SWITCHING REGIME OF MALAYSIAN LISTED PROPERTY COMPANIES WITHIN PAN-ASIAN PUBLIC REAL ESTATE MARKETS

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ABSTRACT

The ever-changing landscape of property investment activities has introduced several methods and formulas to analyse the performance and dynamics of volatility in the property market, especially in developed markets. Due to the limited research on Malaysia and pan-Asian property markets, it is difficult for the findings to be compared with other advanced markets, in terms of the application of advanced statistical methods such as regime-switching. This approach provides more comprehensive results compared to conventional volatility modelling technique. Thus, this research analysed the performance of Malaysian listed property companies within pan-Asian markets, besides employing the more recent volatility modelling approach. Besides, understanding the impact of the Global Financial Crisis (GFC) on the performance and dynamic of volatility of property investment in pan-Asia, particularly Malaysia was also studied. This research employed several quantitative analyses, namely statistical methods and formulas such as total return analysis, risk analysis, Sharpe ratio, correlation and the combination between Markov-switching (MS) and Exponential Generalised Autoregressive Conditional Heteroscedasticity (EGARCH). These were used to analyse secondary data gathered from Thomson Reuters DataStream consisting pan-Asian listed property companies and cash indices. To analyse the impact of the crisis, three sub-periods were established, namely pre-GFC, GFC and post-GFC. The findings showed that Malaysia was one of the most underperforming property markets in pan-Asian between 2000 and 2017. However, Malaysia was able to offer diversification benefits for investors. In addition, based on the sub-period analysis, Malaysia and other pan-Asian markets exhibited negative annual returns with high risk level during the crisis period. This indicated the severe impact of the crisis. Meanwhile, application of regime-switching approach provided new insights into the dynamics of volatility as it is able to divide the property markets into two different volatility regimes, especially during extreme market conditions. The regime-switching approach showed that Malaysian listed property companies recorded negative spill-over effect and leverage effect across three different sub-periods, particularly during high volatility regime. Thus, it is not advisable to invest during those periods. Finally, this study contributes to the literature on the application of regime-switching approach on pan-Asian listed property companies as this has not been studied extensively by previous researchers in the real estate discipline. This is due to the fact that most researchers focus their study towards advanced markets such United States and European property markets. In addition, some recommendations for future studies are made to enhance the knowledge and the quality related to the research on securitised property markets in pan-Asia.

ABSTRAK

Aktiviti pelaburan harta tanah yang sentiasa berubah telah memperkenalkan beberapa kaedah dan formula untuk menganalisis prestasi dan dinamik turun naik dalam pasaran harta tanah, terutamanya di pasaran maju. Oleh kerana kajian yang terhad terhadap pasaran harta tanah Malaysia dan pan-Asia, sukar untuk kajian tersebut dibandingkan dengan pasaran maju yang lain, dari segi penggunaan kaedah statistik lanjutan, seperti penukaran regim. Pendekatan ini memberikan hasil yang lebih komprehensif berbanding teknik pemodelan turun naik konvensional. Oleh itu, kajian ini menganalisis prestasi syarikat harta tanah yang tersenarai di Malaysia dalam lingkungan pasaran pan-Asia, selain menggunakan pendekatan pemodelan turun naik yang lebih baru. Di samping itu, pemahaman mengenai impak Krisis Kewangan Global (GFC) terhadap prestasi dan dinamik turun naik pelaburan harta tanah di pan-Asia, terutamanya di Malaysia juga dikaji. Kajian ini menggunakan beberapa analisis kuantitatif iaitu kaedah dan formula statistik seperti analisis pulangan keseluruhan, analisis risiko, nisbah Sharpe, korelasi dan kombinasi antara penukaran Markov (MS) dan *Exponential Generalised Autoregressive Conditional Heteroscedasticity* (EGARCH). Ini digunakan untuk menganalisis data sekunder yang diperoleh dari Thomson Reuters DataStream yang terdiri daripada data syarikat harta tanah tersenarai di pan-Asia dan juga indeks tunai. Untuk menganalisis kesan krisis, tiga sub-tempoh telah ditubuhkan, iaitu pra-GFC, GFC dan pasca-GFC. Penemuan ini menunjukkan bahawa Malaysia adalah salah satu pasaran harta tanah yang kurang memberangsangkan di pan-Asia antara tahun 2000 dan 2017. Walau bagaimanapun, Malaysia mampu menawarkan faedah kepelbagaian kepada pelabur. Di samping itu, berdasarkan analisis sub-tempoh, pasaran Malaysia dan pasaran pan-Asia lain menunjukkan pulangan tahunan yang negatif dengan tahap risiko yang tinggi semasa tempoh krisis. Ini menunjukkan kesan krisis yang kurang baik. Sementara itu, pendekatan penukaran regim memberi pandangan baru tentang dinamik turun naik kerana ia dapat membahagikan pasaran harta tanah kepada dua regim turun naik yang berbeza, terutamanya semasa keadaan pasaran yang melampau. Pendekatan penukaran regim menunjukkan bahawa syarikat-syarikat harta tanah yang tersenarai di Malaysia mencatatkan kesan negatif dan kesan pengaruh dalam tiga sub-tempoh yang berbeza, terutama semasa regim turun naik yang tinggi. Oleh itu, tidak dianjurkan untuk melabur dalam tempoh tersebut. Akhir sekali, kajian ini menyumbang kepada literatur dalam penggunaan kaedah penukaran regim ke atas syarikat harta tanah yang tersenarai di Asia, kerana ia tidak dikaji secara meluas oleh penyelidik terdahulu dalam disiplin harta tanah. Ini disebabkan oleh kebanyakan penyelidik memberikan fokus kajian mereka terhadap pasaran yang lebih maju seperti pasaran harta tanah Amerika Syarikat dan Eropah. Di samping itu, beberapa saranan untuk kajian masa hadapan dibuat untuk meningkatkan pengetahuan dan kualiti yang berkaitan dengan penyelidikan mengenai pasaran harta tanah yang disekuritikan dalam kawasan negara pan-Asia.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ABBREVIATIONS

AFC	-	Asian Financial Crisis
ARCH	-	Autoregressive Conditional Heteroscedasticity
BNM	-	Bank Negara Malaysia
EGARCH	-	Exponential Generalised Autoregressive Conditional Heteroscedasticity
EPRA	-	European Public Real Estate Association
EU	-	European Union
GARCH	-	Generalised Autoregressive Conditional Heteroscedasticity
GDP	-	Gross Domestic Product
GFC	-	Global Financial Crisis
IMF	-	International Monetary Fund
JLL	-	Jones Lang LaSalle
KLPI	-	KLSX Property Index
KLSE	-	Kuala Lumpur Stock Exchange
MS	-	Markov-switching
REITs	-	Real Estate Investment Trusts
SRBM	-	Single Regime Beta Model
US	-	United States
WEF	-	World Economic Forum

CHAPTER 1

INTRODUCTION

1.1   General Overview

The Global Financial Crisis (GFC) has triggered concern on the risk level of the global financial market. This including the property portfolio market. Over the past decade has seen Asian region emerge as an important property portfolio market. In particular, Malaysia able to play significant role to the property finance growth in this region. Nevertheless, GFC has exposed Malaysian listed real estate market to financial changes. Therefore, it is important for investors to know whether Malaysian securitised real estate market impacted from the crisis spill-overs over the period of January 2000 to December 2017. This research will examined the impact of regime-switching on the performance of Malaysian listed property companies within pan-Asian public real estate markets. By employing Markov-switching (MS) model, it able to provide new way to assess the characteristics of the variation in the relationship between the total return of Malaysian listed property companies within Asian region across regimes as well as during crisis period. This is aim to fully understand the dynamics of Malaysian listed property companies within the context of Asian public real estate market based on three different periods namely μ pre-GFC, GFC and post-GFC. In addition, Malaysian securitised real estate market is compared with then others Asian countries namely China, Hong Kong, Japan, Indonesia, Philippines, Singapore, South Korea, Taiwan, Thailand and Vietnam.

With this research focus on beta-switching analysis, the application of regime-switching model such as MS in this research able to provide new insight on the dynamic of pan-Asian listed property companies, especially Malaysian securitised real estate market. This approach able to segregate two or more regimes, where in this research it is the volatility level. This research divided the volatility levels into two: low and high volatility level. By segregating it into two different levels, it allow to

1

further understand the dynamic of Malaysian listed property companies within regional context based on different volatility levels, where it is impossible to replicate or shown by conventional volatility modelling approach, such as the Autoregressive Conditional Heteroscedasticity (ARCH) type model. According to Ye (2015), the regime-switching based on MS model has the ability to more sophisticated volatility patterns.

Other than assessing the volatility patterns, the MS model also has the ability to analyse the transitional probabilities of one regime to another. This will allow to understand the regime movement across pan-Asian securitised property markets. Besides, the approach also able to provide the durations of different regimes over the analysis period, especially during the crisis period. This will provide an insight on pan-Asian property market condition over the period.

1.2   Background of Study

During the GFC period, the global financial market including the equity market were severely affected by the crisis. Over the period saw numerous companies financially affected and had to close down, especially in the United States. The impact of the crisis on the equity markets has made securitised investment more volatile than before and additionally with high risk or volatility shown by the investment portfolio, investors will find the investment to be unattractive and choose to flee their investment. This include the property investment activities in Asia.

Previous studies shown that macroeconomic changes such as the financial crisis has provide significant impact on property market performances. For instance, Leung and Tang (2011) examine the impact of two financial crises (Asian Financial Crisis and Global Financial Crisis) on Hong Kong real estate market and conclude that the economy behave differently on both occasion and during GFC the adverse effect of external shocks takes shorter time to die out due to the changes in government policy dqg#dovr #p d| #eh#gxh#wr #wkh#EF klqd#idfwru#Š1##Wkh#fkdqj hv#lq#j r yhuqp hqw#s r df| #wdnhv#place after the Asian Financial Crisis (AFC) in 1997. Newell and Razali (2009) study

2

the impact of GFC in the commercial investment activities in Asia, where the event has impacted all financial market including commercial property market in 2008. Furthermore, GFC has also affected the cross-border investment, which resulting the percentages weakens during the crisis. Besides, three Asian public property markets (Singapore, Hong Kong and Japan) less affected during the GFC, compared to US and UK markets (Liow and Angela, 2017). The researchers also added that the lack of similarity between Asian and non-Asian markets will provide benefits for investors that want to geographically diversify their investment.

The inclusion of securitised property markets in the investment portfolio is important as property investment can be considered as balanced investment as it offers unique investment characteristics to the investors, where it is different from other asset classes in the stock market. Furthermore, the different in cycle of property than other asset classes and the inclusion of property in the mixed-asset portfolio enables to potentially improve the portfolio returns and reduce the risk level (Pham, 2013). The introduction of Real Estate Investment Trusts (REITs) in Asia has helped to elevate the securitised property market in this region and made the securitised market more progressive than before. Additionally, as the market becomes progressive it helps to attract more institutional investors. The introduction of REITs also helps to broaden the indirect real estate investment activities and institutional investors have many options on which investment vehicles they would like to invest.

