DIVERSIFICATION, ECONOMIC IMPACT AND VOLATILITY MODELING OF ASIAN REAL ESTATE INVESTMENT TRUSTS

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To my beloved father and mother

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ABSTRACT

A significant amount of past literature in real estate have focussed on the diversification benefits, the macroeconomic influence, and the volatility behaviour of Real Estate Investment Trusts (REITs) in the United States (US) and the Asian property markets. However, studies focussing on the Asian REIT markets consisting of Japan, Singapore, Hong Kong, Malaysia, Thailand, Taiwan and South Korea are far in between. Using data drawn from the Asian REIT markets beginning from the date each market was established until the end of December 2014, this study examines the existence of international diversification among the Asian REIT markets based on the perspective of the long run and short term relationship. A sub-period analysis focussing on the international diversification of the Asian REIT markets during the global financial crisis is also examined. Linked to that, this study also identifies the relevant macroeconomic factors which could influence the return performance and volatility of the returns of the Asian REIT markets. The performance of the volatility models in forecasting the volatility pattern of the Asian REIT markets is also assessed. For the purpose of testing the long term and short run relationship, the Johansen co-integration test model and the Granger causality test model were used. To investigate the volatility spillover effects of this study, the Multivariate Generalized Autoregressive Conditional Heteroskedasticity model was applied. To forecast the volatility of the REIT Index, the Autoregressive Conditional Heteroskedasticity (ARCH) family model was used. Results indicate that cross-border diversification opportunities exist even though the markets were cointegrated since the global financial crisis. Analysis of the macroeconomic impact towards the individual REIT market's return and volatility suggests that the integration of the macroeconomic variables with the REIT market's returns vary across countries. Nonetheless, there was no significant evidence to show that the macroeconomic variables affect the volatility of the REITs return. Finally, the Fractional Integrated Generalized Autoregressive Conditional Heteroskedasticity (FIGARCH), Asymmetric Power Autoregressive Conditional Heteroskedasticity (APARCH) and Fractional Integrated Asymmetric Power Autoregressive Conditional Heteroskedasticity (FIAPARCH) models were found to be more effective compared to other models in forecasting the volatility of the respective Asian REITs markets. The outcome of this study is relevant to several parties. For instance, it serves as a useful reference for the Asian REIT investors in making a more informed investment decision and it also enables policy makers to better understand the implications of any policy changes made on the respective REIT markets.

ABSTRAK

Kebanyakan literatur lepas dalam bidang hartanah telah bertumpu pada manfaat pempelbagaian, pengaruh makroekonomi, dan ketidaktentuan *Real Estate Investment Trusts* (REITs) di pasaran hartanah Amerika Syarikat dan Asia. Walau bagaimanapun, kajian yang memfokuskan kepada pasaran REIT Asia yang merangkumi Negara Jepun, Singapura, Hong Kong, Malaysia, Thailand, Taiwan dan Korea Selatan jarang dilakukan. Dengan menggunakan data yang diperolehi daripada pasaran REIT Asia dari tarikh penubuhannya sehingga akhir bulan Disember 2014, kajian ini mengkaji kewujudan pempelbagaian antarabangsa di kalangan pasaran REIT Asia berdasarkan perspektif hubungan jangka panjang dan pendek. Analisis sub-tempoh terhadap pempelbagaian antarabangsa pasaran REIT Asia semasa krisis kewangan dunia juga dijalankan. Sehubungan dengan itu, kajian ini juga mengenal-pasti faktor-faktor makroekonomi yang relevan yang boleh mempengaruhi prestasi pulangan dan ketidaktentuan pulangan pasaran REIT Asia. Prestasi model ketidaktentuan untuk meramal corak ketidaktentuan pulangan pasaran REIT Asia juga dinilai. Untuk tujuan menguji hubungan jangka panjang dan pendek, model ujian Johansen integrasi bersama dan model ujian penyebab Granger digunakan. Untuk menyiasat kesan limpahan ketidaktentuan dalam kajian ini, model *Multivariate Generalized Autoregressive Conditional Heteroskedasticity* digunakan. Untuk meramal ketidaktentuan Indeks REITs, model dari keluarga *Autoregressive Conditional Heteroskedasticity* (ARCH) digunakan. Hasil dapatan menunjukkan bahawa peluang pempelbagaian pelaburan merentas sempadan wujud walaupun pasaran berintegrasi bersama semenjak waktu masa krisis kewangan global. Analisis kesan makroekonomi terhadap pulangan dan ketidaktentuan pasaran REIT menunjukkan bahawa integrasi antara pembolehubah makroekonomi dan pulangan pasaran REIT berbeza di antara negara. Namun, tiada bukti ketara dikesan untuk menunjukkan bahawa pembolehubah makroekonomi mempengaruhi ketidaktentuan pulangan REIT. Akhir sekali, model *Fractional Integrated Generalized Autoregressive Conditional Heteroskedasticity* (FIGARCH), *Asymmetric Power Autoregressive Conditional Heteroskedasticity* (APARCH) dan *Fractional Integrated Asymmetric Power Autoregressive Conditional Heteroskedasticity* (FIAPARCH) didapati lebih berkesan daripada model lain dalam membuat ramalan ketidaktentuan pasaran REIT Asia. Hasil dapatan kajian ini bermanafaat kepada beberapa pihak. Sebagai contoh ia menyediakan rujukan berguna kepada pelabur REIT Asia dalam membuat keputusan pelaburan yang lebih berkesan dan ia juga membolehkan pembuat dasar memahami implikasi sebarang perubahan dasar yang dibuat terhadap pasaran REIT masing-masing.

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LIST OF ABBREVIATIONS

ADF	-	Augmented Dickey Fuller
AIC	-	Akaike Information Criterion
APARCH	-	Asymmetric Power Autoregressive Conditional Heteroskedasticity
APREA	-	Asia Pacific Real Estate Association
ARCH	-	Autoregressive Conditional Heteroskedasticity
CCIS	-	Code on Collective Investment Schemes
CPI	-	Consumer Price Index
CR-REIT	-	Corporate Restructuring REIT
EGARCH	-	Exponential Generalized Autoregressive Conditional Heteroskedastic
FIAPARCH	-	Fractional Integrated Asymmetric Power Autoregressive Conditional Heteroskedasticity
FIEGARCH	-	Fractional Integrated Exponential Generalized Autoregressive Conditional Heteroskedastic
FIGARCH	-	Fractional Integrated Generalized Autoregressive Conditional Heteroskedastic
GARCH	-	Generalized Autoregressive Conditional Heteroskedastic
GDP	-	Gross Domestic Product
GFC	-	Global Financial Crisis
IS-LM	-	Investment Saving – Liquidity Preference Money Supply
ITL	-	Investment Trust Law
KLSE	-	Kuala Lumpur Stock Exchange
MAE	-	Mean Absolute Error

MAS	-	Monetary Authority of Singapore
MGARCH	-	Multivariate GARCH
MPT	-	Modern Portfolio Theory
PFPO	-	Property Funds for Public Offering
REICA	-	Real Estate Investment Company Act
REIT	-	Real Estate Investment Trust
RESA	-	Real Estate Securitisation Act
RMSE	-	Root Mean Square Error
S&P	-	Standard & Poor's
SC	-	Security Commission
SEC	-	Security and Exchange Commission
SFA	-	Securities and Future Act
SFC	-	Securities and Future Exchange Commission
SC	-	Securities Commission
SIC	-	Schwartz Information Criterion
TIC	-	Theil's Inequality Coefficient
TWSE	-	Taiwanese Stock Exchange
UK	-	United Kingdom
US	-	United States
USD	-	US Dollar

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CHAPTER 1

INTRODUCTION

1.1   General Overview

The seminal paper of Markowitz (1952) has led to the development of modern portfolio theory that discusses about the optimization of risk and return in the portfolio. Subsequently, a proliferation of research was conducted on asset management to study on the optimization of portfolio return through the diversification of risk in the portfolio.

