrial markets. The diversity in

microeconomic influences indicates the unique aspects of the selected property markets. The different fundamentals need to be understood and utilised to assess future space demand and property market performance.

For the macroeconomic influences, the degree of importance index displayed some similarities in all property markets with the highest ranked influences related to defined supply and economic characteristics affecting organisations' space decisions. A distinct variation was the emphasis placed on economic forecasts by new retail occupiers compared with the importance of technical change by new office occupiers. This reflects the nature of retail operations and the influences of new technology in the office workplace compared with alternative property markets.

8.3   CONCLUSIONS

Forecasts are of profound importance in major commercial property decisions. In recent years, considerable emphasis has been placed on formal (explicit) property forecast models to determine future long-term property performance. Even with commercial property market forecasts being at the core of the decision-making process, there appear to be limited testing of the assumptions made to provide the property forecasts. Too often the forecast values are viewed as a simple extension of the property forecast model with limited analysis on the out-of-sample forecast accuracy. This seriously compromises the property forecast procedure and masks the inaccuracy of the forecast values.

To capture the commercial property market changes there is an initial requirement to examine the property market data, particularly the character and form of spatial property data. The selection of local data provides the opportunity to expose the changes in property markets, which may be concealed in aggregated and national property data. While acknowledging the constraints with local data it nevertheless provides the best measure of property performance characteristics and should provide the backbone to any property forecasts and property decision strategy.

In identifying and separating concerns about the source and measurement of commercial property performance, the main issues are the determinants and the property forecast model. At some stage in a single/multi-equation econometric model, the independent determinants will be some form of measure of economic activity. The difficulty is that, while macroeconomic determinants may have a proven historical relationship with the commercial property performance measure, the macroeconomic determinants themselves may unfortunately have a weak forecast track record. Such shortcomings may seriously affect the value of current commercial property forecast models.

In neglecting post-evaluation analysis (out-of-sample forecast accuracy tests), many published articles in the literature review, and those property organisations surveyed, limited their forecasts to confirmation of historical links. The deficiency in this approach seriously limits their commercial property market forecasts. It reconfirms that whilst forecast techniques can be simple or complex depending on the situation, it is stages in the forecast process that need to be initially established and followed to validate forecast accuracy and model selection.

One of the difficulties with selecting macroeconomic determinants is their success in forecasting macroeconomic activity. In recent years there seems to have been continuous changes in the economy's behaviour making it difficult for any orthodox model of the macroeconomic to accurately predict. The advances in the emerging 'new economy' are progressively altering the traditional economic marketplace and, with continuous structural changes, it is inevitable that the precise form future changes will take is to some extent uncertain.

The published articles and the property organisations surveyed give the impression of the extensive importance placed on property forecasting as a technical exercise with econometric models. This seems to overlook the distinct transformation changes occurring in and around the commercial property markets. The broader issue is to understand the causes and patterns of space demand which can provide the framework with a quantitative model to determine the complex drivers of future commercial property market performance. This is best illustrated in Figure 8.1 on the next page, which is reproduced from Chapter Seven, Figure 7.3.

Figure 8.1   **Proposed Commercial Property Forecast System**

Property forecast model
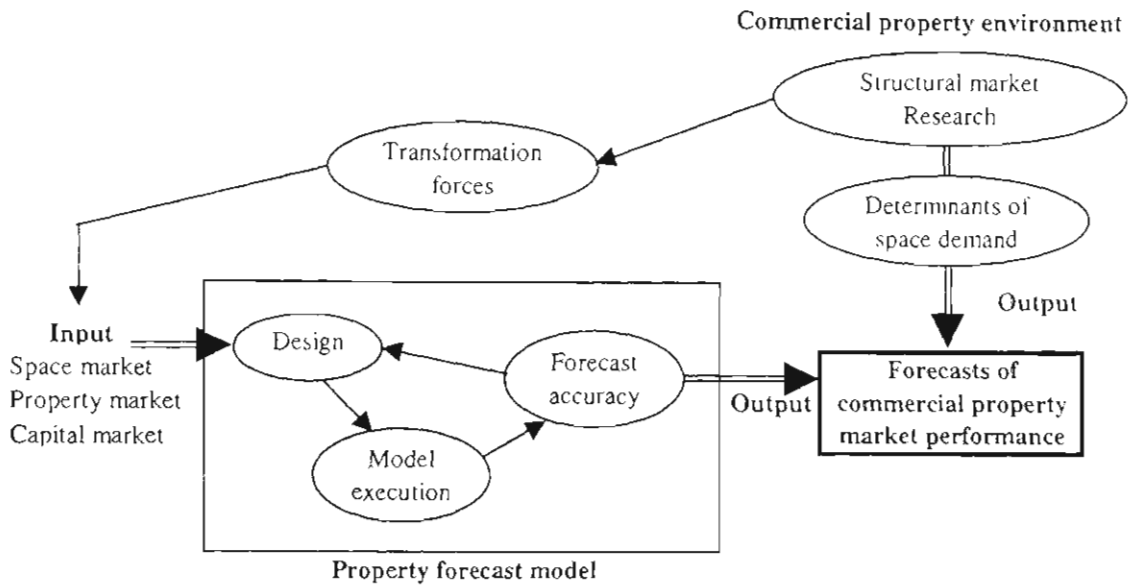
Structural market research provides a detailed insight into organisations' characteristics beyond any traditional empirical property market model. More specifically, the case study profiles the sources of demand by industry categories and organisation structure. Features like the dominance of multi nationals and the impact of mergers and acquisitions in the office market appear new to property forecast research with limited previous analysis. On projecting current growth levels these determinants will emerge as a major influence on future office market performance.

Information on both space locality and the time spent searching for space can likewise add to knowledge on an organisation's space requirements and lease terms. Structural market research supports the theory of cluster analysis in the office and retail markets. The predominately short time (less than six months) organisations spent searching for new space suggests they demonstrated flexibility in their space demands and were able to respond and adapt to a rapidly changing business environment.

A major tool in determining an organisation's approach and requirement for space is to measure the range and importance of property decision influences. The survey information on new-space occupiers identified the demand for space was not simply as a function of the economy. The consequence of diverse microeconomic influences indicated the importance of individual property characteristics to future property decisions. Apart from the direct impact of new technology on office space decisions, the less significant macroeconomic influences displayed general similarities in the property markets. This demonstrates the influence new technology has on space demand considerations.

Structured market research can identify contemporary factors and circumstances as organisations respond to new business environments. This will impact on their demand for space and so change the commercial property market landscape. The patterns that emerge are central to determining future commercial property market performance and are far more comprehensive than identified in previous property literature.

8.4   RECOMMENDATIONS

Underpinning commercial property forecasts are econometric models. In a property forecast model linking past property performance data and economic activity to forecast property performance there is a requirement for transparency and disclosure in all property forecast stages. At present this appears not to take place. The information should include the design, model execution and the accuracy of the forecast values and determinants. Only after gathering all this knowledge, can the property forecast recipient make an informed decision on the forecast values.

The accuracy of the forecast process should be established by continuous post-evaluation analysis. The theoretical basis of forecast models can only be established on a long-term track record, and provided that the selected determinants can be satisfactorily predicted to offer a continuing input to the property forecast model. This is especially significant in the modern economic environment, portrayed by unprecedented change.

The present difficulties exhibited in macroeconomic forecasts and the shifting nature of space demand, mean there is clearly a need for structured qualitative research to guide and support the more established empirical forms of commercial property market analysis. In detailing the factors, structural market research can provide the framework within which the complex dynamics of a commercial property market can be understood and future performance determinants established.

Structural market research provides a systematic and comprehensive examination of space demand characteristics and can disclose previously camouflaged factors on organisations and their occupied space, such as an organisation's operational structure, its primary space requirements, and whether the space is part of a global directive. In addition, registering and benchmarking the decision influences on space demand can illustrate an organisation's changing needs and strategic planning issues. All these are contemporary circumstances outside the domain of econometric models.

In mapping the changes in space demand there is a requirement to comprehend the factors at both macro and microeconomic levels. New property performance triggers in the rapidly changing world economy are more diverse and can be identified initially by structured market research. These trends need to be recognised, measured and benchmarked for the determinants to form part of the commercial property decision process.

This thesis demonstrates that structural changes and the implications for space demand are important in determining prospective long-term commercial property market performance. These should be included in future long-term property forecast systems by ensuring that property forecast models and selected determinants are based on post-evaluation analysis. Furthermore, and in a different medium, structural market research must be used to identify appropriate contemporary factors and circumstances changing the commercial property landscape. In a competitive environment, this proactive strategy is essential for ultimately superior property returns.

8.5 AREAS FOR FURTHER RESEARCH

During this study, it became clear that there was a need for further research beyond the scope and the aims of this thesis including examination of alternative property markets, different time frames and property forecast methods and applications. These areas of research are discussed in detail below.

Alternative property markets

As this thesis only examined the leading Australian office, industrial and retail property markets, there is an opportunity for future research in alternative property markets. The research could also be replicated in different state property markets in Australia, overseas property markets and even secondary Sydney property markets. This would provide (subject to the availability of sufficient data) an interesting sequel to the thesis with analysis comparing structured market research and property forecast models for the various property markets.

Different time frames

The research for this thesis was staged over defined time periods. The start dates for the commercial property forecast model was over three years and the structured market research covered a two-year period. Further research concentrating on different times in both property and economy cycles may lead to changes in the associations between commercial property performance and the macroeconomic determinants.

Property forecast methods and applications

In addition, future research on property forecast methods and applications can be developed in three main areas: property forecast model methodology, property forecast model application (see Chapter Five), and structural market research adaptation.

Property forecast model methodology

(i)   The literature review examined the fundamentals of forecasting and commercial property forecast models and the determinants. Research on forecast models in different asset classes (e.g. resources and equities etc.) may provide an insight to alternative forecast techniques, which can be adapted and used to forecast commercial property market performance. Comparison of the forecast techniques between the asset classes would provide an additional tool in asset allocation theory.

(ii)   The literature review covered published forecast models on the office, retail and industrial property markets. Many of the model forecasts where not tested for forecast accuracy. Data permitting, *ex post* and *ex ante* forecast periods could be established and the accuracy of the property forecasts determined. This would highlight the significance of the property forecast models and add to the Chaplin (1999) analysis on four leading academic property market models where serious concerns were expressed as there was no evidence of formal preliminary data time-series testing for appropriate functional form and stationarity tests.

(iii)   As new computer systems develop, there will be more opportunity to do advanced statistical forecast analysis (e.g. neural network forecasting and chaos theory). In the past, advanced statistical forecast techniques have received limited attention by property forecasters due to historically restrictive property market data. As more property data becomes available, statistical analysis can be undertaken on more advanced forecast modelling techniques.

(iv)   The literature review highlighted the need for further research on qualitative forecast analysis. This can include:

- A comparison of qualitative forecast techniques.

- Combining quantitative property models with judgement forecasts.

- A survey of the property forecast role in property decisions.

- An analysis of property market sentiment surveys to see if they provide a short-term signal for future property market conditions.

(v)   Property forecast models appears to differ depending on property market location. The most striking example shown in the literature review is the absence of vacancy rates in the UK office forecast models. In America and Australia, office rents are predominately linked to lagged vacancy rates. Research on the different overseas property markets may provide the reasons for the apparently unique property market determinants in Australia. Issues like ease of planning consent and lease terms also need investigating.

(vi)   The survey of property organisations in 1998 provided extensive information on the forecast techniques used by practitioners. A follow-up survey would show if new forecast approaches have been adapted and if there is greater importance now placed on the evaluation of past property forecasts.

A new property organisation survey could also show how property forecast research has evolved, as it is interesting to note that of the 15 property analysts who completed the questionnaire just over two years ago, 10 have changed jobs since the original survey. Many of those initially surveyed are no longer employed in property forecasting.

(vii)   If a new survey of property organisations was undertaken, the scope of analysis could be expanded to include:

- Major overseas property forecast organisations. For example: Wheaton Torto Research is a leading provider of American forecasts and has a strong connection to the Massachusetts Institute of Technology in Boston. Similarly, IPG in London provides UK property forecasts for leading property organisations.

- Clients of property forecast organisations, as it would be interesting to understand their property forecast expectations and the level of reliance on the property forecasts in their decision-making process.

- Property equity organisations provide both property market and securitised property market (listed property trusts) forecasts. An analysis of their forecast techniques and accuracy relative to the alternative markets could provide a useful property asset allocation tool.

Application of property forecast model (see Chapter Five)

(i) To provide forecast values, the thesis selected a single equation regression model, as it was the most prominent property forecast technique in the literature review and the survey of property organisations. The quality of alternative property forecast models would provide useful comparisons. especially the time series model, as input determinants to the selected causal model was found to be of limited value.

(ii) The causal model input determinants were restricted due to using corresponding data across the office, industrial and retail markets. Further analysis using additional data for specific property markets may provide better forecasts. For example: supply data is available for the office market. although with limitations as it is extremely difficult to determine future building withdrawals.

(iii) The data for the property forecast model was tested for stationarity. The first difference between each observation passed the test and was selected. Further analysis on different applications of the data may provide alternative forecast values, for example: in the literature review some property forecast model data had been transform by the use of logarithms.

(iv)   The property forecast model provided forecast values for three years commencing December 1994, 1995 and 1996. As the property and macroeconomic data is now available from 1997 onward, the property forecast model could provide additional property forecast values. These could be tested to see if there has been an improvement in the property forecast values. This can also apply to accuracy tests on the forecast macroeconomic input determinants for the property forecast model.

(v)   The accuracy of the property forecast values depended on forecast macroeconomic input determinants selected for the property forecast model. An examination of the macroeconomic forecasts indicated they were affected by major economic shocks and structural changes in the economy. Comparisons of the impact upon the forecast error between these factors would provide better understanding about the selection criteria for property forecast models.

Structural market research

(i)   The structured market research on new space demand clearly provided an insight into operational and space requirements of organisations, together with the influences on their property decisions. Regular surveys of new space occupiers can confirm trends and provide further information on future commercial property market directions.

(ii)   Similar to the new space demand survey, structural market research could provide a satisfaction survey of long-term committed space occupiers, which may highlight different considerations about space and its application.

(iii)   The space demand survey in Section Three examined a range of influences on organisations' space decision-making process. The survey respondents rated every item on a Likert scale 1 to 7 and so provided a degree of importance measure of influences affecting new space decisions. The survey can be taken a step further with the respondents asked to rate each item relative to the current status/performance. This would provide a better understanding of property and economic conditions relative to an organisation's space decision.