Indirect real estate investment allows investors to hold certain amount of ownership of properties through an indirect real estate investment vehicles such as listed property companies, REITs, unlisted property fund or property syndicate. In comparison, direct property investment allows investors to own entire property, with the investment requires higher capital compared to indirect property investment. However, it is up to the investors to choose their investment portfolio and according to Kerrigan (2014), investors with sufficient amount of capital should diversify their investment towards both direct and indirect property investment in order to maximise their return and at the same time reducing the risk level.

The performance of securitised property markets can be measured and captured accurately based on risk and returns performance (Razali, 2015a). This can help investors to identify the risk involved during investment and the return they will gent when investing as it is well known that investor always seek optimal return on investment. Meanwhile, in assessing the dynamic of volatility, several authors that focuses on pan-Asian property markets has employ Exponential Generalised Autoregressive Conditional Heteroscedasticity (EGARCH) model. This help measures the level of volatility involve during investment. This research also employ EGARCH model in assessing the dynamic of volatility, besides new volatility modelling approach in the form of MS-EGARCH. The MS-EGARCH is a combination between MS and ARCH-type model and it has been used by several authors in economics and financial studies such as Henry (2008) and Blazsek *et al.* (2018). However, the application of MS-EGARCH on pan-Asian listed property companies are still under explored as most of the studies focuses on developed markets, even though the MS approach able to provide different insight on the dynamic of volatility.

In conclusion, with the sensitivity of securitised market in Asia, any macroeconomic changes in the global market will significantly impacted the performance of the market. As mentioned before, during the GFC period, the volatility level exhibited by the securitised real estate markets increase tremendously and made the investment activities more risky than before. Therefore, the application of Markov-switching (MS) model in this study will analyse the volatility movement exhibited by pan-Asian listed property companies over the GFC period. Besides movement between 2000 and 2017. MS approach enables investor to identify and predict the discrete movement on the volatility level exerted by pan-Asian listed property companies. As such the application of MS approach during the period, specifically during the GFC period will help investors to predict the probability of risk movement of their investments in the near future based on the current or previous market conditions.

1.3   Overview of Pan-Asian Listed Property Companies

Through initial public offering (IPO), a real estate companies or entities able to offer their companies to the public. Through this offering, the share of the companies will be traded in the securities market. The investment from the public allows the companies to use it as a capital for future investment or to improve their investment activities. In addition, securitised real estate offers the public to invest in s ur s huty #e| # z qlqj #ludfvlr q# i #Alkh#fr p s dqlhvNkduhv#z lvkr xvw hqglqj #aluj h#dp r xqw of capital. In comparison, the nature of listed property companies that is more liquid than conventional real estate allows investors to buy and sell their shares anytime and with listed property companies traded in the stock market, investor able to supervise their investment portfolio.

Meanwhile, FTSE Russell (2018) has classified Asian markets into two categories which are developed and emerging markets (Table 1.1) and it reveals that there are six Asian real estate markets that can be classified as emerging markets as the real estate market in these countries are still developing, whereas four other countries namely Japan, Hong Kong, Singapore and South Korea were identified as developed Asian markets. From the classification of pan-Asia real estate market, investors able to identify the types of market that they invest and the type of risk that involve with their investment as developed markets offers lower risk.

Table 1.1   Classification of Pan-Asian Real Estate Markets

Country	Developed	Emerging
China		X
Hong Kong	X	
Indonesia		X
Japan	X	
Malaysia		X
The Philippines		X
Singapore	X	
South Korea	X	

Country	Developed	Emerging
Taiwan		X
Thailand		X

(Source: FTSE Russell, 2018)

Research on past performance of pan-Asian property market by Razali (2015a) revealed that all pan-Asian listed property companies able to display positive annual return based on the analysis period from 1998 to 2012. Due to the study related to the GFC, the author discovered the crisis had affected the property shares annual return, as such all of the countries exhibited negative annual return during the GFC period. This situation suggest that both developed and emerging markets in Asia are vulnerable to the crisis. In comparison, the performance of pan-Asian listed property companies prior and post to the crisis periods are better in term of annual return with positive annual return recorded by all of pan-Asian countries.

In addition, over the past decade, many researches has been conducted on the property markets in both developed and emerging Asian countries such as Taiwan, Vietnam, Malaysia, Singapore and Hong Kong. Asian listed property companies has receive recognition from international investor as there is increase number of investors to this region (Nguyen, 2011a). The author added, investors feels comfortable with their investment decision at developed market such as Hong Kong, Japan and Singapore, as these countries exhibit better property market transparency than other Asian countries and the countries is also known as the International Financial Centre of Asia. Furthermore, the author also added that investors with more appetite towards riskier Asian market, could pay their attention towards Asian emerging markets consist of Malaysia, South Korea, Taiwan and Thailand. Although the investment activities in Asian emerging or developing markets is riskier than developed markets, it is more attractive to the investors as developing markets able to offer more investment opportunities to the investors.

With this situation, emerging markets in Asia is expected to attract high numbers of institutional investors in the next ten years compared to other region, especially developed region in Europe and Asia, and this will made emerging or

developing Asian market the major investment destination for property investors worldwide. According to CBRE (2015), there will be a significant increase in property investment activities in emerging Asian market in the next ten years with emerging Asia is expected to outperform other markets in terms of growth in real estate investment. In addition, emerging Asia is expected to contribute 26% to the global real estate investment market, followed by North America (25%), developed Europe (19%) and developed Asia (13%) (see Figure 1.1).

		2015	2025
	North America	28%	25%
	Developed Europe	25%	19%
	Emerging Asia	16%	26%
	Developed Asia	15%	13%
	Latin America	7%	7%
	Emerging Europe	5%	6%
	Rest of the World	4%	4%
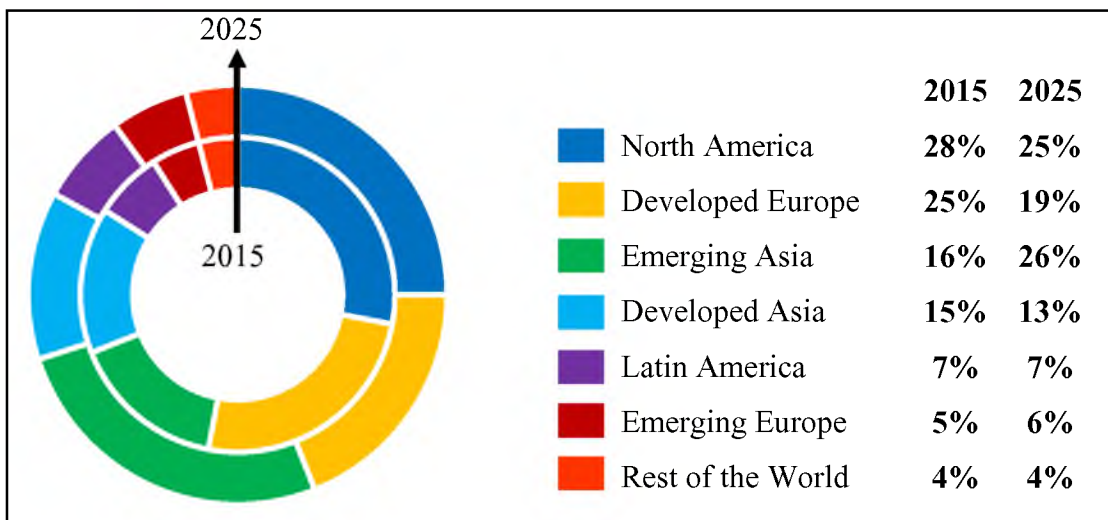
Figure 1.1   Global Investible Real Estate Universe (source: CBRE, 2015)

The inclusion of developed region or countries in the study will provide opportunity to compare the results in term of performance between the countries. The research on the performance of Malaysian listed property companies within Asian real estate market will helps to see how the Malaysia performs compared to other Asian market and this will not just help to improve the performance of the market in the near future, but also to attract institutional investors to come an invest in emerging market.

1.4   Overview of Malaysian Public Real Estate Market

Public real estate market in Malaysia has evolved significantly over the last few years and since the introduction of REITs in Malaysia, it has taken securitised real

estate investment in Malaysia to another level. In addition, both of these property investment vehicles are listed under the Malaysia stock exchange know as Bursa Malaysia. Since the stock market are volatile to the global economic changes, Malaysian public real estate market were also affected by the changes. As such, economic conditions such as the financial crisis can affected the investment activities.

In 2008, Malaysia has been affected by the GFC and the crisis had deteriorate ͮkh#qdͮr qÑ#hfr qrp | Ͱ#ͳkhͰh#ͰvͰͰkdͰͳ#ghfdqhv#Ͱq#Ͱhj lr qdͰ#ht xity and bond market (Bank Negara Malaysia, 2009). Furthermore, the reports also stated that with Malaysia being an open economy, the crisis has strong impact on the trade related sectors which saw the exports and manufacturing production decrease by 7. 4% and 11. 1% respectively. Malaysia foreign direct investment was at the lowest in 2001 and 2009 due the burst of technology bubble (dot-com boom) and GFC respectively. As public real estate market is categorised under the equity market, the securitised property market alongside the shares market are vulnerable to the crisis.

In 2010, foreign direct investment recovers from the crisis and continue to grow. In 2016, 74. 6% of foreign direct investment came from Asia, which accounted for RM35. 2 billion and Europe contribute around 14. 1% (RM6. 65 billion). Hong Kong, Singapore and China were the major countries that contribute to the growth. In 2016, it was reported that 50. 9% of foreign direct investment were channelled to the services sector, while 43. 4% of the investment were contributed from both mining and manufacturing sectors (Department of Statistics, Malaysia, 2017). Real estate or property considered as services sector has becoming lead contributor of foreign direct investment for the sector in 2011 with total contribution of RM16. 9 billion (Malaysian Investment Development Authority, 2012).

Securitised real estate market has increase significantly over the past ten years with listed property companies dominate the sector alongside REITs. As of February 2018, there are 83 property companies and 18 REITs companies listed on Bursa Malaysia main market with majority of the stocks were Shariah compliance. With 83 listed property companies, it contributed more than RM 90,000 million in market capitalisation, while REITs contributed around RM 40,000 million. Despite low

number of REITs companies in Malaysia, it has outperformed listed property companies in term of average market capitalisation. This situation suggest that REITs has the potential to become the main property portfolio investment vehicles in this country. The market capitalisation of both Malaysian listed property companies and REITs are tabulated in Table 1.2.

