THE LINKAGE BETWEEN STOCK MARKET RETURNS OF SINGAPORE AND OTHER ASEAN-5 COUNTRIES.

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FACULTY OF BUSINESS AND FINANCE
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AUGUST 2017

DECLARATION

We hereby declare that:

(1) This undergraduate research project is the end result of our own work and that due acknowledgement has been given in the references to ALL sources of information be they printed, electronic, or personal.

(2) No portion of this research project has been submitted in support of any application for any other degree or qualification of this or any other university, or other institutes of learning.

(3) Equal contribution has been made by each group member in completing the research project.

(4) The word count of this research report is 23722 words.

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Last but not least, we would like to thank our friends, course mate and parents for their guidance and encouragement throughout the duration of accomplishment of this final year project. Their dedications are gratefully acknowledged, together with the sincere apologies to those we have inadvertently failed to mention.

DEDICATION

Firstly, we would like to dedicate our research project to our beloved supervisor, Ms. Josephine Kuah Yoke Chin for her sincere guidance, advice, valuable supports throughout the completion of this research.

Next, we would like to dedicate our research to our respective family members and friends as an appreciation of their encouragement in completing this research and share our achievements with them.

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LIST OF ABBREVIATIONS

ADF	Augmented Dickey-Fuller
ADR	American Depository Receipt
AIC	Akaike Info Criterion
ANOVA	Analysis of Variance
ARCH	Autoregressive Conditional Heteroscedasticity
ASEAN	Association of Southeast Asian Nations
BLUE	Best, Linear, Unbiased and Efficient
BMV	Base Market Value
BP	Breusch-Pagan
BRICS	Brazil, Russia, India, China and South Africa
BSE	Bangkok Stock Exchange
CAPM	Capital Asset Pricing Model
CIC	Capital Issues Committee
CLRM	Classic Linear Regression Model
CMV	Current Market Value
DV	Dependent Variable
EMH	Efficient Market Hypothesis

FIN	Financial Index
FTSE	Financial Times Stock Exchange
FTFBMMES	Financial Times Stock Exchange Bursa Malaysia ACE
GDP	Gross Domestic Products
ICAPM	International Capital Asset Pricing Model
IMF	International Monetary Fund
IND	Indonesia
ISX	Indonesia Stock Exchange
IV	Independent Variables
JB	Jarque-Bera
JCI	Jakarta Stock Exchange Composite Index
KLCI	Kuala Lumpur Composite Index
KLSE	Kuala Lumpur Stock Exchange
MAL	Malaysia
MESDAQ	Malaysian Exchange of Securities Dealing and Automated Quotation
MkSE	Makati Stock Exchange Incorporation
MSCI	Morgan Stanley Capital International
MSE	The Manila Stock Exchange Incorporation
OLS	Ordinary Least Square
PHI	Philippines
PP	Phillips-Perron
PSEi	Philippines Stock Exchange Composite Index
RESET	Regression Specification Error Test

SC	Schwarz Criterion
SC	Securities Commission
SES	Singapore Stock Exchange
SET	Stock Exchange of Thailand
SETI	Stock Exchange of Thailand Index
SGX	Singapore Exchange
SING	Singapore
SPH	Singapore Press Holdings
STI	Straits Times Index
THAI	Thailand
TOL	Tolerance Method
US	United States
VIF	Variance Inflation Factor

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PREFACE

Nowadays, ASEAN-5 stock markets have provided great opportunities for investors to trade across the boundaries after the capital market has been liberalized. This allowed the investors to create more wealth and manage a well-diversified portfolio. Thus, it is essential to investigate the stock market linkages between the ASEAN-5 which will provide a better knowledge and strategies in managing the most diversified portfolio of ASEAN-5 equity. Although past researchers have conducted the research on the stock market integration between ASEAN countries, yet the overall picture of the relationship between the ASEAN stock markets still remains uncertain. In order to take advantage of the accessibility of the capital market, it is important to obtain investment opportunities from the most recent developments in stock market especially ASEAN-5 countries.

The purpose of this research is to investigate the linkage of stock market return between Singapore and other ASEAN-5 countries. Singapore is known as developed countries and successfully transform into a financial hub in ASEAN region. Therefore, the investors from Singapore may concern to diversify their portfolio risk by investing in other nations, especially ASEAN-5 which is their neighbouring countries. Furthermore, this research will broaden the evidence of the linkages of stock markets return between Singapore and the rest of ASEAN-5 countries.