(iv)   The space demand survey on the office market highlighted the importance of technological change. Further research can examine the individual components of technical change and how new space occupiers see them affecting the future office environment. This could then be incorporated into future building design.

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Appendices

A

SELECTED COMMERCIAL PROPERTY MARKETS[1]

Sydney CBD Prime Office Market

Sydney Central Business District (CBD) represents a defined area of 3.7 square kilometres. It extends from Circular Quay in the north to Central Railway Station in the south and from Darling Harbour in the west to Hyde Park and The Domain in the east. As at December 1998 Sydney total office stock was 4,100,000 sqm with 1,400,000 sqm of prime office space.

The Property Council of Australia provides a building classification system with reference to specific building features including floor plates size and standard of building services. At December 1998, Sydney CBD had 58 classified Prime office buildings, being of Premium and grade A office accommodation. These buildings are predominantly owned by institutions and property trusts, and represents an approximate value of $9.1 billion.

There are close to 164,000 office workers employed in the Sydney CBD. Information from the Sydney City Council shows that finance and insurance, and property and business services are the two dominant employment sectors in Sydney CBD with the total number of people employed in these two industries now exceeding 53 percent of the office workforce.

Key property market characteristics

- Defined geographic location providing premium land and building values.

- Sydney CBD has a good transport hub with easy of access to roads, railways and ferries.

- Regular quality research, providing details on property market performance, supply and leasing activity.

- Extensive local planning controls restricting building developments. For example building car spaces restricted to size of development site.

- Long development time line (2-5 years) due to nature of high rise buildings, site access, etc.
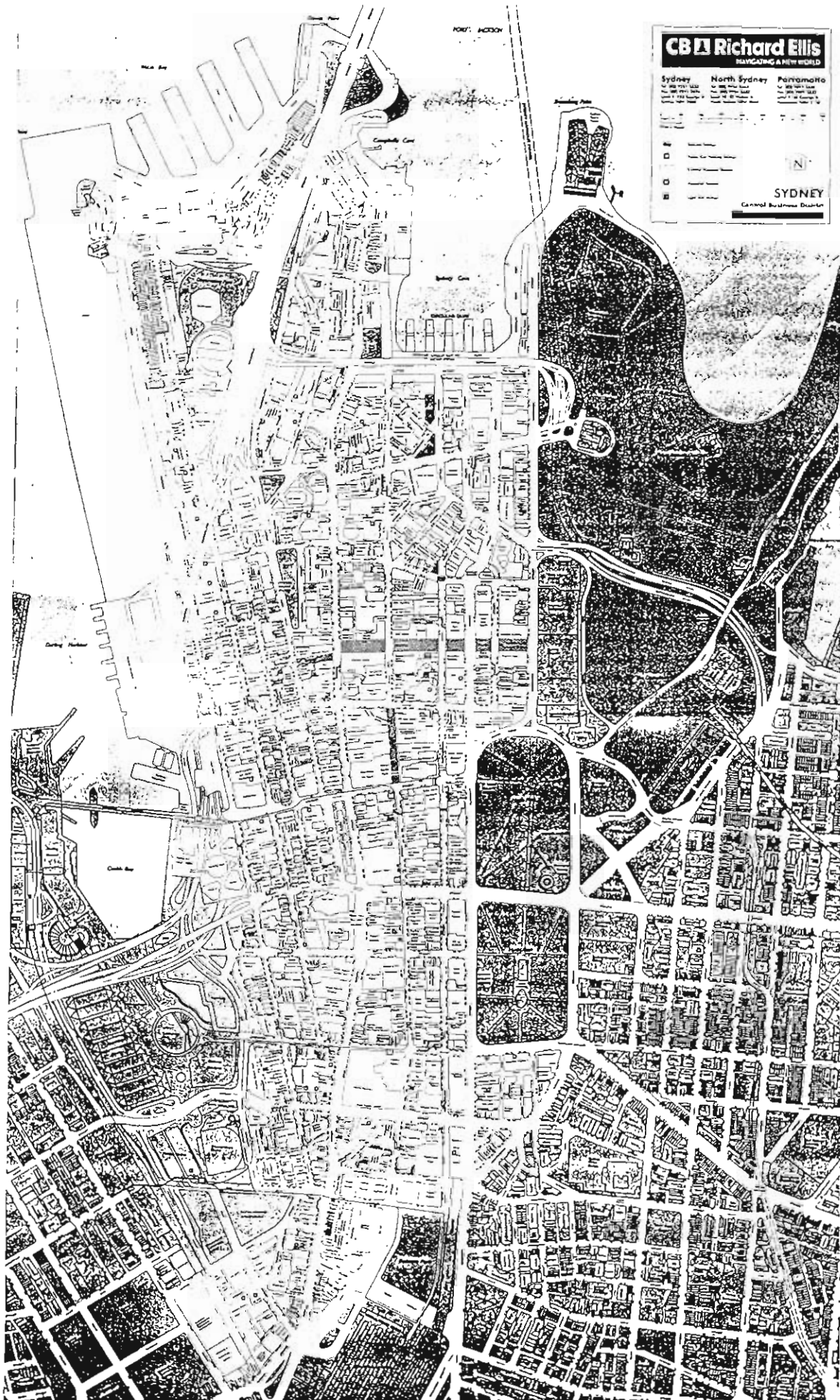
SYDNEY CENTRAL BUSINESS DISTRICT

Sydney Metropolitan Prime Industrial Market

Sydney metropolitan industrial market represents approximately 10,500 hectares of land and is mainly concentrated in the parameters of the Sydney Basin. The major industrial precincts are to the north west and south of Sydney. Location is critical for most industrial business with a requirement for good access to main roads, railways, airports and ports.

Due to the spread of the industrial market and short construction timeframes, the information on Sydney industrial market is limited and those that report the market restrict their analysis to specific locations. Based on Property Council of Australia performance investment indices at December 1998 and sale evidence for the last few years, institutional investor's own approximately 5,100,000 sqm of prime industrial floor space in metropolitan Sydney with a value in the region of $4.8 billion.

Demand for industrial property comprises a diverse range of activity including factories, warehouses and hi-tech premises. Based on occupiers' requirements and changing technology, individual building specifications are extremely important. These can range from the number and location of loading docks to sophisticated air conditioning requirements.

Key property market characteristics

- Dispersed localities influenced by land values and infrastructure facilities.

- Limited historical research and restricted to specific industrial precincts.

- Short development time line (1-2 years) and so can respond more promptly to changing market conditions.

- High risk of building obsolescence due to low replacement costs and rapidly changing production and distribution activities.

- In recent years, multi national organisations have required large-scale purpose built premises providing opportunities for pre-committed developments.

KEY

...... West Sydney Orbital
—— M5 Motorway
M5 East
Eastern Distributor
Harbour Tunnel
Gore Hill Freeway
M2 / Gore Hill Fwy Link
M2 Motorway
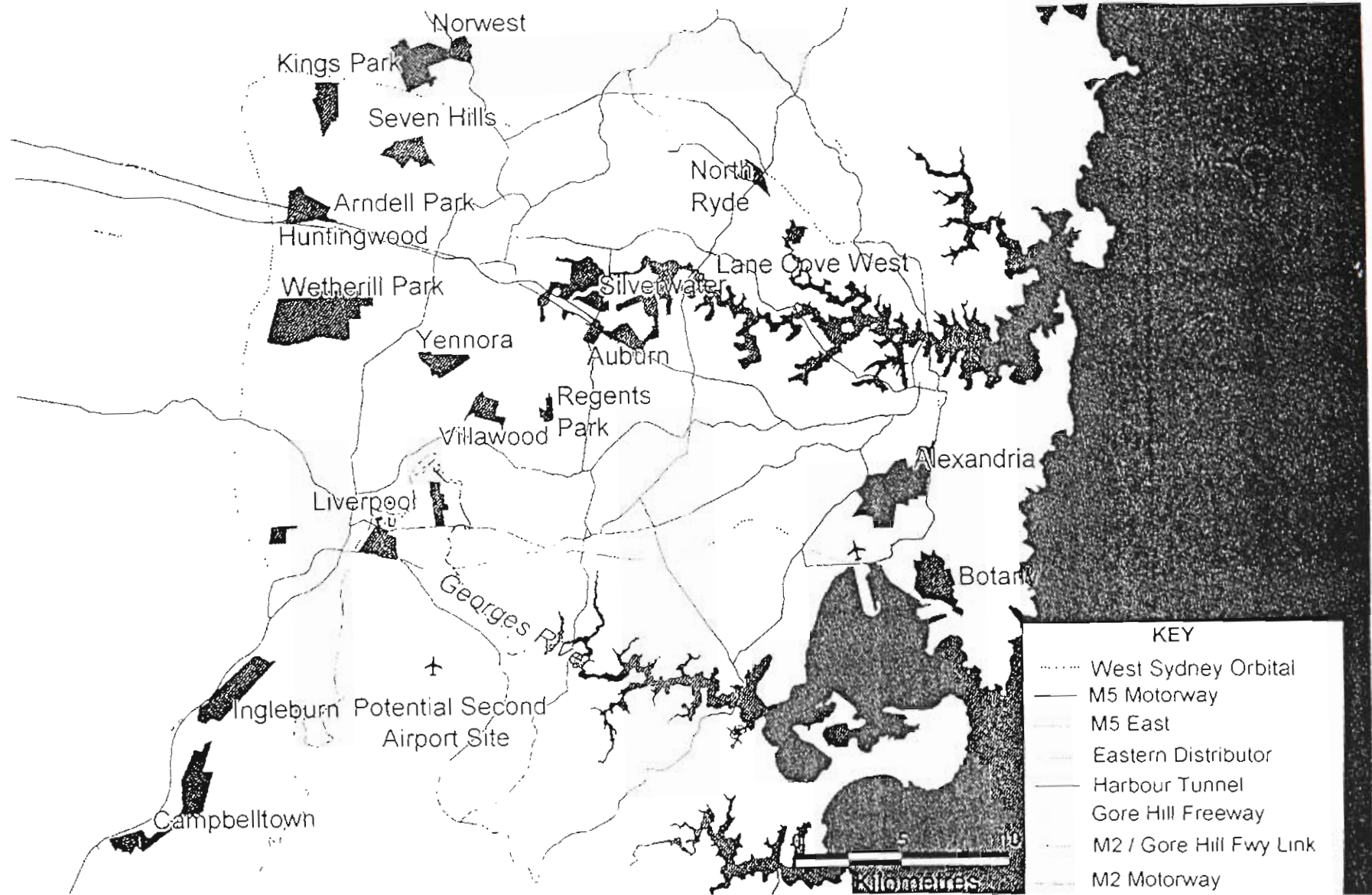
SYDNEY METROPOLITAN INDUSTRIAL MAP

Source: Colliers Jardine

NSW Regional Shopping Centres

At December 1998 there were 27 Super/Regional shopping centres in New South Wales with 19 located in metropolitan Sydney. The Property Council of Australia provides the classification with each centre to have more than 30,000 sqm of retail space with a variety of department stores and at least one supermarket.

The 27 NSW regional shopping centres cover approximately 1,600,000 sqm of floor space and were valued in the region of $6.9 billion. The shopping centres are predominantly owned by a limited number of institutions and property trusts.

In the past 10 years, there has been an enormous expansion in shopping centre floor areas. This is in response to the increased competition for the shopping dollar with the refurbishment and expansion as a defensive strategy against the heightened competition. New destination themes have been introduced, with the most noticeable being the focus on entertainment facilities, such as multi screen cinemas.

Key property market characteristics

- Geographically scattered, dependent on local demographics.

- Specialised research undertaken by only a few organisations.

- Over 40 percent of NSW regional shopping centres are either owned/managed by one company (Westfield Holdings).

- Currently new construction limited to extensions of existing shopping centres.

- Extensive planning consultation for planning and building approval with consideration of impact on surrounding area and requirement for transport facilities.

+ = Regional Shopping Centres
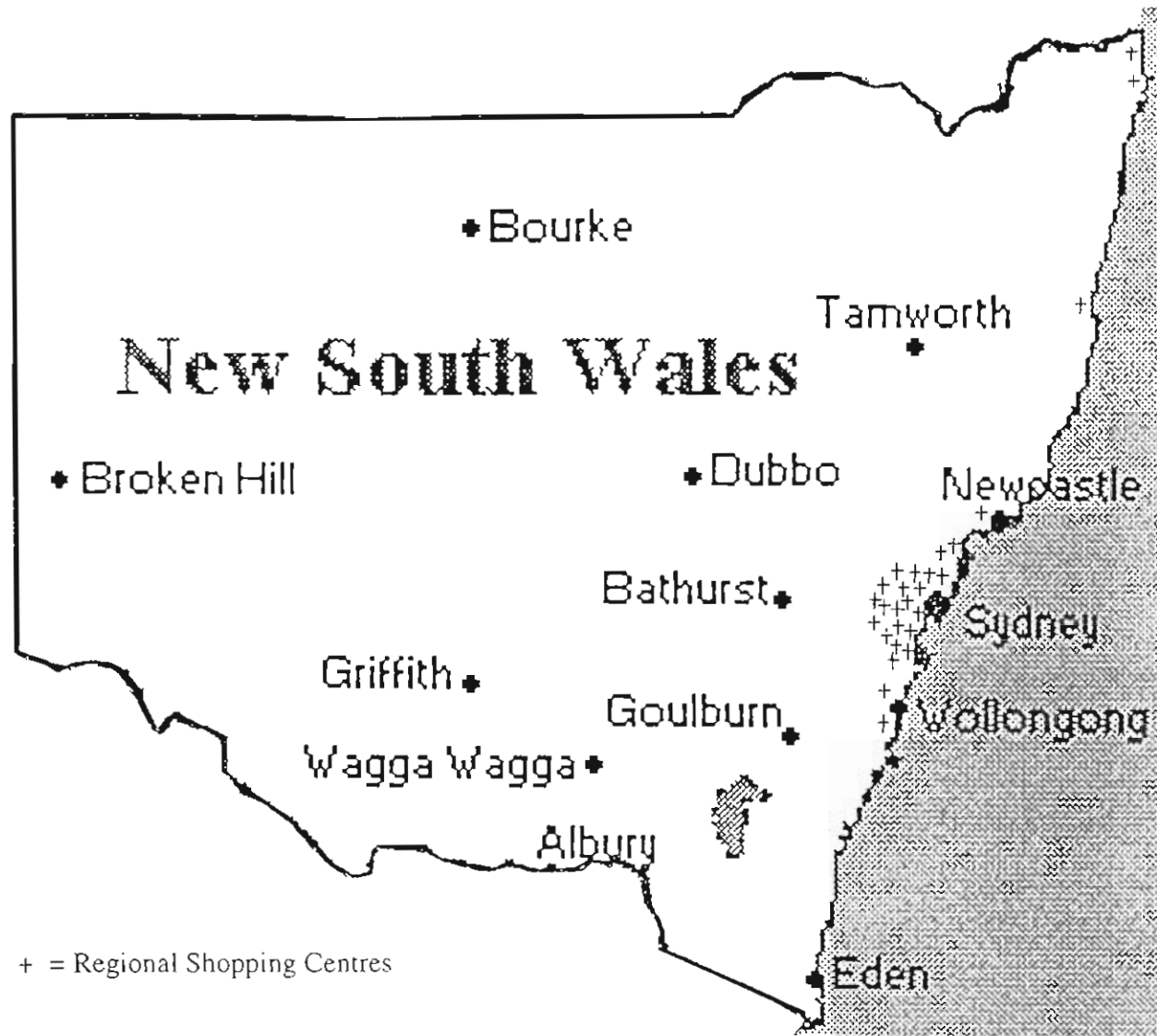
NEW SOUTH WALES REGIONAL SHOPPING CENTRES

Appendices

B

QUESTIONNAIRES

DAVID HIGGINS Ph.D. STUDY
SURVEY OF PROPERTY ORGANISATIONS'
APPROACHS TO FORECASTING
Data Collection Form

Compiler's Guide
Your participation in this questionnaire is valued. It will:

❑ Identify the extent of forecast property series for specific markets.