Table 1.2   Malaysian Property Investment Portfolio Market Capitalisation: March 2018

Property Portfolio	Number of Companies	Market Capitalisation (RM million)	Average Capitalisation per Company (RM million)
Listed Property Companies	83	98,574.50	1,187.64
REITs	18	40,167.25	2,231.51
Total	**101**	**131,741.75**	

(Source: Dxwkr uN#fr p slodwr q#ur p #GdwdVwhdp /#534;)

The size of securitised property market is relatively small compared to other nations as Malaysia still consider as an emerging countries (Lee and Ting, 2009). In order to make property investment more attractive to the investors, Malaysian securities commission has issued a new guidelines in 2005 for REITs investment. The new guidelines has replaced the Property Trust Funds (PTF) guidelines. The new guidelines offers the exemption of real property gain tax (RPGT) and stamp duty on properties transferred to a REITs (Osmadi, 2007).

Malaysia in one of a few countries in this region that introduced REITs where it was first introduced in 2005 and Malaysia was the first country in the world that introduced Shariah compliant REITs which act as a stepping stone for Islamic REITs worldwide. Other countries in this region that adopted REITs are Thailand, Japan, South Korea, Vietnam, Singapore, Hong Kong, Taiwan and the Philippines.

As mentioned by Pham (2013), REITs are less volatile than listed property companies and this is due to the activities involve by listed property companies. Most

of listed property companies in Malaysia consist of property developers and property development or construction can be consider as a risky business as property developers faced all kinds of risk such as the increase in construction cost during the construction process, the imbalance between supply and demand and much more. In addition, Ting (2002) has characterise the type of listed property companies in Malaysia and the characteristics are as follows:

i)   Township developers

ii)   Development focus on major district (e. g. Klang Valley)

iii)   Developers of high and medium cost housing schemes

iv)   Subsidiaries of plantation holding companies

v)   Small market capitalisation

vi)   Property investment companies

vii)   Thinness of trading of property shares in the stock market

In conclusion, as Malaysian public real estate market is still developing and not completely matured compared to other developed Asian countries, however Malaysia able to diversify their property investment portfolio with the introduction of Shariah compliant investment. With the diversification of property investment in Malaysia, institutional investors will be provided with range of investment options. As the global and domestic market already recovered from the GFC, the growth of Malaysian economy will help to accelerate the investment activities in Malaysia, specifically related to property investment.

1.5   Overview of Malaysian Economy

Malaysia is one of the countries in this region have many natural resources and with vast natural resources, Malaysia able to exports their products overseas.

Furthermore, Malaysia able to diverse their economy from plantation, oil production, manufacturing and so on. After gaining its independence from the British in 1957, plantation and mining can be consider as maiq#hf w w#kdw#julyhv#kh#qdw qN#hfr qr p | # before Malaysia moves towards manufacturing and industrial. The idea of *Wawasan* 2020 (Vision 2020) can be considered as the catalyst for the development of Malaysia.

Since the GFC, the international GDP in 2016 growth was at the lowest and this was driven by low investment activities and weak commodity prices. In addition, political and policy instabilities in major economies also one of the reasons for low GDP in 2016 (BNM, 2017). This research also stated that Malaysian economy able to register an excellent growth of 4. 2% in 2016 despite the uncertainties in global economic environment. Table 1.3 represent the economic and performance indicators on Malaysia in 2016.

Table 1.3   Economic and Performance Indicator of Malaysia in 2016

	2016
GDP (Current US$ billion)	296.5
GDP (Constant 2010, US$ billion)	344.1
GDP (RM billion)	1,107.9
GDP Growth, %	4.2
GDP PPP (US$ billion)	863.3
Population (million)	31.7
Labour Force (million)	14.7
Labour Force, %	46.4
Unemployment, as % of labour force	3.5
Household Income	
Income Per Capita (US$)	9,096
Income Per Capita (RM)	37,738
Inflation, %	2.1
World Index	
Global Opportunity Index, Global	#26
Global Opportunity Index, Asia	#7
	2016

Corruption Perceptions Index, Global	#55
Corruption Perceptions Index, Asia	#10
Real Estate Transparency Index	#28
World Competitiveness Index	
Institutions	#26
Infrastructure	#24
Macroeconomic Environment	#35
Health and Primary Education	#44
Higher Education and Training	#41
Goods Market Efficiency	#12
Labour Market Efficiency	#24
Financial Market Development	#13
Technological Readiness	#43
Market Size	#24
Business Sophistication	#20
Innovation	#22
Overall	#25
Global Peace Index	#30

(Source: Transparency International, 2017; JLL, 2016a; World Bank, 2018; Milken Institute, 2016; Institute for Economics and Peace, 2016; BNM, 2017; WEF, 2016)

Early 2017 saw public sector expenditure and investment accelerated. The reason behind the increase in public sector expenditure is due to increase spending in salaries and emoluments besides supplies and services. In addition, the increase in investment by public corporations on fixed assets helps boosting the investment activities (World Bank, 2017). Based on the same research, the key contributor to the fr xqw| Ñ# hfr qr p lf# j ur z vk# z dv# vkh# dj ulf xoxudo# vhf w u/# z klf k# vdz # vklv# vhf w u# outperformed other sector. Rubber production surge for this sector, especially during *El Niño*. W gd| /#P dod| vldÑ#hfr qr p | # hhs # q#j ur z lqj and during third quarter (Q3) of 2017, the annual GDP growth was at 6. 2% compared to the second quarter (Q2) at 5. 8%. The growth of GDP is due to the private sector spending (BNM, 2017).

1.6   Previous Studies

The importance of listed property companies have been globally discussed by academicians from around the world. Past literature have introduced various method to analyse the performance of listed property companies from statistical method to surveys. Based on previous studies, many researchers focused on the significance and performance of listed property companies using several statistical method and techniques such as Sharpe ratio, correlation and efficient frontier. Most of the studies focused on certain approach to determine the performance of listed property companies such risk-return ratio, volatility and diversification analysis is widely used by researchers. For instance, the works of Azmi (2017), Razali (2015a and 2015c), Pham (2013), Nguyen (2010, 2011a, 2011b, 2011c and 2011d), Ting (2011) and Lizieri (2013).

There are a few studies that used advance econometric techniques and approaches such as Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH) and Markov-Switching (MS) approach. For example, Razali (2015a) used ARCH, GARCH and EGARCH technique to examine the volatility performance of Malaysia listed property companies in the mixed-asset portfolio within the Asian public real estate market based on the GFC sub-period. Earlier studies from Nguyen (2011b) also uses similar method, however the analysis divided pan-Asian countries into three different tier consisting of developed and emerging markets. Meanwhile, Liow and Zhu (2006) examined regime-switching in their research and only focused on six major real estate security markets namely US, UK, Hong Kong, Japan, Singapore and Australia. Liow and Ye (2016) uses regime-switching to assess the real estate market dynamics of return and volatility. Other researches from Akimov and Stevenson (2013) and Liow *et al.* (2009) also study the regime-switching in the context of securitised real estate.

Due to the nature of the market in Asia, many study has been done of the developed market. For example the work of Newell and Chau, 1996, Chiang and Joinkey, 2006 (Hong Kong), Ho *et al.*, 2013, Sing *et al.*, 2002, Liow, 1996, 2001, Eng 1994 (Singapore), Liow and Angela, 2017 (Japan, Hong Kong, Singapore). Three of

these countries that were analysed by the researchers is known as the Asian International Financial Centres. As for emerging markets, the literature on the performance of the market is limited compared to developed market. Although there are limited literature on these markets, the numbers of literature related to emerging market especially in Asia increase every year due to the interest from institutional investors.

Several studies has been conducted on emerging markets in this region, especially Malaysia. Studies by Razali (2015a), Ting (2002), Lee and Ting (2009) has helped to provide knowledge on listed property companies in Malaysia. The literature on Malaysian listed property companies is vital to attract investors and as the countries target to become one of the developed countries in Asia by 2020 and with long term development initiative known as *Transformasi Nasional* 2050 (TN50), any research on the performance of Malaysian public real estate market is needed especially the performance of Malaysian listed property companies within the Asian securitised property market.

Furthermore, while Razali (2015a) studied the performance of Malaysian listed property companies in the mixed-asset portfolio, the author compared the performance of Malaysian listed property companies with other Asian public real estate markets. Other researcher such as Ali (2006), examined the company size effect on the performance of listed property companies from the perspective of risk and return. Meanwhile, the impact of GFC on the performance of Asian securitised property market were highlighted by Newell and Razali (2009), Pham (2013) and Razali (2015a) in their research. In addition, other specific Asian property markets were also examined by previous researchers, such as Hong Kong (e.g. Newell and Chau, 1996; Chiang and Joinkey, 2006), Singapore (e.g. Ho *et al.*, 2013; Sing *et al.*, 2002; Liow, 1996, 2001; Eng, 1994), Japan (e.g. Liow and Angela, 2017), China (e.g. Zheng *et al.*, 2011), Indonesia (e.g. Soetanto and Fun, 2014), Vietnam (e.g. Nguyen, 2010) and Philippines (e.g. Nguyen, 2011c).

With growing interest on REITs market in Malaysia, many researcher turns their attention towards the investment, giving the property market in this region grows

with the introduction of REITs. Razali *et al.*, (2015) and Osmadi (2007) analyse the potential and development of Islamic REITs or IREITs in Malaysia respectively. Lee *et al.*, (2006) examined REITs in Malaysia during their introductions in Malaysia based on the response from institutional investors towards Malaysian listed property trusts. The performance determinants of Malaysian REITs were examined by Jalil and Ali (2015), where financing policy, property type, size of firm and location of REITs affect one another and influence the performance of REITs. Additionally, Pham (2013) focus towards REITs market in Asia in terms of its structure, performance and strategic investment implications, while Jalil *et al.*, (2015) examined the impact of economic downturn on the portfolio allocation of Malaysian REITs.

In summary, although there are some previous researchers that include Malaysian listed property companies in their studies, however the numbers is still limited when compared to other markets. For instance the research related to the volatility performance of Malaysian securitised property market, hence, it created an opportunities for future researchers to examine Malaysian public real market and vxevht xhqwj #hqkdqfh#kh#er gj # i#hqr z dhgj h#hadwhg#w#kh#fr xqwj Ñ#s ur s huwj#p dunhw

1.7   Problem Statement

With emerging markets in Asia expected to become one of the main investment hub for institutional investors in the next ten years, it is important to address the issue that existed based on the findings from previous studies. As such this research will keep the institutional investors updated with the recent performance of pan-Asian securitised property market.

The first issue is from the results of majority of previous researchers that focusing on the performance of Asian property markets only using Malaysian property markets as a comparison for case studies. For example, research by Newell and Chau (1996) on linkages between direct and indirect property in Hong Kong only uses Malaysian property market including other markets as a comparison for Hong Kong in terms of contribution of the property market to the GDP. While Newell (2009)

compares the performance of Chinese commercial property market with other pan-Asian and global markets. In addition to these studies, there are several other studies that uses Malaysia in their analysis, however the findings only provides the general view of pan-Asian property markets. For instance the study from Newell *et al.* (2007), Liow and Adair (2009), Nguyen (2011a), Liow (2012) and Pham (2013). These researchers does not provide the findings based on certain property market point of view which is vital to attract investors in this region, particularly Malaysia. According to Razali (2015a), it is important to analyse the markets from the local point of view as it helps to provide better information to local stakeholders. In the case of Malaysian listed property companies, local investors and stakeholders will become more aware on the performance of the property sector, besides improving the property market information for global property players.

