Corporate Behaviour and Market Integration:

Evidence from the Asia-Pacific Real Estate Market

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This dissertation is submitted to the University of Technology Sydney for the degree of Doctor of Philosophy

CERTIFICATE OF ORIGINAL AUTHORSHIP

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

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

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Abstract

This dissertation studies Asia-Pacific real estate market in four key ways: Japanese REIT (J-REIT) mergers, dividend policy of J-REITs and Singaporean REITs, volatility spillovers of foreign information on main Asia-Pacific entities, and the house price comovement in Australian capital cities. It contributes to the real estate literature in terms of corporate behaviour and market integration in the Asia-Pacific real estate market.

Following the Global Financial Crisis (GFC), a wave of mergers occurred in J-REITs. The first essay examines how the local market reacted to these mergers and whether the mergers were successful in improving the prospects of the firms involved. I find significant abnormal trading volume for both surviving and absorbed J-REITs in the immediate days after the merger announcements and significant negative return responses for absorbed J-REITs in the two days before the merger announcements. There was no significant improvement in operating performance post-mergers, and the merger premium for J-REITs inversely predicts post-merger performance.

The second essay examines the motivation for and the effects of Asian REITs paying dividends in excess of mandatory level. I find a substitution role of discretionary dividend payments for reduced agency costs and a significant positive relationship between paying discretionary dividends and externally financed growth.

The third essay quantifies the magnitude and time-varying nature of global and regional volatility spillovers from the US and aggregate Asia-Pacific to individual Asia-Pacific securitised real estate markets respectively. Asia-Pacific real estate markets are generally more sensitive to regional shocks than they are to global shocks from the US. Relative to emerging Asia-Pacific real estate markets, developed markets are more susceptible to

foreign information. Furthermore, I argue that the time invariant volatility spillover intensities are due to monetary policies and the recent GFC.

The fourth essay examines inter-city housing price comovement in eight capital cities in Australia from 1999 to 2015. I find that on average, housing prices in Brisbane correlated most with other capital cities, followed by Canberra and Sydney, while in Darwin housing prices tended to move in the opposite direction to those in other capital cities. From a series of panel regressions, I also find that demand for dwellings enhances housing price co-formation across cities, while increases to local household consumption power and increases to the supply of dwellings result in less intercity housing price comovement.

Introduction

The thesis aims to examine the corporate behaviour and market integration issues in the Asia-Pacific real estate market. Corporate behaviour is an important research area in corporate finance and covers a wide range of topics. This thesis focuses on corporate decisions related to takeover and dividend policy in Asia-Pacific real estate investment trusts (REITs). The following questions have become critical problems to investors and are also examined in this thesis: As globalisation and regional integration enhance real estate market interdependence, how has the Asia-Pacific securitised real estate market responded to foreign shocks? How do intercity housing prices comove in a private real estate market? In four essays on Asia-Pacific real estate markets, this thesis contributes to the literature on real estate by examining corporate behaviour and market integration and fills a gap in the literature by obtaining empirical evidence from Asia-Pacific real estate markets rather than the more dominant US market.

The Asia-Pacific real estate market has grown fast in the last decade as plenty of local and international real estate capital has flowed in. On the one hand, sovereign wealth and institutional capital augment capital injection into Asia-Pacific real estate markets; on the other hand, Asia-Pacific capital has become increasingly dominant in the post-global financial crisis (GFC) environment, especially given the substantial volumes of capital being exported from individual Asia-Pacific countries (China, South Korea and Singapore) into real estate assets across the region. Additionally, although terms for credit may have tightened very slightly in some markets, most Asia-Pacific banks have retained their customary accommodating posture. The loan-to-value ratios remain at 60 to 65 per cent across Asia (and are even higher in Japan), while the cost of debt remains low. The capitalisation of the Asia-Pacific securitised real estate market accounted for 48 per cent of global property securities in 2009. Despite equity prices having dropped significantly in 2013 due to the threat of a tapering of US economic stimulus, the Asia-Pacific securitised real estate market is maintaining its significant position globally. The private market for real estate has not been significantly affected and prices continue to drift upward as they have for the last five or so years.

By investigating not only the Asia-Pacific securitised real estate market but also the physical property market, this thesis provides insights into corporate behaviour and market integration issues. The main topics discussed in this thesis are: (1) how the market reacted to the wave of mergers in Japanese real estate investment trusts (J-REITs) following the GFC and whether these takeover decisions created synergy (2) why Asia-Pacific REITs seek access to more costly external funds while at the same time shrinking the availability of internal funds through paying additional dividends that are not required by law (3) how globalisation and regional integration have led to interdependence between the Asia-Pacific securitised real estate market and global market, and (4) how housing prices comove across cities and what the forces driving this process are.

Using an event study methodology, the first essay (Chapter 1) focuses on the J-REIT market and investigates the market response and shareholder wealth effects around merger announcements for both targets and acquirers. The essay investigates whether there is any improvement in operating performance after mergers, and whether the size of abnormal returns predicts post-merger performance. It also provides some hints for other emerging REIT markets on whether mergers can be an effective way for firms to overcome financial problems. I find results that support the unique nature of J-REITs in takeovers. Both the surviving and the absorbed J-REITs experienced significant abnormal trading volume in the two days after the announcement, while only the absorbed J-REITs had statistically significant and negative abnormal returns in the two days before the merger announcements. The cumulative abnormal returns for the surviving and the target J-REITs were +0.12% and -18.16% respectively, over a three-day event window of [-1, 1]. This finding is inconsistent with the reported US REIT market reactions where acquiring REITs have negative abnormal returns and absorbed REITs gain higher and positive abnormal returns over the three-day event window. Actual post-merger performance also differs from expectations given that the mergers are undertaken in order to improve performance. I find no evidence of any significant improvement in operating performance after mergers. I do find that those mergers that suffer negative cumulative abnormal returns over the event window of [0, +2] generally show greater improvement than those J-REITs that experience higher positive cumulative abnormal returns immediately after the merger.

In the second essay (Chapter 2), I examine two representative Asian REIT markets, the Japanese REIT market (J-REIT) and the Singaporean REIT market (S-REIT) to investigate whether paying dividends in excess of the mandatory level enhances firm growth and whether the growth firms experience can be attributed to the role of discretionary dividends in reducing agency costs. A simultaneous equation model (SEM) is applied to describe the relationship between agency costs, discretionary dividends, and externally financed growth. The model consists of two equations: a discretionary dividend equation and an externally financed growth equation. I apply both pooled and cross-sectional two-stage least square (2SLS) regressions to estimate all the coefficients of the SEM. Equation (1) describes the determinants of discretionary dividend payments, including two variables as proxies for agency costs. I find that more non-mandatory dividends are paid for reducing the potentially increased agency costs. In equation (2) I regress externally financed growth on the fitted discretionary dividends obtained from equation (1) and find a significantly positive relationship between externally financed growth and discretionary dividend payments. Summarising the findings from the SEM, I conclude that the reduced agency costs obtained by paying discretionary dividends can be reflected in the growth of REITs. This essay contributes to the literature on REIT dividend policy by focusing on Asian REITs which have a different market structures to the US REIT market. The findings provide support to the agency cost explanation for paying discretionary dividends with a sample of non-US REITs. They also support the view that distributing dividends in excess of mandatory level enhances firm growth, and they confirm that REITs manage dividend policy to facilitate their access to external capital markets to fund growth.

To understand market integration in the Asia-Pacific securitised real estate market, the third essay (Chapter 3) examines the following questions: (1) Do the US and aggregate Asia-Pacific markets have significant mean and volatility spillover effects on individual Asia-Pacific securitised real estate markets? (2) To what extent can the conditional variance of individual Asia-Pacific securitised real estate markets be explained by global and regional shocks? (3) Was there any change in volatility transmission during the GFC period? and (4) What are the determinants of the time varying volatility spillover intensities? I apply an extended autoregressive (AR) model in which the conditional volatilities are examined using a GARCH (1, 1) model to measure the volatility spillovers from both the US and aggregate Asia-Pacific securitised real estate markets in ten individual securitised real estate markets in Asia (i.e. Australia, Hong Kong, Singapore, Japan, Mainland China, Taiwan, Malaysia, Thailand, the Philippines and Indonesia). As the sample period covers the period of the GFC, another interest in this study is to examine the impact of the GFC on the US and Asia-Pacific volatility spillover effects and market integration. Therefore, I extend the volatility spillover model in Christiansen (2007) by assuming that the volatility spillover effects are different during the GFC period. I find that Asia-Pacific real estate markets were more sensitive to the information transmitted within Asia than they were to information from the US, although all of them experienced significant volatility spillover effects from both the US and aggregate Asia. This finding confirms the necessity of differentiating between regional and global effects. I also find that US volatility spillover effects increased significantly during the GFC period for most Asia-Pacific real estate markets. This indicates the asymmetric nature of US volatility spillovers which mean that the global shocks from the US are greater in down markets than in growth markets. Additionally, the monetary policies that reflect the currency hedging costs and the GFC also play leading roles in affecting the volatility spillover intensities.

The fourth essay (Chapter 4) examines intercity housing price comovement in the Australian housing market in the period from 1999 to 2015 and identifies the driving forces of the evolution of market correlations. I use the dataset of RP Data-Rismark Home Value Indices to measure the process of home value co-formation in Australia's eight capital cities. The time-varying conditional correlations between capital cities are measured. I apply a multivariate VAR (1)-DCC-GARCH (1, 1) model for various home returns and obtain the intercity conditional correlations after controlling for asymmetric volatilities and for the influence of other markets. Our results confirm the time-varying nature of intercity housing price comovement. I also find that (1) Perth is the only capital city whose home values are rarely influenced by the other capital cities. (2) Sydney suffers more asymmetric effects in volatility that the other capitals, as the estimated leverage coefficient in the GARCH model is significant and larger than for the other cities. (3) On average home values in Brisbane comove most with other capital cities, followed by Canberra and Sydney while Darwin moves in a contrary direction to other capital cities.

I also examine the determinants that cause the conditional correlation dynamics by making panel regressions. I find that household power of consumption, and demand and supply in dwellings play important roles in determining intercity housing price comovement. Lower local unemployment rates and higher consumption expenditure, which indicate higher consumption capacities, are associated with more co-formation of housing prices across cities. Second, higher demand for dwellings due to increases in local populations will make housing prices more closely correlated across cities. Third, larger dwelling unit supply will weaken intercity housing price correlations. Additionally, larger disparities in unemployment rates, and less disparity in consumption expenditure or housing supply between capital cities, will enhance intercity housing price comovement.

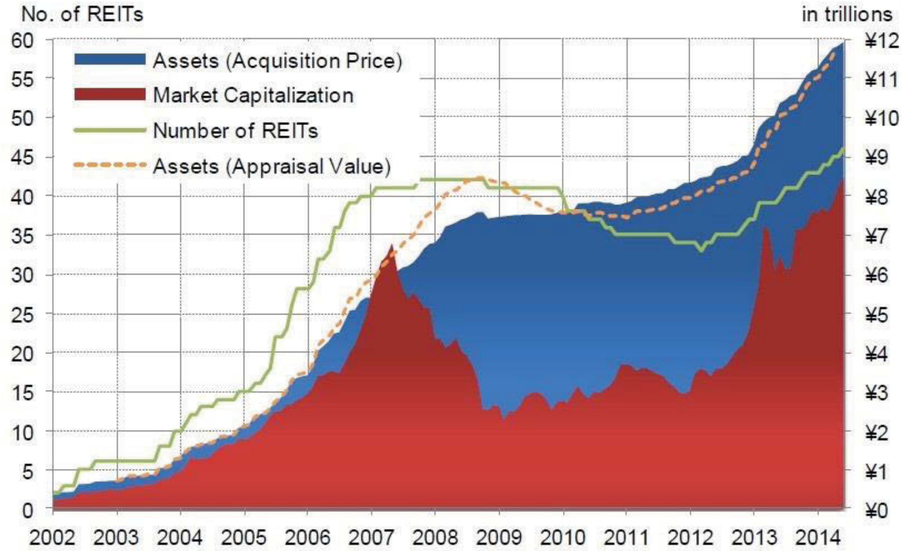
Chapter 1

Takeovers and the market for corporate control in Japanese REITs

1.1 Introduction

Japanese Real Estate Investment Trusts (J-REITs) were introduced in 2001. As the first REIT market in Asia, Japan now has the most REITs in Asia, followed by Singapore and Hong Kong. The first two J-REITs were listed on September 10, 2001 with a total market capitalisation of about $2.15 billion. As of June 2014, the market had grown to 46 listed J-REITs on the Tokyo Stock Exchange (TSE) with a total market capitalisation of $83 billion, representing a 30-fold increase. Figure 1.1 shows the development of J-REITs over the period from 2002 to 2014.[1] However, not all J-REITs survived over the entire period. Following the GFC, the market capitalisation of J-REITs sharply declined to around $24.2 billion and since then nine J-REITs have merged with other J-REITs.[2] These mergers were seen as the optimal approach to overcoming financial distress and seeking new growth opportunities.

Mergers of J-REITs are of particular interest because of their characteristics. First, REIT mergers are not as common as mergers of ordinary corporations. There is a requirement that the five largest REIT unit holders are not allowed to own more than 50% of a company, resulting in a small number of takeovers involving REITs. This arrangement provides a type of protection from takeovers for poorly performing REITs that is not available for regular companies. Second, transaction costs involved in REIT mergers may be higher than the costs incurred by regular corporations, since REITs are required to hold at least 75% of their assets as real estate. These assets are heterogeneous, complex and illiquid, which leads to the opaque value of their underlying real estate assets. Danielsen et al. (2009) find that financial markets penalise financially opaque REITs with higher transaction costs. Harrison et al. (2011) also attribute opacity to the “five or fewer rule” (where five people can’t own more than 50% of a REIT’s equity) that reduces the level of monitoring. Third, takeovers involving synergy across vertically organised businesses may not be as important in real estate since the primary assets all share the same characteristics.



Note: This figure is sourced from the Association for Real Estate Securitisation (ARES).

Figure 1.1 Size of J-REIT market from 2002 to 2014

Mergers are usually associated with the market for corporate control that disciplines poorly performing companies by instigating takeovers and improving efficiency through new management. Arguably, all companies are vulnerable in this market and therefore poorly performing companies will be absorbed or taken over, and subsequent performance will improve. Empirical research on takeovers has confirmed this phenomenon using US REITs. To our knowledge, no work in this area has investigated J-REITs. However, the takeover effects evident in US REITs may not be applicable to J-REITs due to their unique regulatory, management and tax environments. Documenting similarities and differences in the J-REIT markets is important since the unique J-REIT environment may render the market less effective if takeovers are restricted.

J-REITs have characteristics that are different from US REITs and from other Asian REITs. First, like the US REITs, J-REITs are generally formed as corporations while most other Asian REITs are structured as trusts (e.g. Singapore and Hong Kong). Second, the asset management function in J-REITs must be outsourced to an asset manager. This external management structure is common in Asia but is rare in the US. Third, the REIT sponsor plays an important role in the Asian REIT market. The sponsor is typically a participant in the real estate industry and the entity that sources the properties that are initially placed into the REIT at the time of listing. In addition to the external manager, the sponsor in Asian REITs is also very connected to the operations and cash flows of the REIT. This may lead to more potential conflicts of interest in Asian REITs.

The purpose of this chapter is to extend the international REIT merger literature. In particular, by examining a sample of eight public-to-public J-REIT mergers, this study investigates: (1) the market response and shareholder wealth effects around merger announcements for both targets and acquirers, (2) whether there is any improvement in operating performance after mergers, and (3) whether the size of abnormal returns predicts post-merger performance. This study also provides some hints for other emerging REIT markets on whether mergers can be an effective way for REITs to overcome financial problems.

I find results that support the unique nature of J-REITs in takeovers. Both the surviving and the absorbed J-REITs experience significant abnormal trading volume in the two days after the announcement, while only the absorbed J-REITs have statistically significant and negative abnormal returns in the two days before the merger announcements. The cumulative abnormal returns for the surviving and the target J-REITs are +0.12% and -18.16%, respectively, over a three-day event window of [-1, 1]. This finding is inconsistent with the reported US REIT market reactions where the acquiring REITs have negative abnormal returns, while absorbed REITs gain higher and positive abnormal returns over the three-day event window.[3]

The expected post-merger performance also differs from expectations given that the mergers are undertaken in order to improve performance. I find no significant evidence of any improvement in operating performance after the mergers. I do find that those mergers that suffer negative cumulative abnormal returns over the event window of [0, +2] generally have greater improvement than those J-REITs that experience higher positive cumulative abnormal returns immediately after the merger.

This chapter is organised as follows: Section 1.2 introduces the literature on REIT mergers. Section 1.3 provides details on the backgrounds of the eight J-REIT mergers in our sample. Section 1.4 discusses data and the methodology surrounding the short-term analysis around the time of announcement, with Section 1.5 reporting the results, including market responses to announcements and post-merger performance while Section 1.6 concludes the chapter.

1.2 Literature review

Berkovitch and Narayanan (1993) suggest that in friendly mergers both the bidder and the target obtain gains due to synergy. However, empirical research on this issue in the corporate finance literature suggests that targets obtain greater benefits than acquirers from mergers and acquisitions. In fact, acquiring firm shareholders typically earn negative but insignificant abnormal returns, while target shareholders enjoy significant and positive abnormal returns in ordinary corporations (Jensen and Ruback 1983, Jarrell et al. 1988 and Andrade et al. 2001).

Several explanations have been offered for the negative returns experienced by bidders. First, the hubris hypothesis of Roll (1986) suggests that managers of bidding firms always overestimate their own ability to run the takeover firm, resulting in overpayment for targets and negative returns for the bidders. Second, the method of payment in corporate acquisitions may signal valuable information to the market in a world of asymmetric information. DeAngelo, DeAngelo and Rice (1984) suggest that managers prefer a cash offer if they believe that their firms are undervalued, while a common stock exchange offer will be preferred if they believe their firms are overvalued. Travlos (1987) finds that cash is usually used for tender offers while common stock exchange offers are usually used for mergers. Therefore, mergers with common stock exchange offers may be a signal that the bidding firm is overvalued and a negative market response may result. Third, Morck et al. (1990) argue that pursuing personal objectives other than the maximisation of shareholder value by the managers of the acquiring firms might also be a reason for the negative returns experienced by bidders.

In the US most of the literature on REIT mergers has similar findings to those on non-REIT corporations. The exception is the early pre-1990 REIT literature where Allen and Sirmans (1987) find that acquiring REITs experience positive abnormal returns. The more recent REIT literature finds positive returns for targets and negative returns for acquirers. For example, Campbell et al. (1998) examine 27 mergers between equity REITs in the period from 1989 to 1998 and find acquirers' return are 1.1% lower while target shareholders gain 5.2% over the three-day period around the announcement date. Further, they suggest that without hostile takeovers, managers are likely to only negotiate mergers that are beneficial to themselves instead of operating for the benefit of shareholders. Campbell et al. (2001) examine 85 mergers between REITs (40 public-to-public and 45 public-to-private mergers) between 1994 and 1998, and report that abnormal returns for acquiring and target REITs are -0.6% and +3.0%, respectively, over a three-day event window. They attribute this negative market response to merger announcements to the overvaluation of, and overpayment for, the target stock. Similarly, also using acquisitions between 1994 and 1998, Olgun (2005) finds that target REITs show significant positive abnormal returns of 4.3% in the three-day period around the announcement date, while abnormal returns to acquiring REITs are significantly negative (-1.21%). These results are consistent with Womack's (2012) finding that three-day cumulative abnormal returns are 5.69% for targets and -1.14% for bidders. The direction of reaction is consistent for targets in Eichholtz and Kok (2008) with a larger 6.69% reaction, and insignificant positive cumulative abnormal returns reported for bidding REITs. These mostly consistent results for US REITS report positive reactions for targets and mildly negative reactions to bidders/acquirers.

The J-REIT literature has focused on the performance of J-REITs, equity offerings, financing, corporate governance and diversification effects of J-REITs in international portfolios or in mixed-asset portfolios. As stated by Ooi et al. (2011), the rapid growth of the Asian REIT market can be attributed to a boom in the number of new REIT IPOs, as well as to their aggressive growth-by-acquisition strategies. Kutsuna et al. (2008) investigate the pricing and underwriting costs of 40 J-REIT IPOs during the 2001 to 2006 period. They find that J-REIT IPOs have been popular with investors as they are backed by tangible property, with lease agreements producing relatively secure future cash flows. Moreover, they do not show the levels of significant underpricing found in US and Hong

Kong REIT IPOs. They also find economies of scale in underwriting fees for J-REIT IPOs that may lessen the underwriting costs.

Although mergers and acquisitions are costly and expose investors to high uncertainty, they are one of the preferred ways for firms to grow quickly. Ooi et al. (2011) investigate the wealth effects of 228 property acquisitions in J-REITs and Singaporean REITs (SREITs) and find a significantly positive abnormal increase in shareholder wealth around property acquisition announcements. They attribute these gains to economies of scale and better management by acquiring firms. However, Sham et al. (2009) do not find significant scale advantages in the form of increases in total assets in revenue, operating income or equity costs for larger Asian REITs. Larger J-REITs suffer significant and negative returns to scale in revenue and income variables and they do not have scale advantages over smaller J-REITs in terms of equity costs. Sham et al. also suggest that new acquisitions that fail to enhance shareholders' value could be "poison pills" used by REIT managers to avoid potential takeovers.

REITs have access to public markets for equity and debt financing, and this may give them an advantage over other commercial real estate investors when credit is tight. However, MacKinnon (2011) finds that J-REITs' premium-to-net asset value ratios are negatively affected by tighter credit conditions, which is exactly the opposite relationship to that observed in US REITs. This finding is attributed to institutional issues in the Japanese market which limit J-REITs' ability to issue equity to take advantage of market conditions. Therefore, unlike US REIT investors, the investors in Japan would not perceive J-REITs as having an advantage in tight credit conditions. As indicated in Allen et al. (2000) and He et al. (2003) the real estate sector uses long-term liabilities as financing sources. Ito (2013) argues that the negative impact of interest rate increases due to financial stresses during the global financial crisis made it difficult for J-REITs to find funding. Tang et al. (2014) examine the information content of the debt raising and refinancing activities of J-REITs. They find a positive stock price reaction that was more pronounced during the credit crunch of 2007 to 2009.

A main organisational difference between US and Asian REITs is that US REITs are structured as taxable corporations and are governed by directors or trustees, while Asian REITs are governed by a trustee structure. The trustee-asset managers are owned by or closely affiliated with REIT sponsors. In this structure, sponsors can play an important role in asset management and corporate governance. Kudus and Sing (2011) conducted one of a few studies that focuses on the corporate governance in Asian REITs. In five Asian REIT markets, Japan, Singapore, Malaysia, Hong Kong and South Korea, they examine the effects of board independence and share ownership structures on performance. They find strong non-linear insider (sponsor) effects on board independence and stock performance. The entrenchment issue identified in the US can be explained as the insiders (sponsors) using their controlling interest in REITs to appoint fewer and friendly independent directors to the boards, but this issue has not been found in Asian REIT markets. Moreover, Asian REITs with large controlling insiders outperform other REITs that are not backed by strong insider shareholdings. Unlike US REITs, in the emerging Asian REIT markets corporate governance has less impact on monitoring managers' behaviour, and the sponsor affiliation offers Asian REITs more capital and investment opportunities than non-affiliated REITs.

Maroney and Naka (2006) investigate the diversification of Japanese real estate and other assets from a Japanese investor's viewpoint and find that the diversification benefits from real estate are significant, especially after 1990. Newell and Peng (2012) also examine the attractiveness of J-REITs and find that among the major assets, J-REITs offer the best risk-adjusted returns and portfolio diversification benefits in Japan over the period from 2001 to 2011. The J-REIT market is one of the most important REIT markets in Asia and is also included in studies on international interdependence. These studies find that the J-REIT market has important implications for international real estate portfolio diversification. Using the REIT markets of the US, Australia, Japan and Singapore, Chiang et al. (2008) find that the correlations between REIT returns and those of other financial and real assets vary across countries and are also time-varying. Liow (2010) finds that the international interdependence between the US, UK, Japanese and Australian REITs increases over time, and that their links with the global stock market have increased recently. Pham (2012) finds lower correlations among Asian REIT markets, and also finds that the correlations increased during the global financial crisis. These studies consistently show the diversification effect of holding J-REITs in an international portfolio.

1.3 Background of J-REIT mergers

Following three decades of unprecedented growth, Japan's economy has been experiencing a major slowdown which began in the 1990s, but the country remains a major economic power. The economy in Japan has been gradually recovering from the recession it experienced due to the 2008–2009 GFC and the 2011 Great East Japan Earthquake. Table 1.1 presents a brief country profile of Japan.

Table 1.1
Country profile of Japan

People and society
Population: 127,103,388 (July 2014 est.)
Population growth rate: -0.13% (2014 est.)
Urban population: 91.3% of total population (2011)
Rate of urbanisation: 0.57% annual rate of change (2010-15 est.)
Population in major urban areas (2009):
Tokyo (capital): 36.507 million; Osaka- Fukuoka-Kitakyushu: 2.809 million;
Nagoya: 3.257 million Sapporo: 2.673 million

Economy (2013 est.)
GDP (purchasing power parity): $4.729 GDP - real growth rate: 2%
GDP (official exchange rate): $5.007 trillion GDP - per capital: $37,100
GDP - composition, by end use:
Household consumption: Government consumption: Investment in fixed capital: 21.6%
Investment in inventories: - Exports of goods and services: Imports of goods and services: -
GDP-composition, by sector of origin:
Agriculture: 1.1% Industry: Services: 73.2%
Unemployment rate: 4.1% (2013 est.)
Household income or consumption by percentage share (2008):
Lowest 10%: 1.9% Highest 10%: 27.5%

Notes: All data are extracted from the US Central Intelligence Agency website. Data are in 2013 US

The Japanese real estate market was affected by the GFC. In Japan, vacancy rates for both office buildings and luxury rental residences located in urban areas rose due to the GFC, and competition for acquiring tenants intensified in regional areas as a result of the economic downturn. For the J-REIT market, loan-to-value ratios increased and financing costs also rose during the GFC. Falling disposable income and increased employment insecurity led consumers to economise, resulting in a series of government economic policies to avoid further recession, such as the establishment of the Real Estate Market Stabilisation Fund. News of the establishment of these policies increased the confidence of investors and stimulated the real estate market, with the Tokyo Stock Exchange (TSE) REIT index increasing from 837.3 points on April 1, 2009 to 898.47 points on February 25, 2010. Additionally, the announcements of mergers, new property acquisitions, and public offerings were also signs of a recovery during this period. The effect of the Great East Japan Earthquake on 11 March 2011 and poor employment conditions created high levels of economic uncertainty, causing a challenging environment for J-REITs, but the Japanese real estate market has been slowly improving.

Under tough economic conditions, J-REIT mergers have been undertaken for specific purposes. Both parties involved in mergers were expected to maximise shareholders' value by improving their financial structures and asset management. After restructuring, a stronger financial position was expected to reduce financing costs and increase the availability of refinancing. Mergers were also expected to provide new growth opportunities at the beginning of the economic recovery by improving the quality of the real estate portfolio and increasing liquidity. In addition, it was expected that brand power might also be enhanced through mergers. Mergers were perceived to be one way for struggling J-REITs to overcome their financial distress and pursue new growth opportunities with lower financing. Table 1.2 shows the top 15 J-REITs listed on the TSE in terms of market capitalisation as of 30 June 2014 and the eight J-REIT mergers in our sample are also briefly introduced as follows.[4]

Table 1.2
Top 15 J-REITs listed on TSE

J-REIT	Unit Price	Price Returns (%)		Market Cap.	Property Portfolio		
		1month	1year		Total Assets	No. of Assets	Sector
Nippon Building	5.84	-0.7	3.1	8.24	10.59	73	Office
Japan Real Estate	5.82	-0.8	6.6	7.28	8.26	64	Office
Japan Retail Fund	2.25	1.7	9.9	5.18	7.91	84	Retail
United Urban	1.61	0.4	21.9	4.03	4.9	104	Office, Retail
Nippon Prologis	2.33	6	37.4	3.64	3.54	24	Logistics
Advance	2.52	1.9	19.2	3.28	4.12	221	Residential
Japan Prime	3.58	-0.5	19.8	2.96	3.99	62	Office, Retail
ORIX J-REIT	1.4	4.5	25.1	2.75	4.53	89	Office, Retail
Frontier Real	5.43	-0.2	21.1	2.69	2.64	30	Retail
GLPJ-REIT	1.12	5.2	17.5	2.34	2.81	44	Logistics
MORITRUST	1.68	6.3	-3.7	2.22	3.23	16	Office, Retail,etc.
Activia Properties	8.78	4.3	14.1	2.2	2.38	28	Retail, Office
Nomura Real	1.22	6.6	-	2.03	2.35	55	Logistics, Retail
MoriHills REIT	1.45	6.6	19	2	2.49	9	Office, residential
Japan Logistics	2.37	5.7	32.6	1.97	1.96	38	Logistics

Notes: this table introduces the top 15 J-REITs listed on the Tokyo Stock Exchange (TSE) in terms of market capitalisation as of 30 June 2014. Unit prices are in thousands of US dollars while market capitalisation and total assets are in billions of US dollars. Data sourced from the Association for Real Estate Securitisation (ARES).