❑ Evaluate the property analyst's approach to forecasting property performance.

❑ Test the input components in property forecasts.

❑ Provide the basis in a consensus format for a research paper, which will be initially sent to questionnaire participants.

Confidentiality:

❑ All information collected from the survey is **STRICTLY CONFIDENTIAL,** and will only be used for this study and not be disclosed to any third party.

❑ No information on individual forecast property series will be released. The data will be in a consensus format.

❑ The requested information is restricted to the components and approach to forecasting and not the equations in your forecast models.

Require further information:

❑ If you have any questions, please contact David Higgins on phone/fax (02) 9879 6862.

SECTION 1: YOURSELF AND PROPERTY FORECAST PROVIDED

1. Please detail the number of property professionals employed in providing your NSW property forecasts.

	Number of Employees			
	0 - 5	5 - 10	10 - 15	> 15
Property Professionals	❑	❑	❑	❑

2. Please detail the frequency of your forecasts.

	Monthly	Quarterly	Half Yearly	Yearly	As Required
Sydney CBD Prime Office	❑	❑	❑	❑	❑
Sydney Prime Industrial	❑	❑	❑	❑	❑
NSW Regional Shopping Centres	❑	❑	❑	❑	❑

3. How long have you been providing these forecasts.

	Years			
	0 - 5	5 - 10	10 - 15	> 15
Sydney CBD Prime Office	❑	❑	❑	❑
Sydney Prime Industrial	❑	❑	❑	❑
NSW Regional Shopping Centres	❑	❑	❑	❑

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4. Which of the following categories do you forecasts.

Categories	Sydney CBD Prime Office			Sydney Prime Industrial			NSW Regional Shopping Centres		
	Short Term (1-3yrs)	Medium Term (3-10 yrs)	Long Term (>10 yrs)	Short Term (1-3yrs)	Medium Term (3-10 yrs)	Long Term (>10 yrs)	Short Term (1-3yrs)	Medium Term (3-10 yrs)	Long Term (>10 yrs)
Gross Rent	☐	☐	☐	☐	☐	☐	☐	☐	☐
Net Rent	☐	☐	☐	☐	☐	☐	☐	☐	☐
Equivalent Yield	☐	☐	☐	☐	☐	☐	☐	☐	☐
Income Returns	☐	☐	☐	☐	☐	☐	☐	☐	☐
Capital Returns	☐	☐	☐	☐	☐	☐	☐	☐	☐
Demand (employ.)	☐	☐	☐	☐	☐	☐	☐	☐	☐
Supply	☐	☐	☐	☐	☐	☐	☐	☐	☐
- New Supply	☐	☐	☐	☐	☐	☐	☐	☐	☐
- Refurbished Space	☐	☐	☐	☐	☐	☐	☐	☐	☐
Vacancy Rate	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other (Please specify) _____	☐	☐	☐	☐	☐	☐	☐	☐	☐

SECTION 2 : THE VARIABLES USED IN YOUR PROPERTY FORECAST MODELS

5. Listed below are processes to forecast future property performance. Please indicate the processes used in your 5-year forecasts and rank the level of importance.(one being highest)

	Order of Importance
Time series analysis (trends, moving averages)	_____
Causal analysis (econometric modelling)	_____
Questionnaires (related to market conditions)	_____
Judgement based on local market knowledge	_____
Any others, please specify _____	_____
	_____

6. Please list the main variables in your current principal process (see question 5) to forecast 5-year net effective rents and equivalent yields.

a) Sydney CBD Prime Office Rents
1. _____
2. _____
3. _____
4. _____
5. _____

b) Sydney CBD Prime Office Yields
1. _____
2. _____
3. _____
4. _____
5. _____

c) Sydney Prime Industrial Rents
1. _____
2. _____
3. _____
4. _____
5. _____

d) Sydney Prime Industrial Yields
1. _____
2. _____
3. _____
4. _____
5. _____

e) NSW Regional Shopping Centres   f) NSW Regional Shopping Centres Yields
Specialty Shop Rents

1. _____   1. _____
2. _____   2. _____
3. _____   3. _____
4. _____   4. _____
5. _____   5. _____

7. Have the variables used in your forecasts remained constant over the past 5-years.

☐ Always the   ☐ Primarily   ☐ Many variables   ☐ Complete revision
    same   the same   do change   of variables

8. If you do make changes to the variables, please explain your approach. _____

_____

_____

9. For your property forecasts, do you use the following economic projections by.

	Always	Often	Sometimes	Rarely	Never
Independent Economists	☐	☐	☐	☐	☐
In-house Economists	☐	☐	☐	☐	☐
Government Economists	☐	☐	☐	☐	☐

10. Do you amend/qualify the principal economic forecast data you receive?

☐ Always   ☐ Often   ☐ Sometimes   ☐ Rarely   ☐ Never

SECTION 3 : EVALUATION OF YOUR PROPERTY FORECASTS

11. Please complete the following tables detailing your actual and 5-year forecasts from 1992 onwards.

SYDNEY CBD PRIME OFFICE

a) *NET EFFECTIVE RENTS*

Date of Issue	Actual	Forecasts				
		Year 1	Year 2	Year 3	Year 4	Year 5
1992						
1993						
1994						
1995						
1996						
1997						
1998						

SYDNEY CBD PRIME OFFICE

b) EQUIVALENT YIELDS

Date of Issue	Actual	Forecasts				
		Year 1	Year 2	Year 3	Year 4	Year 5
1992						
1993						
1994						
1995						
1996						
1997						
1998						

NSW REGIONAL SHOPPING CENTRE SPECIALITY SHOPS RENTS

c) NET EFFECTIVE RENTS

Date of Issue	Actual	Forecasts				
		Year 1	Year 2	Year 3	Year 4	Year 5
1992						
1993						
1994						
1995						
1996						
1997						
1998						

NSW REGIONAL SHOPPING CENTRE YIELDS

d) EQUIVALENT YIELDS

Date of Issue	Actual	Forecasts				
		Year 1	Year 2	Year 3	Year 4	Year 5
1992						
1993						
1994						
1995						
1996						
1997						
1998						

SYDNEY PRIME INDUSTRIAL

e) **NET EFFECTIVE RENTS**

Date of Issue	Actual	Forecasts				
		Year 1	Year 2	Year 3	Year 4	Year 5
1992						
1993						
1994						
1995						
1996						
1997						
1998						

f) **EQUIVALENT YIELDS**

Date of Issue	Actual	Forecasts				
		Year 1	Year 2	Year 3	Year 4	Year 5
1992						
1993						
1994						
1995						
1996						
1997						
1998						

12. When preparing your forecasts do you analyse other property analysts' forecasts?

☐ Always ☐ Often ☐ Sometimes ☐ Rarely ☐ Never

13. Do you retrospectively check your forecasts.

a) ☐ No ☐ Yes b) If yes, please explain _____
approach _____

14. The findings in a consensus format will form part of David Higgins' Ph.D. study. Would you like a copy of the research paper on the approaches to forecasting commercial property performance.

☐ No ☐ Yes

Compiler's Name/Title: _____

Company Name: _____

Compiler's Phone: _____ Compiler's Fax: _____

Please complete the survey by Monday 30 November 1998. The questionnaire can be faxed to David Higgins (02) 9879 6862 or post to PO. Box K718, Haymarket, NSW 1240.
Thank you for your co-operation

Ref: 08-04que

DAVID HIGGINS Ph.D. STUDY
SURVEY OF NEW SPACE OCCUPIERS'
CAUSES AND PATTERNS OF OFFICE DEMAND
Data Collection Form

David Higgins Fax No 9514 8078

Compiler's Guide

Your participation in this questionnaire is valued. It will:

❏ Identify organisation's selection criteria when occupying new space.
❏ Evaluate the importance of specific business and space requirements in the organisation's decision making process.
❏ Indicate current and future space use trends.
❏ Provide the basis for a research paper, which will be sent to questionnaire participants

Confidentiality:

❏ All information collected from the survey is **STRICTLY CONFIDENTIAL** and will only be used for this study and not be disclosed to any third party.
❏ No information on individual organisations will be disclosed. The data will be in a category basis.

Require further information:

❏ If you have any questions please contact David Higgins on phone (02) 9514 8817.

Please complete the survey by **Friday 17 September 1999** and fax to
David Higgins on (02) 9514 8078 or post to PO. Box K718, Haymarket, NSW 1240.

SECTION 1: INFORMATION ON OCCUPIER OF PRIME OFFICE SPACE

1) Please state the occupation category that best describes your operation in the Sydney CBD prime office space (e.g. Financial and Insurance, Property and Business Services, Government Administration etc).

_____

2) When you occupied the prime office space at what stage in the business cycle was your organisation and the operational category described above. Please tick one box in (a) and one box in (b).

(a) Space Occupier	(b) Operation Category		
☐	☐	Start-up	- new product launch.
☐	☐	Infant	- first steps to cement market position.
☐	☐	Youthful	- adaptation and expansion of product.
☐	☐	Mature	- established product with recognised track record.

3) Is the new office space occupier part of a:

☐ Multi-national ☐ National ☐ Regional ☐ Local ☐ Independent operation

---

4)   Has your organisation recently been involved in a merger/acquisition, which formed part of your decision to occupy the new space. ☐ Yes ☐ No

5)   If your answer to Question 4 is yes, was it:

☐ International ☐ National ☐ Local

6)   What is the length of your organisation's business plan.

☐ No formal plan ☐ <1 year ☐ 1-2 years ☐ 3-5 years ☐ > 5 years

7)   Does your organisation have a strategic plan for the occupied Sydney CBD prime office space.

☐ Yes ☐ No

8)   If your answer to Question 7 is yes, is it:

☐ Independent of business plan ☐ Integrated into business plan

9)   What is the length of your organisation's plan for the occupied prime office space.

☐ <1 year ☐ 1-2 years ☐ 3-5 years ☐ > 5 years

10)   To determine future rentals for your occupied Sydney CBD prime office space did your organisation.

☐ Seek professional advice ☐ Allow for inflation ☐ Add a fixed annual percentage, being _____%

SECTION 2: INFORMATION ON THE PRIME OFFICE SPACE

11)   The primary activity in occupied Sydney CBD Prime Office space is a consequence of:

☐ Relocation ☐ Expansion ☐ New business activity

12)   If your answer to question 11 is relocation or expansion, please tick a box relative to the distance from the principal place of relocation or existing business location.

☐ Local ☐ Metropolitan ☐ Regional ☐ National ☐ Overseas

13)   If your answer to question 11 is a new business activity, please indicate the percentage of new business space relative to the total space the organisation occupies in Sydney CBD.

_____%

Please answer all questions below

14)   When did you decide to lease the new space (lease document signed).   _____/19

15)   How long were you looking for new space.   _____Months

17)   What is the length of your new lease (excluding any lease renewal options). ___ Years

18)   Please complete (i) if you relocated or (ii) for expansion and a new business operation, providing information as when you occupied the Sydney CBD prime office space.

		Area (sq.m)	Number of Employees
i) Relocating	Old space		
	New space		
ii) Expansion and New Business Operation	New space		

SECTION 3: REASONS FOR THE PRIME OFFICE SPACE

19)   Listed below are identified factors that influence the property decision making process. Please tick a box on each line as to the relative importance in your organisation's decision making process to occupy the prime office space. Rate every item applying the scale of 1 to 7.