ABSTRACT

This research project aims to evaluate the linkage of stock market return between Singapore and other ASEAN-5 countries from 2005 to 2016. The secondary data is acquired at monthly basis sources from Bloomberg Terminal. There are a few empirical tests had conducted in this research, such as diagnostic checking, Ordinary Least Squares (OLS) test, Unit Root test, Granger Causality Test and Johansen Cointegration Test. According to the OLS examined results, the stock market returns of Malaysia, Indonesia, Thailand and Philippines are positively significant towards the stock market returns of Singapore. However, the long run relationship between Singapore stock market and stock markets of all other ASEAN-5 countries is exists. Moreover, the granger causality test showed that the short run relationship only occurred between Singapore and Indonesia stock market returns. Although there are some limitations in this research, the recommendations have been proposed for the future researchers to widen the evidence of similar research. Furthermore, the evidence from the results will provide important implications for stock investors, fund managers, government and policymakers.

CHAPTER 1 : RESEARCH OVERVIEW

1.0 Introduction

In this new era of globalisation, the integration of stock market has become crucial and indispensable in finance since it will affect the decision and potential gain in asset allocation, portfolio diversification and other decision making. This is the reason why the study of interrelationship of stock market return between countries received a great attention in international finance (Tiwari, Bhanja & Shah, 2013).

Chapter one is the introductory chapter that gives the idea and an overview about the research project. All the research problems, research questions, objectives and hypotheses of the research project will be discussed in this chapter.

The purpose of this research project is to investigate the interrelationship between the ASEAN-5countries stock market return. Other than this, the research project also investigates how these countries' stock market returns affected Singapore stock market return. A set of sample data from January 2005 to December 2016 will be used in this research project including ASEAN-5 countries namely Malaysia, Indonesia, Thailand, The Philippines and Singapore. Singapore stock market return is dependent variable while the others country stock market return are independent variables.

1.1 Research Background

The term 'stocks' carries the meaning of ownership of a company's certificates or securities held by investors (Fontanills & Gentile, 2001). As such the holders of these securities have claims on the company's future assets and income. Furgang (2011) defined stock market as a place which facilitates the activity of buying or selling shares of publicly-issued companies and enable trades either through exchange markets or over-the-counter markets. Companies will raise capital through issuance of shares in

stock market while the investors who buy certain shares of a corporation will be entitled as shareholders of the corporation. A better structured and managed stock market could bring about accelerated financial economies as well as stimulate the economic activities in a country (Anwar & Raza, 2016). Stock market performance are measured by stock market indices and stock returns. It acts as a benchmark to evaluate the wealth and growth potential of the country. In fact, stock markets of different countries have their own stock indices. Stock indices anticipate the direction of movement of the stock prices, indicating the economic activity level as well as sense the sentiment of stock market (Ho, 2009).

The liberalisation process acts as vital policy which have been enforced by countries in recent decades. Lee and Goh (2016) determined liberalisation as consequences of government relaxed rules and regulations in financial market, loosen quantity restriction and home price of goods in a country as well as enhanced the participant of foreign countries in domestic financial market. Tauchen and Pitt (1983) declared that the number of traders in financial market and the volatility of stock return were negatively related to each other.

There will be more and more domestic and foreign investors being attracted to invest in a stock market due to the relaxation of restriction of financial market. The result to this is the decline in stock return volatility. Integration of local market with foreign markets would be boosted up once the liberalisation is being carried out (Yi & Tan, 2009). When stock market is integrated, a news happen in a country would spread rapidly to other countries' stock markets. At the same time, capital movement between countries would rise while generating fresh ideas and innovation on financial goods and services in the country. Low barrier of trade and finance deregulation which provide opportunities and the possible combination of returns and risks. If the correlation between two different stock markets is low or negative, there will be greater risks being diversified through international portfolio investment.

ASEAN countries have different period of time in experiencing stock markets liberalisation. Date of economic openness can be categorised into variety of indicators, such as the Official Liberalisation Dates, the First ADR (American Depository Receipt)

and the date of introduction of Country Fund (Bekaert, 1995; Bekaert & Harvey, 1995). Definition of the official liberalisation date is the official date which allowed domestic investors to invest in foreign stock markets on the same time foreign investors also have the equal rights to fund their money in local stock market (Bekaert & Harvey, 2000).