Merger 1 between TGR Investment Inc. (TGR) and LCP Investment Corporation (LCP)

The first merger activity occurred in the J-REIT market when TGR (with 61 properties and total assets of $0.44 billion) merged in February 2010 with LCP (with 45 properties and total assets of $0.89 billion). Both J-REITs invested in diversified sectors. The merger was announced on 17 November 2009 during the market recession and this absorption-type merger was expected to be the best way to help both parties overcome their financial problems and maximise the value for their unit holders.

The new investment corporation was also expected to achieve its new growth targets as a result of its improved financial position, further business restructuring, and the inflow of revenue from the sale of properties. However, it was reported in August 2011 that even though TGR sold 49 properties and reduced debt by approximately $0.31 billion after the merger, it remained debt-laden and it was considered possible that it would have to default.

Merger 2 between Advance Residence Investment Corporation (ADR) and Nippon Residence Investment Corporation (NRIC)

Both ADR and NRIC are residential J-REITs and their merger was announced on 6 August 2009. This was a consolidation-type merger rather than an absorption-type merger and it just combined the ADR and NRIC. A new framework was built and a new investment corporation was listed as a fresh start after both ADR and NRIC were dissolved.

ADR owned 50 properties with total assets of $0.85 billion at the end of December 2008 while NRIC owned 137 properties with total assets of $3.08 billion on 31 May 2009. The merger aimed to increase both investment corporations' unit holder values. With a wider coverage of residential assets and the benefits of economies of scale from asset expansion, the new investment corporation was expected to have an enhanced portfolio with additional financial stability given that the combined company would be one of the largest residential J-REITs in terms of asset size. The change of main sponsor also promoted better refinancing and asset management for NRIC.

Merger 3 between Japan Retail Fund Investment Corporation (JRF) and LaSalle Japan REIT Inc. (LJR)

After policies designed to stimulate the economy were implemented by the government, signs of a modest recovery in the volume of transactions in the real estate market were observed. In this recovering environment, JRF and LJR announced on 29 October 2009 their consolidation by merger as their approach to obtaining new growth opportunities and maximising unit holder value.

JRF was listed on the TSE as the first REIT in Japan to focus exclusively on retail facilities and since then it has steadily acquired properties. JRF had invested in 50 properties with total assets of $5.59 billion at the end of August 2009. A major characteristic of LJR was its balanced portfolio that included offices and residential properties while focusing on retail facilities. LJR invested in 21 properties with total assets of approximately $1.23 billion at the end of April 2009. After this absorption-type merger, JRF, as the surviving corporation, not only held own its retail facilities, but also the offices and resident properties from LJR. However, offices and residential properties only accounted for a small proportion and were intended to be sold so that the REIT could focus exclusively on retail facilities.

Merger 4 between Japan Rental Housing Investment Inc. (JRH) and Prospect REIT Investment Corporation (PRC)

The announcement of the establishment of the Real Estate Market Stabilisation Fund in Japan improved potential financing opportunities and reduced concerns about bankruptcies. In order to take advantage of these new growth opportunities, JRH and PRI announced their merger on 26 February 2010. The newly merged J-REIT was expected to be one of the largest domestic residential REIT specialists in Japan. JRH invested in 131 residential properties with total assets of $0.99 billion at the end of September 2009 and PRC invested in 53 residential properties worth $0.65 billion at the end of July 2009.

Merger 5 between Crescendo Investment Corporation (CIC) and Japan Single-Residence REIT Inc. (JSR)

In 2010 demand for real estate was still weakening compared with supply and the market environment for office and residential leasing was expected to continue to be weak in

Japan. However, for J-REITs, some signs of recovery were apparent as a result of the actions taken by the government. CIC and JSR announced their merger on 21 June 2010. This merger was expected to resolve their financial problems and expand the asset scale to achieve new growth and improve the unit holder values of both corporations.

CIC was a multi-sector J-REIT with a total of 47 properties worth approximately $0.97 billion at the end of November 2009. CIC primarily invested in offices and residences located in the heart of Tokyo. JSR was the first REIT in Japan to focus on single residences and owned 43 properties with a total asset value of approximately $0.56 billion at the end of January 2010. In this absorption-type merger, CIC was the surviving corporation while JSR was dissolved.

Merger 6 between United Urban Investment Corporation (UUR) and Nippon Commercial Investment Corporation (NCI)

On April 22, 2010, UUR and NCI announced their merger. Their merger was expected to achieve synergy effects with respect to improved asset management and flexibility to rebalance the portfolio and improve the unit holder values of both UUR and NCI. UUR was the surviving company after this absorption-type merger. As a result of its acquisition of NCI assets (37 properties, $1.62 billion), the total amount of UUR's real estate portfolio increased to about $3.71 billion with 87 properties. Accordingly, UUR became one of the largest J-REITs in terms of asset value. In addition to increased brand power and recognition, UUR aimed to establish itself as a leader in the J-REIT market.

Merger 7 between FC Residential Investment Corporation (FCR) and Ichigo Real Estate Investment Corporation (Ichigo REIT)

In order to maximise both corporations' unit holder wealth and to focus on growth, FCR and Ichigo announced their merger on 8 August 2011. FCR invested in rental housing and hotels with 19 properties worth approximately $0.22 billion at 30 April 2011. Although FCR had explored ways of improving unit holder value through a capital increase by third party allotment and by other means, no effective implementation was realised until the merger. Ichigo REIT held a portfolio of 52 properties (worth approximately $1.07 billion) mainly consisting of medium-scale office buildings primarily in the Tokyo metropolitan area. Given the scale and characteristics of the portfolio held by Ichigo REIT, the income potential of that portfolio, and the liquidity of the properties in that portfolio, FCR initiated the merger with Ichigo REIT.

Merger 8 between Nippon Hotel Fund Investment Corporation (NHF) and Japan Hotel and Resort Inc. (JHR)

Although the Great Japan Earthquake decreased the demand in the Japanese real estate market and reduced foreign tourism and domestic business, the hotel industry was slowly recovering in Japan. As two hotel-focused J-REITs, NHF and JHR announced their merger on 22 December 2011.

NHF listed on the TSE in June 2006 and owned 19 hotel properties with total assets of $0.35 billion at the end of September 2011. JHR was listed on the TSE as the first hotel-focused REIT in Japan and managed 9 properties with total assets of $0.86 billion at the end of August 2011. JHR was absorbed into NHF after this merger to pursue the expansion of asset scale and improvement of asset management.

Table 1.3 summarises the profile of the complete sample of J-REIT mergers. All of these mergers were absorption-type mergers with the exception of the merger between ADR and NRIC, which was a consolidation merger. Among the absorption-type mergers, more than half were in the form of a larger J-REIT being absorbed by a smaller-sized J-REIT.

Five J-REITs diversified their property type through merging with a J-REIT focusing on different sectors, but the others did not change their investment scope. This sample also has some characteristics that are not reported in Table 1.3 in order to save space. For example, the surviving and absorbed JREITs in all the mergers have common main unit holders. Additionally, there is no evidence that any of the absorbed JREITs had a main bank relationship[5]. Almost all the surviving REITs and their respective absorbed REITs had common main creditors except in the case of the mergers of UUR-NCI and FCR-Ichigo.

1.4 Data and methodology

An event study methodology is used to examine how the market responded to J-REIT mergers across two metrics: trading volume and shareholder wealth. The event date is the date of the initial announcement of each merger. The market response is measured by recording both the daily abnormal trading volume and the daily abnormal stock returns over an event window of five days around the day 0 announcement, i.e. day –2 to day +2. Data are extracted from Bloomberg.

Abnormal trading volume around merger announcements is measured by following Campbell et al. (1998) and dividing the daily trading volume by the median daily volume for the four-week period from six weeks through two weeks prior to the beginning of the announcement week. Thus, the abnormal trading volume compares the size of trading volume over the event window to a "normal" trading volume outside the merger period.

The shareholder wealth effect, or return response, is defined as the abnormal returns according to the market model:

$$R_{it} = \alpha_i + \beta_i R_{mt} + e_{it} \tag{1}$$

where R_{it} and R_{mt} are the returns on REIT i and the TSE REIT Index on day t, respectively. R_{mt} is a proxy for the return on market portfolio. As this is an industry-specific study in J-REITs, I use the J-REIT index instead of a broader market index. Equation (1) is estimated over a period from 165 days through to 15 days prior to day 0. After obtaining the coefficient estimates of α_i and β_i from equation (1), the abnormal return can be calculated from the following equation:

$$AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}) \tag{2}$$

where $\hat{\alpha}_i$ and $\hat{\beta}_i$ are ordinary least square values of REIT i's market model parameters. Average abnormal return (AAR) on day t is the mean value of the abnormal returns of all of the J-REITs in our sample:

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \tag{3}$$

Table 1.3
Profile of J-REIT mergers

#	Announce-ment Date	Effective Date	Mergers (Surviving/Absorbed J-REIT)	Establish Date	Market Cap. (billion)	Sector	No. of Properties	Total Assets (billion)	Merger Type
Merger 1	17-Nov-09	1-Feb-10	TGR investment Inc.	18-Jan-02	0.18	diversified	61	0.41	Absorption
			LCP Investment Corporation	20-Sep-05	0.38	diversified	45	0.83	
Merger 2	6-Aug-09	1-Mar-10	Advance Residence Investment Corporation	12-Sep-05	0.34	residential	50	0.82	consolidation
			Nippon Residence Investment Corporation	6-Dec-02	1.41	residential	137	2.87	
Merger 3	29-Oct-09	1-Mar-10	Japan Retail Fund Investment Corporation	14-Sep-01	2.38	retail	50	5.42	absorption
			LaSalle Japan REIT Inc.	2-May-05	0.51	diversified	21	1.14	
Merger 4	26-Feb-10	1-Jul-10	Japan Rental Housing Investment Inc.	7-Oct-05	0.62	residential	131	1.00	absorption
			Prospect Reit Investment Corporation	22-Apr-05	0.33	residential	53	0.65	
Merger 5	21-Jun-10	1-Oct-10	CRESCENDO Investment Corporation	31-Jan-02	0.56	office,	47	0.92	absorption
			Japan Single-residence REIT Inc.	16-Feb-05	0.26	residential, hotel	43	0.54	
Merger 6	22-Apr-10	1-Dec-10	United Urban Investment Corporation	4-Nov-03	1.03	diversified	50	2.09	absorption
			Nippon Commercial Investment Corporation	22-Feb-06	1.11	office, retail	37	2.30	
Merger 7	8-Aug-11	1-Nov-11	FC Residential Investment Corporation	23-Jun-05	0.14	residential	19	0.22	absorption
			Ichigo Real Estate Investment Corporation	18-Nov-05	0.63	office	52	1.08	
Merger 8	22-Dec-11	1-Apr-12	Nippon Hotel Fund Investment Corporation	10-Nov-05	0.22	hotel	19	0.41	absorption
			Japan Hotel and Resort Inc.	8-Sep-05	0.45	hotel	9	0.85	

Notes: This table reports brief information on 8 J-REIT mergers in our final sample. Data was sourced from the Association for Real Estate Securitisation (ARES) website. Data are as of December 2010 and are in 2013 US dollars.

Cumulative abnormal return (CAR) for REIT i over the event window [T1, T2] is the sum of the daily abnormal returns:

$$CAR_{i(T1-T2)} = \sum_{T_1}^{T_2} AR_{it} \tag{4}$$

As the current study uses a small sample, I use a t-statistic to show the significance of difference between our results and the reference value.

$$t\text{-}statistic = \frac{\chi_i - \mu}{\sigma}\sqrt{N} \tag{5}$$

where X_i and σ are the mean value and standard deviation of abnormal trading volume, abnormal returns or cumulative abnormal returns for the surviving J-REITs and the absorbed J-REITs. μ is the reference value. For average abnormal trading volume, μ=1 and for both average abnormal return and average cumulative abnormal return, μ=0. N is the sample size.

1.5 Empirical results

As shown in Table 1.4, Panel A, most J-REITs in the sample experienced significant and increased trading volume on day 1 after the merger announcements. The timing of the announcement may be after trading hours or there may be a trading halt in place on day 0 so this result is not unexpected. The abnormal trading volume of merger 6 between UUR and NCI significantly increases on day 0 while there is decreased abnormal trading volume after the announcement of merger 7 between FCR and Ichigo. Individually, most of the absorbed J-REITs had higher abnormal trading volumes than their corresponding surviving J-REITs.

Table 1.4
Trading volume responses

		DAY-2	DAY-1	DAY0	DAY1	DAY2
Panel A: individual abnormal trading volume around the announcement						
Merger 1	TGR	0.68	0.58	0.68	3.01	2.98
	LCP	0.76	0.23	0.70	3.27	2.65
Merger 2	ADR	2.07	0.97	0.59	5.21	0.74
	NRIC	0.67	0.84	0.82	3.67	0.93
Merger 3	JRF	0.72	0.86	1.63	3.56	2.57
	LJR	2.23	1.59	1.88	6.87	7.2
Merger 4	JRH	0.76	0.43	0.92	1.92	4.6
	PRI	0.89	0.35	1.17	16.94	27.24
Merger 5	CIC	0.61	0.27	2.59	2.47	1.24
	JSR	0.53	0.46	1.96	15.97	5.45
Merger 6	UUR	5.47	2.76	12.77	20.68	8.56
	NCI	1.7	0.77	10.96	0.36	13.88
Merger 7	FCR	7.33	4.42	0.67	0.25	0.33
	Ichigo	2.34	2.27	4.76	3.71	2.03
Merger 8	NHF	1.4	2.02	1.16	8.58	3.16
	JHR	1.95	0.85	2.77	3.91	4.69
Panel B: average abnormal trading volume around the announcement						
	Surviving	2.38 (1.08)	1.54 (0.915)	2.63 (1.04)	5.71* (3.285)	3.02* (2.775)
		(1.514)	(1.056)	(1.108)	(2.038)	(2.161)
	Absorbed	1.38 (1.295)	0.92 (0.805)	3.13 (1.92)	6.84** (3.81)	8.01* (5.07)
		(1.453)	(0.327)	(1.758)	(2.666)	(2.263)

Notes: This table reports the individual abnormal trading volumes for both surviving and absorbed J-REITs in each merger for the two days around the merger announcement in Panel A, and the average abnormal trading volume in Panel B. Abnormal trading volume is reported as the multiple of the volume during each day around the merger announcement compared to the median daily volume for a four-week period from six weeks through two weeks before the beginning of the announcement week. In Panel B, the t-statistics are reported below the mean (median) abnormal trading volume in parentheses.* and ** indicate the significance of the difference between average abnormal trading volume and 1 at the 10% and 5% levels, respectively.

Panel B shows that the abnormal trading volume is significantly different from the normal trading volume on the two trading days after the announcement. This is inconsistent with the finding in Campbell et al. (1998). Although they also note a strong trading volume response with 3.4 times and 15.7 times of normal trading volume for acquiring and absorbed REITs respectively in the US, this significant abnormal trading volume occurs on the announcement day. However, our J-REIT sample shows three to eight times the normal trading volume on the two days after their announcements. In addition, absorbed J-REITs have larger abnormal trading volumes than surviving J-REITs on average.

The daily and cumulative abnormal returns around the announcements are reported in Table 1.5, Panel A. There was a wide variety of market reactions to the merger announcements. In some of the mergers, the market reaction was negative for both the acquirer and target. In some of the mergers, the acquirer experienced a positive market reaction while the abnormal returns for targets were negative. In yet others, the abnormal returns for both J-REITs in one merger were positive. Such a wide variety of responses is consistent with the merger announcement providing new information about J-REITs for which there was a wide variety of pre-merger announcement expectations. For example, in the case of the first merger, between TGR and LCP, the reaction is very negative and this is probably because the announcement informed the market about the poor financial health of the corporations and possibly the industry. Supporting this argument is the fact that later merger announcements were not universally negative, and when they were negative the magnitude was smaller than for the first merger.

The average daily results are reported in Panel B. Surviving J-REITs did not suffer significant abnormal returns associated with the merger announcements. However, for absorbed J-REITs, the days on which negative abnormal returns were statistically significantly different from zero were the two days before the merger announcements. This early reaction suggests that there might have been information leakage, or that the merger may have been a result of poor performance to which the market was already reacting. Additionally, the negative market response suggests that these merger decisions made investors uncertain about the future performance of these J-REITs. The pre-announcement reactions were consistent with the findings in Schaik and Steenbeek (2004) that Japanese non-financial firms have large abnormal returns on the two days before an announcement.

Table 1.5
Abnormal returns around the announcement (in percentage)

		DAY-2	DAY-1	DAY0	DAY1	DAY2	[-2, -1]	[0, +2]
Panel A: individual abnormal returns and cumulative abnormal returns								
Merger	TGR	-13.03	-15.41	-17.73	-21.30	-35.15	-28.44	-74.18
	LCP	-19.22	-22.14	-21.97	-21.88	-22.41	-41.36	-66.26
Merger	ADR	10.08	7.24	9.71	11.38	11.37	17.32	32.46
	NRIC	-27.83	-18.81	-23.62	-14.34	-12.40	-46.64	-50.36
Merger	JRF	-4.09	-3.53	-4.04	-2.17	1.67	-7.62	-4.54
	LJR	-3.90	-4.52	-8.12	-5.52	-1.55	-8.42	-15.19
Merger	JRH	-16.29	-12.22	-10.95	-9.60	-11.38	-28.51	-31.93
	PRI	-9.73	-9.79	-9.83	5.73	2.21	-19.52	-1.89
Merger	CIC	10.70	13.05	21.31	17.12	19.29	23.75	57.72
	JSR	4.15	3.83	5.36	14.03	19.47	7.98	38.86
Merger	UUR	7.90	5.09	6.97	9.60	10.42	12.99	26.99
	NCI	3.09	5.13	13.37	-8.95	-19.71	8.22	-15.29
Merger	FCR	-13.45	-9.29	-4.90	-2.17	0.08	-22.74	-6.99
	Ichigo	-18.12	-18.13	-13.52	1.40	1.75	-36.25	-10.37
Merger	NHF	0.79	1.07	5.14	6.60	5.35	1.86	17.09
	JHR	1.10	3.07	-0.88	4.80	6.74	4.17	10.66
Panel B: average abnormal returns around the announcement								
	Survivin	-2.18	-1.75	0.69	1.18	0.21		
		(-0.488)	(-0.491)	(0.156)	(0.267)	(0.035)		
	Absorbe	-8.81*	-7.67*	-7.40	-3.09	-3.24		
		(-2.095)	(-1.948)	(-1.629)	(-0.742)	(-0.648)		
Panel C: average cumulative abnormal returns during different event windows								
		[-2, -1]	[0, +2]	[-1,0]	[0,+1]	[-1,+1]	[-2,+2]	
	Survivin	-3.93	2.08	-1.06	1.87	0.12	-1.84	
		(-0.527)	(14.20)	(-0.133)	(0.096)	(0.010)	(-0.085)	
	Absorbe	-16.48*	-13.73	-15.07	-10.49	-18.16	-30.21	
		(-2.047)	(-1.177)	(-0.647)	(-1.379)	(-1.618)	(-1.625)	

Notes: This table reports abnormal returns two days around the merger announcement and cumulative abnormal returns for the event window of [-2, -1] and [0, +2] for each merger (Panel A), the average abnormal returns and for surviving and absorbed J-REITs (Panel B), and average cumulative abnormal returns over different event windows for surviving and absorbed J-REITs (Panel C). Abnormal returns are calculated by Equation (2). T-statistics are shown below the average abnormal returns and average cumulative abnormal returns in parentheses.* indicates significance of the difference between cumulative abnormal return/average abnormal returns and 0 at the 10% level.

None of the cumulative abnormal returns using various windows were found to have returns that were statistically significantly different from zero as shown in Panel C, but the data for the window of [-2, -1] for absorbed J-REITs is significant at the 10% level. For the window of [-2, -1], half of surviving J-REITs and five of the absorbed J-REITs suffer negative cumulative abnormal returns and this situation is similar to that for the window [0, +2]. These results may be attributed to the small sample size and the disparity between the different mergers. For these firms, the reaction is tied into the specific merger details that may not have been known by the market before the announcement.

Some studies on merger activities examine post-merger returns, but results in the literature are mixed. Agrawal et al. (1992) argue that firms suffer negative abnormal returns over the long-run post-merger period. In contrast, both Malatesta (1983) and Franks et al. (1991) find no evidence of significant underperformance after an acquisition. Langetieg (1978) examines stockholder gains from mergers and finds that there is no significantly different post-merger performance from that of a control firm in the same industry. This is contrary to the findings of Healy et al. (1992) that the asset productivity of merged firms outperforms that of unmerged firms in the same industry. They apply operating cash flow returns other than stock price as a measure for post-merger performance. More importantly, they find that operating performance changes show a strong positive relation with abnormal stock returns at the time of the merger announcement.

I follow the methodology of Dube and Glascock (2006) to examine post-merger performance – that is, to calculate the abnormal operating performance. However, I apply Funds from Operations (FFO) returns as the indicator for REIT operating performance rather than operating cash flow returns used by Dube and Glascock (2006) as Graham and Knight (2000) and Downs and Guner (2006) indicate that the FFO is widely recognised as an industry-wide standard measure of REIT performance with higher information content than other indicators. I keep the pre-merger performance of surviving and absorbed J-REITs separate in order to test the relationship between the changes in operating performance and the market response to the merger announcements.

Table 1.6
Industry-adjusted FFO returns (in percentage)

Panel A: results for each of the sample J-REITs

		Pre-merger		Post-merger	
		Mean	Median	Mean	Median
merger1	TGR	0.33	0.27	-0.24	-0.25
	LCP	-0.03	-0.03		
merger2	ADR	0.22	0.18	-0.01	0.06
	NRIC	-0.28	-0.32		
merger3	JRF	-0.48	-0.48	0.28	0.29
	LJR	0.19	0.17		
merger4	JRH	-0.27	-0.29	0.22	0.25
	PRI	0.04	0.09		
merger5	CIC	-0.48	-0.49	-0.31	-0.32
	JSR	-0.49	-0.49		
merger6	UUR	0.10	-0.04	0.17	0.12
	NCI	-0.43	-0.43		
merger7	FCR	-0.63	-0.58	-0.07	0.07
	Ichigo	-0.21	-0.18		
merger8	NHF	-0.06	-0.18	0.09	0.08
	JHR	0.38	0.44		

Panel B: aggregate results for all the sample J-REITs

	Surviving		Absorbed	
	Mean	Median	Mean	Median
Pre-merger	-0.16 (-1.256)	-0.24	-0.10 (-0.979)	-0.10
Post-merger	0.02 (0.183)	0.08		
Changes	0.18	0.32	0.11	0.18

Notes: This table reports the mean and median industry-adjusted FFO returns for surviving and absorbed J-REITs during the two years before the merger and during the two years after the merger. T-statistics are shown in parentheses.

FFO returns are defined as the FFO (the sum of earnings and depreciation and amortisation expenses) divided by the total assets. For each J-REIT and year, I employ industry-adjusted FFO returns to measure the abnormal operating performance by controlling for industry events unrelated to the merger. The industry-adjusted FFO returns are calculated by subtracting the median two-year pre- (post-) merger annual FFO returns of the sample J-REIT from those of the J-REIT industry. In each case the sample J-REIT is excluded from the J-REIT industry control portfolio. The year of the merger announcement is defined as year 0. For both the surviving and the absorbed J-REITs, I then calculate the median industry-adjusted FFO returns for the two years post-merger (year +1 to +2) and the two years pre-merger (years -1 to -2) and calculate the difference between them. If the difference is positive (negative), it means that the performance of the J-REIT has improved (declined) after the merger.

Table 1.6, Panel A, reports the industry-adjusted FFO returns for both surviving and absorbed J-REITs before the merger, and for the merged J-REITs after the merger. As shown in Panel B, two years before mergers J-REITs which were later involved in mergers showed worse performance than J-REITs which were not later involved in mergers. But the results are statistically insignificant for both surviving J-REITs (-0.16%) and absorbed J-REITs (-0.10%). Although the aggregate result for two-year post-merger industry-adjusted FFO return (0.02%) is positive, it is also insignificant. This finding is consistent with Langetieg (1978) who find no significant evidence that merged REITs outperform unmerged REITs. Merged J-REITs showed insignificant improvements after the mergers, although the differences between the median industry-adjusted two-year post-merger FFO returns and two-year pre-merger FFO returns for surviving and absorbed J-REITs are both positive.

The two-year pre-merger operating performance of surviving J-REITs is worse than that of the absorbed J-REITs, but the disparity is not significantly different from zero. This result is not intuitively pleasing but it may reflect the wide disparity between the operating performances of firms in such a small sample. The results are not surprising since the merger stories in the Section 3 of this chapter show that the surviving J-REIT is always the REIT that initiates the merger transaction, probably because of financial problems and limitations of growth opportunities. The initiating J-REIT negotiates with the target J-REIT and regards the merger as an effective way to help both of them out of trouble and to benefit the target J-REIT. This scenario is consistent with the target J-REIT outperforming the surviving J-REIT before the merger. This explanation is also consistent with the results reported in Section 5 which show that that surviving J-REITs obtain positive abnormal returns upon the merger announcement while returns for absorbed J-REITs are negative. Post-merger performance is insignificantly different from the industry average and this is a testament to the success of the merger since this represents an improvement for the J-REITs involved.

Table 1.7
Ranking of operating performance changes
Vs. cumulative abnormal returns

#	Operating performance improvement		Cumulative abnormal return [0, +2]	
1	merger 1	-0.57%	merger 1	-74.2%
2	merger 2	-0.23%	merger 4	-31.9%
3	merger 6	0.07%	merger 7	-7.0%
4	merger 8	0.15%	merger 3	-4.5%
5	merger 5	0.17%	merger 8	17.1%
6	merger 4	0.49%	merger 6	27.0%
7	merger 7	0.56%	merger 2	32.5%
8	merger 3	0.76%	merger 5	57.7%

This table reports the ranking of operating performance changes and cumulative abnormal returns during the two-day announcement window for surviving J-REITs. The clustered groups of mergers are framed by the same dashes for easily reading.

To examine the relationship between post-merger performance and the merger premium for surviving J-REITs, I rank the industry-adjusted FFO return changes and cumulative abnormal returns for a three-day window [0, +2] for the eight mergers in ascending order. In Table 1.7, the surviving J-REIT in merger 1 (between TGR and LCP) had the largest operating performance decline of 0.6% in the 2 years after the merger and it also suffered the worst negative announcement premium (-74.2%). For the remaining mergers, there is a reversal in the order of changes, i.e. larger abnormal returns around announcements are associated with smaller operating performance improvements over the next two years. This is contrary to the finding of Healy et al. (1992). There are some possible explanations for this inconsistency. First, some prior studies show that the market may not incorporate underlying operating data efficiently into the stock price (Shiller, 1980; Bernard and Thomas, 1990; Sloan, 1996). Second, information asymmetry and lack of professional competence may blind investors, causing them to react to the merger activities. Third, the small sample size may have impacted the findings.

1.6 Summary

Since the first Asian REIT was established in Japan in 2001, the J-REIT market has become the largest and most developed REIT market in Asia. With the influence of the 2008 GFC on the global economy, the Japanese real estate market suffered sharp decreases and this recession also led to a wave of mergers in J-REITs. These mergers were seen as the most effective way to help both acquiring and target J-REITs get rid of financial distress through the synergy effects of the mergers. After restructuring, a stronger financial position was expected to reduce financing costs and increase the availability of refinancing. The merged J-REITs were also expected to seek new growth opportunities when there were signs of an economic recovery through improving asset management and portfolio allocation.