──────────▶		IMPORTANCE		──────────▶		
1	2	3	4	5	6	7
Nil	Very Low	Low	Average	High	Very High	Extremely High

Degree of Importance

I. Property Market Dynamics   1 2 3 4 5 6 7
a) Current commercial property market sentiment.   ☐ ☐ ☐ ☐ ☐ ☐ ☐
b) Space availability to meet your specific requirements.   ☐ ☐ ☐ ☐ ☐ ☐ ☐
c) Future space availability to meet your specific requirements.   ☐ ☐ ☐ ☐ ☐ ☐ ☐
d) Forecast property market rentals (greater than 1 year).   ☐ ☐ ☐ ☐ ☐ ☐ ☐

II. Technical Change   1 2 3 4 5 6 7
a) New technology (e.g. automation, new communication systems etc).   ☐ ☐ ☐ ☐ ☐ ☐ ☐
b) Future technological advances.   ☐ ☐ ☐ ☐ ☐ ☐ ☐

III. Political Factors
Federal Government: 1 2 3 4 5 6 7
a)   - Monetary policies (e.g. money supply, interest rates etc).   ☐ ☐ ☐ ☐ ☐ ☐ ☐
b)   - Fiscal policies (e.g. taxation etc).   ☐ ☐ ☐ ☐ ☐ ☐ ☐
c)   - Political policies (e.g. superannuation, deregulation laws etc).   ☐ ☐ ☐ ☐ ☐ ☐ ☐
d) State Government policies (e.g. local taxes, services etc).   ☐ ☐ ☐ ☐ ☐ ☐ ☐
e) Local Government policies (e.g. planning law etc).   ☐ ☐ ☐ ☐ ☐ ☐ ☐

IV. Economic Factors   1 2 3 4 5 6 7
a) Company specific factors.   ☐ ☐ ☐ ☐ ☐ ☐ ☐
b) Industry-wide factors.   ☐ ☐ ☐ ☐ ☐ ☐ ☐
c) Australian economic factors.   ☐ ☐ ☐ ☐ ☐ ☐ ☐
d) Global economic factors.   ☐ ☐ ☐ ☐ ☐ ☐ ☐
e) Economic forecasts (greater than 1 year).   ☐ ☐ ☐ ☐ ☐ ☐ ☐

V. Building Locality   1 2 3 4 5 6 7
a) Ease of pedestrian access.   ☐ ☐ ☐ ☐ ☐ ☐ ☐
c) Proximity of public transport.   ☐ ☐ ☐ ☐ ☐ ☐ ☐
d) Vehicle access with ample parking facilities.   ☐ ☐ ☐ ☐ ☐ ☐ ☐
e) Amenities in the building vicinity.   ☐ ☐ ☐ ☐ ☐ ☐ ☐

IMPORTANCE						
1	2	3	4	5	6	7
Nil	Very Low	Low	Average	High	Very High	Extremely High

Degree of Importance

VI. Business Profile

		1	2	3	4	5	6	7
a)	Image associated with the new space.	☐	☐	☐	☐	☐	☐	☐
b)	Vicinity to important clients.	☐	☐	☐	☐	☐	☐	☐
c)	Recognised locality associated with your business category.	☐	☐	☐	☐	☐	☐	☐
d)	To facilitate a new organisational structure.	☐	☐	☐	☐	☐	☐	☐

VII. Cost Implications

		1	2	3	4	5	6	7
a)	Total occupancy costs.	☐	☐	☐	☐	☐	☐	☐
b)	Unit cost of space (e.g. per employee, merchandise, turnover etc).	☐	☐	☐	☐	☐	☐	☐
c)	Fit out costs.	☐	☐	☐	☐	☐	☐	☐

VIII. Lease Arrangements

		1	2	3	4	5	6	7
a)	If applicable, expiry of previous lease.	☐	☐	☐	☐	☐	☐	☐
b)	Length of the new lease.	☐	☐	☐	☐	☐	☐	☐
c)	Structure of rent reviews.	☐	☐	☐	☐	☐	☐	☐
d)	Flexibility in lease terms.	☐	☐	☐	☐	☐	☐	☐

IV. Occupiable Space

		1	2	3	4	5	6	7
a)	Flexibility provided by the new space.	☐	☐	☐	☐	☐	☐	☐
b)	Improvements in the employees working environment.	☐	☐	☐	☐	☐	☐	☐
c)	Overall standard of building finishes and services.	☐	☐	☐	☐	☐	☐	☐

20) What is the single main reason for occupying the prime office space (e.g. political factors etc).

_____

21) Can this single main reason be attributed to:

☐ Sudden change - factors concentrated in time and having a major impact on the demand for new space e.g. new government legislation etc.

☐ Incremental change - continuous gradual pressure creating the new demand for space.

22) The decision to occupy the Sydney CBD prime office space is made at a:

☐ Local ☐ Regional ☐ National ☐ Global

23) Please attribute percentage weightings as to decision input made at the various levels to occupy the Sydney CBD prime office space.

_____ % Local _____ % Regional _____ % National _____ % Global

Thank you for your co-operation with this research

Please complete the survey by **Friday 17 September 1999** and fax to
David Higgins on (02) 9514 8078 or post to PO. Box K718, Haymarket, NSW 1240.

The findings in a consensus format will form part of David Higgins' Ph.D. study. Would you like a research paper on this subject and the report on property analysts' approach to forecasting property performance.

☐   Yes   ☐   No   If yes, please return the questionnaire and the reports will be e-mailed or faxed to you.

Compiler's Name/Title: _____

Company Name: _____

Compiler's Phone: _____ Compiler's Fax: _____

Compiler's E-mail Address: _____

Please complete the survey by **Friday 17 September 1999** and fax to
David Higgins on (02) 9514 8078 or post to PO. Box K718, Haymarket, NSW 1240.

Appendices

C

REFEREED PAPERS

Current Status of Forecasting
the Performance of Australian
Commercial Property Markets

David Higgins

Faculty of Design,
Architecture and Building,
University of Technology,
Sydney

Forecasting the future performance of commercial property markets is now an integral part of the property development and investment decision making process. The emphasis by institutional investors on future cash-flow and capital returns has led to an expansion in the property analysts role to forecast future performance of commercial property markets

The primary purpose of this paper is to investigate this new area of property research by detailing the current extent, model structure and evaluation techniques of those who provide forecasts for three recognised property markets Sydney CBD Prime Office, Sydney Prime Industrial and NSW Regional Shopping Centres. These are premier markets, all of sufficient size to continuously attract institutional investors and have historical market data.

As a lot of the property forecasting research has been developed by property organisations their information can be regarded as commercially sensitive, the survey is therefore focused on components and approaches to forecasting and not forecast model equations. For confidentiality all information is reported in a consensus format.

The remainder of this paper has been divided into four sections. Firstly, a literature review of property

forecasting with particular reference to Australian research in this area Secondly, details of the research design including selected property market categories and information on those surveyed Thirdly, the research results and associated discussion, and finally, some concluding remarks

Literature Review

In the past, property forecast theory has received limited attention in Australia The property boom and subsequent slump of the early 1990s highlighted the requirement to improve the techniques to measure property performance The application of cash-flow evaluation procedures has been illustrated in recent Australian institutional investor surveys (Newell et al 1993, Boyd et al 1995, McIntosh, 1996) Cash-flow analysis now forms an integral part of major institutional investors decision making process

This emphasis on determining future cash flow and capital returns by institutional investors has lead to increasing publicity in approaches to forecasting commercial property performance For example, empirical studies have been conducted in the USA (McClure 1991 Sivitanides 1998, Wheaton and Torto 1988) and UK (Gardiner and Henneberry 1988, 1991, RICS 1994, Tsolacos et al 1998) Previous studies in Australia have concentrated on the

Sydney office market (Hendershott 1995, JLW Advisory 1992, Kummerow 1997, MacFarlane 1997).

Despite the amount of work that has been focussed in the property-forecasting arena, links between theory and practice remain distant (Mitchell and McNamara 1997). A step forward is Chaplin (1998) analysis of three property-forecast models provided by UK real estate organisations. The study evaluates forecast error on projected appraisal – based office indices. A concern in selecting appraisal-based performance measures must be the appraisal smoothing issue, which relates to appraisal data not fully capturing all underlying property market volatility (Brown, 1991 and Geltner, 1989).

Research Design

The property analysts' survey was in two stages. Thirty organisations were initially approached to determine if they provided property forecasts. Of the 16 respondents who did, 15 agreed to complete a detailed questionnaire These can be divided into three tiers. Firstly, property consultants with access to market knowledge and raw data from their leasing and sale teams. Secondly, property equity analysts and their association with the $18 billion securitised property market, and thirdly, major building owners who can be both direct owners and securitised property trust managers. The property equity analysts and the building owners use almost entirely the property consultants' historical data.

The questionnaire addressed a range of practical issues in forecasting rents and yields for specific commercial property markets. Foremost is the varying degree of information and the unique characteristics associated with selected commercial property markets: Sydney CBD Prime Office, Sydney Prime Industrial and NSW Regional Shopping Centres Details of the specific property

markets and their individual attributes are as follows: [1]

Sydney CBD Prime Office Market

Sydney CBD represents a defined area of 3.7 square kilometres. It extends from Circular Quay in the north to Central Railway Station in the south and from Darling Habour to the west to Hyde Park and The Domain in the east The Property Council of Australia classifies prime office as premium and grade A office accommodation [2] These buildings represent approximately 14 million square metres of net office space with a value in the region of $91 billion

Market characteristics

- Defined geographic location
- Benchmark vacancy and supply data published by the Property Council of Australia.
- Long development time line (2-5 years).
- Extensive local planning controls.

Sydney Prime Industrial Market

Metropolitan Sydney industrial market represents approximately 10.500 hectares of land Details on ownership and values are limited Based on Property Council of Australia, Performance Investment Indices and sale evidence for the last few years, institutional investor's own approximately 51 million square metres of floor space with a value in the region of $4.8 billion.

Market characteristics

- Dispersed localities influenced by land values and infrastructure facilities.
- Limited historical research.
- Short development time line (1-2 years)

[1] Due to the limited published data on the extent of the NSW property markets, the author provides estimates made from various property market reports and personal knowledge as at December 1998. The sole purpose of the information is to provide an insight into market dynamics for this report and should not be used for any other purpose
[2] Refer to Property Council of Australia literature for selection criteria

- Primary development being pre-committed on greenfield sites.

NSW Regional Shopping Centres

In NSW there are 27 Super/Regional shopping centres with 19 located in metropolitan Sydney Each centre has more than 30,000 square metres of retail space and a variety of department stores and at least one supermarket [2] Overall the centres have approximately 16 million square metres of floor space with a value in the region of $69 billion

Market characteristics

- Geographically scattered, dependent on local demographics
- Specialised research
- Over 40 percent owned/managed by one company
- Currently new construction limited to extensions of existing shopping centres.

Survey Results and Discussions

Details on Property Organisations Surveyed

The initial survey identified 16 Sydney organisations providing commercial property market forecasts This is a small number considering that the estimated institutional investment in the NSW property market (covered in this survey) is valued in excess of $20 billion. Fifteen organisations completed the questionnaire, all are market leaders in their specific property sectors and 10 form part of multi-national organisations

To provide NSW property market forecasts, 80 percent of the surveyed organisations employ less than five property professionals Generally, those now employing more than five have provided forecasts for more than five years, although, the extent of coverage varies across the specific property classes. All those surveyed provide office forecasts with one

organisation providing forecasts intermittently for over 10 years. Coverage of both industrial and retail was less, with 93 percent and 80 percent of the organisations providing forecasts in the respective areas. All the industrial and retail forecasts were commenced in the last five years except for one organisation's retail forecasts, which started between 5 and 10 years ago.

Property forecasts are predominantly prepared on either a quarterly or six-monthly basis When combined, the organisations forecasting at least semi-annually ranged from office 86 percent, industrial 72 percent and retail 63 percent. Over 20 percent of industrial and retail forecasts are prepared as needed, mainly by the property equity analysts.

In each property class, there can be several forecast categories. Figure 1 highlights these and the percentage of property analysts providing forecasts in each of the categories In addition, some individual organisations forecast specific categories, for example: building outgoings, construction costs and workspace ratios

Most evident from the survey results was the property analysts comprehensive coverage of the rent, and yield categories. The diversity between the property classes in demand and supply categories, highlight the difficulty of retail and industrial market research. For example, industrial vacancy rates are very difficult to substantiate due to the physical size of the industrial market and the relatively short construction timeframes.

Forecasts for the property categories are generally for a period of more than three years, as forecasts are predominately for asset valuations that commonly use a 5 to 10 year cash–flow analysis. Short-term forecasts of less than three years are most evident in the industrial sector, being still a relatively low 11 percent of the total.

Property Forecasting Methodology

The property analysts were asked to list the processes used in their five-year forecasts They were provided with a choice of time series analysis (trends, moving averages). causal analysis (economic modelling), questionnaires (related to market conditions) and judgment (based on market knowledge). Illustrated in Figure 2 are the property analysts' principal techniques.

Each property forecasting technique illustrated in Figure 2 has its advantages in certain situations. Whilst it is not the purpose of this paper to analyse these, an explanation of the techniques in broad terms and examples follows

- Causal method assumes that future property performances exhibit an association with one or more independent variables, namely: property, space and capital variables. The purpose of the causal

model is to discover the form of the relationship and use it to forecast future property performance.

- Time-series analysis assumes that property performances are based on their historical past. The methodology is to discover a pattern in historical data series and extrapolate that pattern into the future

- Judgmental method requires no in-depth statistical analysis and limited historical data. It is a product of intuitive thinking and accumulated knowledge on an individual and group basis to forecast future property market performances

Figure 3 illustrates common examples of forecasting techniques based on past pattern, past relationships or subjective predictions

Property analysts primarily use the causal method to forecast future property performance The processes selected were essentially Building owners - causal method, Property consultants - causal and time series

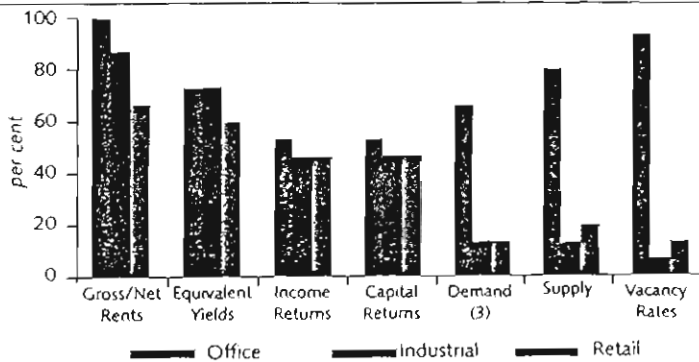Figure 1: Property Analysts - Range of Forecasts Produced

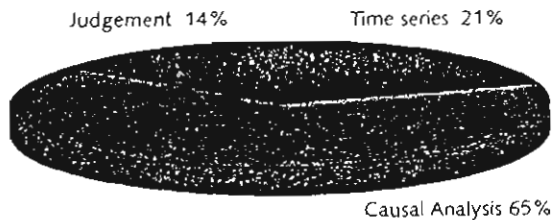Figure 2: Property Analysts Forecast Techniques – Five-Year Forecasts

Judgement 14%   Time series 21%

Causal Analysis 65%

Figure 3: Property Forecast Techniques and Examples

High	Requirement for Data	Low

Techniques		
	Quantitative	Qualitative
Examples	Times-Series Method (generating process)	Casual Method (cause and effect association)	Judgment Method (subjective)
	Moving averages	Correlation analysis	Naive extrapolation
	Time series decomposition	Regression models	Jury of experts
	Box-Jenkins (ARIMA)	Econometric models	Scenario analysis

Table 1: Property Analysts Principal Variables For Net Effective Rent Forecasts

	Sydney CBD Prime Office Rents	Property Analysts Selections	Sydney Prime Industrial Rents	Property Analysts Selections	NSW Regional Shopping Centres Specialty Shop Rents	Property Analysts Selections
Property	Historical Rents	2	Historical Rents	3	Historical Rents	2
	Construction Activity	10	Construction Activity	3	Construction Activity	4
	Construction Costs	1	Construction Costs	1	Construction Costs	1
	Vacancy Rates	8				
	Workspace Ratio	5				
	Lease Incentives	1				
Space	GDP	4	GDP	10	GDP	2
	Office Employment	9	Employed Persons	3	Employment	1
	ASX - Indices	1	Manufact/Wholesale		Retail Turnover	7
	Job Adverts	1	Estimated Utilisation	1	including per Capita	
			Capacity		Population	2
					Private Disposable Income	1
					Consumer Sentiment Index	4
Capital	Interest Rates	1	Interest Rates	2	Inflation	1
			Inflation	2		

Table 2: Property Analysts Principal Variables For Equivalent Yield Forecasts

	Sydney CBD Prime Office Yields	Property Analysts Selections	Sydney Prime Industrial Yields	Property Analysts Selections	NSW Regional Shop Centres Yields	Property Analysts Selections
Property	Historical Yields	4	Historical Yields	4	Historical Yields	4
	Rents	7	Rents	5	Rents	3
	Sales Evidence (trends)	1	Sales Evidence (trends)	1	Capital Growth	1
	Vacancy Rates	2				
Space			Consumer Sentiment Index	1	Consumer Sentiment Index	1
					GDP	1
					Retail Turnover	1
Capital	Interest Rates	6	Interest Rates	4	Interest Rates	6
	Inflation	2	Inflation	1	Inflation	2

analysis, and property equity analysts - equally across the range.