The second problem statement is regarding the dynamic of volatility of pan-Asian listed property companies and the recent financial crisis. Previous literature such as Nguyen (2011b), Razali (2015a) and Pham (2013) assess the volatility level exhibited by pan-Asian listed property companies as a whole based on certain period, including the financial crisis which only provides the general view on the dynamic of volatility of the property markets in this region. However, more recent studies has employ new volatility modelling approach that able to analyse the dynamic of volatility based of different regimes or volatility conditions. For instance the study from Liow and Zhu (2006), Akimov and Stevenson (2013), Ye and Liow (2014), Liow and Ye (2016) and Liow and Ye (2017) who employ regime-switching model to analyse the dynamic of volatility of pan-Asian property markets. However, these studies does not specifically focus entirely on pan-Asian securitised property markets as the author include other developed property markets namely US, UK and EU markets. Moreover, this approach has only been employed on developed markets in Asia, thus creating a gap on the application of regime-switching approach on non-developed markets. In addition, the application of the new approach has also not been studied extensively during the GFC time-period. As such, it has raised a question on how the markets performs during different regimes especially during extreme market conditions such as the GFC. There are a few studies that include the GFC in their analysis, for instance Ye and Liow (2014) included GFC in their research to examined

the volatility using regime-switching model in international public real estate markets based on the analysis period from July 1992 to December 2012. Despite the inclusion of the crisis in their study, it only been used to examine the volatility spill-over exerted by the international public property markets over the analysis period without considering different volatility periods. Meanwhile, in more recent study by Liow and Ye (2017), the authors have investigate the impact of GFC on the international property markets using switching-regime beta models (SRBMs), in which the studies only includes developed Asian property markets (Hong Kong, Japan and Singapore) to represent Asia. This however, does not show the actual dynamic of volatility of other Asian markets. Nonetheless, it is important to compare the different volatility modelling approach as it able to provide different insight and moreover, the application based on regime-switching on certain pan-Asian property markets including Malaysian, has not been studied in the past.

The final issue is regarding the literatures on the performance and the dynamic of volatility of pan-Asian listed property companies, particularly Malaysia. It is well known that developed Asian countries such as Hong Kong (Newell and Chau, 1996, Chiang and Joinkey, 2006, Liow and Angela, 2017, Liow and Ye, 2017), Singapore (Eng 1994, Liow, 1996, 2001, Sing *et al.*, 2002, Ho *et al.*, 2013, Liow and Angela, 2017, Liow and Ye, 2017) and Japan (Liow and Angela, 2017, Liow and Ye, 2017) has been extensively studied by researchers in the past and as a results, there are limited numbers of studies on the performance of real estate sector in emerging countries, particularly Malaysia. Moreover, the literature from developed markets has employ more advance techniques in assessing the listed property market performance which has not studied extensively in Malaysia. However, there are few studies that concentrated on Malaysian listed property companies. For instance, Ting (2002) showed an interest towards the comparative performance of Malaysian listed property companies, however it was limited to few listed property companies in Malaysia and direct residential property markets. Meanwhile, Ali (2006) assessed the size effect on the performance of listed property companies in Malaysia and has segregated the markets into three different market sizes. The results show that big capitalisation market has better performance than small market group. Lee and Ting (2009) in the other hand assess the securitised property markets in the mixed-asset portfolio in

Malaysia and discovered that listed property companies have neither potential for diversification nor return enhancement when included in the mixed-asset portfolio. Recently (Razali, 2015a) analyse the significance and performance of Malaysian listed property companies in pan-Asian property portfolios and it is one of the earliest study that emphasise on Malaysian listed property companies within the pan-Asian context using several advanced statistical and econometric formulas. Even though these studies contributed to the literature of Malaysian listed property companies, it is still far behind more advanced markets, especially in terms of assessing the performance and the dynamic of volatility of the securitised property markets. Clearly, it is important to update and enhance the knowledge of Malaysian listed property companies based on updated approach. As such it provides an opportunity for future studies to compare their findings.

Given the current gaps in the body of literature regarding Asian listed property companies, the general issues that will be addressed by this research are:

(a) There are limited studies on significance and performance Malaysian listed property companies within pan-Asian context, as it able to address the role of Malaysian listed property companies.

(b) The analysis on the dynamic of volatility using regime-switching approach during extreme market condition on pan-Asian property markets are still under explored, as previous studies focus more on regime-switching and developed Asian property markets.

(c) The literature related to the performance and the dynamic of volatility of pan-Asian listed property companies, particularly Malaysia need to be updated to compete with other developed markets.

In the rising of the industrial revolution 4.0 which stressed on the data and information, the literature background that relate to the Malaysian listed property companies research is highly important. This will contribute to the Malaysian real estate transparency and consequently the high transparency of property market able to contribute more institutional investors to invest in local property portfolio market.

This is due to data and information able to access easily as well as increase of ease of doing business. With this research focus on regime-switching analysis on Malaysian public real estate markets within pan-Asian markets, it helps to provide different insight on the dynamic of volatility of pan-Asian public real estate markets. Furthermore, it will enhance the knowledge on the performance of and risk level of pan-Asian property markets during economic downturn and lastly, the comparison between Asian countries will provide an understanding among investors on how each of the countries performs during the analysis period of this research, particularly across the GFC sub-periods.

1.8   Research Questions

From the statement of problem, numerous research questions has arose. The questions are as follows:

(a)   What are the significance and performance of Malaysian listed property companies within pan-Asian property markets between January 2000 and December 2017?

(b)   How different volatility modelling approach affect the dynamic of volatility of pan-Asian listed property companies during extreme market condition (GFC)?

(c)   What are the characteristics of the variation in the relationship between the total return of Malaysian listed property companies within pan-Asian property markets?

1.9   Objectives

With the attention of the research to investigate the impact of regime-switching on the performance of Malaysian listed property companies within Asian public real estate market during the GFC period. Hence, the research objectives are as follows:

(a) To assess the significance and performance of Malaysian listed property companies from January 2000 to December 2017 within pan-Asian context.

(b) To analyse the dynamic of volatility of pan-Asian listed property companies during the GFC by using different volatility modelling approach (EGARCH and regime-switching/MS-EGARCH).

(c) To assess the characteristics of the variation in the relationship between the total return of Malaysian listed property companies within pan-Asian context.

1.10 Scope of Study

The main purpose of this study is to analyse dynamic of volatility of Malaysian listed property companies within the Asian securitised property market under different uhj lp hv##fr qglwlr q l##Wklv#vwxg| #dvvhvv#vkh#s huir up dqfh#r i#P dad| vldN##vhfxulwlvhg# property market with 10 other Asian countries.

In order to achieve the objective of this study, monthly total returns will be assessed over the 17-year period of 2000 to 2017 for:

(a) Malaysian listed property companies and cash

(b) China, Hong Kong, Japan, Indonesia, South Korea, Singapore, Taiwan, Thailand, Philippines and Vietnam listed property companies and cash

The start of the analysis period from year 2000 is due to the fact that most of the researches on the GFC consider 2000 as the year that the crisis started to show its sign. For example, the study from Hume and Sentance (2009) suggest that the period around 2000 is dominated by unusual increase in the US household credit ratio or debt, and this has contributed the GFC in 2008. In addition, the data collected for this research is classified as secondary data collected from DataStream which is a software developed by Thomson Reuters. The data collected from DataStream will be analyse to achieve the objective of the study.

1.11   Significance of Study

This research investigate the dynamic of volatility of Malaysian listed property companies within the pan-Asian property markets during different volatility regimes. This research covers eleven Asian countries including Malaysia. Over the decade saw significant growth in development in Asia, although these countries were affected by two major financial crisis (Asian Financial Crisis and Global Financial Crisis) over the ten year period.

Although being impacted by two major financial crisis, Malaysia still remains as one of the major contributor to the Asian financial markets as well as the property market (Razali, 2015a). With Malaysian economy and politically stable, investors will find the country as an attractive place to invest in the future. Furthermore, with the nation being one of the most transparent country in Asia in term of corruption perception and real estate transparency, it is important to address this situation to institutional investors that have interest in investing in the real estate market in Malaysia. Thus, this is useful for investors when making investment decision as this research able to provide the investment profile of Asian listed property companies.

This research highlight the performance of Malaysian listed property companies market within pan-Asian securitised real estate market. Moreover, comprehensive analysis of public real estate market in Malaysia will be addressed in this research. In addition, this research also covers securitised real estate market in other Asian countries based on the data that is collected from the DataStream from the period of 2000 to 2017. As such, it able to provide useful insights on the performance of Malaysian listed property companies within the pan-Asian market during the period. Furthermore, the information on Malaysian listed property companies is important for local stakeholders to assess as it can to improve the property investment activities in this country by establishing new policy which is beneficial for international and local property players alike.

The usage of advance econometrics and statistical techniques in this research will help to provide better understanding on the volatility level of Asian listed property

companies. Furthermore, with the regime-switching approach being used in this research, it will help to understand the dynamic of volatility of Malaysian listed property companies during different regime conditions, especially during the GFC period as the regime-switching approach has the ability to examine the discrete shift in the volatility movement. Moreover, this research will be one of the first research that employ the regime-switching model in the form of MS-EGARCH in assessing the dynamic of volatility of pan-Asian property markets, particularly Malaysia as this approach has not been utilised before by previous authors in the real estate discipline. Moreover, the application of regime-switching approach based on MS able to replicate more sophisticated volatility patterns (Ye, 2015). This suggest that the approach provides more comprehensive results in terms of dynamic of volatility. Furthermore, this research also highlight the significance, risk-adjusted performance and property diversification benefits of Malaysian listed property companies in context of pan-Asian markets.

Last but not least, this research also address the performance of Malaysian listed property companies during the GFC, thus it will provide an overview on how critical the event have impacted the securitised property market in Malaysia in general. With the establishment of three sub-period μ pre-GFC, GFC and post-GFC, it will provide clear insight on the dynamics of Malaysian listed property companies within pan-Asian securitised property markets, especially when under different regime conditions.

1.12 Research Organisation

This research is organised into six chapters, with Chapter 1 covers the introduction, background, global and Malaysian listed property companies as well as overview of Malaysian economy. In addition, this chapter will also address the issues regarding previous studies, objectives, scope and significance of this study. Besides, the expected outcome of this research will also be explained in this chapter with the limitation of study. The remaining chapters of this research is summarised as follows:

Chapter 2 provides comprehensive review of regime-switching and pan-Asian property market, besides the background of selected Asian countries for this research. Special attention will be given to Malaysian property market. Furthermore, the discussion related to listed property companies in Asia will be addressed in this chapter. As such, the discussion on significance of listed property companies in pan-Asia property investment portfolio will be reviewed. In addition, the literature review on the GFC will also be discussed in this chapter.