This chapter has examined the market responses to merger announcements and post-merger performance of the complete sample of eight public-to-public REIT mergers in Japan that occurred during the 2002 to 2014 period. I find that (1) both surviving and absorbed J-REITs showed significant abnormal trading volume in the two days after the announcement; (2) surviving J-REITs showed insignificant abnormal returns, while absorbed J-REITs suffered statistically significant and negative abnormal returns in the two days before the announcement; (3) there was no strong evidence that merged J-REITs outperformed unmerged J-REITs, and merged J-REITs showed no significant improvement in operating performance; and (4) the merger announcement abnormal return negatively predicted the subsequent operating performance of surviving J-REITs.

Although the total number of J-REITs that experienced mergers is small, these results have some important implications for the J-REIT market. First, with the first wave of J-REIT mergers during its short history, investors may be unable to understand what merger announcements are all about and uncertain about the future performance of merged J-REITs. This uncertainty may lead to irrational and disordered responses to mergers announcements. These J-REIT mergers trigger market responses that do not reflect the typical reactions that occur in non-REIT mergers. Second, the market for corporate control provides the means to improve financially struggling J-REITs, yet the market structure of J-REITs may prevent standard takeovers from occurring. Finally, the negative reaction in advance of merger announcements suggests that some information may have leaked, or the situation was so dire that something had to be done to combat the poor market perceptions. Undoubtedly, the J-REIT literature will expand and future mergers in different economic times will resolve the question of whether these results are unique to J-REITs during the economic malaise of the early 2000s.

Chapter 2

Dividend Policy and Growth: Evidence from Asian REITs

2.1 Introduction

As capital intensive enterprises, Real Estate Investment Trusts (REITs) require substantial capital to fund growth opportunities through either generating enough internal cash flows or having easy access to external capital markets. However, to maintain their tax-exempt status, REITs must pay 90% of their taxable income as dividends to shareholders.[6] This unique regulatory requirement leads to considerable limitations on REITs' ability to use residual internal funds to acquire real estate properties, and thus REITs rely heavily on external capital markets which play an important monitoring role in lowering the risks to capital suppliers.[7] To facilitate their access to capital markets, REITs have to alleviate principal–agent problems, improve transparency and manage assets effectively.

Although the capital distribution requirement is particularly stringent, many REITs still pay dividends in excess of the mandatory level. The discretionary dividends have long been recognised in the US REIT market.[8] Why do REITs exert themselves to get access to the more costly external funds while at the same time shrinking the availability of internal funds by paying additional dividends that are not required by law? One explanation is that they do so to reduce potential agency costs. This is consistent with Jensen (1986) who indicates that that distributing free cash flows as dividends restricts managers' misuse of capital and thereby reduces managerial discretion and resultant agency costs. Hardin and Hill (2008) argue that REITs manage dividend policy to get access to external debt and equity funds which is essential for growth.

Some recent studies link discretionary dividend payments with the development of REITs and provide direct evidence on the notion that as a substitute for reduced agency costs, distributing discretionary dividends can facilitate REITs' access to external capital markets for growth and thus mitigate their inability to use internal cash flows. For example, Chou et al. (2013) find that the reduced agency costs achieved by distributing discretionary dividends can be reflected in the increased value of REITs. Moreover, Ghosh and Sun (2013) find a strong positive relationship between externally financed growth and discretionary dividend payments.

The unique regulatory environment for REITs and the discretionary dividend payments by REITs provide an excellent opportunity to investigate dividend policy. However, what I currently know about the dividend policy of REITs comes mostly from the dominant US REIT market. Few studies focus on REITs in other regions. In this study, I extend the literature on REIT dividend policy by focusing on Asian REIT markets and examining the relationship between dividend policy and growth. Specifically, I take two representative Asian REITs, Japanese REITs (J-REITs) and Singaporean REITs (S-REITs) and investigate whether paying dividends in excess of mandatory levels enhances firm growth, and whether the growth can be attributed to the role of discretionary dividends in reducing agency costs.

There are some advantages in choosing Asian REITs, especially J-REITs and S-REITs for our study. First, externally managed REITs are the predominant form in Asia but this management structure has become rare in the US due to the potential conflicts of interest between REIT managers and shareholders. Therefore, J-REITs and S-REITs are likely to suffer agency conflicts. Second, external managers have incentives to expand assets under their management on account of their own compensation provisions, and most Asian

REITs are in the stage of pursuing a growth-by-acquisition strategy which means that Asian REITs have a greater need for external capital to fund real estate property acquisitions and other investments. Therefore, they are likely to be interested in reducing agency costs through discretionary dividend payments to smooth their access to capital markets.

To investigate the efficacy of discretionary dividends for reducing agency costs and giving REITs higher growth, I employ a simultaneous equation model (SEM) to describe the relationship between discretionary dividends and externally financed growth. Some important reasons for our dependent variable selection and calculations should be noted. First, discretionary dividend payments are applied in the model instead of the total dividends paid. That's because the non-discretionary dividend payments of REITs are statutory and in general cannot be manipulated by managers arbitrarily which indicates that issuing non-discretionary dividends has little to do with agency issues. A discretionary dividend is defined as the amount of a total common dividend that is in excess of the mandatory dividend payment. Because taxable income is hard to accurately measure, I follow Hardin and Hill's (2008) approach to estimate discretionary dividends as total dividends paid minus 90 per cent of before tax net income.[9] Second, I use externally financed growth instead of total growth as a proxy for access to external markets. The reasons are that the limited internal fund availability ensures REITs rely heavily on external capital markets and moreover, agency theory involves funding through external markets. I follow Khurana et al. (2006) and Ghosh and Sun (2013) to measure externally financed growth and construct three versions of externally financed growth to capture the maximum level of growth that is driven by all forms of capital from external channels, both long-term debt and equity, and all equity.

The SEM consists of two equations: a discretionary dividend equation and an externally financed growth equation. I apply both pooled and cross-sectional two-stage least square (2SLS) regressions to estimate all the coefficients of the SEM. Equation (1) describes the determinants of discretionary dividend payments, including two variables as proxies for agency costs. I find that if free cash flow increases or leverage ratio decreases, then more non-mandatory dividends would be paid to reduce the potentially increased agency costs. In equation (2) I regress externally financed growth on the fitted discretionary dividends obtained from equation (1) and find a significant positive relationship between externally financed growth and discretionary dividend payments. Summarising the findings from the SEM, I conclude that the reduced agency costs achieved through paying discretionary dividends can be reflected in the growth of REITs.

This chapter expands the existing literature on REIT dividend policy by focusing on Asian REITs which have a different market structure to US REITs. The findings provide support for the agency cost explanation for the practice of paying discretionary dividends with a sample of non-US REITs. It also provides support for the view that distributing dividends in excess of mandatory levels enhances firm growth. This chapter also confirms that REITs manage dividend policy to facilitate their access to capital markets to fund growth.

The remainder of this chapter is organised as follows: Section 2.2 presents the background and hypothesis development; Section 2.3 briefly introduces the Asian REIT markets; Section 2.4 discusses the methodology and data; Section 2.5 analyses the empirical findings of both pooled and cross-sectional datasets and sensitivity tests. Section 2.6 summarises the chapter.

2.2 Background and hypotheses

Capital demand, the availability of internal cash flows and the cost of external capital determine how frequently a firm goes to capital markets for financing. For Asian REITs, the high mandated dividend payout requirement limits the availability of internal funds, and the use of the growth-by-acquisition strategy boosts their demand for finance. This situation makes them heavily reliant on external channels to finance investments and thus any reduction in the cost of external financing will be important for REITs.

Many studies have provided evidence that the payment of dividends is one way to mitigate agency costs and information asymmetry to enable general corporations to fund growth externally. For example, Easterbrook (1984) suggests that distributing dividends makes firms with high growth opportunities go to the external capital market more frequently, where their management decisions are monitored. The free cash flow hypothesis of Jensen (1986) suggests that the payment of dividends reduces agency costs by restricting managers' abuse of free cash flows to invest in negative NPV projects.

Since REITs are required to pay substantial percentages of their taxable incomes as dividends, is there any discretion for REIT managers related to agency issues? Given the regulatory limits placed on REITs, Down, Guner and Patterson (2000) argue that REIT managers may suffer limited flexibility relative to their counterparts in non-REIT sectors in dividend policy decisions and that this inflexibility may weaken the ability of dividends to reduce agency costs and information asymmetry. However, their finding that REITs that distribute more to shareholders suffer less information asymmetry negates this argument. Hartzell, Kallberg and Liu (2005) and Han (2006) suggest that due to the high level of depreciation expenses for REITs, their cash flows exceed taxable income which gives REIT managers discretion regarding cash retention. By investigating the effects of the regulated distribution requirement placed on REITs, Ghosh, Roark and Sirmans (2011) find that REIT managers do indeed have some flexibility in dividend payments and they pay discretionary dividends exceeding the required amounts. Most importantly, they find that discretionary dividend payments and other governance mechanisms are still significant tools which REITs can use to reduce agency costs and maintain good corporate governance. Therefore, REIT managers are able to pay non-mandatory dividends and the discretionary component of dividend payments is a way to decrease agency costs.

Since Wang et al. (1993) first pointed out that REITs often pay dividends exceeding mandatory levels, it has been apparent that legislation may not be the only determinant of dividend policies, and therefore discretionary dividends have been regarded as the more interesting component to examine. A number of REIT studies have explored the effectiveness of discretionary dividends in alleviating agency conflicts. Wang et al. (1993) argue that agency costs are an important determinant of REIT dividend policy, and that dividend announcements have a significant impact on share value, depending on the extent of asymmetric information between the REIT managers and shareholders.

In a recent study, Hardin and Hill (2008) extend the implications of Wang et al. (1993) by differentiating between the mandatory and non-mandatory components of REIT common dividends. They argue that decisions to pay discretionary dividends reflect managerial discretion and signal the future requirement of external capital which increases transparency to the market. They also find strong evidence that paying discretionary dividends is associated with factors which imply reduced agency costs. Chou et al. (2013) examine how the way a market values REIT dividends is conditional on corporate governance. Their results indicate that the market significantly and positively values discretionary dividend payments. Ghosh and Sun (2013) also find REITs paying more discretionary dividends experience higher growth rates.

Based on the discussion above, our hypotheses are:

Hypothesis 1: More discretionary dividends will be paid when agency costs are higher.

Hypothesis 2: Externally financed growth is positively related to discretionary dividend payments.

2.3 REIT markets in Asia

The introduction of REITs in Asia aimed to increase liquidity in real estate markets and bring international capital to Asia. The first Asian REIT was established in Japan in 2001 followed by South Korea and Singapore in 2002, Thailand in 2003, and Taiwan, Malaysia and Hong Kong in 2005. Compared to US REITs which began 1961, Asia REITs are very young. After a decade of development, Japan and Singapore have become the two largest REIT markets in this region, with market capitalisation as of 31 December 2012 of approximately US$38 billion and US$ 30 billion respectively, while other REIT markets in Asia account for about 10 per cent of the total. The excellent performance of J-REITs and S-REITs should be highlighted. For the year ended 2012, the one-year rates of return were 17.4% and 21.8% respectively in Japan and Singapore, which are higher than the 15.3% rate in the US. The dividend yield for J-REITs and S-REITs of 5.8% and 6.8% in 2012 were also higher than the 3.7% yield for US REITs.

It should also be noted that the market structure of Asia REITs is different from that in the US. First, the umbrella partnership approach is commonly applied in the US to transfer the ownership of private properties to a public REIT on a tax-deferred basis. The more complex organisational structure of Umbrella Partnership REITs (UPREITs) is regarded as providing less transparency. Chou et al. (2013) find that for UPREITs, paying discretionary dividends is valued by the market. Second, due to potential conflicts of interest between REIT managers and shareholders, externally managed REITs are rare in the US. However, most REITs in Asia are externally managed.[10] Third, REIT sponsors also play an important role in Asia because they usually wholly own the REIT manager and provide the sources of properties to REITs.[11] The market structure of Asian REITs leads to potential conflicts of interest between managers/sponsors and shareholders.

2.4 Data and methodology

This chapter investigates (1) the relationship between discretionary dividend payments and factors implying agency costs, and (2) the impact of paying discretionary dividends on externally financed growth. Discretionary dividends rather than total dividends are applied in this chapter as the non-discretionary component is mandated by law and has nothing to do with agency costs. As REITs are more dependent on external funds, their growth is mostly externally financed. I use externally financed growth instead of total growth due to the potential association of total growth with agency issues.

2.4.1 Measurement of Discretionary Dividend

Hardin and Hill (2008) define a discretionary dividend as the difference between the total common dividend paid and the mandatory dividend payment (calculated as 90 per cent of before tax net income). However, Boudry (2011) points out that Hardin and Hill's (2008) measurement of discretionary dividends is based on before tax net income and may create errors as taxable income may vary based on differences in financial and tax accounting. Boudry uses the NAREIT data which provides a decomposition of REIT dividends in Form 1099-DIV to calculate taxable income. Both studies find evidence that REITs appear to use discretionary dividend payments to smooth their payout ratio. Chou et al. (2013) use both methods and their results are consistent with those of Hardin and

Hill (2008) and Boudry (2011). They also mention that using NAREIT data reduces the sample size substantially as the decomposition of REIT dividends is not a mandatory disclosure for REITs, and thus some sample bias may result from this methodology.

Given the data availability and ease of calculation, the methodology proposed by Hardin and Hill (2008) is followed in this chapter. Specifically, I define discretionary dividends as the difference between total annual common dividends paid minus 90 per cent of before tax net income.

2.4.2 Measurement of Externally Financed Growth

I measure the maximum attainable growth rate financed externally by following Demirguc-Kunt and Maksimovic (1998) (2002), Khurana et al. (2006) and Ghosh and Sun (2013).[12] As the external financing needed by a firm is determined by the availability of internal funds and investment opportunities, the external financing needs of a firm at time t can be expressed as:

$$EFN_t = [g_t \times ASSET_t] - [(1 + g_t)(FFO_t \times b_t)] \quad (1)$$

where $\mathrm{EFN_t}$ is a measure of external financing needs, $\mathrm{g_t}$ is firm growth rate, $\mathrm{ASSET_t}$ is firm assets, $\mathrm{FFO_t}$ is funds from operations, and $\mathrm{b_t}$ is the proportion of the firm's FFO that are retained for reinvestment ($\mathrm{b_t = (FFO_t - DIV_t)/FFO_t}$). Therefore, this equation can be interpreted as the difference between the capital required to satisfy a firm growing at $\mathrm{g_t}$ and its internal funds available for investments.

I also calculate three benchmark constrained growth rates that a firm can achieve by using: (1) all funds generated internally (IG), (2) short-term debt financing (SFG) and (3) both short-term and long-term debt (SG).[13] Then the differences between the actual realised growth rate and the three estimates of constrained growth rates (IG, SFG and SG) are the levels of growth a firm can achieve driven by (1) all external funds (EFG_IG), (2) both long-term debt and all equity (EFG_SFG), and (3) all equity (EFG_SG). EFG_IG, EFG_SFG and EFG_SG are the three measures of externally financed growth in our model.[14]

The analysis of Khurana et al. (2006) is based on growth in sales. However, for REITs asset growth is more related to capital investment and therefore can more closely reflect the demand and availability of external funds than growth in sales. Ghosh and Sun (2013) apply the growth rate on both sales and assets basis and the results are consistent. Our test is based on growth in total assets.

IG is the maximum growth rate that is funded only by internal funds. It means the dividend payout ratio is zero (i.e. b=1). IG is obtained by setting external financing needs at zero (i.e. $\mathrm{EFN_t} = 0$). It follows that,

$$IG_t = \frac{RE_t}{(ASSET_t - RE_t)} \tag{2}$$

where $\mathrm{RE_t}$ is retained earnings, calculated as the difference between FFO and total dividends paid. This equation shows that $\mathrm{IG_t}$ is convex and thus more profitable firms have higher internally financed growth rates.

SFG, the second benchmark growth rate, is the maximum growth rate of a firm that reinvests all its earnings after dividends and short-term debt at the current ratio of short-term borrowing to assets.[15] This ensures the feasibility of calculating SFG but it doesn’t capture the changes in the firm’s short-term borrowing capacity. SFG is obtained by setting b to 1, and $\mathrm{EFN_t}$ as 0 and using the value of assets that are not financed by short-term debt instead of total assets as in equation (1). Here, the assets not financed by short-term debt are defined as “long-term debt” which is computed by multiplying total assets by one less the ratio of short-term debt to total assets. Hence,

$$SFG_t = \frac{RE_t}{ASSET_t - STDEBT_t - RE_t} \quad (3)$$

where $\mathrm{STDEBT_t}$ is the amount of short-term debt.

The final estimate of benchmark growth rate, SG, is the maximum sustainable growth rate that can be achieved by a firm if it reinvests all its internal funds and obtains enough short-term and long-term borrowings to maintain a constant ratio of total debt to assets. Therefore, the firm doesn’t issue new equity or change the realised leverage level. Hence,

$$SG_t = \frac{RE_t}{EQUITY_t - RE_t} \quad (4)$$

where $\mathrm{EQUITY_t}$ is the book value of equity.

2.4.3 Model

On one hand, our hypothesis that discretionary dividend payments and externally financed growth of REITs are significantly positively related is based on the argument that discretionary dividend payments are a substitute for reduced agency costs and lower cost of external financing. Therefore, I expect that REITs paying more discretionary dividends grow faster than those paying less. On another hand, compared to REITs with poor performance, well-performing and growing REITs are more likely to pay more discretionary dividends to shareholders. To the extent that discretionary dividends promote growth, and growth promotes discretionary dividends, they are likely to be jointly determined. Given this situation, I apply a simultaneous equation system to examine the relationship between discretionary dividends and externally financed growth. Equation (1) shows the determinants of discretionary dividend payments ($\mathrm{EXDIV_t}$) and is applied to examine the relationship between discretionary dividend payments and factors implying agency costs. Equation (2) captures the variables related to externally financed growth ($\mathrm{EFG_t}$) and is applied to test the relationship between firm growth and discretionary dividend payments.

I take the bi-directional causality between discretionary dividend payments and externally financed growth into account and use $\mathrm{EFG_t}$ as an explanatory variable in equation (1).[16] This SEM system is estimated using the two-stage least squares (2SLS) method to obtain consistent estimates for endogenous variables.

The equations in the system are as follows:

$$EXDIV_t = \alpha_0 + \alpha_1 EFG_t + \alpha_2 EXDIV_{t-1} + \alpha_3 MANDIVRATE_t + \alpha_4 \Delta MANDIVRATE_t + \alpha_5 EXFFO_{t-1} + \alpha_6 \Delta EXFFO_t + \alpha_7 LEV_t + \alpha_8 Q_t + \alpha_9 SIZE_t + \alpha_{10} ASSETTO_t + \alpha_{11} ROA_t + \alpha_{12} TYPE_t + \mu_t; \quad (1)$$

$$EFG_t = \beta_0 + \beta_1 EXDIV_t + \beta_2 Q_t + \beta_3 SIZE_t + \beta_4 FIN_t + \beta_5 \Delta PROFITMGN_t + \beta_6 \Delta ASSETTO_t + \varepsilon_t; \quad (2)$$

where

$MANDIVRATE_t$ = 90% of before tax net income divided by total assets

$\Delta MANDIVRATE_t$ = change in mandatory dividends divided by current year's total assets

$EXFFO_{t-1}$ = the previous year's funds from operations (*FFO*), defined as net income excluding profits from the sale of properties plus depreciation and amortisation, less the mandatory dividend payment, all divided by previous year's total assets

$\Delta EXFFO_t$ = change in excess *FFO* scaled by current year's total assets

LEV_t = leverage ratio, measured as total debt to total assets

Q_t = Tobin's q, measured as the sum of market capitalisation, total debt and preferred equity, scaled by total assets

$SIZE_t$ = natural logarithm of market capitalisation

$ASSETTO_t$ = asset turnover, computed as total revenue divided by total assets

ROA_t = return on assets, calculated as net income available to shareholders divided by total assets

FIN_t = change in debt and equity scaled by total assets

$\Delta PROFITMGN_t$ = change in profit margin, computed as change in net income scaled by current year's total revenue

$\Delta ASSETTO_t$ = change in asset turnover, computed as annual change in total revenue divided by current year's total assets.

Equation (1) specifies discretionary dividends as a function of externally financed growth, lagged discretionary dividends, mandatory dividends, and characteristics of REITs that may have impacts on discretionary dividend payments.

As stated above, growing REITs are more likely to pay out more earnings as dividends. I predict that the sign of externally financed growth (EFG_t) will be positive. Given the persistence of agency costs argued by Florackis and Ozkan (2009), Ghosh and Sun (2013) show that the dividend policy should be serially correlated, conditional on other firm characteristics. They include lagged discretionary dividends ($EXDIV_{t-1}$) in their discretionary dividend model and the results confirm the serial correlation between discretionary dividends. I also include the value of lagged discretionary dividends in equation (1) and predict that the sign will be positive.

Boudry (2011) shows that REITs are less likely to pay non-mandatory dividends when their current mandatory dividends are already high, as the current level of dividends has already met a target payout ratio that reduces their dividends. Following Boudry, I also include mandatory dividends ($MANDIVRATE_t$) and changes in mandatory dividends ($\Delta MANDIVRATE_t$) in this equation and expect the signs of coefficients on these two variables to be negative.

Jensen (1986) proposes that a firm with substantial free cash flow has to pay more dividends to prevent its manager from misusing the resources under his/her control at the expense of shareholders. Jensen indicates that dividend policy can be effective in alleviating agency costs by reducing free cash flow. Thus, free cash flow can be used as a proxy for potential agency costs. For REITs, the cash flow is reflected by funds from operations (FFO) and because a certain proportion of cash flow is distributed as dividends, only the remaining cash flow is discretional and may have impacts on dividend policy. Thus, following Hardin and Hill (2008), I also use excess FFO in our equation, defined as funds from operation minus mandatory dividends, as a proxy for agency costs associated with free cash flow of REITs. I model it using lagged excess funds from operations (EXFFO_{t-1}) and change in excess funds from operations ($\Delta\mathrm{EXFFO}_t$), as suggested by Bradley, Capozza and Seguin (1998). Both values reflect the availability of internal funds and potential agency costs. REITs with more agency conflicts will have to pay more dividends to reduce managers' misuse of free cash flows. I anticipate both EXFFO_{t-1} and $\Delta\mathrm{EXFFO}_t$will be positively related to discretionary dividends.

Another proxy for agency costs applied is leverage ratio (LEV_t). The cost of debt reduces free cash flow under the control of management and increased debt means increased supervision from capital markets. Therefore, leverage may act as a way of reducing agency costs and for REITs with higher leverage, it is not necessary to reduce agency costs by paying discretionary dividends. Moreover, REITs with higher leverage ratios are more likely to suffer from higher volatility of cash flows. Because the market may penalise the REITs that decrease dividends, REITs with more volatile cash flows should not pay more dividends in order to reduce the penalty risk for dividend reduction. Thus, I expect that the leverage ratio is negatively related to discretionary dividends.

Tobin's q (Q_t) is usually used as a proxy for investment opportunity. More investment opportunities mean more external financing demands and therefore more demand to mitigate potential agency costs. According to the hypothesis that paying discretionary dividends is a way of reducing agency costs, REITs with more investment opportunities would have to pay more discretionary dividends to fund acquisitions, implying a positive relationship between Tobin's q and discretionary dividend payments .

I cannot predict the sign of the coefficient for firm size ($SIZE_t$). Because larger REITs are more likely to reduce the volatility of generating cash flows due to the increased diversification of their properties, they are able to afford discretionary dividend payments. However, it is not necessary for large REITs to pay out dividends in excess of the mandatory level to mitigate the cost of external financing, as larger firms tend to have lower information asymmetry and greater access to capital markets, as suggested by Boudry, Kallberg and Liu (2011).

Both asset turnover ($ASSETTO_t$) and return on assets (ROA_t) measure a REIT's ability to generate profit on existing assets.[17] REITs with higher profitability are more likely to pay more discretionary dividends, which implies a positive relationship between profits and discretionary dividends. However, efficient REITs have less need to reduce agency costs by paying extra dividends to get access to capital markets due to their higher productivity of internal funds. This means that the need for highly efficient REITs to pay discretionary dividends is decreasing, and thus both proxies have an inverse relationship with dividend payments. Therefore, the signs of ASSETTO and ROA are unpredictable. As a control variable, the sign of TYPE is not predicted. It is a set of dummy variables and presents different sectors of underlying real estate properties of REITs, including housing, industrial, health care, retail, office, and diversified properties.[18]

In equation (2), I regress the REIT's externally financed growth rate on the fitted value of discretionary dividends using all exogenous variables in equations (1) and (2) and a set of the REIT's characteristics that may have an impact on external financing needs. Discretionary dividend payments are predicted to be positively related to externally financed growth due to their substitution role of reducing agency costs and resultant better access to capital markets.

As the demand on external funds can be influenced by two main factors, the availability of internal and external funds and investment opportunities, I control for these variables using proxies. Q is used as a proxy for investment opportunities. A firm with a higher Q is regarded as having more opportunities to grow, so I expect that Q is positively related to the dependent variable, externally financed growth. The sign of SIZE in equation (2) is also unpredictable. On one hand, larger REITs are more likely to have more investment opportunities and generally an increase in size enhances a REIT's access to external capital markets. Both these factors indicate that size is positively related to externally financed growth. On the other hand, REITs with more assets are more likely to be diversified and mitigate operating risks, thereby generating more internal cash flows steadily which means larger REITs are not as dependent on external financing as smaller REITs. So the relationship between firm size and growth may be ambiguous.

FIN is used as a proxy for the availability of external funds and the reliance of a REIT on external financing. FIN is expected to be positively related to externally financed growth. Fairfield and Yohn (2001) argue that asset turnover measures a firm's ability to generate revenues from its assets, and profit margin measures its ability to control the costs incurred to generate revenues. So I use $\Delta \mathrm{ASSETTO}_t$ and $\Delta \mathrm{PROFITMGN}_t$ to control for changes in firm performance. ASSETO means a firm's efficiency at using its assets to generate profits and PROFITMGN is how much out of each dollar of sales a company actually keeps in earnings. Both reflect a REIT's ability to generate internal funds, indicating that increases in ASSETO and PROFITMGN lead to decreasing demand for external funds. The sign of the change in profit margin is predicted to be negative. However, due to the method used to calculate the change in asset turnover, it has an impact on both internally financed growth and total growth. The signs of changes in asset turnover are unpredictable.[19]

2.4.4 Data

Our sample consists of all REITs listed on the Tokyo Stock Exchange and the Singapore Stock Exchange between 2002 and 2012, including 45 J-REITs and 46 S-REITs. To avoid survival bias, I include all active, suspended and delisted REITs in our sample. After removing the firm years with missing data, I have 417 firm-year observations in our final sample comprising 40 J-REITs and 33 S-REITs. Data for all variables was obtained from Datastream.

Table 2.1 reports the summary statistics of all variables applied in our model. The average rates of growth financed by all external funds, for long-term debt and equity, and all equity are 0.146, 0.142, and 0.125, respectively.[20] Comparing the average mandatory dividends (MANDIVRATE) between our sample and the US REITs, our mean value is 0.025 which is less than the reported mean values of the US REITs in Boudry (2011) and Ghosh and Sun (2013) (both 0.033). The average discretionary dividends (EXDIV) of our full sample is 0.002, suggesting that in general discretionary dividend payments account for 0.2% of a REIT's total assets.[21] The reported average discretionary dividend of the US REITs is 0.6% in Hardin and Hill (2008) and 0.5% in Ghosh and Sun (2013) which are larger than the corresponding figures for our Asian sample.

The average EXFFO of 0.021 is comparable with Hardin and Hill (2008) and Ghosh and Sun (2013). However, the average leverage ratio (LEV) of our sample is less than that of the U.S REITs (0.378 vs. 0.519), indicating that in general the US REITs borrow more than their Asian counterparts to fund investments. Tobin's Q of our sample is 0.89 which is also less than the 1.258 reported in Ghosh and Sun (2013), suggesting a better performance and growth momentum in the US REIT market. The average market capitalisation (MKTCAP) of our sample is US$1068 million which is smaller than the US REITs (US$1732 million). The average ROA is 0.035, indicating that they derive 0.035 dollars of earnings from each dollar of assets under their control. The average of total changes in debt and equity (FIN) for Asian REITs is 0.154. The average changes in asset turnover (ΔASSETTO) and profit margin (ΔPROFITMGN) of our sample are 0.012 and 0.005, respectively. These figures are larger than those of the US sample in Ghosh and Sun (2013) (0 and -0.004), indicating that the abilities of J-REITs and S-REITs to generate revenues from their assets and control the costs incurred to generate revenues are both greater than the US REITs.