Portfolio diversifications can be achieved by incorporating other assets classes into the equity portfolio. Investors may use them as alternative investment vehicle to diversify the risk of their portfolio. Among the assets, real estate was able to improve the portfolio diversification. However, investors are required to invest a substantial amount of capital in order to gain real estate exposure. Thus, real estate investment trusts (REITs) was created so as to provide real estate exposure to investors with smaller amount of capital. It is an indirect real estate investment whereby it lowers the capital requirement while providing real estate exposure to investor. The income is generated through rental income of the underlying properties. Consequently, several countries including the United States, Netherland and Australia have established their own REIT markets to provide additional options to investors and to boost the growth of their national economy. Subsequently, Asian countries such as Japan, Singapore, Hong Kong, Malaysia, Thailand, Taiwan and

South Korea have also formed their own REITs markets with distinctive market structure, which could eventually drive the portfolio diversification.

1.2   Background of the Study

The first real estate investment trust was formed in the United States (US) in the 1960s. Several studies have been done to understand REIT and pioneer work conducted on the risk and return performance of the US-REITs have indicated that the US-REITs had managed to outperform the stock market (Smith and Shulman, 1976). Similar findings that addressed the risk and return performance of the US-REITs (Kuhle *et al.*, 1986; Chiang *et al.*, 2008) have also been documented in other studies. Besides the US-REITs, studies which focus on other REITs markets in Australia (Chiang *et al.*, 2008), France (Newell *et al.*, 2013) and Turkey (Erol and Tirtiroglu, 2008) have also shown results which outperform other asset classes. In looking at the Asian REITs markets, all of them were only established after the 2000s. Prior to the 2000s, the Asian property companies were used as a proxy for REITs in Asian countries. It was found that most of the Asian property companies had underperformed compared to the stock markets (Liow and Sim, 2006). However, the Asian REITs markets had managed to outperform the stock markets (Newell *et al.*, 2010; Newell and Peng, 2012; Peng and Newell, 2012; Newell, Pham and Ooi, 2015).

Subsequently, studies were conducted to determine the diversification capability of REITs in a mixed asset portfolio. Overall, the US-REITs yielded a low return correlation with stocks and bonds (Clayton and MacKinnon, 2001; Conover *et al.*, 2002; Bley and Olson, 2005; Westerheide, 2006). Apart from US-REITs, studies also reported the diversification benefit of Australia REITs (Chiang *et al.*, 2008), French REITs (Newell *et al.*, 2013), Asian property companies (Newell *et al.*, 2010; Newell and Peng, 2012; Peng and Newell, 2012; Pham, 2012) and the Asian REITs (Newell *et al.*, 2010; Newell and Peng, 2012; Peng and Newell, 2012; Pham, 2012) in mixed asset portfolio.

The proven of the diversification benefit of REIT in mixed asset portfolio further motivated the effort in searching for the international diversification among REITs markets in order to improve the portfolio diversification. Due to limited number of REITs markets available, some studies includes property companies to measure the international diversification for the countries that do not have their own REIT market. Generally, the correlation test on the non-Asian REITs (Bond *et al.*, 2006), the Asian property companies (Eichoholtz, 1996; Razali, 2015), and the Asian REITs markets indicated that international diversification exists among certain of the markets. For example, evidences indicated that the emerging Asian REIT markets (Malaysia, Thailand, Taiwan, South Korea) had a lower return correlation among themselves compared to the correlation among the developed Asian REIT markets (Japan, Singapore, Hong Kong) that is possibly attributed to the structural difference among the Asian REIT markets (Pham, 2012).

Beside the correlation test, co-integration test and granger causality test were also used in identifying the international diversification of REITs through examining the long run and short term relationship between assets return. This is to complement the weakness of the correlation test that only measures the static linkage between assets, as the co-integration and granger causality test measure the dynamic linkage among asset return in long run and short term. For instance, long run and short term linkage were detected among the US-REITs and the Asian property companies (Yunus and Swanson, 2007; Liow, 2008). However, some of these markets were not cointegrated in the system. This implies that the diversification can still be achieved if any of the markets can be excluded from the cointegrating vector. As for the Asian REIT markets, international diversification existed among the Japan and South Korea as these two markets were weakly cointegrated together (Kim, 2009). On the other hand, the international diversifications of the remaining five Asian REIT markets have not been proven.

The existence of diversification benefits could be detected from the different underlying forces such as macroeconomic variables and firm specific variables which drive the movement of the REITs. For instance, firm specific variables were applied to measure the underlying movement of individual assets. Conversely, macroeconomic variables were applied to study the movement of individual assets as well as the whole assets market. Among the macroeconomic variables studies, the

pioneer research conducted by Chen, Richard, and Stephen (1986) employed multiple macroeconomic factors to explain the variation of stock returns. According to Chen *et al.* (1986), economic forces are able to affect the discount rate which is one of the components used in calculating the stock price based on the discounted cash flow model. Research have highlighted that a couple of macroeconomic variables have significant impact in explaining the variation of the return movement of non-Asian REITs markets (Bredin *et al.*, 2007; Bredin *et al.*, 2011; Anderson *et al.*, 2012) and Asian property companies (Liow and Yang, 2005; Yunus, 2012). These significant macroeconomic variables consist of elements including interest rate (Chen and Tzang, 1988; McCue and Kling, 1994; Allen *et al.*, 2000), inflation (Glascock *et al.*, 2002; Jirasakuldech and Emekter, 2012; Liu *et al.*, 2012), industrial production index (McCue and Kling, 1994), gross domestic product (GDP) (Ewing and Payne, 2005; Li and Lei, 2011; Chang *et al.*, 2011), and money supply (Bredin *et al.*, 2007; Bredin *et al.*, 2011; Anderson *et al.*, 2012).