Chapter 3 discuss the data and research methodologies employed in this research (e. g. Asian listed property companies and cash monthly return, etc.). The research methodologies used in this research will be explained in details in this chapter. The research methodologies includes advance econometric techniques and formulas.

Next, Chapter 4 reports on the findings based on the method that was employed in Chapter 3. The findings will discuss on the significance of Malaysian listed property within the Asian public real estate market. The results from the sub-period analysis will also be reported. In addition, the findings on regime-switching involving Asian listed property companies will be examined and presented in this chapter. The findings on the diversification benefits of Malaysian listed property companies will be explained.

Chapter 5 addresses the implication of the findings towards property investment in general. The impact of the findings of Malaysian listed property companies in comparison with Asian real estate securitised property market will be discussed. In conclusion, Chapter 5 will discuss the outcome of this research on the property investment activities in Asia, specifically Malaysia.

Chapter 6 concludes everything that has been made in Chapter 4 and Chapter 5. Recommendations for future studies and limitations involving property portfolio research in Malaysia will be address in this chapter.

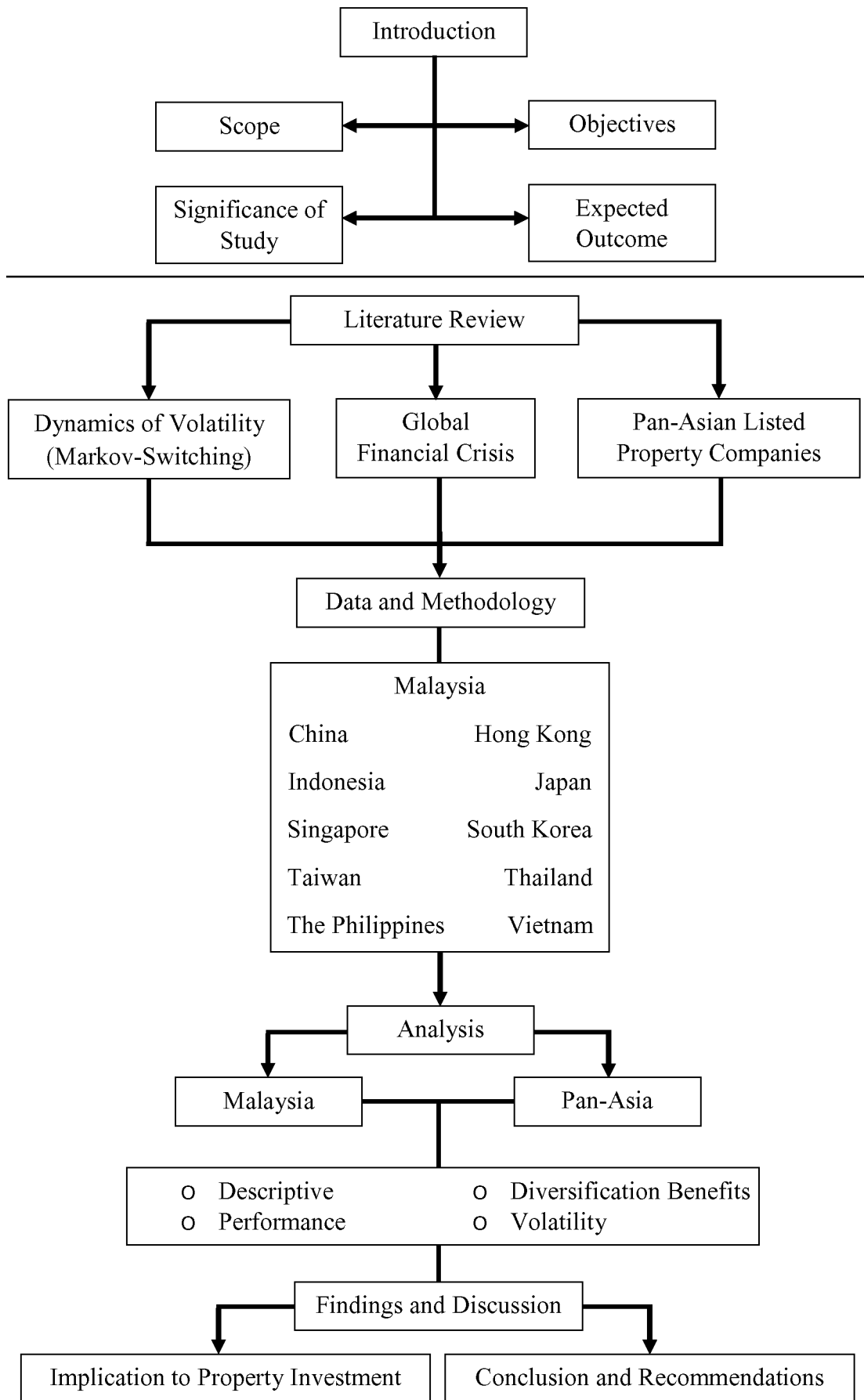The overall structure of this research is illustrated in Figure 1.2

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Figure 1.2   Research Organisation

1.13 Expected Outcome

The outcome of this research will provide an understanding on the impact of the GFC towards the performance of Malaysian listed property companies within the regional context. Institutional investors will have better understanding on the performance of Asian public real estate markets, especially emerging markets after the crisis. Thus, this research will help investors that have an interest in investing in Asian emerging markets, especially the public real estate market.

This research will also build up the literature knowledge on property investment in Asia. Due to limited studies conducted on emerging markets in Asia, this study will help to increase the numbers of studies on the property market in emerging countries in Asia. Furthermore, with advance econometrics techniques, it will help local and international institutional investors to further understand the performance of Malaysian listed property companies.

The findings of this research will help to extend the knowledge on the performance of Malaysian listed property companies and other Asian countries. In addition, the information on the diversification benefits, risk and volatility of property investment in Asia will also be addressed in this study. With the switching beta analysis conducted on Asian property market, it able to provide useful information regarding the dynamics of volatility of investment in this research.

Furthermore, this research will provide information that is vital to the investment activities in Malaysia. Policy maker can improve the investment scenes in the future with this research and learn how to prevent future financial crisis from severely impacted the financial market in Malaysia, specifically the property market.