On detailing the forecasting process, property analysts listed the principal variables used in their five-year forecasts of net effective rents and equivalent yields. Tables 1 and 2 list the variables selected and the frequency For confidentiality and clarity, the variables are in broad terms and grouped under three main headings: Property, Space and Capital.

The tables illustrate five important aspects of forecasting future property performance:

- A wide range of property and space variables used to forecast future rents

- A narrow band of property and capital variables used to forecast future yields

- The space variables selected for the office, industrial and retail rents portray different economic characteristics.

- Vacancy rates is a property variable exclusive to the office sector.

- Supply components of the property variables is confined to forecast rent models.

Generally, the principal property forecast variables have remained the same over the past five-years, with 92 percent of the surveyed property analysts using the same, or primarily the same, variables in their forecasts The continuity highlights the influences of specific variables on property markets

Economic Forecast Data - Sources and Quality

As illustrated in Table 1, an important consideration in forecasting commercial property performance is the future performance of the local economy. There are three principal sources of forecast data independent, in-house, and government organisations Of those surveyed, 73 percent often to always use forecasts provided by independent economists whilst 40 percent often to always use the services of in-house economists There was a mixed response to the government economic forecasts, as 40 percent sometimes referred to the government information, seven percent always and seven percent never used the government forecast data

The property analysts confidence in the principal economic forecast is illustrated by the extent, to which survey respondents amend and, or qualify the economic forecast data, as shown in Figure 4

The wide response range provides inconclusive evidence as to property analysts' approach to modifying forecast economic data However, there are two points of specific consideration

- Generally, those using in-house economists rarely to never amended economic forecasts This could be because the property analysts are consulted during the data preparation.

- The limited confidence property analysts have in the published economic forecasts, with 43

percent regularly amend/qualify the data. They may do so for various reasons including: unrelated volatility between the economic and property markets, pre-selection of economic forecasts to achieve the desired property forecasts, and combining economic forecasts to provide a consensus approach. An explanation by those who prepare the economic forecasts, on their methodology may assist the property analysts to evaluate the data

Evaluations of Property Forecasts

An integral part of property forecasting is the evaluation stage. Here, forecasts can be compared with other current forecasts measuring the same property market performance, and by retrospectively examining past forecasts. The property analysts approach to analysing other property analysts' forecasts is illustrated in Figure 5.

The response to the survey question again initially appears unclear, with a mixed response across all categories. On further analysis, building owners predominantly analyse other property analysts' forecasts. Cost restraints and confidentiality may restrict property equity analysts, and property consultants reviewing competitors' forecasts.

Retrospective examination generally forms a key part of the property analysts evaluation process, with 77 percent of the respondents confirming they undertook some form of historical analysis. However, the property analysts response to the nature of the review appears to be random and short-term.

Discussion

The methodology varied between property analysts for forecasting the future five-year property performance. The causal approach (econometric

Figure 4: Property Analysts That Amend/Qualify Economic Forecast Data
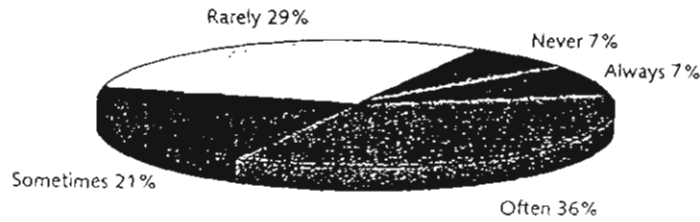
Figure 5: Property Analysts Examination of Other Property Analysts Forecasts
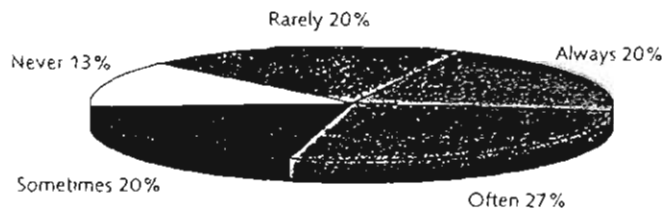
modelling) and then time-series analysis being the preferred techniques. Factors that can influence the forecasting approach can include:

- Pattern and availability of data
- Desired accuracy.
- Ease of operation and understanding of the forecast technology.
- Time and cost constraints

Although, property analysts use various forecasting techniques, they generally forecast the same comprehensive range of performance categories and include office demand, supply and vacancy rates. The additional property variables were also a feature of the principal variables used to forecast five-year net effective rents (see Table 1). Commonly selected in the office sector were both vacancy rates and workspace ratios. This can indicate that these additional variables form a second tier approach to forecasting office net effective rents, i.e. initially

forecast the vacancy rate and from there determine future rents. It would appear that industrial and retail rent forecasts are formed using selected variables in a one-step process

Furthermore, in forecasting future rents the predominant space (demand) variable in each property sector is a different component of the local economy: office employment for office rents, economic activity (Gross State Product) for industrial rents, and retail turnover for retail rents Although, forming part of the overall economy these individual elements perform to some extent separately. The seasonally adjusted economic factors are illustrated in Figure 6

The graph suggests elements of the economy function separately at various points in time, although, there is strong evidence of long-term economic cycle The retail economic influence appears both to perform and lead (up to 18

Figure 6: Leading Local Economic Indicators on the Commercial Property Markets
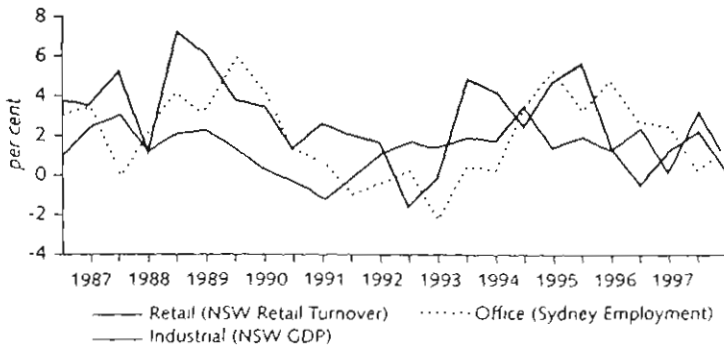
Source ABS

months) those of the respective office and industrial economic variable.

The capital markets appear to have limited direct effect on determining future rents, even though it is the main factor used by the property analysts in forecasting equivalent yields (see Table 2). Here, the predominant feature is the similarity in selected variables across the property market sectors. Property and capital variables are generally the same, with space (demand) variables largely absent. To some extent this is understandable, with the linkage between space and property variables in forecast rental analysis. The space, property and capital market framework and associated complexities have been graphically illustrated by Archer and Ling (1997).

Finally, property forecast model accuracy depends on how close the forecasts are to actual values. The prevailing difficulty for property analysts in measuring their forecasting ability is the limited track record, as most organisations have been forecasting for a relatively short time (less than 5 years). Also, within both the profession and academia, the process to determine property forecast accuracy is primarily informal and unclear. The application of statistical methods to measure forecast accuracy is under utilised and could lead to recognised benchmarks for the property forecasting profession.

Conclusion

Forecasting the future performance of commercial property markets is now an integral part of the property development and investment decision making process. Sixteen property organisations forecast the performance of the $20 billion Sydney CBD Prime Office, NSW Regional Shopping Centres and Sydney Prime Industrial markets. The majority of those surveyed provide rent and yield forecasts on either a quarterly or six monthly bases.

For five-year property forecasts, property analysts principally use the causal (econometric modelling) process. The main space (demand) variable for forecasting office, industrial and retail rents are different characteristics of the economy. This compares to predominantly the same property and capital variables used for all five-year equivalent yield forecasts, with space (demand) variables typically absent. Generally, those surveyed, forecast the same office, retail and industrial performance categories and include office demand, supply and vacancy rates.

Theoretical and technical evaluation of forecasting techniques is still at an early stage in Australia and overseas. Retrospective analysis of property market forecasts by survey respondents appears to be on a random and short-term basis. In part, this may be

due to a limited track record, as the majority of organisations started forecasting in the last five years and there is an absence of a standard approach to accurately measure forecast error ■

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Biography

David Higgins is a PhD candidate studying at the Faculty of Design, Architecture and Building, University of Technology, Sydney, Australia. His doctoral dissertation is on "Commercial Property Markets: Determinants of Future Income and Capital Returns".

He has a B.Sc. Building Surveying from Leicester Polytechnic, UK and a Master of Commerce (Land Economy) from the University of Western Sydney and is a member of the Royal Institution of Chartered Surveyors and the Australian Property Institute.

Professional Certificate in Arbitration and Mediation

R J Connolly

A new course entitled Professional Certificate in Arbitration and Mediation has been developed by the Institute of Arbitrators and Mediators Australia and the University of South Australia which can be undertaken at any of six universities throughout Australia.

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The course has two sections.
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While the course has a strong emphasis on rules of procedural fairness (or natural justice) and other legal principles and practices e.g. contract and tort law, these are areas in which all practitioners should have a basic understanding.

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For some students the emphasis on legal issues in the course can be somewhat intimidating. It must also be said that a knowledge of the law is of assistance in this course. Nevertheless a consistent approach to this course will reward the student with an enhanced understanding of many principles which can be utilised in day to day practice

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The tutorials can be undertaken at six universities throughout Australia including ANU in Canberra. These are on Tuesday and Thursday nights, they run for two hours and when travelling you can undertake the tutorial (or the workshop or exam for that matter) at any of the university venues

While there were a few complaints about the delivery of the course I found that the tutorials provided a stimulating discussion environment as did the workshops

For those members with a little time to spare (and even better an employer willing to pay the relatively formable course fee of $1800 for each section) the course has some very good content that is enhanced through the tutorial session delivery

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For more information please contact Veronica Bondarew, National Education Manager, at national@propertyinstitute.com.au

The Causes and Patterns of New Space Demand in Australian Commerical Property Markets

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Abstract

This paper was awarded the API "New Researcher" Award at the Pacific Rim Real Estate Society Conference held in Sydney during January 2000. This is an annual award of $1000 sponsored by the API to support up-and-coming property researchers in Australia The award was presented by the National President of the Institute, Ian Dalgarno

Australia is part of a rapidly changing world economy Global deregulation, technological advances and financial liberalisation have transformed opportunities and competition for organisations. To succeed, organisations have to respond and adapt to the changing business environment The implication of business reorganisation and new working practices is altering the pattern and demand for space

Demand for space is the key variable in commercial property market economics and provides the platform for property development and investment decisions Past research on space demand has traditionally focused on the relationship to the local economy However, with organisations in a continuous process of change, it is important to translate their decisions and operational characteristics into a structural appraisal of requirements for space For more comprehension and explanation on the changing character of commercial property markets, structured market research can guide and complement the established forms of commercial property market analysis

The aim of this paper is to investigate and provide an overview of the operational characteristics and decision making of organisations that in the past two years committed to new space in three leading property markets. Sydney CBD Prime Office, Sydney Prime Industrial and NSW Regional Shopping Centres. This structured market research

is questionnaire based and identifies the categories of new space occupier, their motives and rationale for the new space and the macro-economic and micro-economic influences in their decision making process

The remainder of this paper has been divided into four sections Firstly, a literature review of the changing structure of organisations and the effect on commercial property markets Secondly, details of the research method utilised including questionnaire structure and information on those surveyed Thirdly the research results are detailed and analysed Finally, concluding remarks summarise the outcome of this research

Literature Review

The changing structure of organisations has been a feature of the last century with major restructuring of market economies and business activity moving away from traditional modes of operation to much more highly flexible and diverse systems (Laing 1993) In reviewing the reasons, three major themes can be identified the role and impact of information and communication technology, the changes to the organisation of production and distribution; and the restructuring of business and new work practices (Lizien et al 1997, Guy and Harris 1997, Nourse and Roulac 1993, Roulac 1999)

Information and communication technology plays a critical role in

creating and enabling new market structures, business organisations and work practices. In breaking down the spatial barriers, information technology provides a key to international business by improving planning, co-ordination and monitoring of operations in diverse markets. It also provides flexibility (at a low cost to the organisation and individual) to where work takes place and even affects the way in which activities are undertaken (Gibson and Lizieri 1998)

Central to the new wave of corporate management theory (Miles and Snow 1994) is organisation strategy, structure and process to respond to customer needs. According to Porter (1985), long-term business development is through the establishment and maintenance of competitive advantages, which can stem from many of the organisation's activities To gain a competitive advantage, an organisation must perform and link the strategic activities more economically and better than its competitors.

Business restructuring and new work practices are fundamental changes that form an integral part of corporate management strategies The consistent message of flexibility and efficiency can be linked to better meeting market demands, which can include economies of scale provided by vertically integrated companies and flat horizontal operational networks replacing the hierarchical management structures (Becker and Joroff 1995).

Historically, anecdotes and case studies provided the evidence of changing business practices on specific commercial property markets. Published survey results detail a clearer picture and show the spread of information technology, management ideas and workplace innovations through organisations and the effect on the demand for new space (Lizieri et al 1997).