On the other hand, the number of literature on the impact of macroeconomic volatility towards the REIT volatility is much lesser compared to the studies on the macroeconomic change to the REIT return. Nevertheless, such information is also important for investor to understand whether or not their REIT portfolio will be affected when the macroeconomic environment become volatile. Based on the evidence from the US-REITs, Jirasakuldech, Robert and Emekter (2009) have documented the evidence of the impact from macroeconomic determinants towards the conditional volatilities of the US-REITs return. They reported that inflation, federal fund rates, industrial production index are the factors that exert volatility spill over effects on US-REITs.

Other than using macroeconomic variables, attempts were done to explain the volatility behaviour of REITs return through the variation of the ARCH-family models (Devaney, 2001; Jirasakuldech *et al.*, 2009; Liow, 2009; Zhou, 2011; Zhou and Kang, 2011; Liow and Chen, 2013; Tsai, 2013; Razali, 2015) and also the volatility forecasting performance of the models (Zhou and Kang, 2011) on REITs markets. For instance, Devaney (2001) found that mortgage-REITs exhibit Autoregressive Conditional Heterosecedasticity (ARCH) and General Autoregressive Conditional Heterosecedasticity (GARCH) effect from the in-sample fitting tests while these effects were not observed in equity-REITs. On the other hand, Zhou and

Kang (2011) observed that most of the US-REITs were fitted with Exponential General Autoregressive Conditional Heterosecedasticity (EGARCH) models, while the equity-REIT was more fitted with GARCH model. Asteriou and Begiazi (2013) reported that mortgage REITs was fitted to EGARCH model while equity REIT was more suitable to GARCH model. These suggested that the volatility behaved differently across different type of the US-REITs. As on the out-of-sample forecast test, Zhou and Kang (2011) compared the accuracy of the models in forecasting the return volatility of US-REITs. Results have showed that Fractional Integrated GARCH (FIGARCH) model was among the best ARCH-family model in forecasting the volatility of US-REIT return as it produced smallest error in forecasting compared to other ARCH-family models.

As for the Asian property companies markets, Liow and Chen (2013) tested the ARCH effects presence among the property companies markets in Australia, Japan, Hong Kong, Singapore, China, Taiwan, Malaysia and Philippines. The presence of ARCH effects in majority of the markets volatility suggested that the volatility of those markets varies with time. Besides, the long memory behaviour of the volatility was also been documented on the Asian property companies (Liow, 2009; Zhou, 2011; Razali, 2015).

1.3   Background of Problems

Overall, there were fewer number of literature focusing on the Asian REITs markets as compared to literature focusing on the Asian property companies and non-Asian REITs markets. All these Asian REITs have different asset structures when compared to the Asian property companies even though all of them are indirect real estate investments. This occurrence can be traced from the weak linkage that currently exists between the Asian REITs markets and the property companies (Newell et al., 2010; Newell and Peng, 2012; Peng and Newell, 2012; Pham, 2011a; Pham, 2012). Based on this, it can thus be said that the research on Asian property companies and Asian REITs markets could yield different results. By comparing to

the literature on the US-REITs and the Asian property companies, there were several issues remained unanswered on the Asian REITs markets. In this regard, the current study focuses on all the seven REITs markets that are available in Asia. As of December 2014, the Asian REITs markets consist of Japan, Singapore, Hong Kong, Malaysia, Thailand, Taiwan, and South Korea.

In Asia, the existence of long run and short term relationship among the Asian REITs markets has not been fully answered. Study was only been done to address the long run and short term relationship between the Japan and South Korea REITs markets (Kim, 2009). However, the results were not sufficient to arrive at a conclusion to determine whether or not the long run and short term relationship exists among all the seven REITs markets in Asia. This is mainly due to each of the Asian REITs markets may behave differently due to its respective market structures. Besides, the correlation test results also suggested that the emerging Asian REIT markets of Malaysia, Thailand, Taiwan, and South Korea have different degrees of correlations when compared to other developed Asian REIT markets such as Japan, Singapore and Hong Kong (Pham, 2012). Due to this difference, it would be interesting to determine how the long run and short term relationship functions among all the Asian REITs markets. More importantly, the inclusion of all Asian REITs markets into the co-integration test can reveal the regional strength of the Asian REITs markets. By doing so, the results will be comparable to the studies made on the Asian property companies' markets (Yunus and Swanson, 2007; Liow, 2008). Such comparison will also be able to reveal the fact which states that linkages among the Asian REITs markets or the Asian property companies are stronger.

Therefore, this study was conducted to determine the long run and the short term relationship among the REITs markets in Asia which encompass Singapore, Hong Kong, Malaysia, Thailand and Taiwan. The information can also serve as additional knowledge that adds to the correlation test results which measures the static linkage between assets. More importantly, such information can help to determine the existence of diversification opportunity among the Asian REITs markets by measuring of the dynamic relationship among these countries. For instance, the absence of long run and short term relationship among two REITs markets can be an indication of diversification opportunity.

The diversification of portfolio during the financial crisis is particularly important as the outbreak of crisis can result a downturn of economy and reduce the portfolio diversification. The international diversification among REITs markets also reduced during the global financial crisis based on the increased correlation among them (Liow and Newell, 2012; Liu et al., 2012; Hoesli and Reka, 2012; Fry et al., 2010). Evidence had shown that the increase of return correlation among REIT markets in US, Australia, Hong Kong, Japan and Singapore during global financial crisis, but the return correlation dropped after the global financial crisis has ended (Liu et al., 2012). Similarly, global financial crisis also caused the existence of long run and short term relationship between Japan and South Korea REIT markets that was not existed before the global financial crisis (Kim, 2009).

In addition, evidences drawn from other non-Asian REITs (Liu et al., 2012; Liow and Newell; 2012; Milunovich and Truck, 2013) and Asian property companies (Fry et al., 2010; Chan et al., 2011; Liow and Newell, 2012; Hoesli and Reka, 2012) have indicated that the linkage among markets tend to change throughout the crisis. Thus far, there has been little discussion about the changes of international diversification among Asian REITs markets over time. However, the return correlations among the Asian REITs markets could be different at three stages: before, during and after the global financial crisis (Pham, 2012). In looking at the long run and short term return linkage among Asian REITs markets, it was noted that only the information regarding the linkage between Japan and South Korea REITs markets from pre-crisis to the global financial crisis (Kim, 2009) is available. On the other hand, the information on the long run and short term linkages among the REITs markets in Singapore, Hong Kong, Malaysia, Taiwan, and Taiwan was not available.

Thus, it is also important to investigate whether or not the international diversification opportunity changes over time. For instance, the international diversification can be reduced due to an economy downturn during the financial crisis. In addition, the linkage among the Asian REITs markets after the global financial crisis is unclear. Consequently, it is difficult to judge whether or not their long run relationship is likely to exist for a longer period of time or whether it has become diminished with the end of the global financial crisis. Further, the sampling time frame of the previous study noted had focused on the global financial crisis period. Those results would be more inclined towards revealing the economic

linkages between assets during the global financial crisis instead of revealing their linkages which are free from the influence of the crisis event. The Granger causality test was not conducted to measure the short term relationship between the Japan and South Korea REITs markets during the pre-crisis period. This is probably due to the lack of co-integration evidence between the markets during that period of research. However, the short term relationship between assets can still exist even though there is no co-integrating evidence between them (Granger, 1969).