For the past decades, there are four major crises being assorted, including the Great Depression 1929, 1987 International Crash of Stock Market, Financial Crisis of 1990s and the 1997 Asian Financial Crisis (Royfaizal, Lee & Azali, 2009b). Lim (2009) investigated the correlation of international stock markets and found that United State (US) financial market acts as leader on other markets. In the 21st century, BRICS (Brazil, Russia, India, China and South Africa) financial economies rank as most influential countries and accounted for approximate 40 per cent of the population in world (Mensi, Hammoudeh, Nguyen, & Kang, 2016). China explained roughly 55% of the global gross domestic products (GDP) and became largest or second-largest trading partner to 78 countries' stock markets by 2011 (Teng, Yen, Chua, & Lean, 2016).

Members of the Association of Southeast Asian Nations (ASEAN) formed by five countries in Asia, including Singapore, Malaysia, Indonesia, Thailand, and the Philippines with a market amounted to approximate 568 million people are extended swiftly since 1970s and being ranked as fourth largest trading region in world (Lim, 2007). After the 1997 Asian Financial Crisis, stock markets of ASEAN-5 become more interdependence and liberalised. Click and Plummer (2005) declared that ASEAN-5 had overcome barrier of trade and created a free-trade area and investment zone among themselves over the past few years.

1.1.1 Background of Singapore's Stock Market

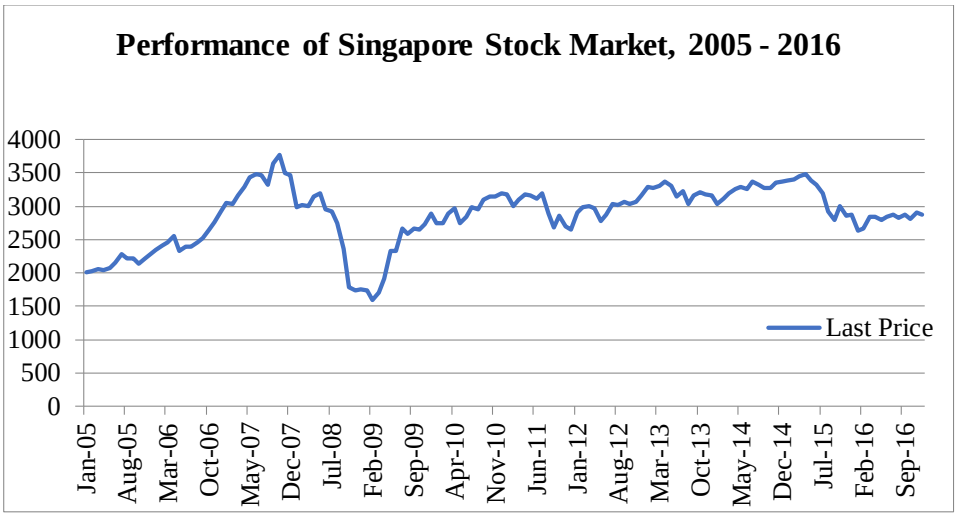
Singapore Stockbrokers Association was established in 1930. Since then, stock trading was conducted in a more formal form under this association to provide higher protection to brokers and investors. The association name was changed to Malayan Stockbrokers Association during 1938, including the brokers from Peninsular Malaysia to trade more safely through this association (Siklos & Ng,

2001). In 1960, a number of firms from Singapore, Kuala Lumpur, Ipoh and Penang jointly set up the Malayan Stock Exchange. In 1973, Stock Exchange of Singapore was established after Singapore withdrawn from being a member of Malaysia. Stock Exchange of Singapore merged with Singapore International Monetary Exchange to form Singapore Exchange in 1999 (Tan, 2005). Singapore had officially undergone stock market liberalisation on June 1978 (Phylaktis & Ravazzolo, 2005, as cited in Lee & Goh, 2016).

Straits Times Index (STI) is a capitalisation-weighted stock market index which indicates the performance of the top 30 public-listed companies on the Singapore Exchange (Brooks, Faff & Ariff, 1998). STI was also known as the market barometer and benchmark index of Singapore stock market.