Table 2.1 Descriptive statistics

Variables	Mean	Median	Max.	Min.	Std.	N
MKTCAP	1068135	695119	7290333	29711	1138561	417
GROWTH	0.166	0.151	0.934	-0.150	0.161	417
EFG_IG	0.146	0.132	0.912	-0.358	0.166	417
EFG_SFG	0.142	0.127	0.887	-0.440	0.170	417
EFG_SG	0.125	0.115	1.211	-1.019	0.197	417
MANDIVRATE	0.025	0.024	0.069	0.000	0.011	417
ΔMANDIVRATE	0.004	0.004	0.051	-0.054	0.009	417
EXDIV	0.002	0.001	0.112	-0.035	0.012	417
LAGEXDIV	0.000	0.000	0.112	-0.050	0.015	417
EXFFO	0.021	0.013	0.285	-0.022	0.031	417
ΔEXFFO	0.004	0.002	0.272	-0.230	0.035	417
LAGEXFFO	0.020	0.013	0.285	-0.040	0.029	417
LEV	0.378	0.383	0.600	0.000	0.111	417
Q	0.890	0.868	2.002	0.360	0.228	417
SIZE	5.822	5.842	6.863	4.473	0.447	417
ASSETTO	0.067	0.067	0.154	0.013	0.017	417
ROA	0.035	0.028	0.268	-0.138	0.042	417
FIN	0.154	0.140	0.892	-0.616	0.159	417
ΔPROFITMGN	0.005	0.004	0.085	-0.088	0.012	417
ΔASSETTO	0.012	0.011	0.079	-0.070	0.015	417

This table presents the descriptive statistics of our sample from 2003 to 2012 which consists of 417 observations from J-REITs and S-REITs. MKTCAP is the market capitalisation in US dollars. GROWTH is the growth rate of total assets. EFG_IG, EFG_SFG and EFG_SG are the differences between growth rate in assets and three relevant benchmark growth rates. MANDIVRATE is 90% of before tax net income divided by total assets. ΔMANDIVRATE is the change in mandatory dividends divided by total assets. EXDIV is the discretionary dividend payments, defined as the difference between total cash dividends paid and 90% of before tax net income, divided by total assets. LAGEXDIV is the previous year's discretionary dividends divided by previous year's total assets. EXFFO is the funds from operations, defined as net income excluding profits from the sale of properties, plus depreciation and amortization, exceeding mandatory dividend payments, scaled by total assets. LAGEXFFO is previous year's FFO, less the mandatory dividend payments, all divided by previous year's total assets. ΔEXFFO is the excess FFO in the current year less the previous year's excess FFO, scaled by current year's total assets. LEV is the leverage ratio, measured as total debt to total assets. Q is measured as the sum of market capitalisation, total debt and preferred equity, scaled by total assets. SIZE is the nature logarithm of market capitalization. ASSETTO is asset turnover, computed as total revenue divided by total assets. ROA is return on assets, calculated as net income available to shareholders divided by total assets. FIN is the sum of the change in total debt and the change in common equity, all divided by total assets. ΔPROFITMGN is the change in profit margin, computed as the change in net income scaled by total revenue. ΔASSETTO is the change in asset turnover, computed as the annual change in total revenue divided by total assets.

Table 2.2 (see Appendix A) presents the descriptive statistics by year and by property type in Panels A and B, respectively. The number of REITs in our sample gradually increases until 2008 before several J-REITs merged between 2009 and 2010 for synergy effects to overcome financial distress. The 2008 global financial crisis spread to Asian real estate markets. As a sector whose underlying assets are real estate properties, REITs were inevitably affected by this crisis. Also in 2008 the overall market capitalisation reached its lowest level. From the growth-relevant variables, I can also find a relatively slower growth situation during this period. Mandatory dividends present a slight drop due to the recession. The averages of discretionary dividend payments were negative in their initial years of establishment while they have been positive since 2007. During a financial crisis the cost of external financing rose sharply. The figures show that REITs distribute more discretionary dividends in challenging times to get better access to capital markets. Other financial variables, such as excess FFO, asset turnover rate, and profit margin also show a trend of fluctuated performance over the period of the financial crisis.

Panel B shows the variable averages of our sample by seven property types. Up to 27.6% of the observations in our sample are related to office properties, followed by retail and diversified properties while only 10 observations in our sample are related to health care properties.[22] Consistent with the US REITs in Ghosh and Sun (2013), the average growth rates and the reliance on external funds among different property types are quite different. As a whole, industrial properties show the highest growth rates and are more dependent on external financing. Following industrial properties, retail and housing properties also have higher growth rates. Diversified properties experience the lowest externally financed growth while health care properties have the slowest growth rates in assets, and investment in them is only funded by external channels. In spite of this, health care properties pay the highest mandatory dividends to their shareholders and their discretionary dividend payments are also high, close behind industrial and retail properties. Housing is the sector paying the lowest dividends.

2.4.5 Correlation

Table 2.3 reports the pairwise correlations between independent variables in discretionary dividends and externally financed growth equations in our model.[23] As shown in Panels A and B, the correlation coefficients between independent variables are ranging from 0.65

to -0.51 in the dividend equation and from 0.62 to -0.27 in the growth equation. All of the correlation coefficients are less than the threshold of 0.80 suggested by Judge et al. (1980). Therefore, there are no serious multicollinearity problems in this model.

Table 2.3 Correlation matrix

Panel A. Independent variables in discretionary dividend equation

	EFG_IG	LAGEXDIV	LAGEXFFO	ΔEXFFO	MANDIVRATE	ΔMANDIVRATE	LEV	Q	SIZE	ASSETTO	ROA
EFG_IG	1.00										
LAGEXDIV	-0.05	1.00									
LAGEXFFO	-0.12	0.05	1.00								
ΔEXFFO	-0.11	-0.14	-0.51	1.00							
MANDIVRATE	-0.14	-0.03	-0.07	0.07	1.00						
ΔMANDIVRATE	0.23	0.01	-0.20	0.22	0.52	1.00					
LEV	0.00	0.01	0.20	0.05	-0.42	-0.11	1.00				
Q	0.08	-0.04	-0.04	0.14	0.27	0.14	-0.03	1.00			
SIZE	0.05	0.15	-0.07	0.02	0.13	0.05	-0.16	0.58	1.00		
ASSETTO	-0.29	0.03	-0.02	0.08	0.65	0.25	-0.16	0.07	0.02	1.00	
ROA	0.35	0.12	-0.14	0.04	0.26	0.19	-0.24	0.17	0.23	-0.04	1.00

Panel B. Independent variables in externally financed growth equation

	EXDIV	Q	SIZE	FIN	ΔPROFITMGN	ΔASSETTO
EXDIV	1.00					
Q	-0.01	1.00				
SIZE	0.08	0.58	1.00			
FIN	-0.06	0.14	0.04	1.00		
ΔPROFITMGN	-0.27	0.13	0.04	0.19	1.00	
ΔASSETTO	-0.05	0.09	-0.07	0.40	0.62	1.00

This table presents correlations between the independent variables in two equations in Panels A and B. EFG_IG is the difference between growth rate in assets and growth rates achieved by all internal funds. MANDIVRATE is 90% of before tax net income divided by total assets. ΔMANDIVRATE is the change in mandatory dividends divided by total assets. EXDIV is the discretionary dividend payments, defined as the difference between total cash dividends paid and 90% of before tax net income, divided by total assets. LAGEXDIV is the previous year's discretionary dividends divided by the previous year's total assets. EXFFO is the funds from operations, defined as net income excluding profits from the sale of properties, plus depreciation and amortization, exceeding mandatory dividend payments, scaled by total assets. LAGEXFFO is previous year's FFO, less the mandatory dividend payments, all divided by the previous year's total assets. ΔEXFFO is the excess FFO in the current year less the previous year's excess FFO, scaled by current year's total assets. LEV is the leverage ratio, measured as total debt to total assets. Q is measured as the sum of market capitalisation, total debt and preferred equity, scaled by total assets. SIZE is the nature logarithm of market capitalisation. ASSETTO is asset turnover, computed as total revenue divided by total assets. ROA is return on assets, calculated as net income available to shareholders divided by total assets. FIN is the sum of the change in total debt and the change in common equity, all divided by total assets. ΔPROFITMGN is the change in profit margin, computed as the change in net income scaled by total revenue. ΔASSETTO is the change in asset turnover, computed as the annual change in total revenue divided by total assets.

2.5 Empirical Results

2.5.1 Regressions

Table 2.4 reports the pooled and cross-sectional 2SLS estimates of the SEM model in Panels A and B. The instrumental variables are all exogenous variables in both equations. Three different measures of externally financed growth (EFG_IG, EFG_SFG, and EFG_SG) are applied and the regression estimates are shown in the relevant columns.

Panel A reports 2SLS estimates of the discretionary dividend equation. The most important relationship in the discretionary dividend equations is the relationship between discretionary dividend payments and factors implying agency costs. The results confirm that paying discretionary dividends is a way to reduce agency costs. First, lagged excess FFO and the change in excess FFO are positively related to discretionary dividend payments at the 10% and 1% levels of significance, respectively. More dividend distribution would be forced to mitigate the increased potential agency costs associated with free cash flows, indicating the role of discretionary dividend payments in reducing agency costs. Second, the relationship between discretionary dividends and leverage ratio is significantly negative at the 10% level. This means that for REITs with more monitoring from capital markets due to higher leverage ratio have less need to distribute their earnings to shareholders to reduce agency costs. These findings are consistent with Hypothesis 1.

Some important features of discretionary dividends in Asian REITs should also be noted. First, growing REITs are more likely to distribute more dividends, as the results show that externally financed growth is significantly and positively related to discretionary dividend payments. Second, consistent with the US REITs, discretionary dividends are serially correlated, and mandatory dividend payments have a significantly negative relationship with discretionary dividends. Third, the relationship between asset turnover ratio and dividends is significantly positive which is contrary to the findings of Ghosh and Sun (2013) on US REITs. This means more efficient REITs tend to pay more dividends. Fourth, REITs investing in industry and healthcare properties distribute more discretionary dividends than other types.

Panel B reports the pooled 2SLS estimates of the externally financed growth equation. As expected, discretionary dividend payments are significantly and positively related to externally financed growth at the 1% level of significance. It means that Asian REITs paying more discretionary dividends to shareholders grow faster by external financing which is consistent with our Hypothesis 2. Combining this with findings from the discretionary dividend equation, it is clear that discretionary dividend payments do indeed enhance firm growth and this can be attributed to the substitution role of paying discretionary dividends in reducing agency costs.

In the second equation, I also control for Tobin's Q, firm size, the change in debt and equity (FIN), the change in profit margin (△PROFITMGN), and the change in asset turnover (△ASSETTO). All the control variables are significant except for △ASSETTO. First, Q is negatively related to external growth which is inconsistent with our expectations. As a proxy for investment opportunity, larger Q doesn't mean higher realised growth. Second, size is significantly positively related to external growth, indicating that larger REITs have more access to external markets and thus experience higher externally financed growth. Third, the changes in debt and external growth are inconsistent with our expectations. As a proxy for investment opportunity, larger Q doesn't mean higher realised growth. Second, size is significantly positively related to external growth, indicating that larger REITs have more access to external markets and thus experience higher externally financed growth. Third, the change in debt and equity is significantly positive. This indicates that better access to external financing leads to higher externally financed growth. Fourth, contrary to our prediction, the coefficient of the change in profit margin is positive and significant at the 10% level, indicating that REITs with improvements in profits experience higher externally financed growth. This can be interpreted as meaning that although these REITs have more internal capital available, they still choose external funds to fund growth.

Table 2.5 reports cross-sectional 2SLS estimates of the SEM model and provides further support for our hypotheses. Excess FFO is insignificant in these cross-sectional regressions, but leverage ratio is more significant (5%) than in pooled regressions (10%). Discretionary dividends are positively related to firm growth at the 1% level. This also provides strong evidence that paying discretionary dividends acts as a means of reducing agency costs and enhances externally financed growth. When ignoring the time-varying effects, REITs with industrial, office and diversified properties are more likely to distribute more discretionary dividends.

In summary, our findings are consistent with the hypothesis that paying discretionary dividends enhances externally financed growth of REITs by reducing agency costs. They provide evidence from non-US REIT markets to support the findings of Ghosh and Sun (2013).

Table 2.4 Pooled 2SLS estimation

Panel A. Estimates of discretionary dividend equation

Variables	Predicted sign	EFG_IG			EFG_SFG			EFG_SG		
		Coefficient		t-Statistic	Coefficient		t-Statistic	Coefficient		t-Statistic
INTERCEPT		0.006		0.764	0.006		0.779	0.003		0.412
EFG	(+)	0.008	**	2.023	0.008	**	2.062	0.013	***	2.877
LAGEXDIV	(+)	0.358	***	10.594	0.358	***	10.612	0.360	***	10.605
MANDIVRATE	(-)	-0.303	***	-3.188	-0.300	***	-3.149	-0.276	***	-2.859
ΔMANDIVRATE	(-)	-0.352	***	-5.161	-0.352	***	-5.183	-0.384	***	-5.488
LAGEXFFO	(+)	0.033	*	1.660	0.035	*	1.760	0.051	**	2.366
ΔEXFFO	(+)	0.054	***	3.230	0.057	***	3.316	0.076	***	3.872
LEV	(-)	-0.009	*	-1.664	-0.009	*	-1.648	-0.008		-1.417
Q	(+/-)	0.003		1.233	0.003		1.224	0.003		1.004
SIZE	(+/-)	-0.001		-0.971	-0.002		-0.988	-0.001		-0.791
ASSETTO	(+/-)	0.171	***	3.962	0.169	***	3.937	0.176	***	4.033
ROA	(+/-)	0.015		1.106	0.015		1.099	0.008		0.545
HOUSING		-0.003		-1.193	-0.003		-1.179	-0.004		-1.371
INDUSTRY		0.005	*	1.852	0.005	*	1.858	0.005	*	1.715
HEALTHCARE		0.007	*	1.817	0.007	*	1.815	0.007	*	1.808
RETAIL		0.001		0.391	0.001		0.399	0.001		0.332
OFFICE		0.000		-0.068	0.000		-0.064	0.000		-0.107
DIVERSIFIED		-0.002		-0.891	-0.002		-0.886	-0.002		-0.888
ADJ. R2		0.380			0.381			0.364		
N		417			417			417		

Panel B. Estimates of externally financed growth equation

Variables	Predicted sign	EFG_IG			EFG_SFG			EFG_SG		
		Coefficient		t-Statistic	Coefficient		t-Statistic	Coefficient		t-Statistic
INTERCEPT		-0.067		-1.302	-0.107	*	-1.894	-0.042		-0.403
EXDIV	(+)	1.605	***	3.138	1.767	***	3.168	2.495	**	2.405
Q	(+)	-0.061	***	-3.091	-0.071	***	-3.274	-0.084	**	-2.096
SIZE	(+/-)	0.020	*	1.902	0.027	**	2.405	0.018		0.841
FIN	(+)	0.939	***	37.259	0.947	***	34.434	0.834	***	16.313
ΔPROFITMGN	(-)	0.762	*	1.747	0.790	*	1.662	1.382		1.563
ΔASSETTO	(+/-)	0.186		0.548	0.060		0.163	-0.017		-0.024
ADJ. R2		0.806			0.778			0.432		
N		417			417			417		

This table reports the pooled 2SLS estimates of both the discretionary dividend equation in Panel A and the externally financed growth equation in Panel B respectively. For each panel, three measures of externally financed growth (i.e. EFG_IG, EFG_SFG, and EFG_SG) are applied. MANDIVRATE is 90% of before tax net income divided by total assets. ΔMANDIVRATE is the change in mandatory dividends divided by total assets. EXDIV is the discretionary dividend payments, defined as the difference between total cash dividends paid and 90% of before tax net income, divided by total assets. LAGEXDIV is the previous year's discretionary dividends divided by the previous year's total assets. EXFFO is the funds from operations, defined as net income excluding profits from the sale of properties, plus depreciation and amortization, exceeding mandatory dividend payments, scaled by total assets. LAGEXFFO is the previous year's FFO, less the mandatory dividend payments, all divided by previous year's total assets. ΔEXFFO is the excess FFO in the current year less previous year's excess FFO, scaled by the current year's total assets. LEV is the leverage ratio, measured as total debt to total assets. Q is measured as the sum of market capitalisation, total debt and preferred equity, scaled by total assets. SIZE is the nature logarithm of market capitalization. ASSETTO is asset turnover, computed as total revenue divided by total assets. ROA is return on assets, calculated as net income available to shareholders divided by total assets. HOUSING, INDUSTRY, HEALTHCARE, RETAIL, OFFICE, AND DIVERSIFIED represent the different sectors of the underlying real estate of REITs. FIN is the sum of the change in total debt and the change in common equity, all divided by total assets. ΔPROFITMGN is the change in profit margin, computed as the change in net income scaled by total revenue. ΔASSETTO is the change in asset turnover, computed as the annual change in total revenue divided by total assets. ***, **, and * indicate the significance of coefficient at levels of 1%, 5% and 10% respectively.

Table 2.5 Cross-sectional 2SLS estimation

Variables	Predicted sign	EFG_IG			EFG_SFG			EFG_SG		
		Coefficie		t-	Coefficie		t-	Coefficie		t-
Panel A. Estimates of discretionary dividend equation										
INTERCEPT		0.013		1.157	0.013		1.177	0.011		0.961
EFG	(+)	0.013		0.956	0.013		0.940	0.014		1.123
LAGEXDIV	(+)	0.451	***	11.040	0.451	***	11.043	0.451	***	11.205
MANDIVRAT	(-)	-0.254		-1.526	-0.251		-1.484	-0.237		-1.422
ΔMANDIVRA	(-)	0.050		0.234	0.044		0.202	0.056		0.291
LAGEXFFO	(+)	-0.004		-0.106	0.000		-0.004	0.001		0.031
ΔEXFFO	(+)	-0.099		-1.522	-0.094		-1.369	-0.082		-1.161
LEV	(-)	-0.016	**	-2.250	-0.016	**	-2.216	-0.014	*	-1.883
Q	(+/-)	0.007		1.227	0.007		1.201	0.007		1.195
SIZE	(+/-)	-0.002		-0.990	-0.002		-1.008	-0.002		-0.864
ASSETTO	(+/-)	0.002		0.031	0.000		0.009	-0.002		-0.035
ROA	(+/-)	0.071	*	1.670	0.072	*	1.701	0.061		1.347
HOUSING		0.003		1.020	0.003		1.044	0.002		0.853
INDUSTRY		0.006	**	2.320	0.006	**	2.338	0.006	**	2.304
HEALTHCAR		0.003		0.843	0.003		0.850	0.003		0.883
RETAIL		0.002		0.830	0.002		0.845	0.002		0.844
OFFICE		0.004	*	1.697	0.004	*	1.702	0.004	*	1.671
DIVERSIFIED		0.005	**	2.023	0.005	**	2.034	0.005	**	2.079
ADJ. R2		0.878			0.878			0.881		
N		73			73			73		
Panel B. Estimates of externally financed growth equation										
Variables	Predicted sign	EFG_IG			EFG_SFG			EFG_SG		
		Coefficie		t-	Coefficie		t-	Coefficie		t-
INTERCEPT		-0.073		-1.044	-0.115		-1.402	-0.011		-0.079
EXDIV	(+)	1.611	***	4.476	1.799	***	4.275	3.130	***	4.406
Q	(+)	-0.115	***	-3.356	-0.122	***	-3.054	-0.140	**	-2.072
SIZE	(+/-)	0.031	**	2.171	0.040	**	2.341	0.023		0.789
FIN	(+)	0.818	***	9.449	0.791	***	7.810	0.799	***	4.673
ΔPROFITMGN	(-)	4.135	***	2.850	4.520	***	2.664	4.184		1.461
ΔASSETTO	(+/-)	-0.781		-0.667	-0.971		-0.709	-1.776		-0.768
ADJ. R2		0.739			0.674			0.448		
N		73			73			73		

This table reports the cross-sectional 2SLS estimates of both the discretionary dividend equation in Panel A and the externally financed growth equation in Panel B, respectively. For each panel, three measures of externally financed growth (i.e. EFG_IG, EFG_SFG, and EFG_SG) are applied. MANDIVRATE is 90% of before tax net income divided by total assets. ΔMANDIVRATE is the change in mandatory dividends divided by total assets. EXDIV is the discretionary dividend payments, defined as the difference between total cash dividends paid and 90% of before tax net income, divided by total assets. LAGEXDIV is the previous year's discretionary dividends divided by the previous year's total assets. EXFFO is the funds from operations, defined as net income excluding profits from the sale of properties, plus depreciation and amortization, exceeding mandatory dividend payments, scaled by total assets. LAGEXFFO is the previous year's FFO, less the mandatory dividend payments, all divided by the previous year's total assets. ΔEXFFO is the excess FFO in the current year less the previous year's excess FFO, scaled by the current year's total assets. LEV is the leverage ratio, measured as total debt to total assets. Q is measured as the sum of market capitalization, total debt and preferred equity, scaled by total assets. SIZE is the nature logarithm of market capitalisation. ASSETTO is asset turnover, computed as total revenue divided by total assets. ROA is return on assets, calculated as net income available to shareholders divided by total assets. HOUSING, INDUSTRY, HEALTHCARE, RETAIL, OFFICE, AND DIVERSIFIED represent the different sectors of the underlying real estate of REITs. FIN is the sum of the change in total debt and the change in common equity, all divided by total assets. ΔPROFITMGN is the change in profit margin, computed as the change in net income scaled by total revenue. ΔASSETTO is the change in asset turnover, computed as the annual change in total revenue divided by total assets. ***, **, and * indicate the significance of coefficient at levels of 1%, 5% and 10% respectively.

2.5.2 Sensitivity analysis

I test the robustness of our regression results by changing some of the particulars of our procedures. To ensure the sample size is large enough, the data I use in our regressions so far have been annual data without any constraints. This may involve outlier issues and selection bias. I re-estimate the model by taking three-year averages of all regression variables to remove the possibility of these issues arising. After this restriction, the final sample had 144 less firm-year observations and six less unique REITs. The unreported results show that with three-year averages, the coefficients on discretionary dividends are positive and greater than those without such restrictions. This indicates that for the excluded REITs without three consecutive years of life, paying discretionary dividends to shareholders has less positive effects on firm growth than similar payments by sustainable REITs. This result is similar to those reported in Tables 2.4 and 2.5 and our results provide supportive evidence on the relationship between dividend payments and externally financed growth.

Another consideration is the variable EXFFO used in the dividend equation. Although it reflects the potential agency costs associated with free cash flows to some extent, it might not be as reliable a proxy for agency costs. To check the robustness of our findings, I undertake further tests by dividing our sample into high and low agency cost groups. If our findings are robust, I expect that the sensitivity of externally financed growth to discretionary dividend payments will be greater for REITs identified as having high agency costs.

I use Tobin's Q-excess FFO interaction as a proxy for agency costs. Tobin's Q is used to measure the investment opportunity of a REIT and excess FFO presents its free cash flows. Those with less investment opportunities and high free cash flows are placed in the high agency cost group. A Tobin's Q dummy variable is constructed which takes the value of

1 if the REIT's Tobin's Q is less than one and zero otherwise. It means that the REIT has less investment opportunity when the Q dummy is 1. I partition our sample by the product of this dummy variable multiplied by excess FFO and then the high agency cost group can be identified. A REIT is placed into the high agency cost subsample if the result is greater than the sample median and all other REITs are placed in the low agency cost subsample .

Table 2.6 Pooled estimation of growth equation: high and low agency cost groups

Variables	EFG_IG				EFG_SFG				EFG_SG			
	High		Low		High		Low		High		Low	
INTERCEPT	-0.104		-0.096	*	-0.169	*	-0.111	*	-0.071		-0.169	*
	(-1.112)		(-1.694)		(-1.652)		(-1.852)		(-		(-1.830)	
EXDIV	5.068	**	0.741	*	5.652	**	0.799	*	6.963	**	1.450	**
	(3.186)		(1.849)		(3.265)		(1.878)		(2.149)		(2.221)	
Q	0.092		-0.135	**	0.091		-0.152	**	0.186		-0.249	**
	(1.393)		(-6.824)		(1.269)		(-7.197)		(1.382)		(-7.716)	
SIZE	0.002		0.037	**	0.012		0.042	**	-0.017		0.066	**
	(0.118)		(3.303)		(0.577)		(3.529)		(-		(3.567)	
FIN	0.931	**	0.979	**	0.949	**	0.979	**	0.711	**	1.016	**
	(19.552		(36.682		(18.301		(34.555		(7.328)		(23.368	
∆PROFITMG	1.484		-0.074		1.463		-0.070		2.136		-0.166	
	(1.619)		(-0.146)		(1.467)		(-0.129)		(1.144)		(-0.201)	
∆ASSETTO	-0.241		0.774	*	-0.400		0.745	*	-0.267		0.600	
	(-0.405)		(1.857)		(-0.619)		(1.683)		(-		(0.883)	
ADJ. R2	0.682		0.898		0.647		0.886		0.161		0.780	
N	208		209		208		209		208		209	

This table reports the pooled 2SLS estimates of the externally financed growth equation. Our sample is divided into two agency cost groups based on the interaction between Tobin's Q and excess FFO. Three measures of externally financed growth (i.e. EFG_IG, EFG_SFG, and EFG_SG) are applied. EXDIV represents discretionary dividend payments which are defined as the difference between total cash dividends paid and 90% of before tax net income, divided by total assets. Q is measured as the sum of market capitalisation, total debt and preferred equity, scaled by total assets. SIZE is the nature logarithm of market capitalisation. FIN is the sum of change in total debt and change in common equity divided by total assets. FIN is the sum of the change in total debt and the change in common equity, all divided by total assets. ∆PROFITMGN is the change in profit margin, computed as the change in net income scaled by total revenue. ∆ASSETTO is the change in asset turnover, computed as the annual change in total revenue divided by total assets. T-statistics are shown in the parentheses below the coefficients. ***, **, and * indicate the significance of coefficient at levels of 1%, 5% and 10% respectively.

The regression estimates are reported in Table 2.6. The high agency cost group shows larger coefficients on discretionary dividends with higher significance, indicating that the growth of REITs with higher potential agency costs is more sensitive to dividend payments. This suggests that when suffering higher external financing costs, REITs manage dividend policy to facilitate their access to capital markets to fund growth. This is also consistent with our hypotheses.

2.6 Summary

Conflicts between managers and shareholders and the resultant costs have been shown to weaken the ability of a firm to seek potentially profitable investments, since high agency costs increase the cost of external financing, and this is especially true for REITs. Since they are required to pay a high proportion of their income in mandated dividends, REITs rely heavily on external capital markets to fund acquisitions and they can therefore benefit if they reduce agency costs and the resultant costs associated with external financing. Paying dividends in excess of the mandatory level is one way to mitigate agency costs and improve the ability of REITs to fund their growth opportunities. Therefore, discretionary dividend payments can positively impact REITs' growth through reducing agency costs and improving access to lower-cost external financing.

I investigate this notion by examining the relationship between discretionary dividend payments of REITs and their growth and a simultaneous equation model is applied. I calculate discretionary dividend as the difference between total cash dividend payments and 90 per cent of before tax net income. Externally financed growth is computed as the rate of growth in assets exceeding the growth that can be obtained by relying strictly on all their internal funds, the short-term debt, and total debt, respectively.

I extend the existing literature on the dividend policies of REITs by using an Asian sample. From the pooled and cross-sectional 2SLS regressions, I find a significantly positive relationship between externally financed growth and discretionary dividends, indicating that paying dividends in excess of the mandatory level enhances access to external markets and promotes firm growth. I also find that REITs with more agency costs tend to pay more discretionary dividends, which suggests discretionary dividend payments play a role in reducing agency costs and ensure that the effect of discretionary dividends on firm growth can be attributed to the reduced agency costs achieved by paying discretionary dividends.