On the other hand, given the significance of macroeconomic variables in non-Asian REITs and the Asian property companies (Yunus, 2012; Liow and Yang, 2005), it would be useful to utilize these macroeconomic variables to understand the Asian REITs markets in details. This knowledge helps in the understanding of what the underlying cause could be which, in turn, can help to explain the variation of a REITs market. For instance, if the macroeconomic variables are manage to drive the movement of those markets, then the fluctuations of such economic forces are expected to explain the movement of the Asian REIT markets as well. However, it is difficult to conclude the influence of macroeconomic variables from evidence of other indirect real estate markets, given that each market has different underlying asset structures.

Overall, the comparison of the Asian REITs markets indicated that the number of macroeconomic factors used in previous research were lesser (Chang *et al.*, 2012; Busaranon and Chintrakarn, 2012; Lean and Smyth, 2012; Takayasu, 2013; Yang *et al.*, 2014) compared to research done on non-Asian REITs markets and Asian property companies. In addition, a number of macroeconomic factors were found to have been omitted in the studies done on the Asian REITs markets even though these factors were proven to be significant in affecting the non-Asian REITs markets and Asian property companies. To the best of author's knowledge, studies had only addressed the impact of interest rate on the REITs markets of Japan (Takayasu, 2013), Malaysia (Lean and Smyth, 2012), and Taiwan (Chang *et al.*, 2012). In addition, the study on the Thailand REITs had only included gross domestic product as the macroeconomic variable (Bursaranon and Chintrakarn, 2012).

Therefore, this study also attempted to determine the impact of the macroeconomic variables towards the return of the Asian REITs markets based on the identified macroeconomic variables in the studies of the non-Asian REITs and the Asian property companies. Such information is important as those factors might have certain impact on the Asian REITs markets. Without such information, it would be difficult to predict the impact of the macroeconomic factors on the Asian REIT markets as there are mixed evidences showing the impact of each macroeconomic factor on the US-REITs and the Asian property company.

Additionally, it is worth to determine whether there is any volatility spill over effect from macroeconomic variables towards the Asian REIT markets. The number of literature on the spillover volatility effect from macroeconomic variables towards the volatility of the REITs markets' return were lesser than the number of literature on the impact of macroeconomic variables towards the return REITs markets. This indicated that this area received much lesser attention from the researchers when compared to studies focusing on measuring the impact of those macroeconomic variables on the REITs return. Regardless of whether or not such information helps in informing investors about the situation or not, it is hereby noted that the volatility of such macroeconomic variables in decision making about the REITs investment should be considered as significant evidence has been found from previous study (Jirasakuldech *et al.*, 2009). The evidence drawn from the US-REITs (Jirasakuldech *et al.*, 2009) and stock markets (Schwert, 1989; Morelli, 2002) on their response towards the volatility spillover effect from macroeconomic variables indicated that each country tend to react differently towards such macroeconomic volatility.

Furthermore, it has been observed that the impact of fiscal policy on the Asian REITs markets has not been addressed in past literature. Fiscal policy plays an important role in influencing stock markets. According to the Keynesian paradigm, policy makers can use fiscal policy in conjunction with the monetary policy to manipulate economy growth. In addition, there is evidence to show that fiscal policy has a significant impact towards stock markets (Pilinkus, 2010; Chatziantoniou *et al.*, 2013; Antwi *et al.*, 2013). As an elaboration, Antwi *et al.* (2013) found that fiscal policy has unidirectional impact towards stock activities at Ghana Stocks Exchange. Likewise, Pilinkus (2010) also stated that fiscal policy should be incorporated into the pricing of securities in markets so as to eliminate all inefficiencies in the market

and to build up investors' confidence. Thus, it is important to know whether or not fiscal policy has any significant impact in affecting the return and volatility of the REITs markets.

It is noted that there is limited information on the volatilities' behaviour of Asian REITs markets as compared to non-Asian REITs markets and Asian property companies. Thus far, there is limited evidence that talks about the presence of long memory behaviour in the volatilities of the Asian REITs markets except for Japan. To the best of author knowledge, no study has examined the forecasting performance on the return volatility of the Asian REITs markets. The determination of the long memory behaviour of the Asian REITs markets is useful for determining whether or not the return volatility of the Asian REITs markets was affected by the slow decay of the past shock which can eventually improve the volatility forecasting accuracy (Pavlova *et al.*, 2014). Thus, it is reasonable to argue that long memory may exist in the return volatilities of the Asian REITs markets as most studies have shown the presence of long memory effect on REITs (Pavlova *et al.*, 2014) and the Asian property companies (Liow, 2009; Zhou, 2011). With regards to the volatilities' forecasting, it appears that each of the Asian REIT markets has exhibited a different market behavior (Tsai, 2013). Thus, the volatility forecasting performance of the models is likely to be different across the Asian REITs markets. Such information can help the Asian REITs investors to do risk evaluation procedures on the Asian REITs as well as help the investment company to create derivatives instrument that can be used to manage the downside risk of their investment on REITs. Therefore, it is important to determine the present of long memory effect in the volatility of Asian REIT markets return and find out whether long memory model is better in forecasting the volatility for different Asian REIT markets.

1.4   Problem Statement

In this study, the first research gap addresses the unanswered questions about the long run and short term relationship among the Asian REITs markets. Previous

CHAPTER 1

INTRODUCTION

1.1   General Overview

The seminal paper of Markowitz (1952) has led to the development of modern portfolio theory that discusses about the optimization of risk and return in the portfolio. Subsequently, a proliferation of research was conducted on asset management to study on the optimization of portfolio return through the diversification of risk in the portfolio.

Portfolio diversifications can be achieved by incorporating other assets classes into the equity portfolio. Investors may use them as alternative investment vehicle to diversify the risk of their portfolio. Among the assets, real estate was able to improve the portfolio diversification. However, investors are required to invest a substantial amount of capital in order to gain real estate exposure. Thus, real estate investment trusts (REITs) was created so as to provide real estate exposure to investors with smaller amount of capital. It is an indirect real estate investment whereby it lowers the capital requirement while providing real estate exposure to investor. The income is generated through rental income of the underlying properties. Consequently, several countries including the United States, Netherland and Australia have established their own REIT markets to provide additional options to investors and to boost the growth of their national economy. Subsequently, Asian countries such as Japan, Singapore, Hong Kong, Malaysia, Thailand, Taiwan and

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The first real estate investment trust was formed in the United States (US) in the 1960s. Several studies have been done to understand REIT and pioneer work conducted on the risk and return performance of the US-REITs have indicated that the US-REITs had managed to outperform the stock market (Smith and Shulman, 1976). Similar findings that addressed the risk and return performance of the US-REITs (Kuhle *et al.*, 1986; Chiang *et al.*, 2008) have also been documented in other studies. Besides the US-REITs, studies which focus on other REITs markets in Australia (Chiang *et al.*, 2008), France (Newell *et al.*, 2013) and Turkey (Erol and Tirtiroglu, 2008) have also shown results which outperform other asset classes. In looking at the Asian REITs markets, all of them were only established after the 2000s. Prior to the 2000s, the Asian property companies were used as a proxy for REITs in Asian countries. It was found that most of the Asian property companies had underperformed compared to the stock markets (Liow and Sim, 2006). However, the Asian REITs markets had managed to outperform the stock markets (Newell *et al.*, 2010; Newell and Peng, 2012; Peng and Newell, 2012; Newell, Pham and Ooi, 2015).