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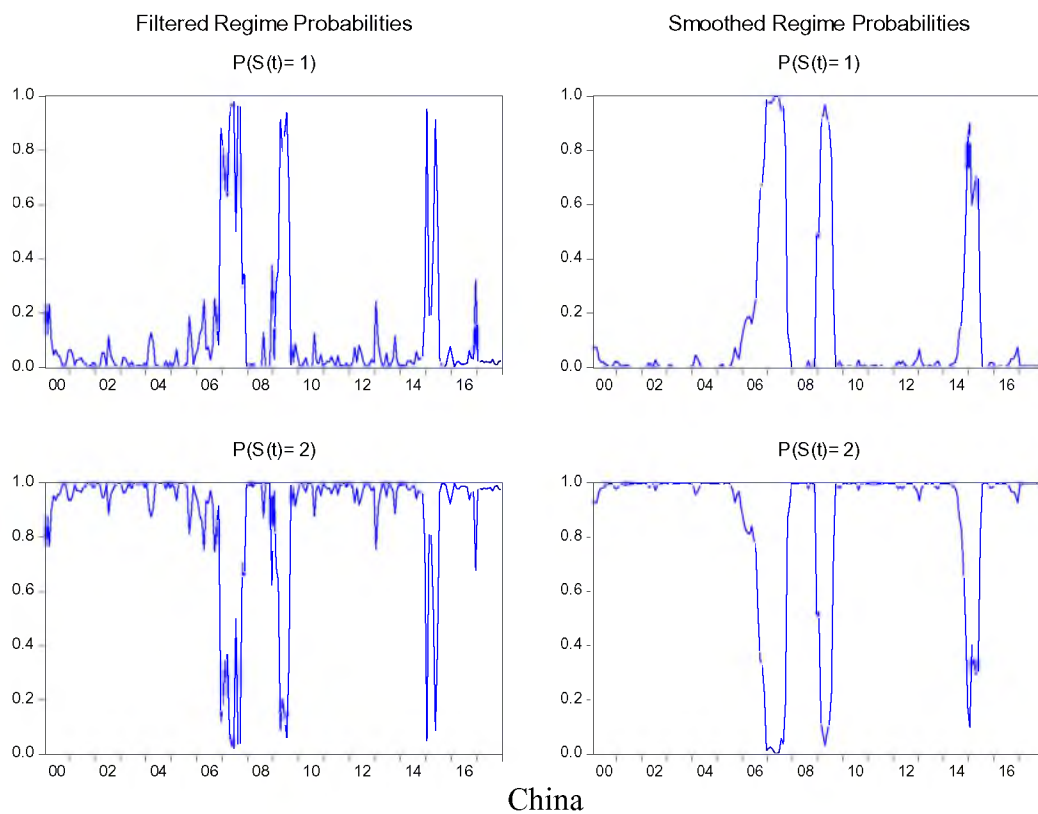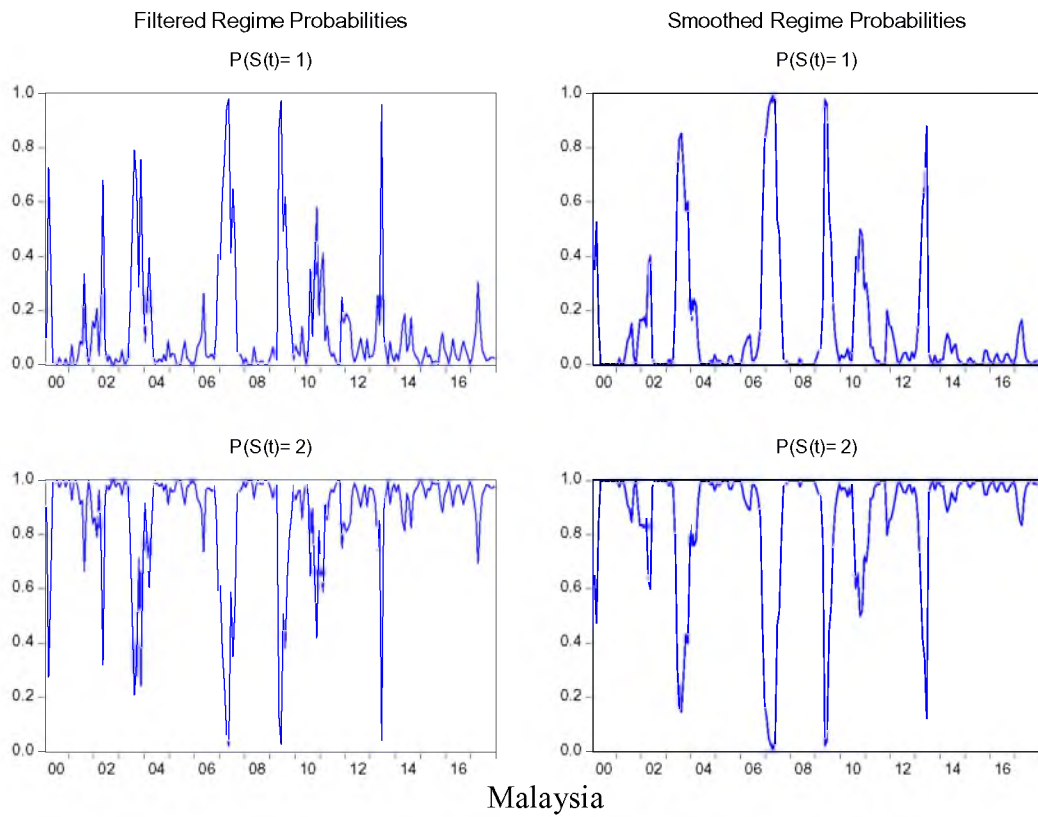
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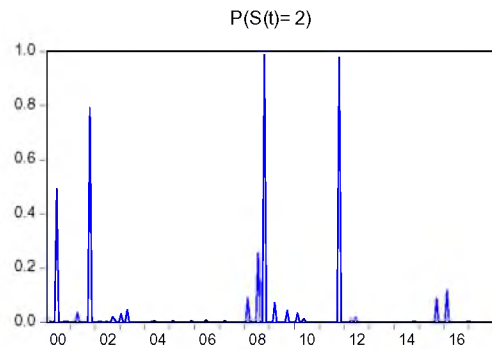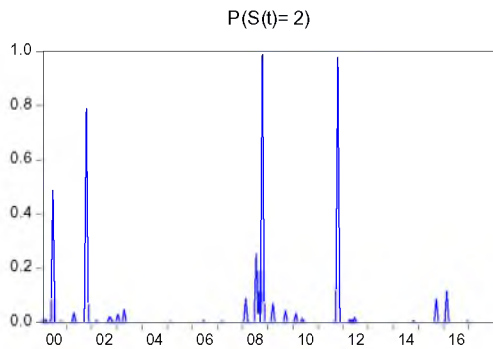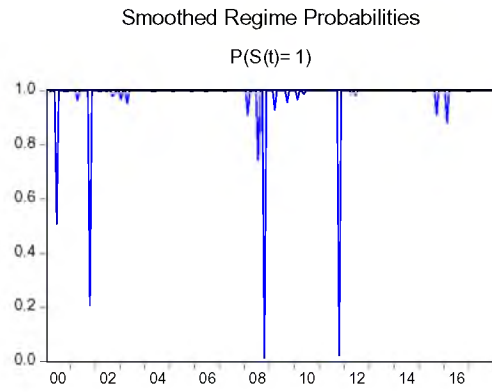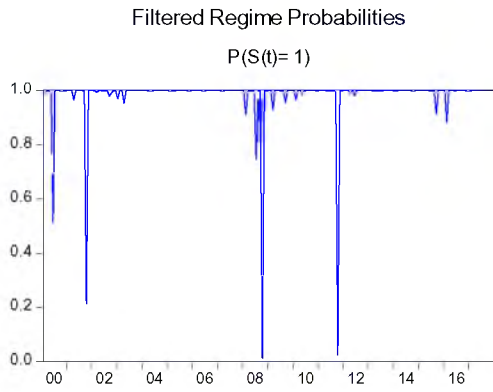
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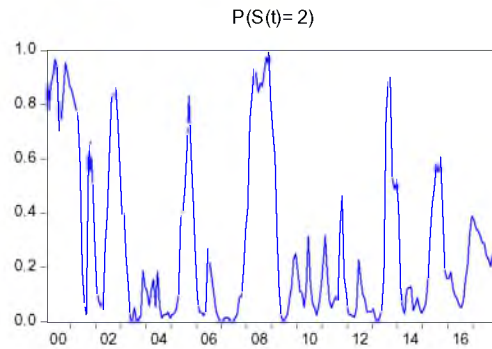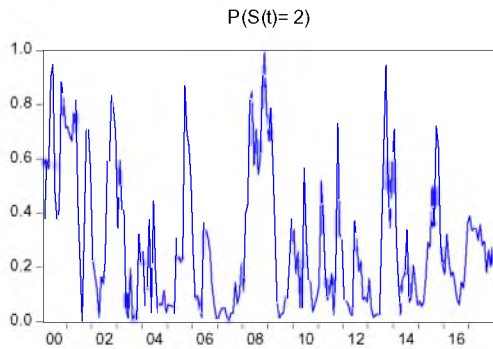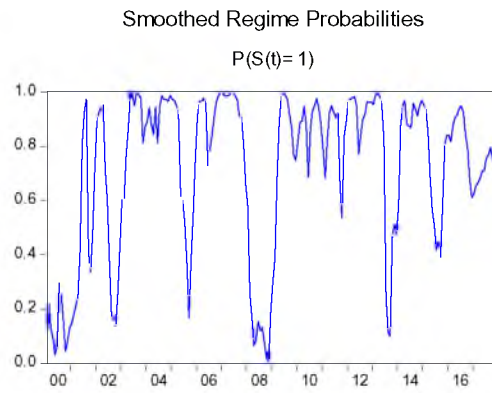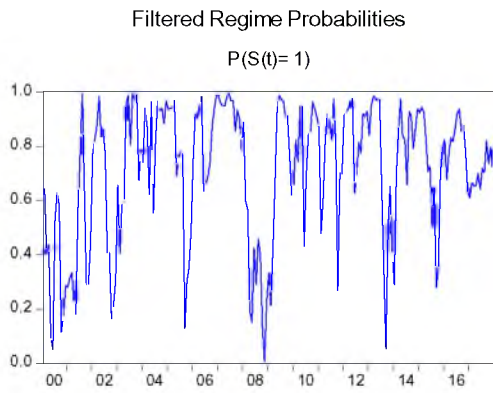
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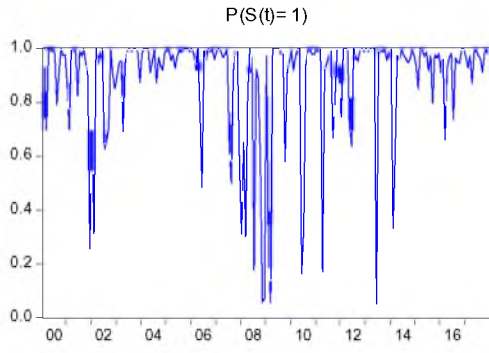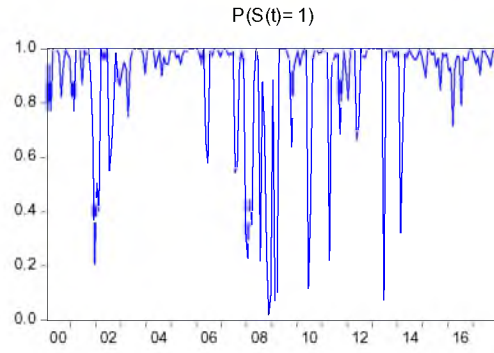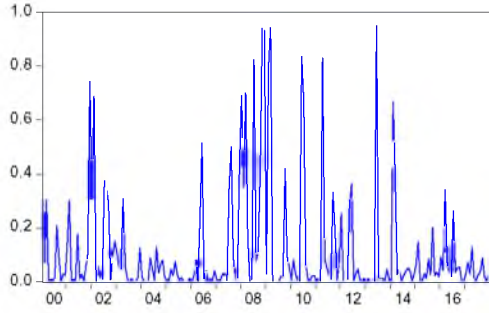# Appendix A   Regime Probabilities (January 2000 – December 2017)

Malaysia

China

Filtered Regime Probabilities   Smoothed Regime Probabilities

P(S(t)= 1)   P(S(t)= 1)

P(S(t)= 2)   P(S(t)= 2)

Hong Kong

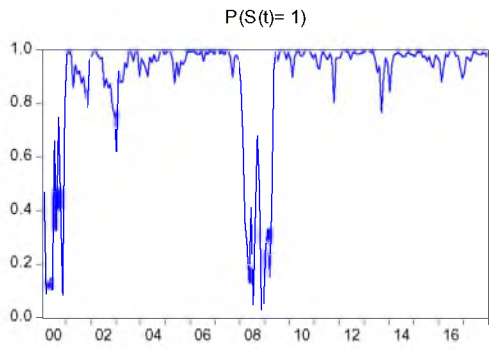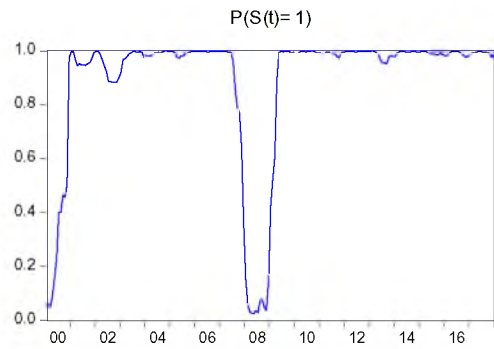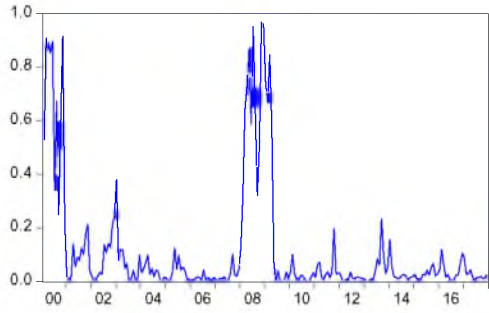Filtered Regime Probabilities   Smoothed Regime Probabilities

P(S(t)= 1)   P(S(t)= 1)

P(S(t)= 2)   P(S(t)= 2)

Indonesia

Filtered Regime Probabilities

P(S(t)= 1)

P(S(t)= 2)

Smoothed Regime Probabilities

P(S(t)= 1)

P(S(t)= 2)

Japan

Filtered Regime Probabilities

P(S(t)= 1)

P(S(t)= 2)

Smoothed Regime Probabilities

P(S(t)= 1)

P(S(t)= 2)

Philippines

217

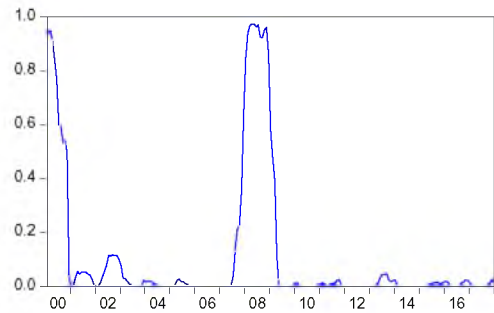Filtered Regime Probabilities   Smoothed Regime Probabilities

P(S(t)= 1)   P(S(t)= 1)