Chapter 3

Volatility Spillover Effects in Asia-Pacific Securitised Real Estate Markets

3.1 Introduction

With the process of economic integration, the volatility transmission across international financial markets is of concern. Information shared across markets is one of the factors that results in information volatility transmission. Investors refer to all relevant information not only from the local market but also from foreign market to optimise their portfolios internationally. Milunovich and Throp (2006) argue that volatility spillovers are large enough to matter to investors and find evidence that portfolio efficiency gains due to volatility spillover effects are significant. This indicates the importance of understanding the sources of volatility in asset allocation decisions. In earlier phase, there were few studies on spillover analysis in direct real estate market. One possible reason might be previous findings such as those of as Hoesli et al. (2004) who report that real estate assets tend to be dominated by local factors. Eichholtz (1996) and Paul et al. (1991) also provide evidence that real estate markets are less globally integrated than other financial assets, unlike the literature prior to their studies which indicated the opposite. This lack of global integration is due to the lower cross-country correlations for real estate returns. They attribute this lower integration to the segmentation between countries and a higher degree of importance of local factors compared to foreign information flows. This specific feature probably leads to the finding in Glascock et al. (2004) that REITs are less vulnerable to market downturns than other forms of equity.

In earlier real estate literature (e.g. Eichholtz et al. (1998)) it is reported that in the Asia-Pacific, real estate returns are not driven by continental factors, and thus this region offers attractive international diversification opportunities. Nevertheless, some recent studies (e.g. Gerlach et al. (2006) and Liow (2008)), show the increasing interdependence in Asia-Pacific property markets since the 1997 Asian Financial Crisis and less international diversification benefits than reported in previous studies in this region. Therefore, with the integration of the global economy and the development of information technology, more information is being transmitted across real estate markets and this exerts an influence on local markets. Moreover, the role of regional factors in the Asia-Pacific real estate markets might also be changing.

However, unlike direct real estate investment, indirect real estate investment, (i.e. the securitised real estate market) not only facilitates investments in properties and enhances liquidity, but is also exposed to more systematic risks. One potential question in this study that examines the volatility spillover effects in Asia-Pacific real estate markets is the validity of focusing on securitised real estate markets rather than direct real estate markets. However, this concern can be dispelled by the strong association between direct and indirect real estate markets. In general, indirect real estate markets move with approximately six to nine months' lead time over the direct markets. In one of the studies on the relationship between direct and indirect real estate markets, Kallberg et al. (2002) find that for Asian real estate markets the correlations between direct and indirect real estate returns are relatively strong, and that securitised markets lead to changes in direct markets. Therefore, in addition to dodging the lack of available high-frequency observations for direct real estate markets, investigating the volatility spillover effects across securitised real estate markets has significant implications for direct real estate pricing and portfolio selection strategies.

To examine volatility spillover effects in Asia-Pacific real estate security markets, I apply an extended autoregressive (AR) model in which the conditional volatilities are modeled in a GARCH (1, 1) model to measure the volatility spillovers from both the US and the aggregate Asia-Pacific securitised real estate markets on ten securitised real estate markets in Asia (i.e. Australia, Hong Kong, Singapore, Japan, Mainland China, Taiwan, Malaysia, Thailand, the Philippines and Indonesia). As the sample period covers the 2007–2008 Global Financial Crisis (GFC), another interest of this study is to examine the effects of the GFC on the US and Asia-Pacific volatility spillover effects and market integration. Therefore, I extend the volatility spillover model in Christiansen (2007) by assuming that the volatility spillover effects are different during the GFC period.

The following questions are addressed in this study: (1) Do both the US and aggregate Asia have significant mean and volatility spillover effects on individual Asia-Pacific securitised real estate markets? (2) To what extent can the conditional variance of individual Asia-Pacific securitised real estate markets be explained by global and regional shocks? (3) Was there any change in volatility transmission during the GFC period? (4) What are the determinants of the time varying volatility spillover intensities?

This chapter contributes to the existing literature in the following ways: First, it extends the real estate literature by focusing on the regional shocks that may have an influence on real estate returns in addition to the global shocks from the US. It analyses the interdependence of international real estate security markets by separating the volatility spillovers into factors that reflect geographical proximity and country boundaries in an Asia-Pacific setting. Although some real estate studies have examined the information leadership of the US real estate market worldwide, none of them attach importance to the influence of regional information. The enhanced regional economic integration in Asia motivates us to shed light on the regional volatility spillover effects in Asia-Pacific real estate markets. I follow the spirit in Bekaert and Harvey (1997), Ng (2000) and Baele (2005) to allow local unexpected returns being driven by the US and regional innovations by using a series of AR(1)-GARCH (1, 1) models. I find that Asia-Pacific real estate markets are more sensitive to the information transmitted within Asia than they are to information from the US, although all of them experience significant volatility spillover effects from both the US and Asia. This finding confirms the importance of differentiating between regional and global effects.

Second, I provide evidence on the effects of a major financial crisis on interdependency in Asia-Pacific real estate markets and the asymmetry of volatility spillovers. A large number of studies have examined the asymmetry of correlations and volatilities, but there is little data on the asymmetry of volatility spillovers. By adding a GFC dummy to the standard volatility spillover model, I find that the US volatility spillover effects increased significantly during the GFC period for most of Asia-Pacific real estate markets. This indicates the asymmetric nature of the US volatility spillovers which means that the global shocks from the US are greater in down markets than in growth markets.

Finally, I associate the volatility spillover intensities with some macroeconomic factors to identify their economic determinants. Bilateral trade does not play an important role in volatility transmission in Asia-Pacific real estate markets. However, the monetary policies that reflect currency hedging costs play a leading role in affecting the volatility spillover intensities. The GFC dummy is also an important factor.

The remainder of this chapter is organised as follows. Section 3.2 introduces related literature. Section 3.3 describes the data, offers some descriptive statistics, and introduces the volatility spillover model applied in this study. Empirical results are presented in Section 3.4. Section 3.5 concludes the chapter.

3.2 Literature review

Since Engle (1990), volatility spillover analysis has come to the fore. Early studies of volatility spillovers typically focus on the volatility transmission from developed to emerging equity markets and/or from larger to smaller markets. Examples include Hamao et al. (1990), Theodossiou and Lee (1993), and Wei et al. (1995). Additionally, geographic locality is also likely to be a factor in volatility spillovers. Bekaert and Harvey (1997) were the first to distinguish between local and global shocks. Ng (2000) finds that in addition to the global effects from the US, regional factors are also important for Pacific Basin markets and thus she separates the shocks to returns in individual Asian equity markets into three types of shocks: local, regional, and global. Using this approach, she uses the volatility spillover model constructed by Bekaert and Harvey (1997) to examine the spillover effects from Japan and the US on Pacific Basin equity markets. Miyakoshi (2003) uses a bivariate EGARCH model to examine the volatility spillovers to Asian equity markets from the US and Japan. Like Asia, Europe has been a particularly interesting region for volatility spillover analysis since the European Monetary Union (EMU) came into effect. With the introduction of regime-dependent shock spillover intensities, Baele (2005) constructs a regime-switching model based on Bekaert and Harvey (1997) and Ng (2000) to examine the volatility spillover effects from aggregate Europe and the US to European equity markets. Christiansen (2007) applies a similar model on European bond markets. All of them find significant regional and global volatility spillovers to local markets.

However, in the real estate literature only a few studies focus on volatility spillovers, while most studies examine correlations. Some studies, such as Kallberg et al. (2002), Clayton and Mackinnon (2003), Wilson and Zurbruegg (2003), Liow and Yang (2005), and Cotter and Stevenson (2006),Yang et al. (2012), focus on correlations between the real estate and broader stock markets. Some have an international perspective. For example, Liow et al. (2009) investigate the conditional correlation dynamics between five main real estate security markets, the US, the UK, Japan, Hong Kong and Singapore. Their results show a significantly positive relationship between the conditional correlations and their conditional volatilities. This indicates the importance of including information on changing correlations and volatilities when designing more optimal portfolios for international real estate assets. Additionally, they confirm that relative to the correlations between the stock market returns, the correlations between securitised real estate market returns are lower. In another paper focusing on eight Asian real estate markets, Liow (2012) finds time-variant conditional real estate-stock correlations at the local, regional, and global levels. Liow also finds that real estate-global stock correlations comove significantly and positively with real estate regional correlations and real estate local stock correlations.

However, volatility spillover analysis in real estate markets has not been deeply explored. Some papers examine volatility transmission between segments. For example, Stevenson (2002) examines the volatility linkages between REITs and equity and fixed income sectors in the US. Real estate markets may also be interrelated across countries. Michayluk et al. (2006) find strong evidence of interaction between the US and UK securitised real estate markets on a daily basis. Their finding that the US market has more influence on the UK than vice versa confirms the finding of the significance of the US property market in influencing smaller property markets in Wilson and Zurbruegg (2003).

Hoesli and Reka (2013) examine the volatility transmissions between local and global securitised real estate markets and between real estate and common stock markets with a sample from the US, the UK and Australia, and find that spillover effects are largest in the US.

With an Asian sample, Lin (2013) investigates the spillover effects from stock and bond markets on REIT markets and finds a negative spillover effect from the stock market to the REIT market, but a positive spillover from the bond market to the REIT market. Liow and Newell (2012) examine the volatility transmission within Greater China and between Greater China and the US securitised real estate markets. They find that the Greater China real estate security markets are more integrated with each other than with the US market due to geographical proximity and closer economic links.

3.3 Data and methodology

3.3.1 Data

I use Standard and Poor's (S&P's) total return global property indices extracted from Datastream for the US, aggregate Asia, and ten Asia-Pacific markets including Australia (AU), Hong Kong (HK), Singapore (SG), Japan (JP), Mainland China (CN), Taiwan (TW), Malaysia (ML), Thailand (TH), the Philippines (PH), and Indonesia(IND)[24]. The data were sampled weekly to avoid the issues of discrepant trading hours and the day-of-the-week effect. This approach also guarantees that information can be shared across markets. The data cover the period from 17 July 2006 to 28 July 2014. Log-returns are applied ($R_{it} = \ln(P_t) - \ln(P_{t-1})$) and calculated in terms of US dollars by assuming that investors are unhedged against foreign exchange risks. The profile of total return indices is shown in Figure 3.1.

Table 3.1 presents the summary statistics for the weekly returns in the US, aggregate Asia, and individual Asian securitised real estate markets. The mean returns range from 0.03% in Australia to 0.35% in Thailand. In all of the return distributions are skewed to the left and all the distributions show excess kurtosis which suggests the non-normality of the returns. The Jarque-Bera test rejects the null hypothesis that the series are normal distribution and thus further confirms the non-normality of the series. The ADF unit root null hypothesis of a unit root is also rejected. Therefore the series are stationary and do not need to be further differenced. According to the Ljung-Box Q tests, half of the return series and all of the squared returns are significantly auto-correlated, which indicates that the AR specification is useful. The conditional heteroscedasticity is confirmed by the ARCH (1) LM tests. This supports the usage of ARCH models in this study.

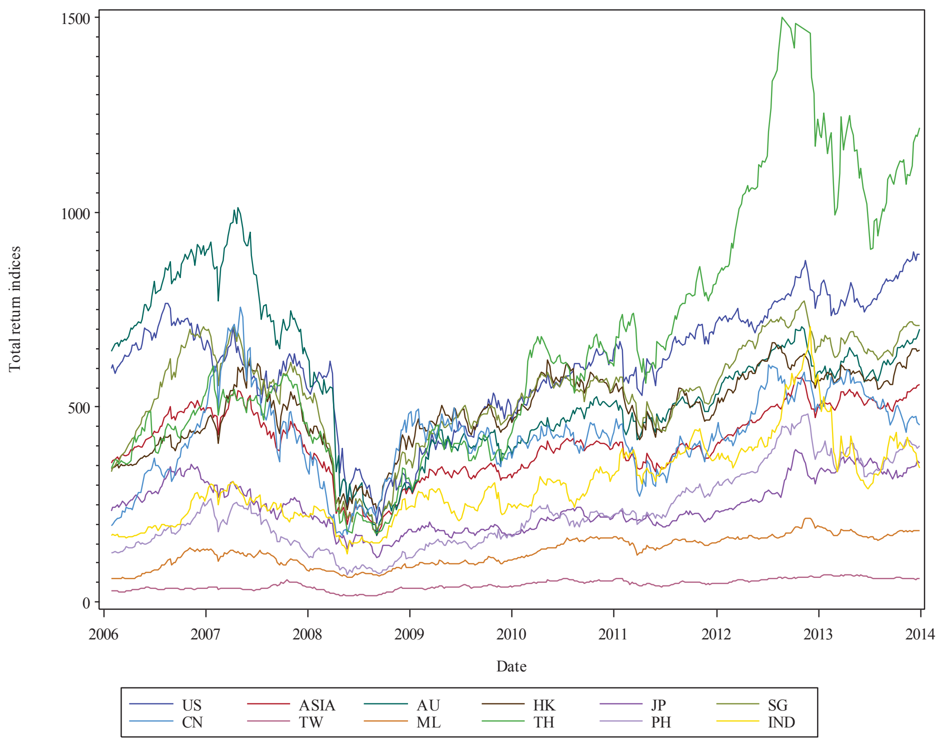


Figure 3.1 Total return indices

Table 3.1 Summary statistics

Variable	US	ASIA	AU	HK	SG	JP	CN	TW	ML	TH	PH	IND
Mean	0.11%	0.12%	0.03%	0.17%	0.19%	0.11%	0.24%	0.18%	0.28%	0.35%	0.29%	0.22%
Std Dev	0.04	0.03	0.05	0.04	0.04	0.04	0.06	0.04	0.03	0.05	0.05	0.05
Median	0.35%	0.43%	0.52%	0.17%	0.46%	0.15%	0.25%	0.28%	0.32%	0.57%	0.66%	0.50%
Kurtosis	5.33	7.93	18.33	3.52	6.95	2.14	1.8	2.35	2.13	12.85	2.27	4.09
Skewness	-0.27	-1.06	-2.45	-0.19	-0.14	-0.21	-0.13	-0.49	-0.33	-1.51	-0.62	-0.42
Maximum	0.22	0.14	0.17	0.13	0.24	0.15	0.2	0.17	0.13	0.15	0.17	0.26
Minimum	-0.21	-0.25	-0.41	-0.22	-0.24	-0.17	-0.25	-0.17	-0.14	-0.41	-0.23	-0.26
JB statistic	485.02[a]	1142.33[a]	6119.64[a]	211.22[a]	820.30[a]	79.85[a]	55.59[a]	109.26[a]	83.94[a]	2958.82[a]	113.16[a]	294.46[a]
ADF	-21.01[a]	-21.83[a]	-13.15[a]	-20.77[a]	-12.27[a]	-20.95[a]	-20.79[a]	-12.11[a]	-19.33[a]	-11.85[a]	-21.43[a]	-20.87[a]
Q(12)	18.80[c]	19.69[c]	51.73[a]	11.71	34.85[a]	23.48[b]	8.87	37.75	15.06	25.51[b]	9.68	6.54
$Q^2(12)$	463.08[a]	145.02[a]	123.32[a]	145.90[a]	170.57 [a]	251.88 [a]	68.36[a]	195.77[a]	68.77[a]	19.75[c]	69.79[a]	27.71[a]
ARCH(1)	133.10[a]	31.42[a]	13.28[a]	18.52[a]	14.58 [a]	39.61 [a]	5.57[b]	3.52[c]	19.93[a]	0.05	15.93 [a]	2.05

The descriptive statistics are for weekly returns measured in US dollars of S&P global real estate total return indices over the period from 17 July 2006 to 28 July 2014 for the US (US) aggregate Asia (ASIA), Australia (AU), Hong Kong (HK), Singapore (SG), Japan (JP), Mainland China (CN), Taiwan (TW), Malaysia (ML), Thailand (TH), the Philippines (PH), and Indonesia (IND). ADF is the augmented Dickey-Fuller test for stationarity. The JB statistic is the Jarque-Bera test for normality. The Q(12) and $Q^2(12)$ tests are for the twelfth-order autocorrelations of the returns and squared returns. ARCH (1) is a standard LM test for autoregressive conditional heteroskedasticity of order one. a, b, and c denote the significance at the 1%, 5%, and 10% levels, respectively.

Table 3.2 Correlation analysis

	AU	HK	JP	SG	CN	TW	ML	TH	PH	IND
Panel A: Correlations with the US and aggregate Asia										
US	0.56	0.41	0.34	0.50	0.23	0.28	0.24	0.34	0.43	0.29
Asia	0.82	0.86	0.82	0.85	0.58	0.55	0.48	0.52	0.63	0.47
Panel B: Correlations with the US, by the US volatility										
Low	0.45	0.30	0.34	0.42	0.24	0.17	0.27	0.27	0.33	0.25
High	0.75	0.69	0.38	0.72	0.26	0.63	0.19	0.55	0.70	0.44
Panel C: Correlations with aggregate Asia, by Asia-Pacific volatility										
Low	0.73	0.79	0.73	0.79	0.46	0.37	0.49	0.34	0.56	0.43
High	0.95	0.99	0.97	0.97	0.54	0.78	0.93	0.87	0.78	0.92

This table reports the correlation coefficients between individual Asia-Pacific markets and the US/aggregate Asia-Pacific real estate stock markets. Panel A presents the full sample correlations, while Panels B and C classify the US and aggregate Asia-Pacific return volatilities into three categories, low, moderate, and high, to investigate whether the correlations of returns change with volatilities. The low category contains the days when the squared returns in the US/Asia are within one standard deviation from the mean. The high category contains the days when the squared returns in the US/Asia are more than two standard deviations away from the mean and the remainder are classified as moderate. This classification follows Ng (2000).

Table 3.2 reports the unconditional correlations between individual Asia-Pacific securitised real estate markets and the US/Asia-Pacific markets. Consistently higher correlations with Asia-Pacific real estate market than with the US market is found in Panel A for all Asia-Pacific markets in our sample. I follow the approach in Ng (2000) to classify the returns into three categories based on volatility (i.e. low, moderate, and high volatility returns). The low category contains the days when the squared returns in US/Asia are within one standard deviation of the mean. The high category contains the days when the squared returns in the US/Asia are more than two standard deviations away from the mean and the remainder are classified as moderate. The purpose is to investigate whether the correlations of returns change with volatilities. In Panels B and C, a positive relationship between correlations and volatilities can be observed, – that is, the contemporaneous correlations between individual Asia-Pacific and the US/Asia-Pacific securitised real estate returns tend to increase when volatility is high.

3.3.2 Methodology

The volatility spillover model applied in this study is based on the standard model in Christiansen (2007). However, as the GFC period is covered by the sample period, the effects of turbulence in this market on the information shared across markets should be taken into consideration. Therefore, I extend Christiansen's model by assuming that the US/Asia-Pacific volatility spillover effects were different during the GFC period. The spirit of this model is consistent with the models constructed in Bekaert and Harvey (1997), Ng (2000), and Baele (2005) which allows the shocks from foreign markets to affect the returns on each Asian real estate market through error terms. Thus the idiosyncratic shocks from the US and aggregate Asia-Pacific real estate security markets are applied as explanatory variables in the mean models for individual Asia-Pacific markets.

In order to further understand to what extent the volatility of the returns on each Asia-Pacific market is influenced by global, regional and local factors, I measure the US, Asia-Pacific, and local variance ratios. Their relative importance and time-dependent nature can also be observed.

3.3.3 Standard spillover model

Firstly, the US returns follow an AR (1) process. The idiosyncratic shock of the US returns is normally distributed with mean zero and the conditional variance follows a GARCH (1, 1) model:

$$R_{US,t} = C_{0,US} + C_{1,US}R_{US,t-1} + e_{US,t} \tag{1}$$

$$e_{US,t} \sim N(0, \sigma^2_{US,t})$$

$$\sigma^2_{US,t} = \omega_{US} + \alpha_{US}e^2_{US,t-1} + \beta_{US}\sigma^2_{US,t-1} \tag{2}$$

where $\omega_{US}, \alpha_{US}, and\ \beta_{US} > 0$.

The aggregate Asia-Pacific returns follow an extended AR (1) model which enables us to examine the influence from the US real estate market to aggregate Asia-Pacific market. This specification is confirmed by the findings in Wilson and Zurbruegg (2003) and Michayluk et al. (2006) that the US property market has a significant influence on smaller property markets. A Granger Causality test was applied to further examine the direction of causality and only a unidirectional relationship was found in which the US market influenced the Asia-Pacific market. Therefore, in addition to the influence of their local lagged returns, the conditional mean of aggregate Asia-Pacific returns also depends on the lagged US returns and the idiosyncratic shock of the US returns.

$$R_{Asia,t} = C_{0,asia} + C_{1,Asia}R_{Asia,t-1} + \gamma_{Asia,t-1}R_{US,t-1} + \emptyset_{Asia,t-1}e_{US,t} + e_{Asia,t} \quad (3)$$

$$e_{Asia,t} \sim N(0, \sigma^2_{Asia,t})$$

$$\sigma^2_{Asia,t} = \omega_{Asia} + \alpha_{Asia}e^2_{Asia,t-1} + \beta_{Asia}\sigma^2_{Asia,t-1} \quad (4)$$

where $\omega_{Asia}, \alpha_{Asia}, and\ \beta_{Asia} > 0$.

Similarly, the conditional mean returns on Asia-Pacific real estate security market i depend on their own lagged returns, US and aggregate Asia-Pacific lagged returns, and the idiosyncratic shocks of US and aggregate Asia-Pacific returns. The lagged US and aggregate Asia-Pacific returns provide the mean spillover effects while the idiosyncratic shocks of the US and aggregate Asia-Pacific returns introduce volatility spillover effects. However, the aggregate Asia-Pacific index applied in equation (3) may lead to spurious correlations in equation (5). To avoid this issue, I develop the following mean model by using a market-value weighted aggregate Asia-Pacific index that excludes the market under investigation. I follow Bekaert et al. (2005) to construct the aggregate Asia-Pacific index, $\mathrm{R}_{\mathrm{Asia/i,t}}$, as

$$\mathrm{R}_{\mathrm{Asia/i,t}} = \sum_{\mathrm{k}\neq\mathrm{i}} \mathrm{w}_{\mathrm{k,t}}\mathrm{R}_{\mathrm{k,t}} \Big/ \sum_{\mathrm{k}\neq\mathrm{i}} \mathrm{w}_{\mathrm{k,t}} \tag{5}$$

with i denoting the market under investigation, w_{k} the market capitalisation of market k, and R_{k} the real estate index for market k.

$$R_{i,t} = C_{0,i} + C_{1,i}R_{i,t-1} + \gamma_{i,t-1}R_{US,t-1} + \delta_{i,t-1}R_{Asia,t-1} + \emptyset_{i,t-1}e_{US,t} + \varphi_{i,t-1}e_{Asia,t} + e_{i,t} \tag{6}$$

$$e_{i,t} \sim N(0, \sigma_{i,t}^2)$$

$$\sigma_{i,t}^2 = \omega_i + \alpha_i e_{i,t-1}^2 + \beta_i \sigma_{i,t-1}^2 \tag{7}$$

where $\omega_i, \alpha_i, and\ \beta_i > 0$.

3.3.4 Variance ratios

As stated above, volatility spillover effects from the US market and aggregate Asia market on individual Asia-Pacific markets are introduced by the idiosyncratic US and Asia-Pacific shocks, $e_{US,t}$ and $e_{Asia,t}$. Therefore, the unexpected returns for the US, aggregate Asia and individual Asia-Pacific market i are given as follows:

$$\epsilon_{US,t} = e_{US,t}$$

$$\epsilon_{Asia,t} = \emptyset_{Asia,t-1}e_{US,t} + e_{Asia,t} \tag{8}$$

$$\epsilon_{i,t} = \emptyset_{i,t-1}e_{US,t} + \varphi_{i,t-1}e_{Asia,t} + e_{i,t}$$

The idiosyncratic shocks, $e_{US,t}$,$e_{Asia,t}$, and $e_{i,t}$, are assumed to be independent, but the unexpected returns are not. For individual market i, the conditional variance of its unexpected return is dependent on the information available at time t-1. The conditional variance of the unexpected return of market i is

$$h_{i,t} = E(\epsilon_{i,t}^2 | I_{t-1}) = \emptyset_{i,t-1}^2 \sigma_{US,t}^2 + \varphi_{i,t-1}^2 \sigma_{Asia,t}^2 + \sigma_{i,t}^2 \quad (9)$$

The variance ratios from the US market, the aggregate Asia-Pacific market, and market i are:

$$\mathrm{VR}_{i,t}^{US} = \frac{\emptyset_{i,t-1}^2 \sigma_{US,t}^2}{h_{i,t}}$$

$$\mathrm{VR}_{i,t}^{Asia} = \frac{\varphi_{i,t-1}^2 \sigma_{Asia,t}^2}{h_{i,t}} \quad (10)$$

$$\mathrm{VR}_{i,t}^{i} = 1 - \mathrm{VR}_{i,t}^{US} - \mathrm{VR}_{i,t}^{Asia}$$

Formula 10 measures the proportions of the variance of the unexpected return of market i that is caused by the US and Asia-Pacific volatility spillover effects, and thus range from 0 to 1.

3.3.5 GFC spillover model

Based on the standard spillover model in Christiansen (2007), I construct a GFC spillover model by assuming that the spillover parameters were different during the GFC period. The dummy variable D_t in the following GFC volatility spillover model equals 1 during the GFC period from 01 July 2007 to 31 December 2008 and 0 otherwise.[25] This specification provides an approach for capturing the effects of the GFC on both global and regional spillovers through the parameters $\gamma_{1,i}$, $\delta_{1,i}$, $\emptyset_{1,i}$, and $\varphi_{1,i}$.

$$\gamma_{i,t} = \gamma_{0,i} + \gamma_{1,i} D_t$$

$$\delta_{i,t} = \delta_{0,i} + \delta_{1,i} D_t \quad (11)$$

$$\emptyset_{i,t} = \emptyset_{0,i} + \emptyset_{1,i} D_t$$

$$\varphi_{i,t} = \varphi_{0,i} + \varphi_{1,i} D_t$$

3.4 Empirical results

3.4.1 GFC spillover model

Table 3.3 (see appendix B) reports the estimates for the GFC spillover model. For aggregate Asia, significant US mean ($\gamma_{0,i}$) and volatility ($\emptyset_{0,i}$) spillover effects can be found[26]. Strong evidence also shows that the US volatility spillover effects ($\emptyset_{1,i}$) increased during the GFC period. The joint Wald test rejects the null hypothesis of no change in the US volatility spillover effects during the GFC ($\gamma_{1,i} = \emptyset_{1,i} = 0$).

The US mean spillover effects ($\gamma_{0,i}$) are significant for Australia, Singapore, Japan, Malaysia, and the Philippines while Asia-Pacific mean spillover effects ($\delta_{0,i}$) are only significant for Taiwan during the non-GFC period. The parameters $\gamma_{1,i}$ and $\delta_{1,i}$ show that the US mean spillover effects increased significantly during the GFC period for Australia, Singapore, and Thailand while Asia-Pacific mean spillover effects decreased for Singapore, Japan, and Taiwan although they increased for Australia and mainland China. The null hypothesis of no mean spillover changes during the GFC ($\gamma_{1,i} = \delta_{1,i} = 0$) is rejected for Australia, Singapore, Japan, mainland China, and Thailand. The null hypothesis of no significant mean spillover effect ($\gamma_{0,i} = \gamma_{1,i} = \delta_{0,i} = \delta_{1,i} = 0$) is rejected for all Asia-Pacific markets except Indonesia.

Both the US and Asia-Pacific volatility spillovers ($\emptyset_{0,i}$ and $\varphi_{0,i}$) are significant for all Asia-Pacific real estate markets during the non-GFC period although the coefficients for Asia-Pacific volatility spillovers are consistently larger than those for the US volatility spillovers.[27] This finding is in line with the unconditional correlations in Section 3. A significant increase in the US volatility spillover effects ($\emptyset_{1,i}$) during the GFC period can be found for all developed Asia-Pacific real estate markets and Thailand and the Philippines, while the regional volatility spillover effects ($\varphi_{1,i}$) only increased in Thailand. The joint Wald test ($\emptyset_{1,i} = \varphi_{1,i} = 0$) further confirms the significant changes introduced by the GFC for these markets. The null hypothesis of no volatility spillover effect ($\emptyset_{0,i} = \emptyset_{1,i} = \varphi_{0,i} = \varphi_{1,i} = 0$) is rejected for all markets.

The joint Wald tests $\gamma_{1,i} = \emptyset_{1,i} = 0$ and $\delta_{1,i} = \varphi_{1,i} = 0$ provides evidence on the changes in spillover effects from the US and Asia during the GFC. All developed Asia-Pacific real estate markets suffered increased US and regional spillover effects during the GFC with the exception of Hong Kong where only the US spillover effect increased significantly. For emerging Asia-Pacific real estate markets, Thailand and the Philippines experienced increased US volatility spillovers, while mainland China and Taiwan suffered more regional shocks during the GFC.