Subsequently, studies were conducted to determine the diversification capability of REITs in a mixed asset portfolio. Overall, the US-REITs yielded a low return correlation with stocks and bonds (Clayton and MacKinnon, 2001; Conover *et al.*, 2002; Bley and Olson, 2005; Westerheide, 2006). Apart from US-REITs, studies also reported the diversification benefit of Australia REITs (Chiang *et al.*, 2008), French REITs (Newell *et al.*, 2013), Asian property companies (Newell *et al.*, 2010; Newell and Peng, 2012; Peng and Newell, 2012; Pham, 2012) and the Asian REITs (Newell *et al.*, 2010; Newell and Peng, 2012; Peng and Newell, 2012; Pham, 2012) in mixed asset portfolio.

The proven of the diversification benefit of REIT in mixed asset portfolio further motivated the effort in searching for the international diversification among REITs markets in order to improve the portfolio diversification. Due to limited number of REITs markets available, some studies includes property companies to measure the international diversification for the countries that do not have their own REIT market. Generally, the correlation test on the non-Asian REITs (Bond *et al.*, 2006), the Asian property companies (Eichoholtz, 1996; Razali, 2015), and the Asian REITs markets indicated that international diversification exists among certain of the markets. For example, evidences indicated that the emerging Asian REIT markets (Malaysia, Thailand, Taiwan, South Korea) had a lower return correlation among themselves compared to the correlation among the developed Asian REIT markets (Japan, Singapore, Hong Kong) that is possibly attributed to the structural difference among the Asian REIT markets (Pham, 2012).

Beside the correlation test, co-integration test and granger causality test were also used in identifying the international diversification of REITs through examining the long run and short term relationship between assets return. This is to complement the weakness of the correlation test that only measures the static linkage between assets, as the co-integration and granger causality test measure the dynamic linkage among asset return in long run and short term. For instance, long run and short term linkage were detected among the US-REITs and the Asian property companies (Yunus and Swanson, 2007; Liow, 2008). However, some of these markets were not cointegrated in the system. This implies that the diversification can still be achieved if any of the markets can be excluded from the cointegrating vector. As for the Asian REIT markets, international diversification existed among the Japan and South Korea as these two markets were weakly cointegrated together (Kim, 2009). On the other hand, the international diversifications of the remaining five Asian REIT markets have not been proven.

The existence of diversification benefits could be detected from the different underlying forces such as macroeconomic variables and firm specific variables which drive the movement of the REITs. For instance, firm specific variables were applied to measure the underlying movement of individual assets. Conversely, macroeconomic variables were applied to study the movement of individual assets as well as the whole assets market. Among the macroeconomic variables studies, the

Kang (2011) observed that most of the US-REITs were fitted with Exponential General Autoregressive Conditional Heterosecedasticity (EGARCH) models, while the equity-REIT was more fitted with GARCH model. Asteriou and Begiazi (2013) reported that mortgage REITs was fitted to EGARCH model while equity REIT was more suitable to GARCH model. These suggested that the volatility behaved differently across different type of the US-REITs. As on the out-of-sample forecast test, Zhou and Kang (2011) compared the accuracy of the models in forecasting the return volatility of US-REITs. Results have showed that Fractional Integrated GARCH (FIGARCH) model was among the best ARCH-family model in forecasting the volatility of US-REIT return as it produced smallest error in forecasting compared to other ARCH-family models.

As for the Asian property companies markets, Liow and Chen (2013) tested the ARCH effects presence among the property companies markets in Australia, Japan, Hong Kong, Singapore, China, Taiwan, Malaysia and Philippines. The presence of ARCH effects in majority of the markets volatility suggested that the volatility of those markets varies with time. Besides, the long memory behaviour of the volatility was also been documented on the Asian property companies (Liow, 2009; Zhou, 2011; Razali, 2015).

1.3   Background of Problems

Overall, there were fewer number of literature focusing on the Asian REITs markets as compared to literature focusing on the Asian property companies and non-Asian REITs markets. All these Asian REITs have different asset structures when compared to the Asian property companies even though all of them are indirect real estate investments. This occurrence can be traced from the weak linkage that currently exists between the Asian REITs markets and the property companies (Newell et al., 2010; Newell and Peng, 2012; Peng and Newell, 2012; Pham, 2011a; Pham, 2012). Based on this, it can thus be said that the research on Asian property companies and Asian REITs markets could yield different results. By comparing to

the literature on the US-REITs and the Asian property companies, there were several issues remained unanswered on the Asian REITs markets. In this regard, the current study focuses on all the seven REITs markets that are available in Asia. As of December 2014, the Asian REITs markets consist of Japan, Singapore, Hong Kong, Malaysia, Thailand, Taiwan, and South Korea.

In Asia, the existence of long run and short term relationship among the Asian REITs markets has not been fully answered. Study was only been done to address the long run and short term relationship between the Japan and South Korea REITs markets (Kim, 2009). However, the results were not sufficient to arrive at a conclusion to determine whether or not the long run and short term relationship exists among all the seven REITs markets in Asia. This is mainly due to each of the Asian REITs markets may behave differently due to its respective market structures. Besides, the correlation test results also suggested that the emerging Asian REIT markets of Malaysia, Thailand, Taiwan, and South Korea have different degrees of correlations when compared to other developed Asian REIT markets such as Japan, Singapore and Hong Kong (Pham, 2012). Due to this difference, it would be interesting to determine how the long run and short term relationship functions among all the Asian REITs markets. More importantly, the inclusion of all Asian REITs markets into the co-integration test can reveal the regional strength of the Asian REITs markets. By doing so, the results will be comparable to the studies made on the Asian property companies' markets (Yunus and Swanson, 2007; Liow, 2008). Such comparison will also be able to reveal the fact which states that linkages among the Asian REITs markets or the Asian property companies are stronger.

Therefore, this study was conducted to determine the long run and the short term relationship among the REITs markets in Asia which encompass Singapore, Hong Kong, Malaysia, Thailand and Taiwan. The information can also serve as additional knowledge that adds to the correlation test results which measures the static linkage between assets. More importantly, such information can help to determine the existence of diversification opportunity among the Asian REITs markets by measuring of the dynamic relationship among these countries. For instance, the absence of long run and short term relationship among two REITs markets can be an indication of diversification opportunity.