Leading executive management surveys of large corporate organisations covered

the managed efficiency of corporate real estate (Schnefers 1999, Veale 1989), organisational and operational functions (Cam et al 1999, Gibson and Lizieri 1999, Kimbler and Rutherford 1993), and location issues (Shilton and Stanley 1999)

Comprehensive office market surveys provide an overview of office space requirements, workplace configurations, and building performance satisfaction (Bottom et al 1999, Dent and White 1998, Gerald Eve 1997 and the RICS series of reports "Right Place, Right Space" (Lizieri et al 1997) Australian surveys include the Property Council of Australia's space use study (Property Council of Australia, 1998) and their sponsored Leading Edge Research Tenant Demand (Knight Frank Hooker 1995)

Research Design

For the purpose of the study, leading property organisations provided information on new leasing deals covering the July 1997 to June 1999 period for the Sydney CBD Prime Office, Sydney Prime Industrial and NSW Regional Shopping Centre markets) The target population was organisations that committed to new space outside their current location

The research was based on a three-part questionnaire providing information on the following·

- Section one - Occupier of the new space;
- Section two - New space details;
- Section three - The degree of importance of macro and micro-economic factors in the organisations' decision making process

The 54 questions were predominantly in a multiple-choice format. The questionnaire was conducted in the spring of 1999 and was specifically addressed to senior executives making the property leasing decision For confidentially, all information is reported in a summary format.

Research Results and Discussion

Data availability and response levels always underpin surveys In this instance, five leading property organisations provided the comprehensive population data, representing published information and their own leasing deals The questionnaire was sent to 437 new space occupiers and 167 responded providing overall a 38% response rate Table 1 and 2 presents the distribution of respondents according to floor sizes and Table 3 for the industry categories

The respondents total floor area and as a percentage of the total stock at December 1998 is shown in Table 2 The

Table 1 Structure of the Research Sample by Floor Size

Floor area (sqm)	Office Frequency	Office Percentage	Industrial Frequency	Industrial Percentage	Retail Frequency	Retail Percentage
0-500	7	17%	0	0	60	88%
501-1,000	8	19%	5	9%	2	3%
1,001-1,500	4	10%	4	7%	0	0%
1,501-2,000	8	19%	4	7%	0	0%
>2,000	15	36%	44	77%	6	9%
Total	42	100%	57	100%	68	100%

Table 2 Profile of Respondents by Total Floor Area

	Office	Industrial	Retail
Total Floor Area (sqm)	219,528	370,655	39,684
% of Total Property Markets [2]	16%	7%	3%

high office content relates to 110,000 sqm of pre-committed space.

The industry classification in Table 3 represents the primary operation of the organisation. For each property market the frequency distribution for the main industry category appears similar. The zero response in the office and industrial market related to one retail operator and a government organisation respectively.

The response rate indicates a satisfactory spread across floor sizes and industry categories, showing no consistent tendency to deviate in one direction from the true value of the population parameter.

Section One: Information on the Occupier of the New Space

The survey examined four aspects of the new space occupier: the respondent industry classification and the size of space occupied; the type of organisation, where the ultimate decision to occupy the new space was made, and if a merger or acquisition formed part of the decision to occupy the new space.

The size of space occupied by the respondents is shown in Table 1. The space criteria for the office market appeared to range in size compared to the defined requirements of the retail and industrial market. The retail market is dominated by specialty shops with floor areas of less than 500 sqm, the average size being 163 sqm. Alternatively, new space occupiers in the industrial market were primarily above 2,000 sqm with the average size being 8,063 sqm. For each property market, the new space above 2,000 sqm represented over 70% of the total floor area surveyed.

The respondent's industry classification is shown in Table 3. The new space occupiers in the property categories were essentially, office market – finance and business services (71%): industrial

market – transport, wholesale and retail trade (65%): and retail market – retail trade (63%). Communication organisations occupied approximately 10% by industry category in all three property markets.

In addition to the industry category and floor size, the respondents provided information on their organisational structure, as shown in Table 4.

The overall structures of organisations vary in the three property markets but were essentially office market – multi-national organisations, retail market – national organisations, and industrial market – a range of multi-national and national organisations.

The diversity in organisations' structure can affect the response to local economic conditions. Local instabilities are easier to manage for multi-national organisations with their operating flexibility, economies of scale and vast access to capital.

Whilst multi-national and national organisations represent the main space

occupiers, the ultimate decision to occupy the new space was generally made (57%) at a national level. The final decisions for the new space made overseas ranged from office (20%), industrial (7%) and retail (3%). This would indicate a level of autonomy in multi-national organisations for Australian corporate real estate operations.

Table 5 illustrates if a recent merger or acquisition formed part of the organisation's decision to occupy the new space. The 40% of office respondents whose decision was in part caused by a recent merger or acquisition represent approximately 57,000 sqm of space being 26% of respondents' total floor area.

Collectively, the 43 respondents in the three property markets affected by a merger or acquisition advised that it was internationally (42%), nationally (49%) and locally (9%) based. Primarily, in the office market, mergers and acquisitions involved national finance and insurance

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Table 3 Structure of the Research Sample by Industry Category

Industry category	Office		Industrial		Retail	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Manufacturing Construction and Mining	4	10%	9	16%	0	0
Government utilities	3	7%	0	0%	7	10%
Wholesale Trade Transport Storage	0	0%	27	47%	0	0%
Retail Trade Recreational Services	0	0%	12	21%	44	65%
Communication Finance Business Services	35	83%	9	16%	17	25%
Total	42	100%	57	100%	68	100%

Table 4 Organisation Structure by Property Category

	Office		Industrial		Retail	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Multi National	28	67%	24	43%	16	24%
National	8	19%	22	39%	47	69%
Regional	1	2%	2	4%	1	1%
Local Operations	5	12%	8	14%	4	6%
Total	42	100%	56	100%	68	100%

Table 5 Decision to Occupy New Space as part of a Recent Merger or Acquisition

Merger/ Acquisition	Office Frequency	Percentage	Industrial Frequency	Percentage	Retail Frequency	Percentage
No	25	60%	42	74%	58	85%
Yes	17	40%	15	26%	10	15%
Total	42	100%	57	100%	68	100%

organisations The retail market comprises international retail trade organisations. and the industrial market was international and national transport and wholesale organisations.

Mergers and acquisitions is now an important feature in an organisation's decision to take new space. This trend is set to increase, particularly internationally as reported mergers worldwide rose to a record $US 3.4 trillion in 1999, spurred by a wave of cross-border transactions. This compared to $US 2.5 trillion in 1998, an increase of 36%. In 1998, Australian mergers and acquisitions were $A 51.2 billion, an increase of 16.7% over 1997. In terms of the number of mergers and acquisitions, Australia ranks fourth on a worldwide basis (Thomson Financial Services 2000)

On the trend continuing, the level of mergers and acquisitions will oversee demand for space and building values in particular property markets For the future, a merger and acquisition index by property class and industry category will be a useful tool for property investment decisions.

Section Two: Information on the New Space

The survey examined three aspects of the new occupied space. the rationale for the new space as part of the organisation's primary activity, the time spent searching for the new space; and the lease period excluding renewals. Also examined was the relationship between the time spent looking and the length of the new lease.

The respondent's prime requirement for the new space is shown in Table 6

The new space was primarily required by respondents' for relocation and expansion purposes with new business activity restricted to new retail space. This suggests organisations place established operations above new ventures in the selected prime property markets. The distance from the principal place of relocation or existing business location is shown in Table 7

The new space demand in the office and retail markets is generally from organisations in the local vicinity Industrial occupiers appeared more flexible to relocate or expand to surrounding areas. The attraction of the space to relocating

or expanding national and overseas organisations appears limited to the retail market. The information in Table 6 and Table 7 illustrates the appeal of locality in the organisation's space decision, with most new occupiers being established and from the vicinity of the new space

Table 8 shows the time respondents took in looking for new space Overall. 58% of the organisations took less than 6 months to decide and commit to new space The organisations that took more than 24 months represented the major floor space occupiers

The time searching for space in the office market took 93% of the organisations less than one year This suggests flexibility by organisations in their space demand to respond and adapt to the rapidly changing business environment and a limited appetite to long term precommitments for new developments

Table 6 Organisations' Prime Requirement for the New Space

New Space Requirement	Office Frequency	Percentage	Industrial Frequency	Percentage	Retail Frequency	Percentage
Relocation	21	53%	20	35%	24	36%
Expansion	18	45%	32	56%	29	43%
New Business Activity	1	3%	5	9%	14	21%
Total	40	100%	57	100%	67	100%

Table 7 Distance from the Principal Place of Relocation or Existing Business Location

Distance	Office Frequency	Percentage	Industrial Frequency	Percentage	Retail Frequency	Percentage
Local	31	82%	17	37%	31	61%
Metropolitan	6	16%	25	54%	6	12%
Regional	0	0%	4	9%	4	8%
National	0	0%	0	0%	9	18%
Overseas	1	3%	0	0%	1	2%
Total	38	100%	46	100%	51	100%

Table 8 Time Searching for New Space

Searching Time	Office Frequency	Percentage	Industrial Frequency	Percentage	Retail Frequency	Percentage
0-6 months	32	76%	29	52%	23	48%
7-12 months	7	17%	17	30%	15	31%
13-18 months	1	2%	3	5%	0	0%
19-24 months	0	0%	6	11%	8	17%
>24 months	2	5%	1	2%	2	4%
Total	42	100%	56	100%	48	100%

Table 9 details the length of the respondent's new leases excluding any lease renewal options.

The lease terms across the property markets appear similar with the majority of respondents preferring short term leases with major space occupiers committed to leases greater that 12 years. The long leases in the retail market represent organisations associated with major shopping centre anchor tenants. The average new lease term for an organisation with less than 2,000 sqm was 5 7 years for office and 5.8 years for retail space. For industrial space to 10,000 sqm, the average new lease term was 6.4 years

Combining the respondent's information on time searching and length of lease would provide a useful key in determining timing and nature of future space demand. The scattergram in Figure 1 shows the relationship.

The scattergram illustrates a concentration of points at the convergence of the horizontal and vertical axis with the slope of the points moving upwards from left to right providing a positive association. However, a correlation co-efficient of 0.3 indicates an overall moderate to weak relationship On removing the two outliers there is only a slight improvement. A linear correlation co-efficient of 0.4 to 0.5 for the three property markets suggests a moderately positive relationship of time searching and length of lease. Although the information is inconclusive, the scattergram does clearly show the limited time organisations spend in searching for new space

Section Three: Decision Making – Degrees of Importance of Economic Influences

The survey examined in two stages the factors that influenced the organisations' decision making process for the new space. The degrees of importance of the

Table 9 Length of New Space Leases (excluding renewals)

Lease Term	Office		Industrial		Retail	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
0-6 years	25	60%	30	55%	51	82%
7-12 years	14	33%	24	44%	4	6%
13-18 years	3	7%	1	2%	0	0%
19-24 years	0	0%	0	0%	1	2%
>24 years	0	0%	0	0%	6	10%
Total	42	100%	55	100%	62	100%

Figure 1 Scattergram of Time Searching by Lease Terms
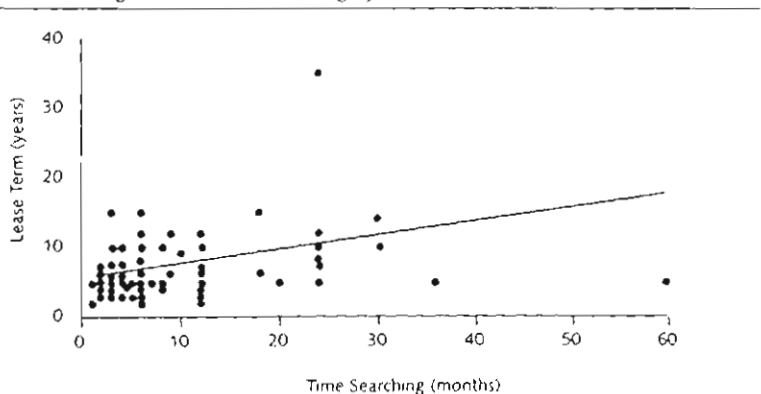
identified factors were rated by the respondents on a Likert scale from 1 (nil) to 7 (extremely high) The first stage covers current macro-economic influences including property market dynamics, technical change, political and economic factors The second stage covers current micro-economic influences building locality, business profiles, cost implications, lease arrangements and occupiable space The response by property category to all questions is shown in Table 10.

The current macro-economic issues identified considerations relevant to present market conditions and separate from company specific factors. Figure 2 shows the respondents' degree of importance on current macro-economic considerations

The degree of importance of macro-economic influences recorded a low to average level across the property markets. The retail and industrial markets presented similar results for economic factors, property market dynamics and technical change The office market respondents placed a

distinct premium on current property market dynamics and technical change, rating them above economic factors by 5% and 13% respectively

All respondent groups marked political implications very low to low Similar scores were recorded on all Federal, State and Local government questions covering fiscal, monetary and planning issues The low score contrasts to the governments' direct and indirect effect on the performance of the economy and property markets.

The technical change category provided the most variation with the office respondents rating the importance of new technology 23% above industrial respondents and 33% above retail respondents Similarly, the office (±1 3), industrial (±1 6), and retail (±1 8) standard deviations further demonstrate the diversity within occupier groups. The results illustrated the varying impact of technical change on the property markets and individual space occupiers

Figure 3 shows the influence of current micro-economic factors on organi-

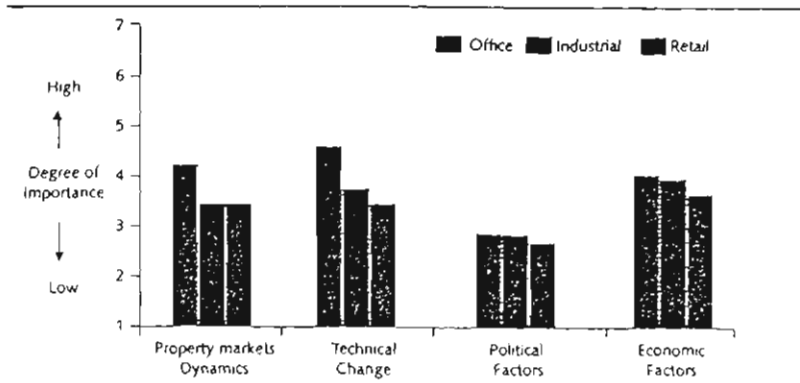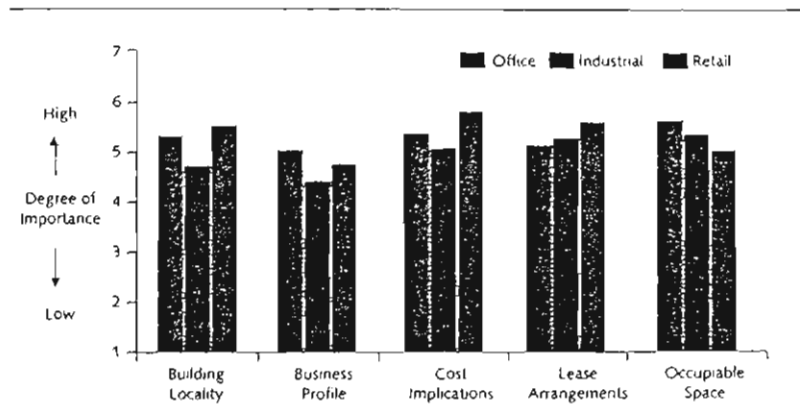Figure 2 Influence of Current Macro-economic Factors on New Occupier Decision Process

Figure 3 Influence of Current Micro-economic Factors on New Occupier Decision Process

sation's decision process for new space The ranges of group responses for all micro-economic influences were in a relatively narrow 4.4 to 5.8, average to high band. When ranked, office and industrial respondents placed occupiable space aspects first compared to cost implications preferred by retail respondents. Business profile received the lowest grade from all property categories with lease arrangement scoring second lowest for office and the second highest for both retail and industrial.