3.4.2 Variance ratios

To depict the time-varying nature of the US and Asia-Pacific volatility spillover intensities, Figure 3.2 shows the tendency chart for each Asia-Pacific real estate market. The US and Asia-Pacific variance ratios are volatile and interweave for the whole period in Australia, and for the first half of the period, in Singapore. After the GFC period, the regional factors seem to be more predominated than the US shocks in Singapore. For the other two developed Asia-Pacific markets, Hong Kong and Japan, the returns are affected more by the information from the region of Asia. The increased influence during the GFC period from both the US and aggregate Asia can be found in all charts with the exception of Malaysia, although the sudden rises are more unexpected for the emerging Asia-Pacific real estate markets. Malaysia is a small open economy and has less exposure to securities linked to the US subprime loans than the other markets in the sample. The negative shocks due to the GFC were transmitted to Malaysia in the fourth quarter of 2008. That is the reason for the delayed response to the GFC in Malaysian real estate market.

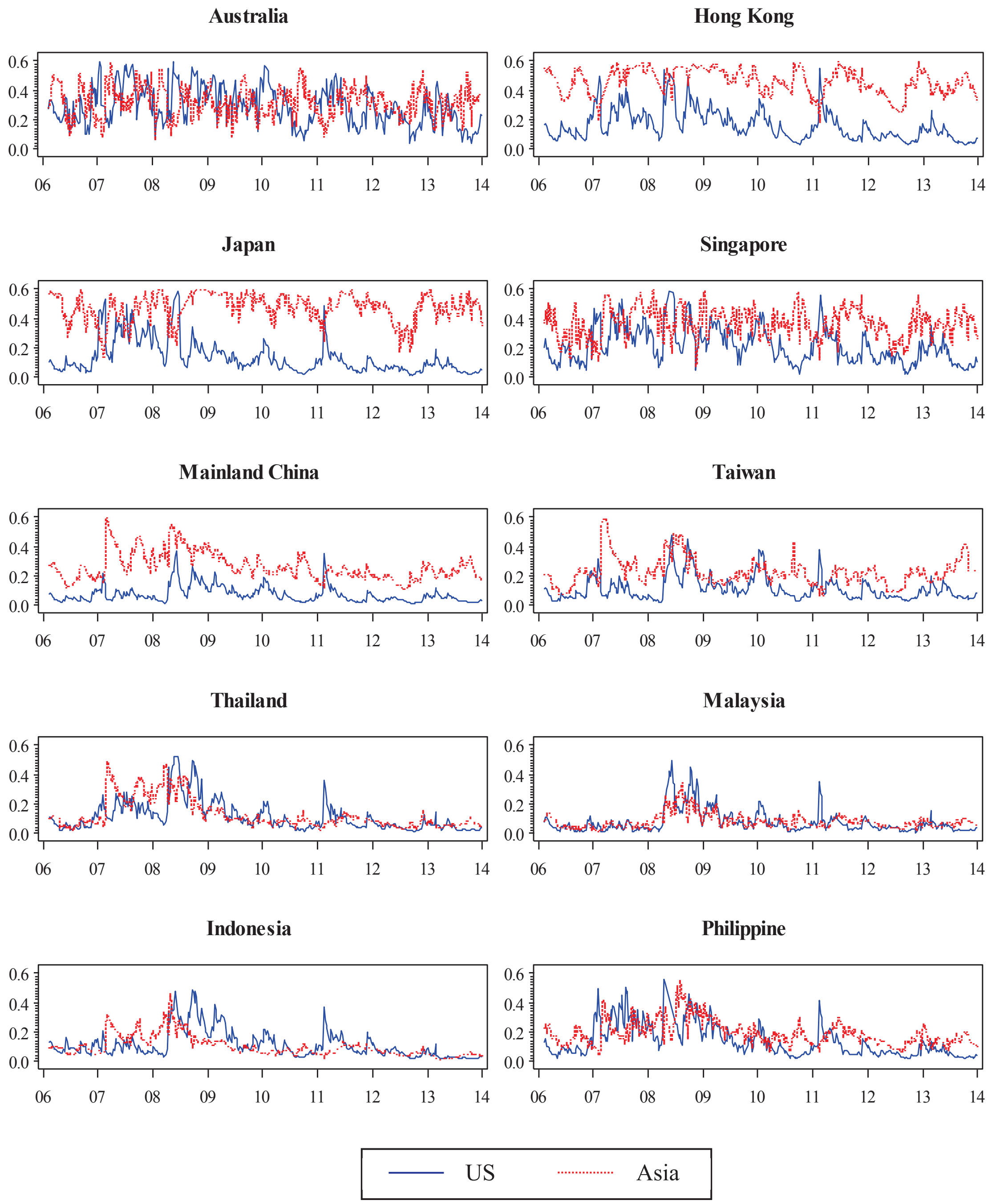


Figure 3.2 Plots of the US/Asia-Pacific variance ratios

Table 3.4 Variance ratios for GFC spillover model

	US		Regional		Local	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
AU	29.5%	0.147	32.3%	0.110	38.2%	0.168
HK	16.1%	0.109	48.3%	0.119	35.6%	0.162
SG	21.9%	0.133	37.5%	0.114	40.6%	0.172
JP	13.7%	0.127	49.7%	0.120	36.6%	0.150
CN	7.01%	0.055	26.2%	0.096	66.7%	0.125
TW	11.1%	0.080	22.5%	0.095	66.4%	0.138
ML	7.50%	0.080	7.90%	0.052	84.7%	0.121
TH	11.3%	0.106	12.5%	0.103	76.2%	0.182
PH	14.8%	0.138	19.1%	0.086	66.1%	0.186
IND	11.1%	0.093	10.0%	0.071	78.9%	0.138

This table presents the mean and standard deviation of the US, aggregate Asia-Pacific, and own variance ratios for the volatility spillover model: $VR_{i,t}^{US} = \frac{(\emptyset_{0,i}+\emptyset_{1,i}D_t)^2\sigma_{US,t}^2}{h_{i,t}}$, $VR_{i,t}^{Asia} = \frac{(\varphi_{0,i}+\varphi_{1,i}D_t)^2\sigma_{Asia,t}^2}{h_{i,t}}$, and $VR_{i,t}^{i} = 1 - VR_{i,t}^{US} - VR_{i,t}^{Asia}$ where $h_{i,t}$ is the conditional variance of the unexpected return of market i, $h_{i,t} = (\emptyset_{0,i} + \emptyset_{1,i}D_t)^2\sigma_{US,t}^2 + (\varphi_{0,i} + \varphi_{1,i}D_t)^2\sigma_{Asia,t}^2 + \sigma_{i,t}^2$. D_t equals 1 during the GFC period from 01 July 2007 to 31 December 2008 and 0 otherwise.

Table 3.4 presents the mean and standard deviations of the US, aggregate Asia-Pacific, and each market's own variance ratios. It indicates the relative importance of US, regional, and local information to each Asia-Pacific real estate market. The regional variance ratios (7.9% to 49.7%) are consistently larger than the US variance ratios (7.0% to 29.5%) for all Asia-Pacific real estate markets with the exception of Indonesia (10.0% vs. 11.1%). Regional information therefore has more impact on the real estate markets in Asia than global information. This suggests a better regional integration than global integration for Asia-Pacific real estate markets on average.

The local volatility transmission is dominant for emerging Asia-Pacific real estate markets (66.1% to 84.7%). This indicates their relatively lower integration with other markets. Conversely, developed Asia-Pacific real estate markets suffer less local shocks (35.6% to 40.6%). This dependence on foreign markets leads to the conclusion that developed markets are more susceptible to the information conveyed from the US and

Asia compared to emerging markets. Moreover, they experience a few more shocks from the US, and many more from the region of Asia than emerging markets. This further confirms that developed markets are more integrated internationally, even though they are integrated more regionally than globally.[28]

3.4.3 Determinants of volatility spillover intensities

I investigate the link between the US/Asia-Pacific variance ratios for the GFC spillover model and the variables that reflect the degree of economic integration and monetary policy. I apply the growth rates of total imports and exports with the US/Asia as a proxy for economic integration. As stated by Lawrence (1996), the process of deep economic integration is aimed at reducing the market segmenting effects of domestic regulatory policies through policy liberalisation, policy reform and policy cooperation across partner countries. The weakened influence of local factors on real estate markets is therefore replaced by the influence of foreign shocks. A large number of studies argue that bilateral trade is an effective way to promote economic integration with markets in different regions (e.g. Dee (2007) and Kalirajan (2007)). Strong trade flows mean close economic integration and thus bilateral trade is expected to be positively related to the US/Asia-Pacific volatility spillover intensities.

Currency hedging costs play an important role in international investment. Higher currency hedging costs are definitely a barrier for investors holding real estate assets overseas. Therefore, lower currency hedging costs are desirable for eliminating this barrier and lead to more information shared across Asia-Pacific real estate markets. Excess interest rates, excess inflation rates, and exchange rate volatility are accordingly included as explanatory variables. I measure excess interest rate as the difference between Asia-Pacific market i's lending rate and the US lending rate/average lending rate across the ten Asia-Pacific markets in our sample. Similarly, the excess inflation rate is measured as the difference between Asia-Pacific market i's inflation rate and the US inflation rate/average inflation rate across the ten Asia-Pacific markets. Exchange rate volatility is determined by the GARCH (1, 1) variance for individual Asia-Pacific market i's USD exchange rate. A more stable exchange rate is expected to lead to a stronger integration and thus more shocks from foreign markets. Thus a negative coefficient is implied for exchange rate volatility.

I also investigate whether the US/Asia-Pacific spillover intensities were higher during the GFC period. A GFC dummy is applied and it equals 1 during the period from 01 July 2007 to 31 December 2008, and 0 otherwise. Based on our previous findings, I presume asymmetric volatility spillover intensities – that is, I assume that the US/Asia-Pacific variance ratios are higher during down market periods than during growth periods.

Table 3.5 (see Appendix C) reports the OLS estimates of the determinants on the US variance ratios in Panel A and Asia-Pacific variance ratios in Panel B. Trade integration is unexpectedly insignificant in influencing both the US and Asia-Pacific variance ratios for all Asia-Pacific real estate markets. This implies that bilateral trade across markets does not play an important role in volatility spillovers for Asia-Pacific real estate markets.

However, currency policies and the GFC dummy have leading roles in influencing foreign variance ratios. First, currency volatility is as expected significantly and negatively related to both the US variance ratios for Singapore, mainland China, and Taiwan and to Asia-Pacific variance ratios for mainland China, and Taiwan, while they are positive or insignificant for other Asia-Pacific markets. This indicates that international associations across markets will be enhanced when there is currency volatility. Second, excess interest rate has a significant influence in most of Asia-Pacific real estate markets. It has positive coefficients for Taiwan, the Philippines, and Indonesia with the US variance ratios while for all Asia-Pacific markets with the exception of Australia and mainland China, it has positive coefficients with Asia-Pacific variance ratios. This implies that Asia-Pacific real estate markets with higher local financing costs will be affected more by global and regional shocks. Third, excess inflation rate is significantly and negatively associated with the US/Asia-Pacific variance ratios for most Asia-Pacific real estate markets. This relationship suggests that the securitised Asia-Pacific real estate markets share more information in a low-inflation environment, which is consistent with the findings for European equity markets in Baele (2005).

Finally, GFC dummy is significantly and positively related to the US variance ratios for Singapore, mainland China, Thailand, and Indonesia which means the global volatility spillovers increased for these Asia-Pacific markets during the GFC period. For all Asia-Pacific real estate markets with the exception of mainland China and Taiwan, regional variance ratios increase during down markets. This finding confirms that, like the asymmetry of equity market correlations and volatilities, volatility spillover intensities also show asymmetry. That is, volatility spillover intensities are higher in times of turmoil than in growth periods.

3.5 Summary

This study examines the volatility spillover effects of the US and Asia-Pacific securitised real estate markets on ten Asia-Pacific securitised real estate markets in order to examine the global and regional integration of these markets. The volatility spillover model is constructed by assuming that the returns on individual Asia-Pacific real estate markets are influenced by global shocks from the US and regional shocks from the Asia-Pacific region through error terms. A GFC dummy was added to the standard spillover model for investigating the effects of the GFC on spillovers. This is the main innovation of the model.

To further understand the relative impacts of the US, regional, and local factors on the conditional variance in individual Asia-Pacific real estate markets, variance ratios were also measured. This enables us to assess their relative importance and the processes of global and regional integration. Finally, I associate the time-varying US/Asia-Pacific variance ratios with some macroeconomic factors to identify the driving forces of global/regional integration in Asia-Pacific real estate markets.

I contribute to real estate literature by differentiating between global and regional volatility spillover effects, and our findings confirm this differentiation is statistically and economically important. First, significant volatility spillover effects from both the US and Asia are found and more importantly the effects from Asia are consistently larger than those from the US for all Asia-Pacific real estate security markets. This implies that in Asia securitised real estate markets are regionally integrated with each other and are not as well integrated with the US. However, during the GFC period the US volatility spillover effects increased significantly for most Asia-Pacific real estate markets, which suggests an enhanced global integration and thus a decline in diversification effects during a major crisis. This provides a hint for investors that in growth periods, holding US real estate assets in an Asia-Pacific real estate portfolio offers diversification benefits, but it is not so sensible to hold them in a down market when the risk originates from the US.

Second, Asia-Pacific real estate markets on average suffer more shocks from the region of Asia than from the US, although obvious increases in the influence of US volatilities during the GFC period can be observed. Moreover, compared to developed markets, emerging real estate security markets in Asia are more dominated by local factors and thus less integrated with other Asia-Pacific markets or with the US. Therefore, the real estate assets in these emerging markets might be good choices for investors to spread risk.

Finally, currency hedging costs can partly explain volatility spillover intensities. I find that global/regional integration is higher in markets with relatively lower inflation, higher interest rates, or higher currency volatility. Enhanced cross market interdependence can also be triggered by a financial crisis.

Chapter 4

Intercity Housing Price Comovement in Australia

4.1 Introduction

In the real estate literature, research on Australian market is not as common as research on the US market. However, the Australian real estate market is important and unique, and should not be ignored in academic research. First, the housing market accounts for more than half of all household wealth in Australia. According to Corelogic RP data, as of July 2015, the Australian housing market was valued at $6 trillion which is four times larger than the stock market ($1.5 trillion) and three times more valuable than superannuation ($2.0 trillion). Second, the housing market is critical to the Australian economy. Over the 12 months to December 2014, the Australian gross domestic product (GDP) in 2014 was recorded at $1.59 trillion, meaning that Australia's housing market was more than three times larger than the Australian economy. The New Zealand housing market is also around three times larger than its economy, but for the UK the figure is 2.8, for Canada it is 1.8, and for the US it is only 1.2. Therefore, the sheer size of the housing market and its significance for the overall Australian economy means that the government should be very cautious in its policy settings and more studies should be done on the housing market.

Housing boom in Australia has been the focus of a huge amount of public discussion and policy debate in recent years. Numerous media reports have argued that Australian house prices are overvalued and are already showing some bubble-like features. However, little research has been done to measure the level and dynamics of house price comovement in correspondence with the housing boom. It is becoming increasingly important to understand the regional synergistic relationships and the diversification effects of underlying portfolios of residential real estate loans for mortgage-backed securities.

This study fills this gap by conducting an empirical investigation that examines intercity housing price comovement in the Australian housing market in the period from 1999 to 2015 and identifies the driving forces of the evolution of market correlations. I use the dataset of RP Data-Rismark Home Value Indices to measure the process of home value co-formation in Australia's eight capital cities. The methodology in this study follows a two-step procedure. First, the time-varying conditional correlations between capital cities are measured. I apply a multivariate VAR (1)-DCC-GARCH (1, 1) model for various home returns and obtain the intercity conditional correlations after controlling for asymmetric volatilities and the influence from the other markets. Our results confirm the time-varying nature of intercity housing price comovement. I also find that (1) Perth is the only capital city whose home value is rarely influenced by other capital cities. (2) Sydney suffers more asymmetric effects in volatility as the estimated leverage coefficient in the GARCH model is significant and larger than for the other cities. (3) On average home values in Brisbane comove more with other capital cities, followed by Canberra and Sydney while Darwin moves in a contrary direction to other capital cities.

Second, I examine the determinants that cause the conditional correlation dynamics by making panel regressions of estimated conditional correlation series on various potential explanatory variables. I find that household power of consumption, and demand and supply in dwellings play important roles in determining intercity housing price comovements. First, lower local unemployment rates and higher consumption expenditure, which represent more consumption capacities, result in more co-formation of housing prices across cities. Second, more demand for dwellings due to increases in local populations will make housing prices more closely correlated across cities. Third, an increase in the supply of dwelling units will weaken intercity housing price correlations. Additionally, larger disparities in unemployment rates, and lower disparities in consumption expenditure or housing supply between capital cities, will increase intercity housing price comovement.

This chapter is organised as follows: Section 4.2 introduces the literature on the Australian housing market. Section 4.3 discusses data and the methodology for estimating intercity housing price correlations, with Section 4.4 reporting intercity correlations and the driving forces of the housing price co-formation across cities while Section 4.5 concludes the chapter.

4.2 Literature review

There are a great number of studies on housing price based on different regions in the world and increasingly more studies show their interest in dynamic housing price comovement at a disaggregate level. For example, Clark and Coggin (2009), Chien (2010), Holmes et al. (2011), McDuff (2011), and Kim and Rous (2012) discuss the convergence of regional house price in the US. Holmes (2007), Holmes and Grimes (2008), Cook and Watson (2015), and Cook (2003, 2005, 2012) examine the UK housing market; Balcilar et al. (2013) analyzes the ripple effect of house prices in major metropolitan areas in South Africa; Lean and Smyth (2013) focuses on the Malaysian housing market.

There are many studies on Australian housing price movements and their potential driving forces. Australian capital cities experienced 35% real house price increases on average from

1979 to 1993. Bourassa and Hendershott (1995) conclude that real wage income and population growth caused by net overseas migration are the two main fundamental factors that have resulted in price increases in each capital city. Berry and Dalton (2004) discussed the drivers behind variations in house prices across geographic and dwelling type sub-markets, such as interest rates, investor behaviour, economic growth and demographic change. They also pointed out that interest rate policy has not been successful in controlling complex and highly segmented housing markets, especially in a small open economy like Australia's. Using a longer sample period of 1970 to 2003, Abelson et al. (2005) find that, in the long run, real house prices are determined by real disposable income, the consumer price index, unemployment rates, real mortgage rates, equity prices and housing stock. They also find that housing market adjustment to equilibrium shows significant lags in the short run and the market adjusts more quickly when real house prices are rising by a rate of more than 2 percent per annum than it does when real house prices are static or falling. Otto (2007) identifies the effects of economic factors on each capital city and finds that the major drivers of house price growth and mortgage rates have substantially different effects across cities. Economic factors can explain 40 to 60 per cent of house price changes. With a cross-country co-integration perspective, Tumbarello and Wang (2010) examine the factors driving Australian house prices and they find that terms of trade shocks are a more important factor than strong capital inflow episodes in house price increases in Australia.

Some studies also show the disparities or mutual influences between Australian subnational housing markets. For example, Maher (1994) examines the median house price dispersion in Australian major cities during the 1980s, a period during which there was a recession which severely affected the market and brought about considerable change in asset prices in general.

He analyses the interaction effect between house price comovement and economic and social restructuring. Parallels between changes at the aggregate level (inter-metropolitan level) and those at the disaggregated level (intra-metropolitan level) are also observed. Australia experienced significant social, demographic and economic changes over past decades as a result of economic restructuring and these changes were considerably greater in non-metropolitan regions than in metropolitan regions (Baum et al., 2006). At the disaggregated level, Burke and Hayward (2001) report that in the Melbourne housing market, inner and outer suburbs experienced unbalanced housing affordability during the 1990s. Residents in inner suburbs had the fastest growth in after tax incomes and also experienced the fastest growth in house prices. They also indicate that government housing policies had a significant influence on regional housing markets in Australia. Yates finds that house prices are likely to be highest, or to have increased more, in the regions with household income polarisation, and income that polarisation will result in lower rates of home ownership. From 1986 to 1996 metropolitan regions suffered more rapid declines in home ownership rates than non-metropolitan regions. In order to be able to own their homes, low and moderate income households in metropolitan regions tend to relocate to non-metropolitan regions.

However, although the above studies noted some evidence of regional interactions, no researchers undertook further statistical analysis. To the best of our knowledge, only the studies discussed below shed light on housing price transmission between subnational housing markets. Tu (2000) argues that in the long run Australian housing markets are highly segmented at the subnational level and the dynamics of Sydney real housing prices do not dominate Australian national housing prices or any other city's housing prices. This segmentation implies regional economic disparities, variations in the influence of national housing policy on different capital cities, and the importance of local economic factors in driving the real housing price movement. In the short run, the house price diffusion paths he finds are from Brisbane to Sydney and then to Melbourne, or from Brisbane to the nation then to Melbourne. Luo et al. (2007) examine the ripple effect of house prices across state capital cities and find a 1-1-2-4 diffusion pattern in which Sydney and Melbourne are the on the top and second tier respectively, Perth and Adelaide are at the third level and the other four cities lie on the bottom. Costello et al. (2011) argue that in general NSW is more susceptible to spillover transmitted from other states while ACT and WA are least affected and this may due to their economic and geographical isolation from the rest of the country[29].

4.3 Data and methodology

4.3.1 Data

I use the RP Data-Rismark Home Value Index[30] which measures property value changes in Australia's capital cities across three broad housing types: houses, units and a "combined dwellings" index that includes both houses and units[31]. It includes all eight capital cities – Sydney (SYD), Melbourne (MEL), Brisbane (BRI), Adelaide (ADE), Perth (PER), Hobart (HOB), Darwin (DAR), and Canberra (CAN) – and an eight-city composite. Our sample covers monthly data[32] from April 1999 to March 2015 which is the longest time series data that are available for all sample cities.

4.3.2 Measuring intercity housing price comovement

Although rolling correlation is the most common way to estimate dynamic correlations, one potential problem of this unconditional technique is that rolling correlation coefficients can be biased upward during high volatility periods in some markets due to heteroscedasticity in returns as noted by Forbes and Rigobon (2002). The Dynamic Conditional Correlation (DCC) methodology proposed by Engle (2002) avoids this issue by modelling it directly within a family of multivariate GARCH models. The DCC model is a generalisation of the Constant Conditional Correlation (CCC) model of Bollerslev (1990). It can explore high dimension systems with multiple assets. It assumes that the conditional correlations are time invariant and introduces a small number of parameters to model the correlations for multiple assets while preserving consistency. The volatilities are modelled with univariate specifications, and this makes the GARCH models easier to interpret.

- VAR (1)-DCC-GARCH (1, 1) model

The VAR (1) model for home returns

$$R_{i,t} = c_i + \sum_{j=1}^{8} m_{ij} R_{j,t-1} + \varepsilon_{it}; \quad \varepsilon_{i,t}|\Omega_{t-1} \sim N(0, h_{ii,t}) \tag{1}$$

Where *i, j* =1 for Sydney; 2 for Melbourne; 3 for Brisbane; 4 for Adelaide; 5 for Perth; 6 for Hobart; 7 for Darwin; 8 for Canberra.

$$H_t \equiv D_t R_t D_t \tag{2}$$

$$where\ D_t = diag[\sqrt{h_{ii,t}}]_{(8,8)}$$

$$each\ element\ of\ R_t\ is\ defined\ by\ \rho_{ij,t} = \frac{h_{ij,t}}{\sqrt{h_{ii,t}}\sqrt{h_{jj,t}}} \qquad i \neq j$$

$$h_{ii,t} = c_i + \alpha_i \varepsilon_{i,t-1}^2 + \beta_i h_{ii,t-1}^2 + \delta_i I_{i,t} \varepsilon_{i,t-1}^2$$

$$h_{ij,t} = (1 - a - b)\bar{\rho}_{ij} + a\eta_{i,t-1}\eta_{j,t-1} + bh_{ij,t-1}$$

$$where\ \eta_{i,t} = \frac{\varepsilon_{it}}{\sqrt{h_{ij,t}}}$$

4.3.3 Summary statistics

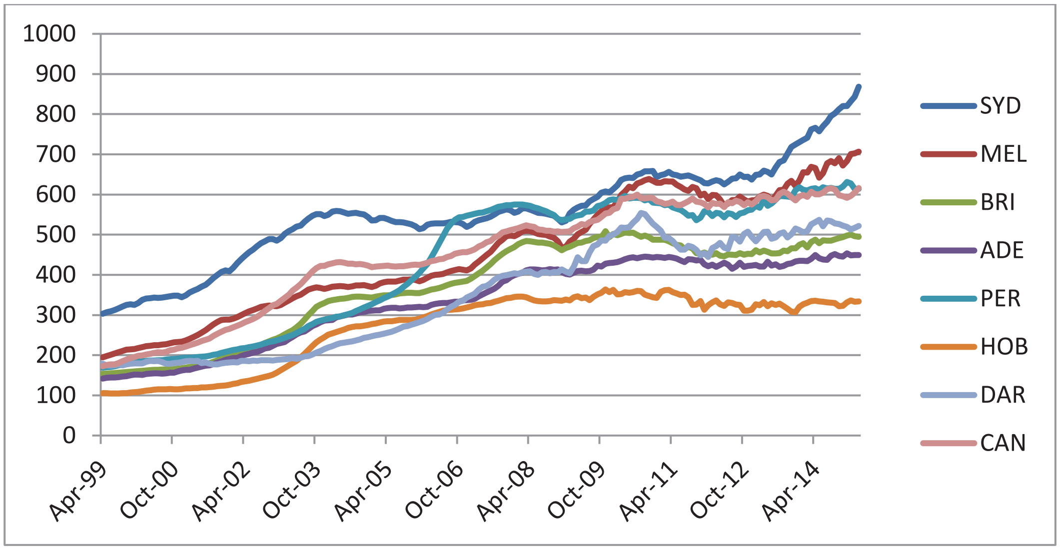


Figure 4.1 Home value index

Figure 4.1 plots the home value index for dwellings over time. An upward trend can be found for all capital cities before around 2008 with the exception of Sydney in which a slight decline occurred after 2004 with no significant increase until 2009. The recession that occurred at the end of 2007 seems to have been followed by a recovery at the beginning of 2009 for most of capital cities. However, property markets didn't show prosperity after that until 2013 for the largest two capital cities, Sydney and Melbourne. No substantial increases like the ones in these two cities were found after 2010 for other capital cities, and the indices are quite volatile.

Table 4.1 Descriptive statistics for return series

	SYD	MEL	BRI	ADE	PER	HOB	DAR	CAN
Panel A. Summary statistics								
Mean	0.55	0.68	0.61	0.60	0.68	0.60	0.56	0.67
Median	0.60	0.74	0.58	0.56	0.63	0.59	0.69	0.63
Max.	3.33	3.68	3.78	3.14	4.19	4.70	6.33	3.97
Min.	-2.30	-3.66	-2.95	-2.63	-2.54	-6.55	-3.61	-2.36
Std.	1.04	1.25	1.09	1.04	1.14	1.67	1.63	1.08
ADF	-2.64	-4.31	-2.75	-4.35	-1.99	-6.89	-3.61	-2.70
Panel B. Unconditional correlation matrix								
SYD	1.000	0.684	0.460	0.213	0.098	0.220	0.065	0.517
		(<.0001)	(<.0001)	(0.003)	(0.178)	(0.002)	(0.375)	(<.0001)
MEL		1.000	0.481	0.254	0.161	0.123	0.173	0.523
			(<.0001)	(0.000)	(0.026)	(0.090)	(0.017)	(<.0001)
BRI			1.000	0.533	0.437	0.529	0.126	0.573
				(<.0001)	(<.0001)	(<.0001)	(0.083)	(<.0001)
ADE				1.000	0.152	0.334	0.077	0.441
					(0.036)	(<.0001)	(0.289)	(<.0001)
PER					1.000	0.359	0.193	0.229
						(<.0001)	(0.008)	(0.001)
HOB						1.000	0.000	0.404
							(0.997)	(<.0001)
DAR							1.000	0.183
								(0.012)
CAN								1.000

Notes: Panel A presents mean, median, maximum, minimum, standard deviation, and ADF statistics of the return series for each capital city. The return series are obtained by taking natural logarithmic differences of home value indexes for combined dwellings. All of these figures are presented in percentages except the ADF statistics. Panel B reports the spearman unconditional correlation matrix and the P-values are shown below correlations in parentheses.