The diversification of portfolio during the financial crisis is particularly important as the outbreak of crisis can result a downturn of economy and reduce the portfolio diversification. The international diversification among REITs markets also reduced during the global financial crisis based on the increased correlation among them (Liow and Newell, 2012; Liu *et al.*, 2012; Hoesli and Reka, 2012; Fry *et al.*, 2010). Evidence had shown that the increase of return correlation among REIT markets in US, Australia, Hong Kong, Japan and Singapore during global financial crisis, but the return correlation dropped after the global financial crisis has ended (Liu *et al.*, 2012). Similarly, global financial crisis also caused the existence of long run and short term relationship between Japan and South Korea REIT markets that was not existed before the global financial crisis (Kim, 2009).

In addition, evidences drawn from other non-Asian REITs (Liu *et al.*, 2012; Liow and Newell; 2012; Milunovich and Truck, 2013) and Asian property companies (Fry *et al.*, 2010; Chan *et al.*, 2011; Liow and Newell, 2012; Hoesli and Reka, 2012) have indicated that the linkage among markets tend to change throughout the crisis. Thus far, there has been little discussion about the changes of international diversification among Asian REITs markets over time. However, the return correlations among the Asian REITs markets could be different at three stages: before, during and after the global financial crisis (Pham, 2012). In looking at the long run and short term return linkage among Asian REITs markets, it was noted that only the information regarding the linkage between Japan and South Korea REITs markets from pre-crisis to the global financial crisis (Kim, 2009) is available. On the other hand, the information on the long run and short term linkages among the REITs markets in Singapore, Hong Kong, Malaysia, Taiwan, and Taiwan was not available.

Thus, it is also important to investigate whether or not the international diversification opportunity changes over time. For instance, the international diversification can be reduced due to an economy downturn during the financial crisis. In addition, the linkage among the Asian REITs markets after the global financial crisis is unclear. Consequently, it is difficult to judge whether or not their long run relationship is likely to exist for a longer period of time or whether it has become diminished with the end of the global financial crisis. Further, the sampling time frame of the previous study noted had focused on the global financial crisis period. Those results would be more inclined towards revealing the economic

linkages between assets during the global financial crisis instead of revealing their linkages which are free from the influence of the crisis event. The Granger causality test was not conducted to measure the short term relationship between the Japan and South Korea REITs markets during the pre-crisis period. This is probably due to the lack of co-integration evidence between the markets during that period of research. However, the short term relationship between assets can still exist even though there is no co-integrating evidence between them (Granger, 1969).

On the other hand, given the significance of macroeconomic variables in non-Asian REITs and the Asian property companies (Yunus, 2012; Liow and Yang, 2005), it would be useful to utilize these macroeconomic variables to understand the Asian REITs markets in details. This knowledge helps in the understanding of what the underlying cause could be which, in turn, can help to explain the variation of a REITs market. For instance, if the macroeconomic variables are manage to drive the movement of those markets, then the fluctuations of such economic forces are expected to explain the movement of the Asian REIT markets as well. However, it is difficult to conclude the influence of macroeconomic variables from evidence of other indirect real estate markets, given that each market has different underlying asset structures.

Overall, the comparison of the Asian REITs markets indicated that the number of macroeconomic factors used in previous research were lesser (Chang *et al.*, 2012; Busaranon and Chintrakarn, 2012; Lean and Smyth, 2012; Takayasu, 2013; Yang *et al.*, 2014) compared to research done on non-Asian REITs markets and Asian property companies. In addition, a number of macroeconomic factors were found to have been omitted in the studies done on the Asian REITs markets even though these factors were proven to be significant in affecting the non-Asian REITs markets and Asian property companies. To the best of author's knowledge, studies had only addressed the impact of interest rate on the REITs markets of Japan (Takayasu, 2013), Malaysia (Lean and Smyth, 2012), and Taiwan (Chang *et al.*, 2012). In addition, the study on the Thailand REITs had only included gross domestic product as the macroeconomic variable (Bursaranon and Chintrakarn, 2012).

Therefore, this study also attempted to determine the impact of the macroeconomic variables towards the return of the Asian REITs markets based on the identified macroeconomic variables in the studies of the non-Asian REITs and the Asian property companies. Such information is important as those factors might have certain impact on the Asian REITs markets. Without such information, it would be difficult to predict the impact of the macroeconomic factors on the Asian REIT markets as there are mixed evidences showing the impact of each macroeconomic factor on the US-REITs and the Asian property company.

Additionally, it is worth to determine whether there is any volatility spill over effect from macroeconomic variables towards the Asian REIT markets. The number of literature on the spillover volatility effect from macroeconomic variables towards the volatility of the REITs markets' return were lesser than the number of literature on the impact of macroeconomic variables towards the return REITs markets. This indicated that this area received much lesser attention from the researchers when compared to studies focusing on measuring the impact of those macroeconomic variables on the REITs return. Regardless of whether or not such information helps in informing investors about the situation or not, it is hereby noted that the volatility of such macroeconomic variables in decision making about the REITs investment should be considered as significant evidence has been found from previous study (Jirasakuldech et al., 2009). The evidence drawn from the US-REITs (Jirasakuldech et al., 2009) and stock markets (Schwert, 1989; Morelli, 2002) on their response towards the volatility spillover effect from macroeconomic variables indicated that each country tend to react differently towards such macroeconomic volatility.

Furthermore, it has been observed that the impact of fiscal policy on the Asian REITs markets has not been addressed in past literature. Fiscal policy plays an important role in influencing stock markets. According to the Keynesian paradigm, policy makers can use fiscal policy in conjunction with the monetary policy to manipulate economy growth. In addition, there is evidence to show that fiscal policy has a significant impact towards stock markets (Pilinkus, 2010; Chatziantoniou et al., 2013; Antwi et al., 2013). As an elaboration, Antwi et al. (2013) found that fiscal policy has unidirectional impact towards stock activities at Ghana Stocks Exchange. Likewise, Pilinkus (2010) also stated that fiscal policy should be incorporated into the pricing of securities in markets so as to eliminate all inefficiencies in the market

and to build up investors' confidence. Thus, it is important to know whether or not fiscal policy has any significant impact in affecting the return and volatility of the REITs markets.

It is noted that there is limited information on the volatilities' behaviour of Asian REITs markets as compared to non-Asian REITs markets and Asian property companies. Thus far, there is limited evidence that talks about the presence of long memory behaviour in the volatilities of the Asian REITs markets except for Japan. To the best of author knowledge, no study has examined the forecasting performance on the return volatility of the Asian REITs markets. The determination of the long memory behaviour of the Asian REITs markets is useful for determining whether or not the return volatility of the Asian REITs markets was affected by the slow decay of the past shock which can eventually improve the volatility forecasting accuracy (Pavlova *et al.*, 2014). Thus, it is reasonable to argue that long memory may exist in the return volatilities of the Asian REITs markets as most studies have shown the presence of long memory effect on REITs (Pavlova *et al.*, 2014) and the Asian property companies (Liow, 2009; Zhou, 2011). With regards to the volatilities' forecasting, it appears that each of the Asian REIT markets has exhibited a different market behavior (Tsai, 2013). Thus, the volatility forecasting performance of the models is likely to be different across the Asian REITs markets. Such information can help the Asian REITs investors to do risk evaluation procedures on the Asian REITs as well as help the investment company to create derivatives instrument that can be used to manage the downside risk of their investment on REITs. Therefore, it is important to determine the present of long memory effect in the volatility of Asian REIT markets return and find out whether long memory model is better in forecasting the volatility for different Asian REIT markets.