P(S(t)= 2)   P(S(t)= 2)

Singapore

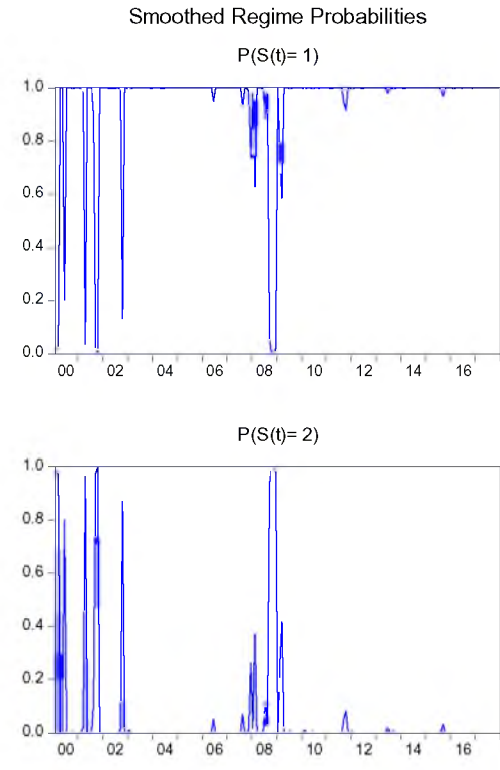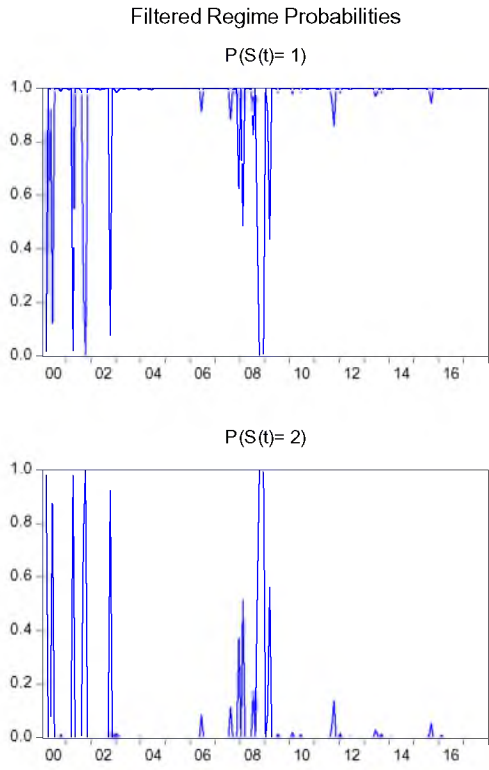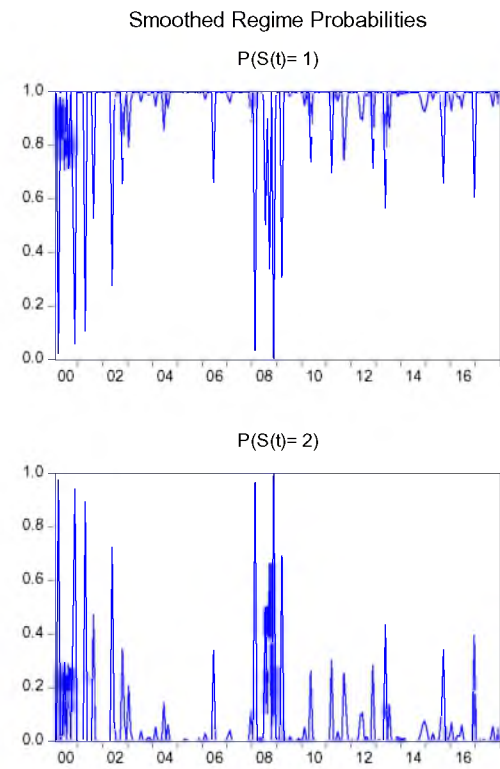Filtered Regime Probabilities   Smoothed Regime Probabilities

P(S(t)= 1)   P(S(t)= 1)

P(S(t)= 2)   P(S(t)= 2)

South Korea

218
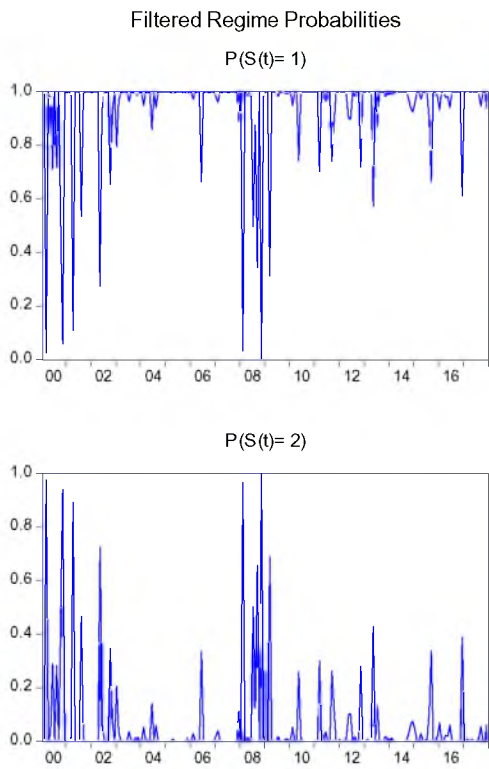
Filtered Regime Probabilities
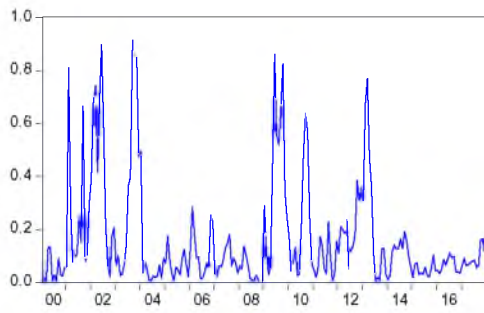
P(S(t)= 1)

Smoothed Regime Probabilities
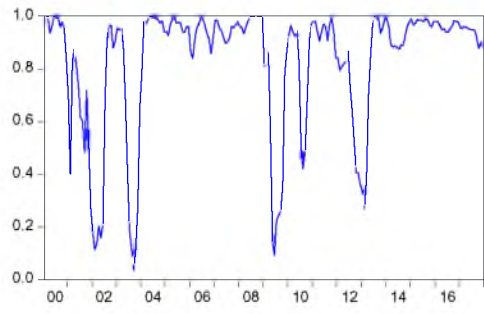
P(S(t)= 1)

P(S(t)= 2)

P(S(t)= 2)

Taiwan

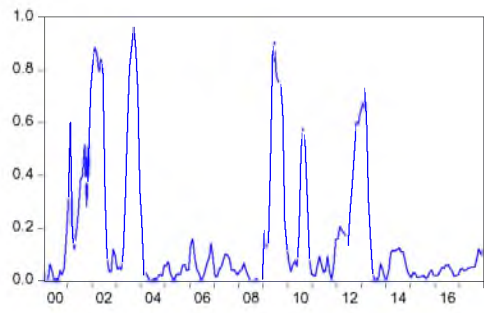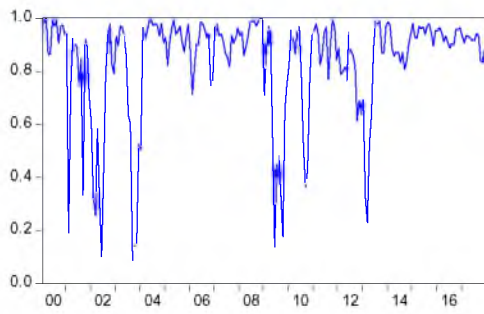Filtered Regime Probabilities
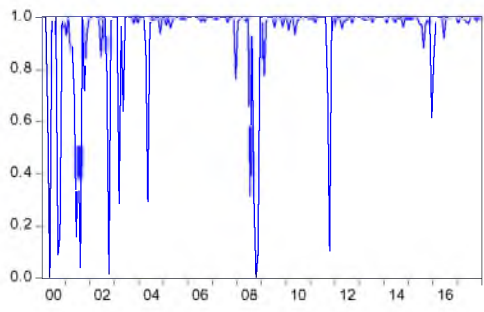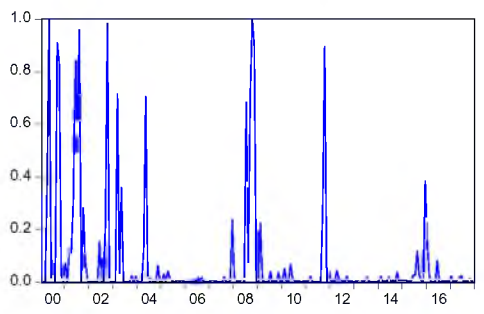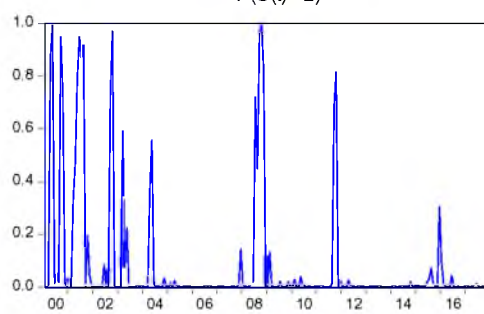
P(S(t)= 1)

Smoothed Regime Probabilities

P(S(t)= 1)

P(S(t)= 2)

P(S(t)= 2)

Thailand

219

Filtered Regime Probabilities

P(S(t)= 1)

P(S(t)= 2)

Smoothed Regime Probabilities

P(S(t)= 1)

P(S(t)= 2)

Vietnam

220
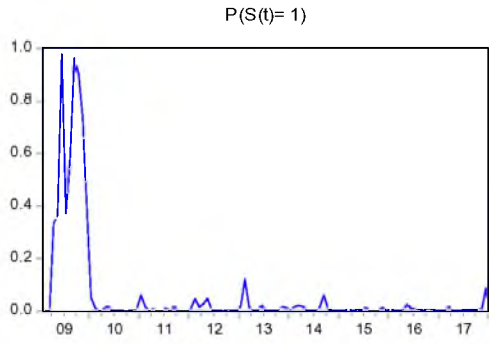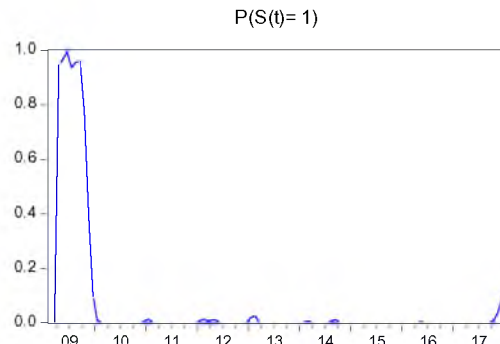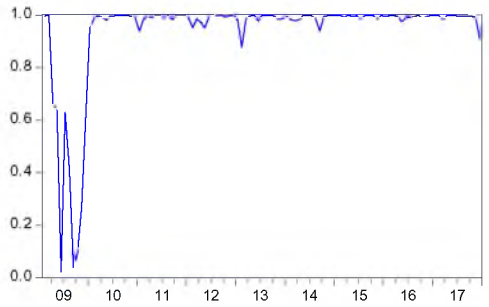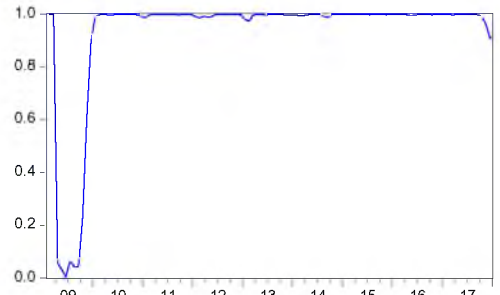
Appendix B   Summary of Results between EGARCH and MS EGARCH