The technical change represents the impact of new technology on an organisation's operation and requirements in the various property markets. New technology in the office market offers the ability for diversity and greater flexibility in work practices like hoteling and telecommuting. Alternatively, new technology can provide a streamline logistic solution replacing multiple layers of real estate used in manufacturing, warehousing and retailing Goods can move directly from manufacturer to the retail store and with electronic shopping from the manufacturer direct to the consumer

Generally, the differences in the responses to micro-economic influences were associated with the operational features of the organisations in the individual property markets The retail organisations appear driven by customer needs, whilst the office and industrial organisations seem to focus on organisational issues For example, pedestrian access and proximity to public transport provide limited locality benefits to wholesale trade, transport and storage organisations, which represent the main industry category for industrial occupiers. Similarly, most retail organisations surveyed occupy limited space and

with few employees, their space cost considerations take preference to issues relating to organisational structures and the working environment

Conclusion

The commercial property market landscape is changing to accommodate the requirements of organisations as they respond to new business environments Survey information about new space occupiers in three leading property markets contained in this report illustrate the diversity in industry categories, organisation structures and space requirements Specific features of the new space survey results included·

- Organisation decision to occupy the new space as part of a recent merger or acquisition represented 40% of office market respondents and to a lessor extent, retail (26%) and industrial (15%) If the current growth in mergers and acquisitions continues it will have a major impact on commercial property markets A merger and acquisition index should be established to monitor the affect by property class and industry category

- It is necessary to understand the sources of demand, as in this study, demand for space from new business activity was all but restricted to the retail market Generally, new office and retail space demand was from organisations in the local vicinity with industrial occupiers more flexible in relocating or expanding to surrounding areas

- The demand for space can change rapidly as the time organisations searched for new space in the selected property markets was predominantly less than six months and the relationship to the agreed lease term was inconclusive

Organisations placed more importance on current micro-economic issues than

Table 10 Economic Influences on Organisations' New Space Decision

	Office	Industrial	Retail
Macro Economic Factors			
1. Property Market Dynamics			
a Current property market	4 2	3 4	3 4
b Available supply	5 6	5 9	5 9
c Future supply	5 3	5 5	4 3
d Forecast rentals projections	4.5	4 3	4 0
2. Technical Changes			
a New technology	4 6	3.7	3 4
b Future technological advances	4 5	3 8	3 5
3. Political Factors			
a Monetary policies	3 0	2 9	2 7
b Fiscal policies	2.9	2 7	2 7
c Political policies	2 8	2 9	2 5
d State Government	2 8	2.9	2 5
e Local Government	2 8	3.2	2 9
4. Economic Factors			
a Organisation specific	5 4	5 7	5 2
b Industry -wide	4 3	4 5	4 4
c Australian economy	4 0	3 9	3 7
d Global economy	3 6	3 1	3.1
e. Economic forecasts	3 9	3 6	4 0
Micro Economic Factors			
5. Building Locality			
a Pedestrian accessibility	5 2	3 8	6 0
b Public transport	5 6	4 3	5 1
c. Vehicle access/transport	4 8	5 9	5 8
d Surrounding amenities	5.5	4 7	5 1
6. Business Profile			
a Image	5 5	4 7	5 6
b Vicinity to clients	5 0	4 6	4 9
c Locality associated with business category	4 6	4 1	5 1
d organisational structure	5 0	4 1	3 2
7. Cost Implications			
a Total occupancy costs	5 7	5 6	6 2
b Unit cost of space	5.0	4 6	5 4
c Fit out costs	5 3	4 9	5 7
8. Lease Arrangements			
a Previous lease expiry	4 4	4 1	5 2
b. New lease length	5 1	5.4	5 5
c Rent review structure	5 2	5 3	5 7
d Flexible lease terms	5.0	5 1	5 6
9. Occupied Space			
a Space flexibility	5 5	5 5	5 2
b Employee working environment	5 6	5 2	4 4
c Standard of building finishes and services	5 6	5 2	5 3

Note Importance of influences measured on a Liken Scale
1=Nil, 2=Very Low, 3=Low, 4=Average, 5=High, 6=Very high, 7=Extremely high

on current macro-economic issues in their new space decision process. For macro-economic influences, office occupiers registered a distinct premium on property market dynamics and technical change to retail and industrial organisations. Generally, the differences in the micro-economic influences

appear driven by retail customer needs to office and industrial organisational issues. The collection and evaluation of this information will in the future form an integral part of major property development and investment decisions.

Knowledge on the rapid changes in business environment is now a

requirement to comprehend the causes and patterns of new space demand and the prospects for commercial property markets. This type of structural market analysis is the framework for understanding the complex dynamics of the demand market and the backbone to future research on commercial property markets

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Available on the API website - www.propertyinstitute.com au

Footnotes

1 Retail survey excluded food courts, kiosks and single stand-alone retail operators Classification of prime industrial space made on recognised industrial location and recorded annual rental above $100,000 per annum

2 See Higgins (2000) for total property stock information as at December 1998

Biography

Influences on Australian organisations' new space demands

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ABSTRACT

New business opportunities and challenges are changing the structure of office, industrial and retail organisations and altering the pattern and demand for space These agents of change on organisations' decisions for new space formed the basis for a questionnaire survey of 167 new space occupiers An index of degree of importance constructed from the results can provide a new platform for corporate real estate planning

and a strategic approach to commercial property market decisions.

INTRODUCTION

The last few years have witnessed a major transformation as organisations have embraced new business opportunities and challenges from the emerging new world economy, with global, financial deregulation and significant advances in communication and information technology. To succeed, organisations have to respond and adapt to the changing business environment with restructuring and new working practices.

The pattern and demand for space are altering to accommodate the changing needs of organisations. Comprehensive surveys of organisations[1] reveal the structural changes and the real estate implications Similarly, Joroff et al. (1993) and Becker and Joroff (1995)[2] provide an insight by case study into the future role of commercial real estate. A common theme in the reports is the requirement for better understanding of organisation decisions for new space.

Space demand has historically focused on local economic dynamics. These traditional views do not seem adequate to

explain new patterns of demand associated with changes in organisational structures. A fresh approach is to examine the level of importance of factors that influence organisation decisions for new space. These agents of change on organisations' space decisions can be measured and translated into a structural appraisal of the requirements for space, providing a platform for corporate real estate planning and a complement to the traditional analysis linking space demand to the local economy.

According to Roulac (1995, p. 17),[3] real estate decisions are driven by the problems and choices faced by organisations in the real estate markets and are influenced by a multitude of forces that define the environment in which such decisions are made. Several reports have identified and analysed these factors; for example, Guy and Harris (1997, p. 133),[4] Nourse and Roulac (1993, p. 486)[5] and Maginn and Tuttle (1990, pp. 6–54).[6] The opportunity is to model organisation decisions for new space on these factors.

Performance measures are common in facilitating and assisting in determining real estate decisions. Theses can range from basic tools to measure the property performance as an asset[7] to benchmarking corporate facility design and management standards.[8] In the search to understand and improve the performance of real estate, Noha (1993, p. 513)[9] suggests the benefits of benchmarking critical real estate drivers. This is similar to the practical applications extensively documented in social science research: for example, marketing strategies and the affect on consumer behaviour.[10]

The aim of this paper is to identify and evaluate the factors influencing organisations' new space decisions. The report investigates and benchmarks the influences on the decisions of organisations that in the past two years com-

mitted to new space in three leading Australian commercial property markets: Sydney CBD prime office; Sydney prime industrial; and NSW regional shopping Centres. Details of the specific markets appear in Table 1.

The remainder of this paper has been divided into three sections: first, the research design detailing the framework of influences selected for the questionnaire and the statistical model for the degree-of-importance index. Secondly, the research results are detailed and analysed, and finally, there are some concluding remarks.

RESEARCH DESIGN

For the purpose of this study, five leading property organisations provided published information and their own new leasing deals covering the period from July 1997 to June 1999 for the Sydney CBD prime office, Sydney prime industrial and NSW regional shopping centre markets.[11] The target population was organisations that committed to new space outside their current location. The identified 437 new space occupiers (office 124, industrial 146 and retail 167) were sent a questionnaire in late 1999. Where possible the questionnaire was addressed specifically to the senior executive who made the new space decision.

The questionnaire was based on the literature review and a pilot study Figure 1 categorises the 34 multi-choice questions to macroeconomic and microeconomic factors. The organisations rated each factor on a Likert scale from 1 (nil) to 7 (extremely high) in relation to the degree of importance in their decision to occupy the new space. For confidentiality all information is reported in a summary format.

For each factor the response on the Likert scale was recorded and shown as a

Table 1: Details of leading Australian property markets[1]

Property market characteristics	Sydney CBD prime office market[2]	Sydney prime industrial market[3]	NSW regional shopping centres[2]
Value (AU$)	9.1 billion	5.1 billion	4.8 billion
Floor space (m²)	1 4 million	6.9 million	5 1 billion
Number of buildings	58	Not known	27
Location	Defined geographic location of 3 7 sq. kilometres	Dispersed; defined by land value and associated infrastructure	Geographically scattered dependent on location demographics
Status of research	Extensive and well documented	Limited to specific locations, primarily rents and yields	Specialised and limited to overall performance
Planning issues	Extensive local planning controls	Leading development being pre-committed on greenfield sites	. Restricted to extensions and refurbishment of existing centres
Development time-frames	Long term (2–5 years)	Short term (1–2 years)	N/A
Key feature	Impact of new supply and technological change on office space use	Changing market — both location and type ie manufacturing to hi-tech etc	More than 40% owned/managed by one company

[1] As published data on the extent of NSW property markets are limited, the author provides estimates made from various property market reports and personal knowledge as at December 1998. The sole purpose of the information is to provide an insight into market dynamics for this report, and it should not be used for any other purpose.

[2] Refer to Property Council of Australia literature for selection criteria.

[3] Classification of prime industrial space made on recognised industrial location and recorded annual rental above AU$100,000 per annum.

Decision Framework for
Influences on Space Demand

Level I: Categories

MacroEconomic Factors

MicroEconomic Factors

Level II: Factors (A)

Property Market Dynamics
a Current property market
b Available supply
c Forecast supply
d Forecast rental projections

Technical Change
a New technology
b Future technological advance

Economic Influences
a Organisation specific
b Industry-wide
c Australian economy
d Global economy
e Economic forecasts

Political Factors
Federal government
a) Monetary policies
b) Fiscal policies
c) Political policies
d State government
e Local government

Level II: Factors (B)

Building Locality
a Accessibility
b Public transport
c Vehicle access/parking
d Surrounding amenities

Business Profile
a Image
b Vicinity to clients
c Locality associated with business category
d Organisational structure

Cost Implication
a Total occupancy costs
b Unit cost of space
c Fit out costs

Lease Arrangements
a Previous lease expiry
b New lease length
c Rent review structure
d Flexible lease terms

Occupiable Space
a Space flexibility
b Employee working environment
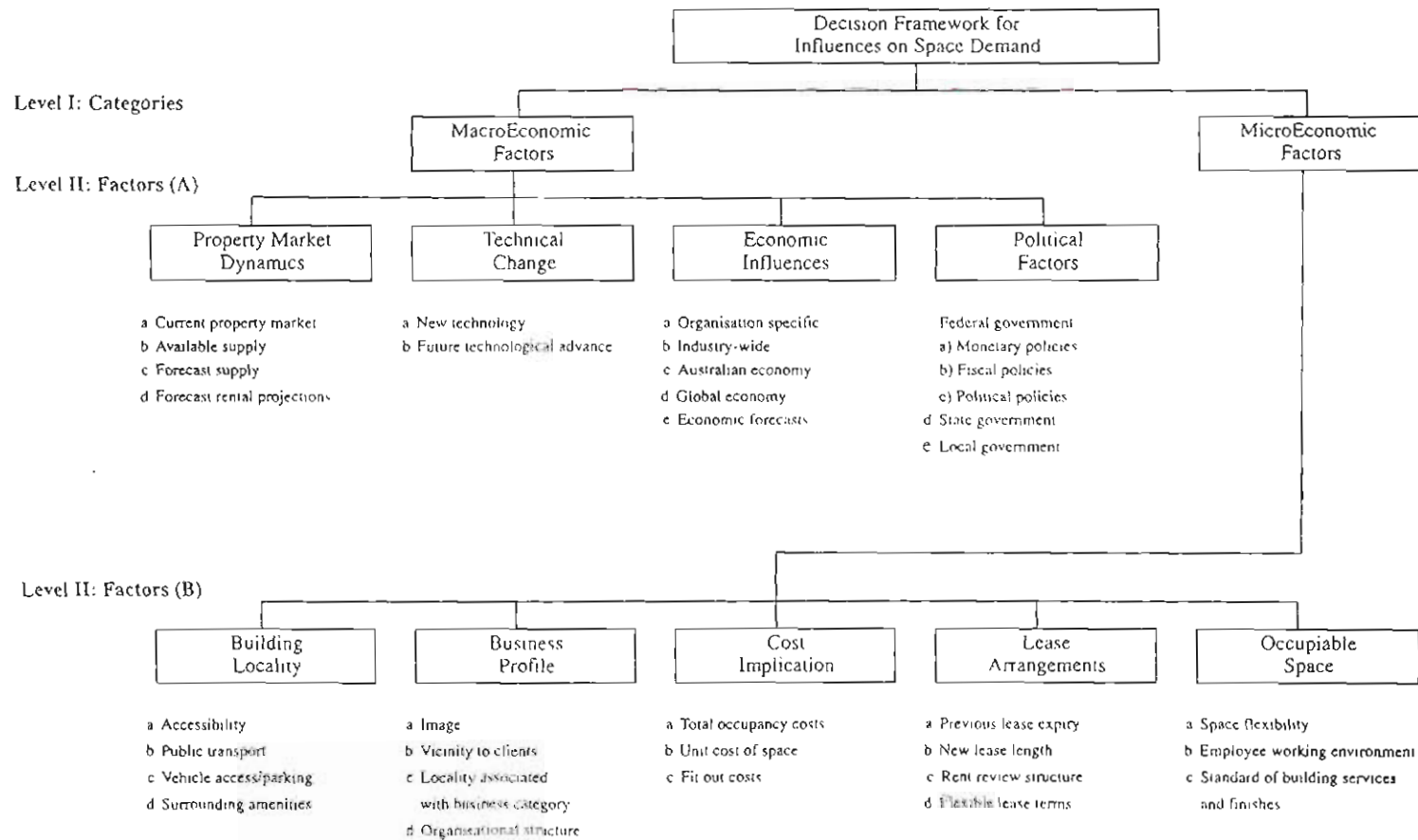c Standard of building services and finishes