1.4   Problem Statement

In this study, the first research gap addresses the unanswered questions about the long run and short term relationship among the Asian REITs markets. Previous

studies have conducted correlation test (Brueggeman and Fisher, 1997; Mull and Seonen, 1997; Khoo *et al.*, 1993, Chandrashekaran, 1999) co-integration test (Glascock *et al.*, 2000), and Granger causality test (Yunus and Swanson, 2007) to determine their strength of linkage for non-Asian REITs and Asian property companies. Studies done on the Asian REIT markets had only addressed the correlation among the Asian REITs markets while the amount of information available on the long run and short term relationship on the Asian REITs markets is limited. More comprehensive information is required as it can reveal dynamic linkages among all of the Asian REITs markets. The current study addresses this research gap by determining if there is any long run and short term relationship existing in a multivariate context among all the seven Asian REITs markets. In addition, the findings will be able to provide a broader picture on how the REITs markets were linked together in the regional context.

The second research gap reveals that there is a lack of study which specifically addresses the long run and short term relationship among the Asian REITs markets across different time frame. This is supported by the time-varying diversification evidence which is shown in the US-REITs and the Asian property companies (Bond *et al.*, 2006). In addition, as the occurrence of the financial crisis had resulted in the downturn of the economy and a stronger assets linkage, it would be useful to identify which of the Asian REITs markets was able to provide international diversification during the crisis. Consequently, this research gap was addressed by measuring the long run and short term relationship among all the seven Asian REITs markets for the periods of before, during and after global financial crisis. The global financial crisis period was set as between 01 September 2007 and 30 June 2009 after a reference was made to studies that measured the impact of global financial crisis on the Asian REITs markets.

The third research gap is the lack of studies noted on the impact of macroeconomic variables towards the Asian REIT markets from the long run and short term perspectives. Previous studies looking at the Asian property companies have highlighted that the significance of each macroeconomics variables can be different across countries (Bardhan *et al.*, 2008; Chang *et al.*, 2011; Lee *et al.*, 2011; Leone, 2011; Bursanranon and Chintrakarn, 2012). Further, it was noted that most of the studies that had focused on the Asian REITs markets did not utilize all the

macroeconomic factors when accessing their influence towards the REITs markets. This seems to indicate that there could be some impact of some of the macroeconomic variables remaining unaddressed in the studies. To the best of author's knowledge, it was found that there was no previous research done on REITs and property companies which studied the impact of fiscal policy. However, the literature focusing on stock market had documented evidence of fiscal policy in affecting the stock markets as implied by the Keynesian paradigm. The current study examines the response of the Asian REITs markets towards the identified macroeconomic variables which consist of short term interest rate, long term interest rate, gross domestic product, industry production, and money supply and the significance they make in influencing the Asian REITs markets. In addition, government spending was also included as the proxy of fiscal policy so as to determine whether or not the fiscal policy can also affect the Asian REIT markets.

The fourth research gap lies in the lack of studies focusing on the macroeconomic spillover effect on the Asian REITs markets. According to Schwert (1989), the volatility of assets can be affected by macroeconomic risk as the risk of macroeconomic variables is related to the nominal return of assets. Studies on stock markets have shown that the spillover effect varies across countries (Morelli, 2002; Erdem *et al.*, 2005). It was observed that studies addressing macroeconomic risk towards REITs markets had only been carried out on the US-REITs market. In order to fill in this research gap, the current study examines whether or not there is any volatility spillover effect from short term interest rate, long term interest rate, gross domestic product, industry production, money supply and government spending towards the volatility of Asian REIT markets return.

Lastly, the fifth research gap concerns the presence of long memory effect in the volatility of the Asian REIT markets return and performance of the ARCH model in forecasting the volatility of the Asian REITs markets. For instance, the presence of long memory effect in the Asian REITs markets has not been answered even though it has been established in the US-EITs and the Asian property companies. In addition, it is difficult to conclude that the model which forecasts the US-REITs with the highest accuracy can give the same result on the Asian REITs as the Asian REITs markets has different volatility characteristics. For this reason, the current study intends to address this research gap of the Asian REIT markets volatility by testing

the presence of long memory effect on the Asian REITs markets by using long memory ARCH models. Additionally, these long memory models, together with the short memory models, would also be used to forecast the volatility for the return of the seven Asian REITs markets and ultimately, the forecast accuracy of these models.

1.5   Research Questions

The research questions for this study are as follow:

1) Which of the Asian REITs markets provide international diversification on their return in long run and short term?
2) How does the long run and short term relationship among return of the Asian REIT markets differ before, during and after global financial crisis?
3) What are the long run and short term effects of macroeconomic variables that can affect the Asian REIT markets return performance?
4) Which of the Asian REITs markets' return volatility was affected by volatility spillover effect from the macroeconomic variables?
5) How do the ARCH-family models differ in terms of forecasting the volatility of the Asian REIT markets?

1.6   Objective of Study

Several objectives have been defined to carry out the research plan. The objectives are as follow:

1)   To investigate whether or not international diversification exists among the Asian REIT markets based on the long run and short term relationship of their return.

2) To observe whether or not the long run and short term return relationship among the Asian REIT markets differ before, during and after global financial crisis.

3) To identify the relevant macroeconomic factors that can influence the return performance of Asian REIT markets in long run and short term.

4) To determine whether there is any volatility spill over effect from macroeconomic variables towards return volatility of the Asian REIT markets.

5) To determine the present of long memory effect in the volatility of Asian REIT markets return and find out whether long memory model is better in forecasting the volatility for different Asian REIT markets.

1.7 Significance of the Study

This study focuses primarily on Asian REITs. The reason for doing so is because of the strong return performance of the Asian REITs and its capability to provide diversification benefits to the mixed asset portfolios. All the seven Asian REIT markets were selected for this study as all have undergone a tremendous increase of capital since their establishment in 2000s. In addition, literature focussing on the Asian REIT markets appears to be lesser in comparison to literature focussing on non-Asian REITs and Asian property companies. In looking at the Asian REITs markets, past studies focused on the performance measurement (Pham, 2012; Chiang *et al.*, 2013, Ooi *et al.*, 2006) as well as mixed asset portfolio management (Wong *et al.*, 2012; Lee and Ting, 2009). However, limited information was available on issue regarding international diversification, macroeconomic linkage and volatility modelling of the Asian REITs. Those issues had, eventually, been set as the focus of this study. It is acknowledged that such information is important for expanding the body of knowledge on Asian REITs and for improving the policy implementation process that is related to the Asian REIT markets.