The home returns applied in following analysis are obtained by using the natural logarithmic differences of the home value index. Table 4.1 Panel A reports the summary statistics for all return series. The monthly mean returns per month vary from 0.55% (Sydney) to 0.68% (Melbourne and Perth). The standard deviations range from 1.04% (Sydney and Adelaide) to 1.67% (Hobart). The statistics of ADF unit root tests show that all return series are stationary.

Panel B presents the spearman unconditional correlation matrix. The correlations range from 0 to 0.68 and most of them are significant at the 10% level.

Table 4.2 Test of the equality of unconditional correlations over time

Periods compared		Average correlations		Test (t-value)	
Period 1	Period 2	Period 1	Period 2		
Sydney					
04/99-03/03	04/03-03/07	0.15	0.35	5.88	***
04/03-03/07	04/07-03/11	0.35	0.30	-1.35	*
04/07-03/11	04/11-03/15	0.30	0.27	-0.78	
04/99-03/03	04/07-03/11	0.15	0.30	3.90	***
04/99-03/03	04/11-03/15	0.15	0.27	2.03	**
04/03-03/07	04/11-03/15	0.35	0.27	-1.63	*
Melbourne					
04/99-03/03	04/03-03/07	0.11	0.34	6.20	***
04/03-03/07	04/07-03/11	0.34	0.34	0.02	
04/07-03/11	04/11-03/15	0.34	0.20	-3.37	***
04/99-03/03	04/07-03/11	0.11	0.34	5.40	***
04/99-03/03	04/11-03/15	0.11	0.20	2.10	**
04/03-03/07	04/11-03/15	0.34	0.20	-2.91	***

Notes: the whole sample period is divided into four sub-periods with the same intervals. I compare not only the average correlations of adjacent sub-periods but also those of non-adjacent sub-periods. The average for each period and the t-value for each comparison are reported. ***, **, and * stand for the statistical significance at the level of 1%, 5%, and 10%, respectively.

This study follows the assumption of time-invariant intercity correlations so that the DCC model applies reasonably. I test the equality of unconditional intercity correlations over four adjacent sub-periods as well as non-adjacent sub-periods through t-tests. To make the intercity correlations comparable, the whole period is divided into four sub-periods with the same intervals of 48 months. The results in Table 4.2 confirm that the difference between the averages is statistically significant for most comparisons which indicates the significant phased changes of intercity correlations.[33] Similar to the findings by Eichholtz (1996) about international property share correlations, the intercity private property correlations are also stable between some time-periods and unstable between others.

4.4 Empirical results

4.4.1 Intercity correlations

Table 4.3 (see Appendix D) presents the estimates from the mean and variance models as well as the DCC model. In Panel A, I find that future returns on the private real estate market can be strongly predicted by local past returns for all capital cities, indicating the importance of local factors in private property pricing. Meantime, with the exception of Perth, local markets can also be influenced by other markets to varying degrees. For example, the home returns in Sydney can be predicted from past returns in Melbourne, Perth, Hobart, Darwin, and Adelaide while Canberra can only be influenced by Hobart. I attribute the different magnitudes and ranges of intercity associations to the different levels of fluency of information transmission across markets.

As shown in Panel B, all of the estimated coefficients of the GJR-GARCH model are positive and most of them are significant. The volatility of real estate returns in each capital city is shown to be highly persistent by the fact that the sum of the ARCH and GARCH coefficients is close to 1 for all sample cities but Sydney. Furthermore, the leverage coefficients show volatility asymmetries in Sydney, Melbourne, Adelaide, and Hobart. This suggests that these cities are more volatile after negative shocks than after positive shocks. It is noteworthy that Sydney suffers more asymmetric effects in volatility as the estimated leverage coefficient is significant and larger than for the other cities. Panel C reports the estimates of the DCC model.

The parameters are both statistically significant, which provides empirical evidence to reject the assumption of constant intercity conditional correlations.

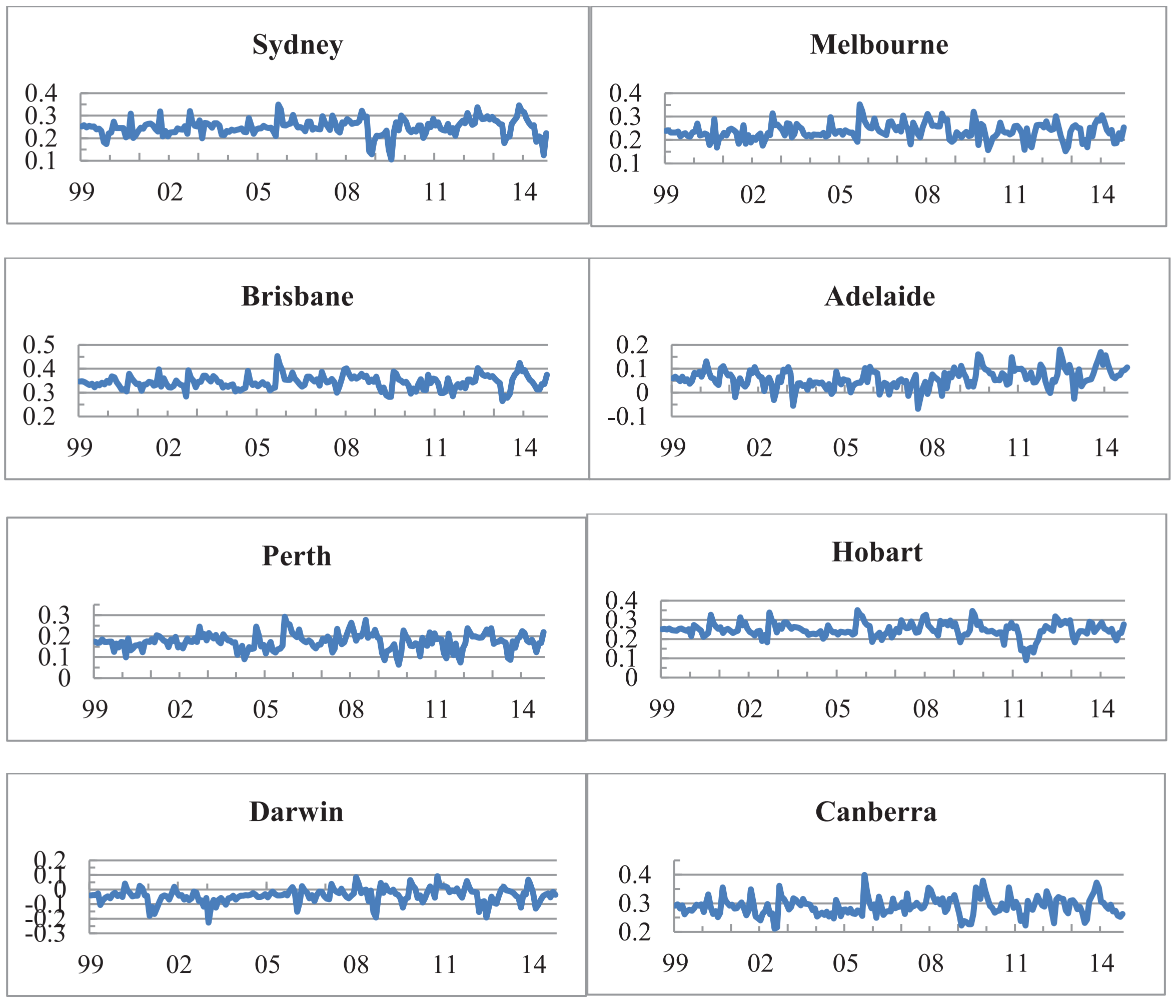


Figure 4.2 Plots of time-varying average intercity correlations for each capital city

The plots of average intercity correlations with other capital cities in Figure 4.2 show the time-varying nature of intercity comovements for each capital city. Table 4.4 Panel A reports the pairwise average intercity conditional correlations which range from -0.234 (Sydney vs. Adelaide) to 0.757 (Sydney vs. Melbourne). Some capital cities have positive home return correlations on average while some have negative returns on average. As shown in the last column, Darwin is the only capital city with a negative correlation with other capital cities on average which suggests that housing prices in Darwin tend to move in the opposite direction to prices in other cities. Other capital cities all have positive average correlations, generally indicating the consistency of their housing price movements.

I also examine whether these correlations have changed significantly since the GFC by using t-tests.[34] The results in Panel B show that Adelaide, Darwin and Canberra have experienced statistically significant changes of correlation with other capital cities since the GFC. Adelaide and Canberra turned to be more closely correlated with other capital cities since the GFC as the correlations increased significantly. However, the correlations for Darwin have declined since GFC and Darwin housing prices are less influenced by other housing markets in Australia. For other capital cities, although the changes to the correlations were not statistically significant, all of them had increased correlations on average. This means that since GFC the intercity comovement of housing prices has increased, while the intercity disparity in housing prices has decreased. Housing prices in different regions of Australia are more influenced by the same factors, more closely correlated with each other, and therefore less diversified.

Table 4.4 Intercity conditional correlations

	SYD	MEL	BRI	ADE	PER	HOB	DAR	CAN	AVG.
Panel A: Pairwise averages									
SYD	1.000	0.757	0.523	-0.234	0.124	0.184	-0.079	0.468	0.249
MEL		1.000	0.497	-0.191	0.108	0.086	0.014	0.385	0.237
BRI			1.000	0.198	0.336	0.432	-0.068	0.487	0.344
ADE				1.000	0.139	0.359	-0.078	0.229	0.060
PER					1.000	0.379	0.007	0.120	0.173
HOB						1.000	-0.060	0.355	0.248
DAR							1.000	-0.020	-0.041
CAN								1.000	0.289
Panel B: T-tests of correlations before and after the GFC cut-off									
SYD	1.000	-0.021 ***	-0.034 ***	0.059 ***	0.008	0.004	0.029 ***	-0.008	0.005
		(-3.994)	(-3.299)	(5.407)	(0.621)	(0.382)	(2.621)	(-1.084)	(0.958)
MEL		1.000	-0.019 ***	0.055 ***	0.000	-0.015 *	0.020 *	0.006	0.004
			(-2.428)	(5.363)	(0.001)	(-1.443)	(1.540)	(0.737)	(0.740)
BRI			1.000	0.053 ***	0.008	0.002	0.017 *	-0.014 **	0.002
				(5.369)	(0.775)	(0.158)	(1.478)	(-1.792)	(0.443)
ADE				1.000	-0.030 ***	-0.015 **	-0.004	0.019 **	0.019 ***
					(-2.893)	(-1.793)	(-0.341)	(1.887)	(3.598)
PER					1.000	-0.001	0.022 **	0.010	0.002
						(-0.046)	(1.918)	(0.830)	(0.398)
HOB						1.000	0.010	0.004	-0.002
							(0.890)	(0.424)	(-0.292)
DAR							1.000	0.047 ***	0.020 ***
								(4.374)	(2.520)
CAN								1.000	0.009 **
									(2.061)

Notes: this table reports the average intercity conditional correlations for each of the 28 pairs in Panel A. T-tests are applied for examining the correlation changes before and after the GFC and April 30, 2007 is set as the GFC cut-off . The differences in average correlations before and after the GFC cut-off are reported. T-statistics are shown below correlations in parentheses. ***, **, and * stand for the statistical significance at the level of 1%, 5%, and 10%, respectively.

4.4.2 Panel regressions

Another interest of this study is to examine the driving forces of intercity housing price correlation dynamics. I apply a series of regressions by using panel data. First, I test how economic and demographic factors affect the housing price comovements of each capital city on average with other capital cities. The explanatory variables are set as the indicators for the capital city under investigation and the difference between the indicators for the capital city under investigation and for Australia as the dependent variable is the average for each sample city. Second, I change the dependent variable to pairwise intercity correlations (28 pairs in total). That is, I calculate the individual housing price correlation of each capital city with other capital cities. Therefore, each independent variable is calculated as the absolute difference between the indicators for the two capital cities under investigation. As I emphasize the size of the difference between the indicators for the cities in each pair under investigation, absolute differences are applied in Model 3.

Tables 4.5 Descriptions of variables

Variabl e	Description	Source
INFL	Inflation rate: percentage change of Consumer Price Index from previous period	ABS 6401
MORT	Inflation adjusted real mortgage rate: standard variable home loan rate offered by banks minus inflation rate	RBA
UNEM	unemployment rate, trend estimates	ABS 6202
POP	Population change: percentage change of estimated resident population	ABS 3101
CONS	Consumption: percentage change of state final demand (consumption expenditure), seasonally adjusted estimates	ABS 5206
INC	Percentage change of household disposable income, seasonally adjusted estimates	ABS 6523
APPR	Percentage change of the total number of dwelling units approved, including both houses and units	ABS 8731

The descriptions and summary statistics of the potential determinant variables I test are as shown in Tables 4.5 and 4.6, respectively. All of these variables are obtained from the Australian Bureau of Statistics (ABS) or the Reserve Bank of Australia (RBA) and given as percentages. Inflation rate (INFL) is reported at the city and national levels. Real mortgage rate (MORT) is applied and calculated for each capital city as the national standard variable home loan rate offered by banks deflated by each city's inflation rate. For the variables, unemployment rate (UNEM), population (POP), consumption expenditure (CONS), and dwellings approved (APPR), I do not report city-level data; I apply state-level data in regressions as in Australia most people live in capital cities. Disposable income (INC) is reported only at the national level and it does not change in Models 1, 2, and 3.

Table 4.6 Summary statistics for regression variables

	Model 1		Model 2		Model 3	
Variable	Mean	S.D.	Mean	S.D.	Mean	S.D.
CORR	19.50	12.23	19.50	12.23	19.59	24.81
INFL	0.72	0.60	0.00	0.26	0.28	0.24
MORT	6.36	0.92	6.36	0.92	6.37	0.90
UNEM	5.36	1.34	-0.02	1.05	1.27	0.95
POP	0.34	0.21	-0.03	0.18	0.22	0.16
CONS	1.00	2.52	0.00	2.24	2.25	2.56
INC	1.57	1.83	1.57	1.83	1.58	1.83
APPR	4.10	31.07	2.93	28.64	25.15	32.31

Note: Means and standard deviations are reported for the variables in Models 1, 2, and 3 and all of them are in percentages. Models 1 and 2 are set as regressing the average intercity housing price correlations (CORR) for each capital city with other capital cities on the variables for the capital city under investigation and on the differences between the variables for the capital city under investigation and for Australia, respectively. Model 3 is a regression of pairwise intercity correlations (CORR) on the absolute difference between the variables for the two capital cities under investigation. Therefore, INFL, MORT, UNEM, POP, CON, and APPR which represent inflation rate, real mortgage rate, unemployment rate, population change rate, consumption expenditure change rate, and the number of dwellings approved change rate respectively, have different meanings in these three models. INC (disposable income change rate) is at the national level and remains the same for the three models.

Estimates for Models 1, 2, and 3 are presented in Table 4.7. The variables UNEM and POP are both positively related to intercity housing price correlations at the significance level of 1%. This indicates that the growth in local unemployment and population will enhance housing price comovement across different regions. Both CONS and APPR are significantly negative at the level of 10%. When I test the city-fixed effect model, POP and CONS show the same sign and significance as the pooled OLS regression while APPR turns out to be more significant. UNEM is not significant in the fixed effect regression while INC is significantly negative at the 10% level meaning that as household disposal income increases intercity housing prices comove more.

The pooled OLS estimates for Model 2 confirm the significance of UNEM, POP, CONS, and APPR in determining intercity housing price correlations. This means that the housing prices in a capital city with an unemployment rate or a population growth rate that is higher than the national average are more closely correlated with other capital cities on average while more consumption expenditure or dwellings approved than national average will result in less intercity housing price correlation. In the city-fixed effect regression, only the variables MORT and APPR are significant. Examining the determinants of pairwise intercity correlations, Model 3 further confirms the explanatory power of UNEM, CONS, and APPR. The two capital cities with larger gaps in local unemployment rate, smaller gaps in local consumption levels or dwelling supply are likely to be more closely correlated in housing prices. INFL is also significantly negative which suggests that inflation disparity between two capital cities will weaken their housing price comovement.

Table 4.7 Estimates from panel regressions

	Model 1				Model 2				Model 3			
Intercept	0.036		0.270	***	0.188	***	0.271	***	0.230	***	0.206	***
	(0.56)		(16.25)		(4.84)		(24.99)		(5.18)		(15.19)	
INFL	0.146		0.224		-1.350		0.288		-8.173	***	0.280	
	(0.14)		(0.86)		(-0.62)		(0.53)		(-3.33)		(0.47)	
MORT	0.654		0.242		0.208		0.340	**	0.473		0.375	**
	(0.91)		(1.32)		(0.35)		(2.30)		(0.73)		(2.44)	
UNEM	1.482	***	-0.056		1.747	***	0.011		2.913	***	0.395	**
	(3.2)		(-0.37)		(3.3)		(0.05)		(4.64)		(2.10)	
POP	12.949	***	2.832	***	14.522	***	1.730		-4.335		0.658	
	(4.56)		(3.28)		(4.59)		(1.59)		(-1.17)		(0.65)	
CONS	-0.399	*	-0.101	*	-0.472	*	-0.068		-1.770	***	-0.052	
	(-1.85)		(-1.93)		(-1.95)		(-1.13)		(-7.44)		(-0.89)	
INC	-0.110		-0.129	*	-0.044		-0.063		-0.172		-0.067	
	(-0.36)		(-1.75)		(-0.15)		(-0.87)		(-0.55)		(-0.90)	
APPR	-0.033	*	-0.018	***	-0.037	*	-0.015	***	-0.103	***	-0.018	***
	(-1.91)		(-4.24)		(-1.94)		(-3.09)		(-5.59)		(-3.87)	
City dummies			YES (7)				YES (7)				YES (27)	
R^2	0.253		0.571		0.266		0.577		0.301		0.582	
F-stat.			1062.4				1073.86				1062.4	

Note: Models 1 and 2 are set as regressing the average intercity housing price correlations for each capital city with other capital cities on the variables for the capital city under investigation and on the differences between the variables for the capital city under investigation and for Australia, respectively. Model 3 is a regression of pairwise intercity correlations between each capital city based on the absolute difference between the variables for the two capital cities under investigation. Both pooled OLS and city-fixed effect regressions are applied for each model. T-statistics are shown below coefficients in parentheses. ***, **, and * stand for the statistical significance at the level of 1%, 5%, and 10%, respectively.

The variables UNEM and CONS can to some extent be regarded as proxies for the power of consumption; that is, a higher unemployment rate means less power of consumption while higher consumption expenditure means more power of consumption. The estimated coefficients show that higher consumption capacity or more disparity in consumption capacity will enhance intercity housing price comovement. The variable POP represents the demand for dwellings. As local population increases, more dwellings are needed. Therefore, the rising local demand for dwellings will make housing prices more closely correlated across cities. The variable APPR is a proxy for the supply of dwellings. The results show that as more dwellings are supplied, or when there is more supply disparity between cities, housing price comovement is weakened.

4.5 Summary

The Australian housing market is a large and indispensable part of the Australian economy and it accounts for a larger share of the local economy than the housing markets in the US and some other developed countries. In addition, the current housing boom in Australia makes it really stand out. Therefore, the government should treat this section of the economy with kid gloves and academia cannot ignore it either.

This study contributes to the literature by examining housing price comovement across eight capital cities in Australia with a multivariate VAR (1)-DCC-GARCH (1, 1) model. I find that (1) Perth is the only capital city whose home value is rarely influenced by other capital cities. (2) Sydney suffers more asymmetric effect in volatility as the estimated leverage coefficient in the GARCH model is significant and larger than it is for the other cities. (3) On average home values in Brisbane comove the most with other capital cities, followed by Canberra and Sydney while Darwin moves in the opposite direction to other capital cities.

This study also investigates the potential explanatory variables that could have an impact on intercity housing price correlations by a series of panel regressions. I find that (1) lower local unemployment rates and higher consumption expenditures, which represent more consumption capacity, are associated with the comovement of housing prices across cities; (2) increased demand for dwellings due to increases to local populations will cause housing prices to become more closely correlated across cities; (3) an increase in the supply of dwelling units will weaken intercity housing price correlations; and (4) larger disparities in unemployment rates, and smaller disparities in consumption expenditure or housing supply between capital cities, will enhance intercity housing price comovement.

This study improves the understanding of synergistic regional relationships and the diversification effects of underlying portfolios of residential real estate loans for mortgage-backed securities. The connection between housing prices across cities is influenced by complicated factors and co-formation mechanisms but this study provides some hints regarding the determinant variables. Therefore, although the pattern of intercity housing price comovement is not time-invariant, it should always be considered in policy making regardless of national or regional factors. A new policy launched to the nation or to a specific state may influence housing price linkages with other regions. Moreover, fund managers should also be aware of the intercity comovements in the Australian housing market in order to make more effective investment decisions.

Conclusions

This thesis, in a collection of four essays, contributes to the real estate literature by examining corporate behaviour and market integration in Asia-Pacific real estate markets. Due to the dominant position of the US real estate market in academic research, most empirical evidence is from the US market. However, Asia-Pacific real estate markets are in different stages of development to the US market and have their own unique market mechanisms. Therefore more attention should be paid to these markets to offset the lack of real estate research on emerging markets.

The first essay in this thesis is based on the phenomenon of the merger waves in J-REITs following the GFC. J-REITs were established in 2001, and have rapidly grown in number and size, but there have already been many J-REIT mergers following the GFC. J-REITs typically have a common ownership which renders most takeovers friendly. Therefore, the motivations for mergers are likely related to financial hardship. Are these mergers successful in improving prospects for these merged J-REITs? Using the methodology of event study, I examine the market responses to, and the post-merger performance of, these J-REIT mergers and find significant abnormal trading volume for both surviving and absorbed J-REITs in the immediate days before the merger. Absorbed J-REITs suffer a significantly negative return response in the two days before the merger announcement and there is no observed improvement in the post-merger operating performance. Unlike other mergers in Japan, the merger premium for J-REITs inversely predicts post-merger performance.

The second essay focuses on dividend policies in Asian REITs. It is well known that agency conflicts weaken the ability of a firm to seek potentially profitable investments due to the high costs of external financing. REITs are required to pay high levels of dividends to maintain their tax status and as a result they rely heavily on external capital markets to fund acquisitions. Paying dividends in excess of mandatory levels is one way to mitigate agency costs and improve the ability of REITs to fund their growth opportunities. This paper examines (1) the role of discretionary dividends in lowering agency costs and (2) the effect of discretionary dividend payments on externally financed growth. Using an Asian REIT sample, I find a substitution role of discretionary dividend payments for reduced agency costs and a significantly positive relationship between paying discretionary dividends and externally financed growth, providing evidence from non-US REIT markets on the agency cost explanation for the payment of discretionary dividends.

The third essay examines the extent to which globalisation and regional integration have led to real estate market interdependence in a sample of ten Asia-Pacific securitised real estate markets. I quantify the magnitude and time-varying nature of global and regional volatility spillovers from the US and Asia-Pacific securitised real estate markets to local markets. The effect of the recent GFC on volatility transmission is considered. Asia-Pacific real estate markets are more sensitive to regional shocks than they are to global shocks from the US, even though both of them are significant to Asia-Pacific markets. A significant increase in the US volatility spillover effects during the GFC period can be found in most of Asia-Pacific markets. Further, developed Asia-Pacific real estate markets, which are found to be more regionally integrated than globally integrated, are more susceptible to the impact of foreign information than emerging markets. Finally, the time invariant volatility spillover intensities can be partly attributed to monetary policies and the recent crisis.

The fourth essay examines intercity correlation of housing markets using monthly returns in eight capital cities in Australia from 1999 to 2015. A multivariate VAR (1)-DCC-GARCH (1, 1) model is applied. I find that (1) Perth is the only capital city whose home value is rarely influenced by other capital cities. (2) Sydney suffers more asymmetric effect in volatility as the estimated leverage coefficient in the GARCH model is significant and larger than it is for the other cities. (3) On average, home values in Brisbane comove most with other capital cities, followed by Canberra and Sydney while Darwin moves in the opposite direction to other capital cities. I attribute the different magnitudes and ranges of intercity associations to the different levels of fluency in information transmission across markets, and I also find that local household power of consumption and demand for dwellings enhance housing price co-formation across cities, while supply in dwellings results in less intercity housing price comovement.

Appendix A

Table 2.2 Descriptive statistics by year and property type

Panel A. Descriptive statistics by year

Variables	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
N	7	12	18	29	48	62	61	58	59	63
MKT	83726	98812	138754	128626	125578	70793	75713	97065	118387	141135
GROWTH	0.222	0.384	0.277	0.120	0.263	0.186	0.125	0.075	0.187	0.118
EFG_IG	0.198	0.368	0.249	0.099	0.226	0.163	0.108	0.058	0.176	0.103
EFG_SFG	0.197	0.364	0.246	0.097	0.217	0.156	0.103	0.055	0.173	0.099
EFG_SG	0.184	0.353	0.215	0.080	0.181	0.161	0.089	0.035	0.160	0.079
MANDIVRAT	0.029	0.028	0.027	0.025	0.025	0.026	0.024	0.025	0.024	0.024
△MANDIVRA	0.001	0.010	0.008	0.003	0.008	0.006	0.001	0.003	0.003	0.003
EXDIV	-0.006	-0.004	-0.001	-0.001	0.000	0.002	0.005	0.002	0.006	0.003
LAGEXDIV	-0.023	-0.007	-0.009	-0.006	-0.007	-0.003	0.002	0.007	0.006	0.006
EXFFO	0.017	0.011	0.026	0.018	0.033	0.024	0.021	0.017	0.016	0.017
LAGEXFFO	0.019	0.015	0.013	0.020	0.013	0.026	0.022	0.021	0.018	0.018
△EXFFO	0.003	0.001	0.016	0.001	0.022	0.003	0.002	-0.003	0.001	0.000
LEV	0.295	0.361	0.351	0.348	0.381	0.397	0.376	0.380	0.381	0.389
Q	1.056	1.057	1.113	1.119	1.118	0.769	0.742	0.825	0.826	0.878
SIZE	5.844	5.874	6.046	5.964	5.890	5.621	5.609	5.780	5.906	5.991
ASSETTO	0.068	0.068	0.066	0.065	0.064	0.068	0.071	0.068	0.068	0.066
ROA	0.031	0.029	0.044	0.044	0.056	0.021	0.008	0.036	0.045	0.047
FIN	0.206	0.348	0.261	0.114	0.252	0.159	0.110	0.079	0.176	0.110
△PROFITMGN	0.001	0.011	0.009	0.004	0.009	0.005	0.002	0.004	0.003	0.004
△ASSETTO	0.006	0.025	0.018	0.009	0.022	0.018	0.011	0.003	0.011	0.007

Table 2.2 Continued

Panel B. Descriptive statistics by property type							
Variables	Housing	Retail	Office	Industrial	Hotel	Health	Diversified
N	65	78	115	53	18	10	78
MKT	410577	1591378	1594693	864987	599317	484735	637543
GROWTH	0.178	0.176	0.154	0.179	0.142	0.150	0.163
EFG_IG	0.152	0.169	0.130	0.175	0.128	0.150	0.126
EFG_SFG	0.143	0.169	0.126	0.173	0.125	0.150	0.117
EFG_SG	0.151	0.164	0.101	0.166	0.117	0.150	0.073
MANDIVRATE	0.022	0.026	0.022	0.031	0.027	0.045	0.023
∆MANDIVRATE	0.005	0.004	0.003	0.007	0.003	0.009	0.004
EXDIV	-0.002	0.003	0.002	0.010	0.000	0.002	0.000
LAGEXDIV	-0.004	0.001	0.000	0.012	-0.002	-0.002	-0.003
EXFFO	0.022	0.010	0.025	0.013	0.014	0.002	0.033
LAGEXFFO	0.022	0.010	0.023	0.013	0.013	0.004	0.029
∆EXFFO	0.003	0.002	0.004	0.002	0.002	-0.002	0.008
LEV	0.434	0.289	0.410	0.344	0.353	0.232	0.422
Q	0.792	0.885	0.959	0.923	0.889	0.895	0.851
SIZE	5.446	6.057	6.043	5.772	5.588	5.587	5.693
ASSETTO	0.071	0.066	0.063	0.074	0.059	0.066	0.070
ROA	0.022	0.051	0.031	0.047	0.038	0.070	0.026
FIN	0.163	0.158	0.142	0.171	0.138	0.142	0.154
∆PROFITMGN	0.005	0.005	0.003	0.007	0.003	0.010	0.005
∆ASSETTO	0.016	0.011	0.010	0.016	0.010	0.013	0.013

This table presents the variable averages of our sample by year in Panel A and by property type in Panel B, respectively. MKTCAP is the market capitalisation in US dollars. GROWTH is the growth rate of total assets. EFG_IG, EFG_SFG and EFG_SG are the differences between growth rate in assets and three relevant benchmark growth rates. MANDIVRATE is 90% of before tax net income divided by total assets. ∆MANDIVRATE is the change in mandatory dividends divided by total assets. EXDIV is the discretionary dividend payments, defined as the difference between total cash dividends paid and 90% of before tax net income, divided by total assets. LAGEXDIV is the previous year's discretionary dividends divided by previous year's total assets. EXFFO is the funds from operations, defined as net income excluding profits from the sale of properties, plus depreciation and amortization, exceeding mandatory dividend payments, scaled by total assets. LAGEXFFO is previous year's FFO, less the mandatory dividend payments, all divided by previous year's total assets. ∆EXFFO is the excess FFO in the current year less previous year's excess FFO, scaled by current year's total assets. LEV is the leverage ratio, measured as total debt to total assets. Q is measured as the sum of market capitalisation, total debt and preferred equity, scaled by total assets. SIZE is the nature logarithm of market capitalization. ASSETTO is asset turnover, computed as total revenue divided by total assets. ROA is return on assets, calculated as net income available to shareholders divided by total assets. FIN is the sum of the change in total debt and the change in common equity, all divided by total assets. ∆PROFITMGN is the change in profit margin, computed as the change in net income scaled by total revenue. ∆ASSETTO is the change in asset turnover, computed as the annual change in total revenue divided by total assets.