Figure 1 Influences on organisations decision for new space

percentage of the total responses. The selected benchmark equation (1) below places a weighted significance on the frequency of responses to form a degree-of-importance index.

$$\text{Importance index} = \Sigma(\alpha X) * 100/f \tag{1}$$

Where:

α = the constant expressing the weighting given to each response;

X = frequency of the responses ÷ total number of responses; and

f = range of permitted responses

RESEARCH RESULTS AND DISCUSSION

There were 167 responses (office 42, industrial 57 and retail 68) to the new-space occupiers' questionnaire, providing a 38 per cent response rate. An examination of the response rate indicates a satisfactory spread across floor sizes and industry categories, showing no consistent tendency to deviate in one direction from the true value of the population parameter (see Higgins 2000 for response distribution).[12] Furthermore, the range of frequencies selected by organisations in each property category appeared similar, in so far as response weighting relates to the influences rather than respondents' bias.

The influences on organisations' new space decisions are ranked by category and individual factors. The macroeconomic influences on organisations' decisions for new space are shown in Table 2.

The degree-of-importance index for macroeconomic categories illustrates the significance of understanding property market behaviour. In providing the highest ranking in all property markets,

the interaction of the many different aspects of property market supply and demand needs to be recognised and measured. In the selected commercial property markets the level of information varies considerably because of a range of practical issues and market characteristics.

Given the significance of property market behaviour, the degree-of-importance index computations findings were that the office market ranked technical change a distinct second, compared to retail and industrial markets' third ranking below economic factors. This reveals the impact of new technology on organisations' new space decisions, with office occupiers giving a greater importance to new technology than do retail and industrial organisations.

The macroeconomic categories were loosely grouped together, apart from the low index score for political factors. Marking political factors low contrasts with the government's direct and indirect controls on social and economic issues and the planning restraints on the location and patterns of development.

Table 3 shows the degree-of-importance index of microeconomic categories on organisations' decisions for new space. The indices were in a relatively narrow band. The office and retail microeconomic categories recorded degree-of-importance scores above all corresponding macroeconomic categories.

Ranking the degree of importance for microeconomic categories illustrated the different requirements for new space occupiers. The office and industrial respondents marked occupiable space aspects first; cost implications headed the retail index. Business profile received the lowest index score from the industrial and retail categories, with lease arrangements ranked from second to fifth (last for office market) in the selected property classes.

Categorising and then indexing the de-

Table 2: Influence of macroeconomic categories on organisations' decisions for new space

	Office					Industrial					Retail				
	Percentage of respondents			Importance		Percentage of respondents			Importance		Percentage of respondents			Importance	
Categories of influences	<3	4	>5	Index	Rank	<3	4	>5	Index	Rank	<3	4	>5	Index	Rank
Property market dynamics	9%	19%	72%	70	1	14%	20%	66%	68	1	11%	23%	66%	63	1
Economic influences	18%	30%	52%	60	3	23%	19%	58%	59	2	15%	27%	58%	58	2
Technical change	11%	20%	69%	65	2	24%	25%	51%	53	3	25%	21%	54%	49	3
Political factors	61%	29%	11%	41	4	57%	16%	27%	41	4	60%	21%	18%	38	4

Table 3: Influence of microeconomic categories on organisations decisions' for new space

	Office					Industrial					Retail				
	Percentage of respondents			Importance		Percentage of respondents			Importance		Percentage of respondents			Importance	
Categories of influences	<3	4	>5	Index	Rank	<3	4	>5	Index	Rank	<3	4	>5	Index	Rank
Occupiable space	1%	7%	91%	80	1	2%	13%	85%	76	1	8%	14%	78%	71	4
Cost implications	5%	9%	86%	76	2	5%	17%	78%	72	2	1%	9%	89%	82	1
Building locality	4%	10%	86%	75	3	12%	17%	71%	67	4	3%	12%	86%	78	2
Business profile	7%	12%	81%	72	4	18%	18%	64%	62	5	13%	17%	70%	67	5
Lease arrangements	6%	13%	81%	71	5	6%	12%	83%	71	3	2%	14%	84%	78	2

Table 4: Influence of macroeconomic factors on organisations' decisions for new space

	Office					Industrial					Retail				
	Percentage of respondents			Importance		Percentage of respondents			Importance		Percentage of respondents			Importance	
Macroeconomic Factors	<3	4	>5	Index	Rank	<3	4	>5	Index	Rank	<3	4	>5	Index	Rank
Property Market Dynamics															
a) Current property market	18%	23%	59%	60	8	33%	44%	23%	48	10	16%	50%	33%	49	9
b) Available supply	3%	3%	94%	80	1	1%	4%	95%	85	1	0%	10%	90%	84	1
c) Future supply	4%	17%	80%	76	3	4%	8%	89%	78	3	9%	6%	85%	61	4
d) Forecast rentals projections	11%	32%	56%	65	4	19%	25%	57%	61	5	19%	24%	57%	57	5
Economic Factors															
a) Organisation-specific	1%	13%	86%	77	2	1%	6%	93%	81	2	5%	7%	88%	74	2
b) Industry-wide	14%	34%	51%	61	7	15%	16%	70%	64	4	4%	28%	67%	64	3
c) Australian economy	18%	36%	45%	57	9	21%	25%	54%	56	6	18%	37%	45%	52	7
d) Global economy	29%	35%	36%	51	11	45%	32%	24%	44	12	35%	30%	35%	45	11
e) Economic forecasts	28%	30%	42%	55	10	33%	17%	50%	52	9	13%	35%	52%	57	5
Technical Changes															
a) New technology	11%	19%	70%	65	4	24%	23%	54%	53	8	27%	19%	54%	49	9
b) Future technological advances	11%	22%	68%	65	4	24%	28%	48%	54	7	24%	22%	54%	50	8
Political Factors															
Federal government:															
a) - Monetary policies	56%	26%	17%	42	12	54%	15%	32%	42	13	62%	20%	18%	39	13
b) - Fiscal policies	58%	23%	18%	42	12	67%	13%	20%	39	15	59%	22%	18%	38	14
c) - Political policies	63%	28%	9%	40	14	69%	17%	14%	36	16	64%	23%	13%	37	15
d) State government	61%	35%	4%	40	14	52%	20%	29%	41	14	64%	24%	12%	36	16
e) Local government	64%	32%	4%	40	14	43%	13%	43%	45	11	51%	19%	30%	41	12

gree of influences provide the framework for organisations' decisions for new space. Identifying individual factors can highlight specific considerations. Table 4 shows the degree-of-importance index for all macroeconomic factors.

The degree-of-importance index for macroeconomic factors displayed similar scores for individual influences in the categories of technical changes and political factors. This compared to a range of scores for specific influences in the property market dynamics and economic factor categories. The highest-ranked influences related to defined supply and economic characteristics affecting organisations' space decisions. Political factors recorded the lowest rankings.

The degree-of-importance index exhibited a similar span in the property classes, although the emphasis differed, the top five ranked industrial and retail influences accounting for nearly 50 per cent of range. The office market appeared more constant, with relatively equal distribution of marks.

A distinct variation was the emphasis placed on economic forecasts by occupiers of new retail space when compared with the importance placed on aspects of technical change by new office occupiers.

Table 5 shows the degree-of-importance index for the microeconomic influences. The scores for the individual influences were associated with the organisations' operational features in the selected property markers. Generally, microeconomic influences for new space occupiers appear driven by total costs and then, separately, office by organisational issues; industrial by building flexibility and access; and retail by customer needs.

The differences in the property sectors can be illustrated further:

Office Market: The degree-of-importance index is in a narrow 18-point band, with the top five influences covered by two points. These represent: total occupancy costs; employee working environment; public transport; building image; and standard of finishes and services. The least important were previous lease expiry and locality associated with business category

— *Industrial Market*: The 29-point span in the degree-of-importance index exhibited a consistent spread of influences The top influences were vehicle access/parking; total occupancy costs, space flexibility, new lease length; and rent review structure. The least important was the same as the office market plus pedestrian accessibility.

— *Retail Market*. A wide 43-point range appeared in the degree-of-importance index, with the bottom three influences spanning 22 points. The top influences were: total occupancy costs; pedestrian accessibility; vehicle access/parking; fit-out costs; and rent review structure. Employee working environment, organisational structure and vicinity to clients were the least important.

The microeconomic influences on occupiers' decisions for new space were associated with the operational features of the organisations Table 6 illustrates the range of most and least important influences on the selected property markets.

A common factor in organisations' decisions for new space was the high degree of importance placed on total occupancy costs The difference to the low-ranking unit cost of space suggests organisations see space as primarily a large single-expenditure item. The significance of space as part of an organisation's strategic demand requirement for a competitive advantage can be illustrated by the very low importance placed on

Table 5: Influence of microeconomic factors on organisations' decisions for new space

	Office					Industrial					Retail				
	Percentage of respondents			Importance		Percentage of respondents			Importance		Percentage of respondents			Importance	
Macroeconomic Factors	<3	4	>5	Index	Rank	<3	4	>5	Index	Rank	<3	4	>5	Index	Rank
Occupied Space															
a) Space flexibility	3%	9%	88%	79	5	2%	8%	90%	79	3	3%	9%	88%	74	11
b) Employee working environment	1%	5%	94%	81	1	3%	16%	82%	75	5	17%	22%	61%	63	17
c) Standard of building finishes and services	0%	9%	91%	80	3	2%	14%	84%	74	7	5%	11%	84%	76	10
Cost Implications															
a) Total occupancy costs	0%	8%	92%	81	1	0%	11%	89%	80	2	0%	3%	97%	89	1
b) Unit cost of space	7%	13%	80%	71	13	9%	20%	71%	65	12	4%	11%	95%	77	9
c) Fit-out costs	8%	5%	87%	76	8	6%	20%	74%	70	9	0%	14%	86%	81	4
Building Locality															
a) Pedestrian accessibility	2%	13%	85%	74	10	22%	18%	59%	55	18	1%	7%	92%	85	2
b) Public transport	1%	9%	91%	80	4	17%	16%	66%	61	14	3%	19%	78%	73	13
c) Vehicle access/parking	12%	10%	78%	68	16	1%	6%	93%	84	1	1%	5%	94%	83	3
d) Surrounding amenities	0%	10%	90%	78	7	7%	27%	66%	67	11	5%	15%	79%	72	15
Business profile															
a) Image	2%	7%	91%	79	5	13%	10%	77%	68	10	0%	15%	85%	80	6
b) Vicinity to clients	9%	8%	84%	71	13	15%	20%	65%	65	12	9%	11%	80%	70	16
c) Locality associated with business category	9%	17%	74%	65	17	25%	17%	58%	58	16	3%	12%	86%	73	13
Lease Arrangements															
a) Previous lease expiry	7%	8%	75%	71	13	17%	26%	57%	59	15	41%	29%	29%	46	18
b) New lease length	13%	8%	80%	63	18	14%	12%	74%	58	16	2%	13%	85%	74	11
c) Rent review structure	3%	17%	80%	73	11	1%	8%	91%	77	4	1%	15%	84%	78	8
d) Flexible lease terms	2%	17%	81%	75	9	3%	15%	82%	75	5	3%	11%	86%	81	4
	5%	12%	83%	72	12	5%	12%	84%	72	8	1%	16%	83%	80	6

Table 6: Main microeconomic influences on organisations' decisions for new space

Degree of Importance	Office	Industrial	Retail
Highest	Total occupancy costs	Vehicle access/parking	Total occupancy costs
	Employee working environment	Total occupancy costs	Pedestrian accessibility
	Public transport	Space flexibility	Vehicle access/parking
	Vehicle access/parking	Locality associated with business category	Vicinity to clients
	Locality associated with business category	Previous lease expiry	Employee working environment
Lowest	Previous lease expiry	Pedestrian accessibility	Organisational structure

previous lease expires by office and industrial organisations.

CONCLUSION

The commercial property market landscape is changing to accommodate the requirements of organisations as they respond to new business environments. Measuring the decision influences on new space occupiers illustrates the range and importance of factors relative to selected property markets. The survey information on new space occupiers identifies the demand for space not simply as a function of the local economy, but a consequence of wider macroeconomic and microeconomic issues.

Organisations place a distinct premium in their space decisions on microeconomic factors. The leading factors range from customer needs in the retail markets to organisational issues for office and industrial markets. The least important factors were previous lease expiry and locality aspects for office and industrial markets and organisation and workforce issues in the retail market.

The macroeconomic factors in the degree-of-importance index display simi-larities in the property markets, with the highest-ranked influences related to defined supply and economic characteristics affecting organisations' space decisions. A distinct variation is the emphasis placed on economic forecasts by new retail space occupiers, compared with the importance of technical change to new office occupiers. This reflects the nature of retail operations and influences of new technology in the office workplace, compared to alternative property classes.

Knowledge of the changing business environment and organisation structure is now a requirement to comprehend the causes and patterns of new space demand. Benchmarking the degree of importance of influences on organisations' new space decisions can provide the framework for understanding the complex drivers determining future space demand

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