The outcome of this study will contribute to the expansion on the body of knowledge on Asian REITs. The first contribution derived from this study lies in extending the long run and short term linkages of REIT markets in Japan and South Korea (Kim, 2009) to other remaining Asian REIT markets. For instance, this study focuses on the long run and short term relationship among all the seven Asian REIT markets. This focus reflects how the Asian REITs interact among themselves in long run and short term from a regional perspective. In addition, data collected for the purpose of this study had been further disaggregated into three periods, pre-global financial crisis, global financial crisis and post-global financial crisis. This helps to assess whether or not the global financial crisis situation had changed the relationship among the Asian REIT markets. In other words, this study investigates the regional strength of the Asian REITs markets in order to see if it was stronger during the global financial crisis.

The second significance of this study is its achievement in determining whether or not the Asian REIT markets and their domestic macroeconomic variables form a significant relationship in the long run and short term basis. The proliferation of research, since the study done by Chen *et al.* (1986), had led to the identification of the impact of macroeconomic variables towards non-Asian REITs and Asian property companies. To complement the few literature focussing on the impact of macroeconomic variables on the Asian REIT markets, this study also determined which of the macroeconomic factors were bounded with the return of the Asian REITs markets in the long run and short term basis. More importantly, this study also reports on the impact of fiscal policy on the return of the Asian REIT markets. This finding, without doubt, has improved the practice of using a future macroeconomic model on REITs which when used, can consider the impact of the fiscal policy. In addition, this study also provides a broader picture on how the relationship between the macroeconomic variables and the Asian REIT markets is affected by examining the volatility spillover effects of the macroeconomic variables towards the volatility of Asian REITs' return.

Through the modelling of the return volatility behaviour on Asian REIT markets, it indicates how the return volatility of the Asian REIT markets behaves. For instance, the presence of the long memory impact indicates the volatility pattern of the Asian REIT markets decays over the long period. Besides, comparison among

the forecasted accuracy of the volatility models also informs portfolio managers and investors about the volatility forecasting performance of the Asian REIT markets. Such information is beneficial for derivative pricing of REITs as the price of a derivative is sensitive towards the forecasted return volatility.

From the perspective of policy implication, the findings are important for making more informed decisions before implementing any changes in macroeconomic policy. Evidence drawn from the long run and short term relationship can also be used to advise policy makers on whether or not they should consider the changes of the macroeconomic policy made on Asian REIT markets before making any policy changes. For example, a longer term may be needed to observe the impact of a macroeconomic variable on the Asian REIT markets. In addition, this study also informs policy makers on how fiscal policy affects the Asian REIT markets.

The findings of this study are also important in managing their portfolios and in modelling asset pricing on Asian REIT markets. For instance, the findings derived from looking at the long run and short term relationship among the Asian REIT markets indicate whether or not the international diversification of the Asian REIT markets can still be achieved. This is done by incorporating international REITs into Asian domestic portfolios. The identification of significant macroeconomic variances which influence the Asian REIT markets also provides a reference for portfolios management by changing asset al.location based on changes in economic conditions. Nonetheless, the study on the forecasting performance of ARCH-family models on the return volatility of REITs informs compares the historical and forecasted volatility of REITs. Such information would also be useful for doing the derivative pricing of REITs.

1.8   Scope of Study

This study focuses on all the seven REITs markets that are available in Asia. As of December 2014, the Asian REITs markets consist of Japan, Singapore, Hong Kong, Malaysia, Thailand, Taiwan, and South Korea. The REIT Index constructed using Standard and Poors index construction methodology is used as to proxy the Asian REITs markets. The study period spanned from the date of establishment of each country's index until 31 December 2014 (refer to Table 1.1). Additionally, the period of study was further divided into pre, during, and post global financial crisis period by defining the date prior to 01 September 2007 as pre-crisis and the date after 30 June 2009 as post crisis. The study periods was separated in order to compare the impact of global financial crisis towards the long run and short term relationship among the Asian REITs markets.

Table 1.1 : The Date of Establishment of the Asian REITs Markets

Country	The Date of Establishment of the Asian REITs Markets
Japan	01 October 2001
Singapore	01 July 2003
Hong Kong	02 July 2004
Malaysia	02 November2006
Thailand	30 October 2003
Taiwan	01 February 2006
South Korea	23 May 2001

This study strived to identify the long run and also short term relationship among the return of the Asian REIT markets. In addition, this study determined the influence of the global financial crisis towards the long run and short term relationship among the Asian REITs market. This study also investigated the return and volatility linkage among the Asian REIT markets and macroeconomic variables. For instance, the return of the Asian REITs markets and macroeconomic variables was measured based on their long run and short term relationship. The volatility spill over measurement was employed to determine the relationship between return volatility of the Asian REITs markets with macroeconomic variables. Those

macroeconomic variables contain short term interest rate, long term interest rate, gross domestic product, industrial production, and money supply. In addition, government spending was included as suggested by stock literatures. Lastly, this study examined the present of long memory in the return volatility of the Asian REIT market and determines the relative volatility forecasting performance of the volatility forecasting model for each Asian REIT markets.

1.9   Limitation of Study

This study has few limitations. Firstly, there are relatively small numbers of REITs constitute to the market index when each market was formed. Thus, the fluctuation of the REIT Index during the initial period can be caused by a small change in a particular REIT rather than other factors.

Secondly, REIT index is used to measure the behaviour of particular market. In other words, this study employs a top to down approach to study the REIT markets on how it is influenced by general economic condition. For this reason, the results may be not able to represent the firm specific performance.

Lastly, the study period is relatively shorter than the studies done on the US-REITs and Asian property companies as the Asian REIT markets data is only available from the 2000s. Thus, the results may not be able to yield a comprehensive comparison on relationship of Asian REITs and macroeconomic variables before 2000s. In addition, some of the markets like Malaysia, Taiwan, Thailand, and South Korea have relatively smaller market capitalization compared to Japan, Singapore and Hong Kong. As a result, the relationship among these markets may change due to the growth of market capitalization of these markets in the future.

1.10   Organization of the Thesis

The thesis is presented in six chapters. Chapter one provides the introduction to the thesis. It presents the introduction, background of study, background of problem, problem statement, research question, research objectives, significance of the study, and scope of study and limitation of study.

Chapter two presents the background of the Asian REITs markets. This included the details on the assets structures and regulatory environment for each of the Asian REITs markets. Chapter three reviews the literatures that cover the aspect of risk and return performance, portfolio diversification in mixed assets and international diversification contexts, the impact of macroeconomic variables and the volatility modelling using the ARCH-family models non-Asian REITs, Asian property companies, and Asian REITs.

Chapter four focuses on the research design. It describes the approach to the study. This covers description of variables, data collection approach, and the research methodology applies to answer the research questions. Chapter five provides the results and the analysis of data. Lastly, chapter six presents the discussion of the results and concludes the findings of this study.

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