	EGARCH		MS EGARCH	
	Leverage Effect	Spillover Effect	Leverage Effect	Spillover Effect
Malaysia			✓***	✓*
China				
Hong Kong	✓		✓**	
Indonesia	✓			✓***
Japan			✓**	
Philippines	✓		✓***	
Singapore	✓		✓***	
South Korea			✓**	✓**
Taiwan	✓		✓*	✓***
Thailand	✓			
Vietnam			✓**	✓***

*   regime 1
**   regime 2
***   both regimes

Appendix C   Comparison between EGARCH and MS EGARCH (pre-GFC: GFC and post-GFC)

	EGARCH		MS EGARCH	
Pre-GFC	**Spillover**	**Leverage**	**Spillover**	**Leverage**
Malaysia	✓		✓***	✓***
China	✓		✓***	
Hong Kong	✓	✓		
Indonesia	✓		✓**	
Japan			✓**	
Philippines	✓	✓	✓*	✓**
Singapore	✓	✓	✓**	✓***
South Korea	✓	✓	✓*	✓**
Taiwan			✓***	
Thailand	✓		✓*	✓**
GFC	**Spillover**	**Leverage**	**Spillover**	**Leverage**
Malaysia	✓		✓**	✓**
China	✓	✓	✓***	✓**
Hong Kong	✓		✓***	
Indonesia			✓***	✓**
Japan	✓	✓	✓***	
Philippines			✓*	
Singapore			✓***	✓**
South Korea				✓*
Taiwan	✓		✓***	✓**
Thailand		✓	✓***	✓**
Post-GFC	**Spillover**	**Leverage**	**Spillover**	**Leverage**
Malaysia		✓	✓***	✓**
China	✓		✓*	
Hong Kong	✓	✓	✓***	✓***
Indonesia			✓***	
Japan			✓*	✓**
Philippines		✓		✓*
Singapore		✓	✓*	✓***

Post-GFC	Spillover	Leverage	Spillover	Leverage
South Korea	✓		✓***	✓*
Taiwan			✓***	
Thailand				

*	regime 1
**	regime 2
***	both regimes

Appendix D   Performance Matrices (EGARCH and MS EGARCH

January 2007 – December 2017

COUNTRY	LL SR	LL MS	LR	AIC SR	AIC MS	HQC SR	HQC MS	GCLT SR	GCLT (0)	GCLT (1)
Malaysia	2.2718	2.2644	0.0074	-4.4971	-4.4822	-4.6540	-4.4505	0.0093	0.0129	0.0135
China	1.7457	1.6989	0.0468	-3.4450	-3.3515	-3.4133	-3.3198	0.0174	0.0244	0.0245
Hong Kong	1.9555	1.9425	0.0130	-3.8645	-3.8385	-3.8328	-3.8068	0.0106	0.0126	0.0162
Indonesia	1.8781	1.8863	0.0082	-3.7097	-3.7260	-3.6780	-3.6943	0.0309	0.0380	0.0510
Japan	1.8884	1.8598	0.0286	-3.7303	-3.6731	-3.6986	-3.6414	0.0128	0.0167	0.0197
Philippines	2.0269	1.9618	0.0651	-4.0073	-3.8771	-3.9757	-3.8454	0.0206	0.0270	0.0306
Singapore	2.1935	2.0929	0.1006	-4.3404	-4.1393	-4.3087	-4.1076	0.0116	0.0149	0.0182
South Korea	1.7971	1.7657	0.0314	-3.5476	-3.4848	-3.5160	-3.4532	0.0194	0.0249	0.0309
Taiwan	1.8957	1.7934	0.1023	-3.7449	-3.5404	-3.7132	-3.5087	0.0146	0.0256	0.0304
Thailand	1.8072	1.7513	0.0559	-3.5679	-3.4561	-3.5363	-3.4244	0.0196	0.0188	0.0230
Vietnam	1.8588	1.7818	0.0770	-3.6241	-3.4701	-3.5735	-3.4194	0.0103	0.0145	0.0147

Notes: Mean log-likelihood (LL); mean Akaike information criterion (AIC); mean Hannah-Quinn criterion (HQC); Gaussian central limit theory (GCLT), EGARCH (single regime, SR); MS EGARCH (Markov-switching, MS); likelihood-ratio (LR)

Pre-GFC (January 2000 – November 2007)

COUNTRY	LL SR	LL MS	LR	AIC SR	AIC MS	HQC SR	HQC MS	GCLT SR	GCLT (0)	GCLT (1)
Malaysia	2.1651	2.2030	0.3146	-4.2239	-4.2995	-4.1693	-4.2449	0.0106	0.0144	0.0154
China	1.8765	1.8527	0.0238	-3.6467	-3.5991	-3.5920	-3.5444	0.0224	0.0327	0.0300
Hong Kong	2.0215	1.9457	0.0758	-3.9367	-3.7850	-3.8821	-3.7304	0.0114	0.0148	0.0146
Indonesia	1.7673	1.7861	0.0188	-3.4282	-3.4659	-3.3736	-3.4112	0.0283	0.0404	0.0332
Japan	1.9386	1.9334	0.0052	-3.7708	-3.7604	-3.7162	-3.7058	0.0218	0.0284	0.0333
Philippines	1.9647	1.8824	0.0824	-3.8231	-3.6583	-3.4684	-3.6037	0.0176	0.0258	0.0226
Singapore	2.0501	2.0627	0.0126	-3.9988	-4.0199	-3.9392	-3.9643	0.0195	0.0268	0.0275
South Korea	1.6856	1.6739	0.0117	-3.2648	-3.2414	-3.2102	-3.1867	0.0299	0.0396	0.0378
Taiwan	1.6643	1.6800	0.0156	-3.2223	-3.2535	-3.1676	-3.1989	0.0193	0.0334	0.0396
Thailand	1.8317	1.5430	0.2887	-3.5570	-2.9797	-3.5024	-2.9250	0.0253	0.0242	0.0309

Notes: Mean log-likelihood (LL); mean Akaike information criterion (AIC); mean Hannah-Quinn criterion (HQC); Gaussian central limit theory (GCLT), EGARCH (single regime, SR); MS EGARCH (Markov-switching, MS); likelihood-ratio (LR)

GFC (December 2007 – June 2009)

COUNTRY	LL SR	LL MS	LR	AIC SR	AIC MS	HQC SR	HQC MS	GCLT SR	GCLT (0)	GCLT (1)
Malaysia	2.3586	2.0886	-0.2699	-4.4162	-3.6217	-4.1275	-3.5876	0.0242	0.0475	0.0273
China	1.2898	1.2575	-0.0323	-2.0241	-1.9595	-1.9900	-1.9254	0.0382	0.0458	0.0596
Hong Kong	1.9405	1.5850	-0.3555	-3.3055	-2.6144	-3.2914	-2.5803	0.0310	0.0461	0.0406
Indonesia	1.8192	1.7309	-0.0884	-3.0829	-2.9061	-3.0488	-2.8720	0.0335	0.0315	0.0439
Japan	1.5473	1.5622	0.0150	-2.5990	-2.5689	-2.5049	-2.5348	0.0367	0.0610	0.0468
Philippines	1.7054	1.6215	-0.0839	-2.8553	-2.6875	-2.8212	-2.6534	0.0326	0.0379	0.0446
Singapore	1.5422	1.4806	-0.0616	-2.5288	-2.4056	-2.4947	-2.3715	0.0405	0.0676	0.0540
South Korea	1.2472	1.3442	0.0970	-1.9389	-2.1328	-1.9048	-2.0987	0.0331	0.0432	0.0494
Taiwan	1.7848	1.4083	-0.3765	-3.0140	-2.2610	-2.9799	-2.2269	0.0307	0.0667	0.0492
Thailand	1.5341	1.3801	-0.1540	-2.5126	-2.2046	-2.4785	-2.1705	0.0373	0.0419	0.0506

Notes: Mean log-likelihood (LL); mean Akaike information criterion (AIC); mean Hannah-Quinn criterion (HQC); Gaussian central limit theory (GCLT), EGARCH (single regime, SR); MS EGARCH (Markov-switching, MS); likelihood-ratio (LR)

COUNTRY	LL SR	LL MS	LR	AIC SR	AIC MS	HQC SR	HQC MS	GCLT SR	GCLT (0)	GCLT (1)
Malaysia	2.4943	2.4932	-0.0011	-4.8895	-4.8874	-4.3714	-4.8349	0.0079	0.0115	0.0104
China	1.8793	1.8103	-0.0689	-3.6595	-3.5217	-3.0710	-3.4692	0.0137	0.0193	0.0178
Hong Kong	2.2133	2.1099	-0.1034	-4.3276	-4.1208	-4.2752	-4.0684	0.0053	0.0064	0.0083
Indonesia	2.1737	2.1271	-0.0466	-4.2484	-4.1552	-4.1960	-4.1028	0.0196	0.0242	0.0330
Japan	2.0527	1.9742	-0.0785	-4.0063	-3.8494	-3.9539	-3.7969	0.0147	0.0199	0.0225
Philippines	2.2973	2.2604	-0.0369	-4.4956	-4.4218	-4.4432	-4.3694	0.0172	0.0216	0.0270
Singapore	2.6628	2.6189	-0.0439	-5.2266	-5.1388	-5.1742	-5.0864	0.0043	0.0050	0.0069
South Korea	2.1791	2.2045	0.0254	-4.2593	-4.3100	-4.2069	-4.2576	0.0120	0.0161	0.0180
Taiwan	2.2865	2.1167	-0.1698	-4.4740	-4.1343	-4.4216	-4.0819	0.0065	0.0203	0.0262
Thailand	2.2643	2.2680	0.0036	-4.4297	-4.4369	-4.3773	-4.3845	0.0163	0.0089	0.0092

Notes: Mean log-likelihood (LL); mean Akaike information criterion (AIC); mean Hannah-Quinn criterion (HQC); Gaussian central limit theory (GCLT), EGARCH (single regime, SR); MS EGARCH (Markov-switching, MS); likelihood-ratio (LR)