Appendix B

Table 3.3 Estimates for GFC spillover model

	US	ASIA	AU	HK	SG	JP	CN	TW	ML	TH	PH	IND
$C_{0,i}$	0.004[b]	0.003[a]	0.003[a]	0.004[a]	0.003[a]	0.003[a]	0.004[b]	0.001	0.003[a]	0.005[a]	0.006[a]	0.004[c]
	(-0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)
$C_{1,i}$	-0.057	-0.042	-0.186[a]	-0.036[c]	0.055	0.013	-0.048	-0.14[b]	0.008	0.094	-0.071	0.057
	(0.054)	(0.053)	(0.066)	(0.041)	(0.063)	(0.043)	(0.060)	(0.066)	(0.059)	(0.068)	(0.057)	(0.064)
$\gamma_{0,i}$		0.115[a]	0.094[b]	0.058	0.103[a]	0.198[a]	0.027	0.005	0.193[a]	0.091	0.111[c]	0.066
		(0.041)	(0.043)	(0.035)	(0.03)	(0.041)	(0.096)	(0.059)	(0.043)	(0.060)	(0.059)	(0.086)
$\gamma_{1,i}$		0.050	0.146[b]	0.032	0.103[b]	-0.102	0.144	0.185	-0.012	0.336[a]	0.013	0.055
		(0.060)	(0.057)	(0.046)	(0.047)	(0.058)	(0.123)	(0.134)	(0.068)	(0.105)	(0.095)	(0.111)
$\delta_{0,i}$			0.104	0.088	0.03	-0.165	0.093	0.271[a]	-0.021	-0.055	0.032	-0.067
			(0.086)	(0.08)	(0.076)	(0.086)	(0.151)	(0.104)	(0.073)	(0.098)	(0.105)	(0.123)
$\delta_{1,i}$			0.276[a]	-0.017	-0.164[a]	-0.19[b]	0.394[b]	-0.288[b]	-0.007	0.093	0.173	-0.073
			(0.091)	(0.088)	(0.055)	(0.089)	(0.184)	(0.139)	(0.085)	(0.16)	(0.117)	(0.143)
$\emptyset_{0,i}$		0.384[a]	0.544[a]	0.353[a]	0.384[a]	0.308[a]	0.371[a]	0.385[a]	0.213[a]	0.349[a]	0.395[a]	0.441[a]
		(0.036)	(0.022)	(0.031)	(0.023)	(0.032)	(0.07)	(0.046)	(0.032)	(0.053)	(0.047)	(0.056)
$\emptyset_{1,i}$		0.240[a]	0.194[a]	0.197[a]	0.228[a]	0.379[a]	0.052	0.058	-0.052	0.162[b]	0.307[a]	-0.075
		(0.079)	(0.033)	(0.045)	(0.043)	(0.044)	(0.117)	(0.124)	(0.053)	(0.076)	(0.082)	(0.092)
$\varphi_{0,i}$			0.834[a]	0.962[a]	0.776[a]	1.084[a]	1.063[a]	0.776[a]	0.337[a]	0.516[a]	0.775[a]	0.555[a]
			(0.041)	(0.042)	(0.045)	(0.056)	(0.109)	(0.087)	(0.057)	(0.092)	(0.095)	(0.108)
$\varphi_{1,i}$			0.007	0.066	0.068	-0.092	0.102	0.172	-0.125	0.241[b]	-0.046	0.048
			(0.058)	(0.059)	(0.063)	(0.063)	(0.168)	(0.136)	(0.082)	(0.122)	(0.128)	(0.144)

Table 3.3 Continued

	ASIA	AU	HK	SG	JP	CN	TW	ML	TH	PH	IND
$\gamma_{1,i} = \delta_{1,i} = 0$		40.92 [a]	0.51	10.23 [a]	16.71 [a]	9.81 [a]	4.39	0.05	18.7 [a]	3.32	0.32
		[<.0001]	[0.773]	[0.006]	[<.0001]	[0.007]	[0.112]	[0.973]	[<.0001]	[0.19]	[0.851]
$\gamma_{0,i} = \gamma_{1,i} = \delta_{0,i} = \delta_{1,i} = 0$		87.66 [a]	18.96 [a]	60.78 [a]	52.69 [a]	27.35 [a]	11.99 [b]	32.15 [a]	38.08 [a]	15.68 [a]	3.48
		[<.0001]	[<.0001]	[<.0001]	[<.0001]	[<.0001]	[0.017]	[<.0001]	[<.0001]	[0.004]	[0.481]
$\emptyset_{1,i} = \varphi_{1,i} = 0$		34.01 [a]	19.09 [a]	28.97 [a]	78.32 [a]	0.51	1.61	3.22	8.59 [b]	14.29 [a]	0.78
		[<.0001]	[<.0001]	[<.0001]	[<.0001]	[0.774]	[0.447]	[0.2]	[0.014]	[<.0001]	[0.678]
$\emptyset_{0,i} = \emptyset_{1,i} = \varphi_{0,i} = \varphi_{1,i} = 0$		2672 [a]	1292 [a]	1243 [a]	2351 [a]	216.1 [a]	259.1 [a]	103.3 [a]	299.6 [a]	321.5 [a]	159.2 [a]
		[<.0001]	[<.0001]	[<.0001]	[<.0001]	[<.0001]	[<.0001]	[<.0001]	[<.0001]	[<.0001]	[<.0001]
$\gamma_{1,i} = \emptyset_{1,i} = 0$	13.11 [a]	39.24 [a]	19.50 [a]	37.68 [a]	77.44 [a]	1.62	2.23	1.08	17.42 [a]	14.58 [a]	1.52
	[0.001]	[<.0001]	[<.0001]	[<.0001]	[<.0001]	[0.444]	[0.328]	[0.582]	[0.000]	[0.001]	[0.468]
$\delta_{1,i} = \varphi_{1,i} = 0$		9.25 [a]	1.47	10.46 [a]	5.65 [c]	4.60 [c]	6.07 [b]	2.32	4.20	2.27	0.42
		[0.010]	[0.479]	[0.005]	[0.059]	[0.100]	[0.048]	[0.314]	[0.123]	[0.322]	[0.810]

This table presents the estimates for the GFC spillover model. US returns: $R_{us,t} = C_{0,us} + C_{1,us}R_{us,t-1} + e_{us,t}$,where $e_{us,t}$ has mean 0 and conditional variance: $\sigma^2_{us,t} = \omega_{us} + \alpha_{us}e^2_{us,t-1} + \beta_{us}\sigma^2_{us,t-1}$. Aggregate Asia-Pacific returns: $R_{Asia,t} = C_{0,asia} + C_{1,Asia}R_{Asia,t-1} + (\gamma_{0,asia} + \gamma_{1,asia}D_t)R_{US,t-1} + (\emptyset_{0,asia} + \emptyset_{1,asia}D_t)e_{US,t} + e_{Asia,t}$, where $e_{Asia,t}$ has a mean of 0 and conditional variance: $\sigma^2_{Asia,t} = \omega_{Asia} + \alpha_{Asia}e^2_{Asia,t-1} + \beta_{Asia}\sigma^2_{Asia,t-1}$. Market i returns: $R_{i,t} = C_{0,i} + C_{1,i}R_{i,t-1} + (\gamma_{0,i} + \gamma_{1,i}D_t)R_{US,t-1} + (\delta_{0,i} + \delta_{1,i}D_t)R_{Asia,t-1} + (\emptyset_{0,i} + \emptyset_{1,i}D_t)e_{US,t} + (\varphi_{0,i} + \varphi_{1,i}D_t)e_{Asia,t} + e_{i,t}$, where $e_{i,t}$ has a mean of 0 and conditional variance: $\sigma^2_{i,t} = \omega_i + \alpha_i e^2_{i,t-1} + \beta_i\sigma^2_{i,t-1}$. Heteroskedasticity-consistent standard errors are given in parentheses and p-values for joint Wald statistics in brackets. a, b, and c denote significance at the 1%, 5%, and 10% levels, respectively.

Appendix C

Table 3.5 Determinants of the US/Asia-Pacific variance ratios

Variable	AU	HK	SG	JP	CN	TW	ML	TH	PH	IND
Panel A: Determinants of the US variance ratios										
C	0.29 [a]	0.44 [a]	0.43 [a]	0.55 [a]	0.27 [a]	0.45 [a]	-0.02	0.11 [a]	0.13 [a]	-0.16 [a]
	(13.14)	(23.88)	(21.16)	(4.10)	(26.66)	(3.99)	(-0.60)	(9.11)	(12.10)	(-4.20)
Trade Integration	0.20	0.07	0.08	0.12	0.03	0.02	-0.06	-0.01	0.10	-0.07
	(1.43)	(0.79)	(0.81)	(0.75)	(0.75)	(0.27)	(-1.26)	(-0.13)	(1.23)	(-1.50)
Currency Volatility	-0.25	65688.00	-10.91 [a]	-3532.80	-174.94 [a]	-7656.69 [a]	30.65 [b]	-1070.18	-3652.05	-13.96
	(-0.46)	(0.91)	(-3.72)	(-0.87)	(-3.93)	(-2.98)	(2.31)	(-0.81)	(-1.20)	(-0.74)
Excess Interest rate	0.02	-0.06 [a]	0.03	0.00	-0.03 [a]	0.07 [c]	-0.11 [a]	-0.03 [a]	0.02 [c]	0.03 [a]
	(1.54)	(-3.35)	(1.48)	(0.08)	(-2.93)	(1.88)	(-3.55)	(-2.89)	(1.87)	(5.92)
Excess Inflation*100	-0.17	-1.84 [b]	-0.03	0.61	-1.12 [b]	0.45	1.19 [b]	-1.84 [a]	2.85 [a]	-0.09
	(-0.12)	(-2.26)	(-0.04)	(0.44)	(-2.46)	(0.57)	(2.55)	(-4.10)	(4.53)	(-0.37)
GFC	0.02	0.05	0.06 [c]	-0.06	0.14 [a]	0.04	0.01	0.18 [a]	0.02	0.14 [a]
	(0.61)	(1.47)	(1.83)	(-1.51)	(7.83)	(1.47)	(0.63)	(10.99)	(1.16)	(12.45)
R-Square	9.2%	30.7%	23.6%	7.5%	54.3%	27.7%	34.2%	72.2%	43.3%	68.8%

Table 3.5 Continued

Variable	AU	HK	SG	JP	CN	TW	ML	TH	PH	IND
Panel B: Determinants of Asia-Pacific variance ratios										
C	0.26 [a]	0.10 [a]	0.21 [a]	0.08 [a]	0.12 [a]	0.14 [a]	-0.02	0.04	-0.04 [b]	-0.20 [a]
	(7.93)	(3.84)	(8.45)	(3.66)	(9.39)	(8.48)	(-1.61)	(1.73)	(-2.14)	(-4.24)
Trade Integration	-0.04	0.02	-0.07	-0.12	0.00	-0.05	-0.04	-0.07	-0.05	--
	(-0.34)	(0.26)	(-0.64)	(-1.26)	(0.08)	(-0.85)	(-0.74)	(-0.84)	(-0.89)	--
Currency Volatility	1.36 [c]	41463.00	-6.03	-1793.42	-194.84 [a]	-5625.24 [a]	138.13 [a]	2869.42	12529.00	9.28
	(1.88)	(0.62)	(-1.60)	(-0.72)	(-5.01)	(-2.69)	(7.65)	(1.31)	(3.88)	(0.27)
Excess Interest rate	0.00	0.04 [a]	0.02 [b]	0.01 [c]	-0.01 [b]	0.02 [a]	0.04 [a]	0.02 [a]	0.05 [a]	0.04 [a]
	(0.09)	(2.91)	(2.03)	(1.94)	(-2.05)	(3.42)	(7.07)	(3.01)	(7.44)	(7.08)
Excess Inflation*100	-0.71	-2.05 [a]	-0.88	-1.95 [b]	-0.74 [a]	-1.42 [b]	-0.53	-2.44 [a]	-1.72 [a]	-0.57
	(-0.44)	(-4.03)	(-1.31)	(-2.17)	(-3.34)	(-2.34)	(-1.44)	(-5.73)	(-2.72)	(-1.60)
GFC	0.13 [a]	0.18 [a]	0.18 [a]	0.25 [a]	0.02	0.04	0.07 [a]	0.19 [a]	0.28 [a]	0.09 [a]
	(3.97)	(6.56)	(4.26)	(11.75)	(1.52)	(1.44)	(4.06)	(7.26)	(11.07)	(3.89)
R-Square	18.4%	38.3%	32.2%	65.3%	32.6%	19.8%	48.8%	44.2%	69.1%	39.7%

This table reports the OLS estimates of the determinants on the US and Asia-Pacific variance ratios in Panels A and B, respectively. Trade integration is measured as the growth rate of total imports and exports with the US/Asia. Currency volatility is determined by the GARCH (1, 1) variance for individual Asia-Pacific market i's USD exchange rate. Excess interest rate is measured as the difference between individual Asia-Pacific market i's lending rate and the US lending rate/average Asia-Pacific lending rate across the ten Asia-Pacific markets in our sample. Excess inflation rate is measured as the difference between individual Asia-Pacific market i's inflation rate and the US inflation rate/average Asia-Pacific inflation rate across the ten Asia-Pacific markets. GFC, a dummy variable, equals 1 during the period from 01 July 2007 to 31 December 2008, and 0 otherwise. T-statistics are shown in the brackets below the coefficients. a, b, and c denote significance at the 1%, 5%, and 10% levels, respectively.

Appendix D

Table 4.3 Parameter estimates of VAR-DCC-GARCH Model

Panel A: Estimated coefficients of VAR(1) models

	Constant	SYD	MEL	BRI	ADE	PER	HOB	DAR	CAN
SYD	0.03***	0.56***	0.17***	0.05	-0.16***	-0.17***	0.06	-0.10***	-0.01
	(3.07)	(7.72)	(3.49)	(0.73)	(-3.41)	(-4.03)	(1.62)	(-3.96)	(-0.20)
MEL	0.04***	-0.05	0.75***	0.05	-0.10	-0.13**	0.04	-0.09**	0.01
	(3.54)	(-0.70)	(8.64)	(0.47)	(-1.61)	(-2.44)	(0.67)	(-2.18)	(0.07)
BRI	0.02***	-0.11**	0.11**	0.69***	0.06	-0.10***	0.10***	-0.03	0.04
	(2.75)	(-2.04)	(2.08)	(11.67)	(1.24)	(-2.81)	(2.81)	(-1.06)	(0.80)
ADE	0.02***	0.12	0.19**	0.31***	0.13**	-0.12***	0.08*	0.04	0.03
	(2.74)	(1.35)	(2.35)	(3.44)	(1.97)	(-2.79)	(1.66)	(1.16)	(0.38)
PER	0.02**	0.05	-0.07	0.04	-0.04	0.70***	-0.01	0.00	0.07
	(2.02)	(0.89)	(-1.25)	(0.53)	(-0.83)	(7.90)	(-0.18)	(0.13)	(1.09)
HOB	0.02*	0.03	-0.25***	0.14	0.13*	-0.03	0.67***	-0.04	0.11
	(1.77)	(0.29)	(-2.99)	(1.40)	(1.94)	(-0.68)	(10.42)	(-1.01)	(1.30)
DAR	0.04***	-0.04	0.11	0.19	-0.20*	0.18**	0.14*	0.24***	-0.17
	(3.07)	(-0.31)	(0.79)	(1.34)	(-1.77)	(2.08)	(1.76)	(3.23)	(-1.34)
CAN	0.03***	0.09	0.12	0.13	-0.01	-0.08	0.11**	-0.05	0.35***
	(3.83)	(1.11)	(1.55)	(1.60)	(-0.13)	(-1.54)	(2.22)	(-1.44)	(4.13)

Table 4.3 Continued

Panel B: Estimated coefficients of GJR-GARCH(1,1) models								
	100*W		A		B		R	
SYD	0.09	**	0.13	*	0.44	***	1.34	***
	(2.28)		(1.88)		(5.14)		(3.28)	
MEL	0.02		0.13		0.78	***	0.27	*
	(0.72)		(1.28)		(9.20)		(1.76)	
BRI	0.01		0.25	***	0.69	***	0.20	
	(1.49)		(3.66)		(9.87)		(1.27)	
ADE	0.01		0.04		0.86	***	0.19	*
	(1.43)		(0.62)		(16.58)		(1.93)	
PER	0.01		0.35	***	0.65	***	0.10	
	(1.28)		(4.62)		(8.45)		(0.87)	
HOB	0.01	*	0.09	*	0.77	***	0.38	***
	(1.82)		(1.84)		(17.51)		(2.72)	
DAR	0.03		0.20	**	0.78	***	0.07	
	(1.27)		(2.40)		(12.08)		(0.43)	
CAN	0.02		0.19	**	0.78	***	0.05	
	(1.18)		(2.24)		(10.34)		(0.40)	

Panel C: Estimated coefficients of DCC (1,1) model				
	A		B	
	0.08	***	0.44	***
	(3.46)		(2.85)	

Notes: this table presents the estimated coefficients of VAR (1) models ($R_{i,t} = c_i + \sum_{j=1}^{8} m_{ij} R_{j,t-1} + \varepsilon_{it}$), GJR-GARCH(1,1) models ($h_{ii,t} = c_i + \alpha_i \varepsilon_{i,t-1}^2 + \beta_i h_{ii,t-1}^2 + \delta_i I_{i,t} \varepsilon_{i,t-1}^2$), and DCC (1,1) model ($h_{ij,t} = (1 - a - b)\bar{\rho}_{ij} + a\eta_{i,t-1}\eta_{j,t-1} + bh_{ij,t-1}$), where i, j =1 for Sydney; 2 for Melbourne; 3 for Brisbane; 4 for Adelaide; 5 for Perth; 6 for Hobart; 7 for Darwin; 8 for Canberra. T-statistics are shown below coefficients in parentheses. ***, **, and * stand for the statistical significance at the level of 1%, 5%, and 10%, respectively.

Endnotes

1. See the ARES J-REIT Report (No.56) on the ARES website: http://www.ares.or.jp/en/index_en.html

2. Nine J-REITs were delisted from TSE during the period from 2002 to 2014 and all these delistings were due to the mergers. Actually nine J-REIT mergers occurred during this period with eight public-to-public mergers that are included in this study and one private-to-public merger (between NewCity Residence and Blife) that is excluded from this chapter. Among the eight public-to-public mergers, seven were absorption-type mergers in which the target J-REITs were dissolved while one was a consolidation-type merger in which both bidder and target were dissolved.

3. See Campbell et al. (1998, 2001), Olgun (2005), Womack (2012), and Eichholtz and Kok (2008).

4. The top 15 J-REITs listed on the TSE are extracted from the ARES J-REIT Report (No.56). See more details on http://www.ares.or.jp/en/index_en.html. These merger stories are sourced from their merger announcements.

5. Mehrotra et al. (2011) show that mergers in Japan tend to be counter-cyclical and a significant proportion of Japanese bidder and target firms have a common main bank, which may lead to the observed negative announcement day wealth effects for both target and bidder shareholders in the 1990s.

6. Prior to 2001, US REITs were required to pay at least 95% of their taxable income in dividends in order to avoid taxation. For most Asian REIT markets, such as Japan and Singapore, the percentage is 90%.

7. Besides the allocation function of capital markets, Tadess (2004) also finds theoretical support and international empirical evidence to support the view that the financial system provides investors with a variety of mechanisms for monitoring inside decision-makers and that this helps mitigate the various agency problems of firms.

8. Since Wang et al. (1993) first argued that tax regulations are not the only reason for REITs paying dividends and that REITs often distribute dividends in excess of required levels, some studies have investigated the determinants of the discretionary dividends of the US REITs. See Hardin and Hill (2008), Boudry (2011), Chou et al. (2013), and Lee and Chiu (2010).

9. In the US, taxable income is estimated from mandatory disclosures under SFAS 109. However, Hanlon (2003) and Lisowsky (2009) argue that the common method of estimating the taxable income used in the literature is likely to be inaccurate except for firms with the simplest corporate structures. This issue also exists in the US REITs as stated in Boudry (2011). For Asian REITs, the disclosure of taxable income is also not mandatory and I can only estimate it using the available data.

10. The Link REIT listed in Hong Kong is managed internally. Under this structure, the trust owns the assets and the management company.

11. Although a REIT is a completely separate listed entity, the sponsor is often still very connected to its operations and cash flow. It is very common for the manager and the property

manager to be wholly owned subsidiaries of the sponsor. Therefore, the sponsor captures the entire fee stream paid by the REIT to the manager. The sponsor can also have large shareholders in the REIT, which not only allows it to retain interest in the underlying cash flows of the properties, but also gives it significant control over the REIT.

12. The externally financed growth is measured by using the "percentage of sales" approach to financial planning and this is done under the assumptions that (1) the ratio of assets used in production to sales is constant; (2) the profit rate per unit of sales is constant; and (3) the economic depreciation equals the depreciation amount reported in the firm's financial statements.

13. The method for measuring the constrained growth rate driven by total debt (SG) was developed by Ghosh and Sun (2013).

14. Demirguc-Kunt and Maksimovic (1998; 2002), Khurana et al. (2006) and Ghosh and Sun (2013) use the proportion of years in which EFG_IG, EFG_SFG, and EFG_SG are greater than zero in three consecutive years to reduce the effect of outliers. In order to avoid a substantial decrease of sample size, I use EFG_IG, EFG_SFG and EFG_SG directly as dependent variables in our model and it is consistent with the calculation of other variables used in our model.

15. I follow Ghosh and Sun (2013) to calculate SFG, which is more suitable for REITs. The definition of SFG in their paper takes the payout ratio into consideration. However, Demirguc-Kunt and Maksimovic (1998; 2002) and Khurana et al. (2006) assume the payout ratio is zero.

16. In Ghosh and Sun's (2013) model, they do not include the endogenous variable EFG_t as an independent variable in discretionary dividend equation. This ignores the bi-directional causality between discretionary dividend payments and externally financed growth. Our results confirm this bi-directional causality.

17. ROA is excluded from the dividend equation in Ghosh and Sun (2013) as the Spearman rank correlation between ROA and the mandatory dividend is close to 1 in their sample. Wang et al. (1993) and Ghosh and Sirmans (2006), and Hardin and Hill (2008) all find an inverse relationship between dividend payments and ROA.

18. This classification is from Bloomberg.

19. Change in asset turnover in this chapter is calculated as the annual change in total revenue divided by total assets.

20. Ghosh and Sun (2013) report that the proportions of years in which EFG_IG, EFG_SFG and EFG_SG are greater than zero in three consecutive years are 73.3%, 69% and 56.5% for the US REITs, which is larger than the reported proportions for the industrial firms in Khurana et al. (2006). To make the results of the US REITs and the Asia-Pacific REITs comparable, I use the same measure to calculate the proportions for our Asia-Pacific sample. I find 81% of REITs in our sample rely on external financing for their growth, 80% rely on long-term debt and equity issues and 77.3% on equity financing. These larger percentages in our sample are consistent with the growth-by-acquisition strategy of Asia-Pacific REITs and confirm that they rely more heavily on external capital markets to fund growth compared to US REITs.

21. The negative minimum discretionary dividend shows that estimate for the EXDIV is imprecise.

22. Actually, none of the J-REITs in our sample invested in health care properties. All these 10 health care observations are from the Singaporean market.

23. Only the correlations between EFG_IG and other independent variables in the dividend equation are reported in Table 2.3 due to space limitations. The unreported correlations of EFG_SFG and EFG_SG with other independent variables also satisfy the argument of Judge et al. (1980) that the Spearman's rank correlation should not be lower than 0.8.

24. The S&P global property index comprises more than 550 constituents from 36 global markets, both developed and emerging. The index is market-capitalisation weighted, as are many of its sub-indices. Companies included are involved in a wide range of real estate-related activities such as property management, development, rental and investment.

25. Consumer defaults on subprime mortgages had dramatic effects on the US financial sector, and the recent Global Financial Crisis is also known as the US subprime mortgage crisis. Although there is no agreement as to when the Global Financial Crisis first started and finally ended, the widely accepted view is the beginning date should be somewhere near end of the second quarter of 2007. Liow and Newell (2012) specify the GFC period as starting in June 2007 while Puri et al. (2011) argue that it began in August 2007. Duchin et al. (2010) date the beginning of the crisis as July 1, 2007 which makes their findings conservative given the crisis began in August 2007. I follow Duchin et al. (2010) and define the GFC period as

starting in July 2007 but extend the end from 30 June 2008 to 31 December 2008. Therefore, our findings are conservative.

26. For aggregate Asia, unreported $\alpha_i + \beta_i$ is less than 1. This implies a highly persistent volatility process.

27. For all Asia-Pacific real estate markets, unreported $\alpha_i + \beta_i$ is also less than 1, implying a highly persistent volatility process.

28. Relative to the unreported variance ratios for the standard volatility spillover model that does not use different parameters for the GFC and non-GFC periods, the US variance ratios increase for all Asia-Pacific markets except Australia and Thailand, while the regional variance ratios decrease for all but mainland China and Taiwan. This implies that after taking the effects of the GFC on spillover effects into consideration, the US information on average has more impact on the unexpected returns of individual Asia-Pacific real estate markets. This is consistent with the findings in Liow (2008) that a major crisis can trigger market interdependence.

29. Australia has six states: New South Wales (NSW), Victoria (VIC), Queensland (QLD), South Australia (SA), Western Australia (WA) and Tasmania (TAS), as well as two territories: the Australian Capital Territory (ACT) and the Northern Territory (NT). The capital cities of each state/territory are Sydney (SYD), Melbourne (MEL), Brisbane (BRI), Adelaide (ADE), Perth (PER), Hobart (HOB), Canberra (CAN), and Darwin (DAR).

30. Rather than relying solely on transacted sale prices to provide a measure of housing market conditions, the CoreLogic RP Data Daily Home Value Index is based on a ‘hedonic imputation’ methodology which includes the attributes of properties that are transacting as

part of the analysis. Understanding factors such as the number of bedrooms and bathrooms, the land area and the geographic context of the property allows for a much more accurate analysis of the true value of movements across specific housing markets. This method also allows for compositional change in consumer buying patterns when measuring capital gains without introducing bias.

31. Only the results for combined dwellings are reported due to space limitations. I also use the datasets for houses and units. The results are the same.

32. These monthly data quote the daily index level calculated as at the last calendar day of the month. The daily index is only available for five capital cities

33. Only the results for Sydney and Melbourne are reported due to space limitations. The other capital cities have similar results for inequality.

34. Although there was no consensus as to when the GFC first started, the widely recognised starting date should be somewhere near end of the second quarter of 2007. To ensure that the two sub-samples have equal numbers of observations, and that the comparison meaningful, I make 30 April 2007 the cut-off date. I also made some informal analyses using shorter sub-periods that have a cut-off point of 30 June 2007 and found that the results are similar.

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