The stock market return performance of Singapore from year 2005 to 2016 was analysed using the monthly last price. The stock market return of STI shown an increasing trend beginning from year 2005 and peaked in mid-year of 2007. From mid-year of 2007, the stock market return experience a huge drop and the lowest price on February 2009. This trend shown that Singapore stock market was affected by the global financial crisis happen within these period (Lee & Goh, 2016). The market started to recover from March 2009. The stock market return was increased on March 2009 and shown a fluctuating trend until year 2016.

Figure 1.1.1: Performance of Singapore Stock Market, 2005 – 2016



Source: Developed for research.

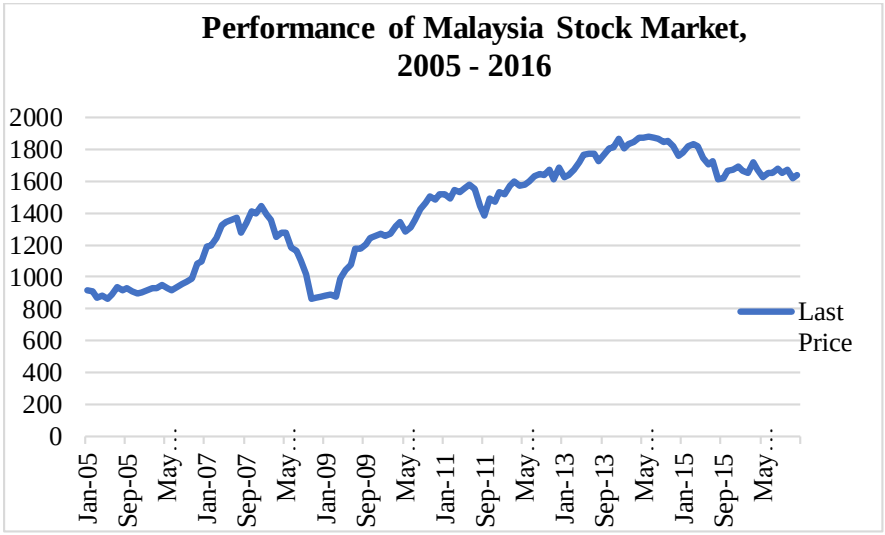
1.1.2 Background of Malaysia's Stock Market

Abd Karim and Gee (2008) stated that Kuala Lumpur Stock Exchange (KLSE) and the Malaysian Exchange of Securities Dealing and Automated Quotation (MESDAQ) played significant duties as the secondary markets in Malaysia. This allowed investors to trade their securities publicly as well as increase the liquidity of shares. In March 1960, stock market of Malaysia was established and named as The Malayan Stock Exchange. In May 1960, investors had begun to trade stocks and shares in the clearing house of Bank Negara Malaysia. The Capital Issues Committee (CIC) was built in 1968. As a result of instability of Malaysian Ringgit and the termination of currency interchangeability with Singapore, The Malayan Stock Exchange was then divided into the KLSE and the Singapore Stock Exchange (SES) in 1973. In 1993, Securities Commission (SC) was implemented to entrust the responsibility of regulating and comprehensively development of stock market of Malaysia (Abd Karim & Gee, 2008). KLSE was renamed to Bursa Malaysia Berhad in 2004. Lee and Goh (2016) stated that the Official Liberalisation Date of Malaysia stock market was allocated on December 1988.

Kuala Lumpur Composite Index (KLCI) acts as the Malaysia's benchmark stock market index to measure the value of stock market. Roshaiza, Sisira and Svetlana (2009) indicated that Bursa Malaysia collaborated with its partner of index, FTSE International Limited (FTSE) changed name of stock market index of Malaysia from KLCI to FTSE Bursa Malaysia KLCI in 2009. Cooperation between them brought about improvement in the methodology of index calculation to a more transparently-managed, tradable and investable index. Moreover, these modifications provide the opportunity to improve the Malaysian stock market to an extended range of investment and on the same time facilitate economy growth of country.

From 2005 to 2007, the last price of KLCI, indicator of stock market performance, were boosted up steadily with a little downfall. In 2007, stock market Malaysia performance stay almost alike with the previous year before the Asian financial crisis. when the global financial crisis attacked in 2008, the stock market return performance declined intensely (Anwar & Raza, 2016). There was a firm rose with minimal fluctuation of the graph of stock market performance after year 2008 until August 2015. Then there was a minimal decline of trend up to the end of year 2016.

Figure 1.1.2: Performance of Malaysia Stock Market, 2005 – 2016



Source: Developed for research.

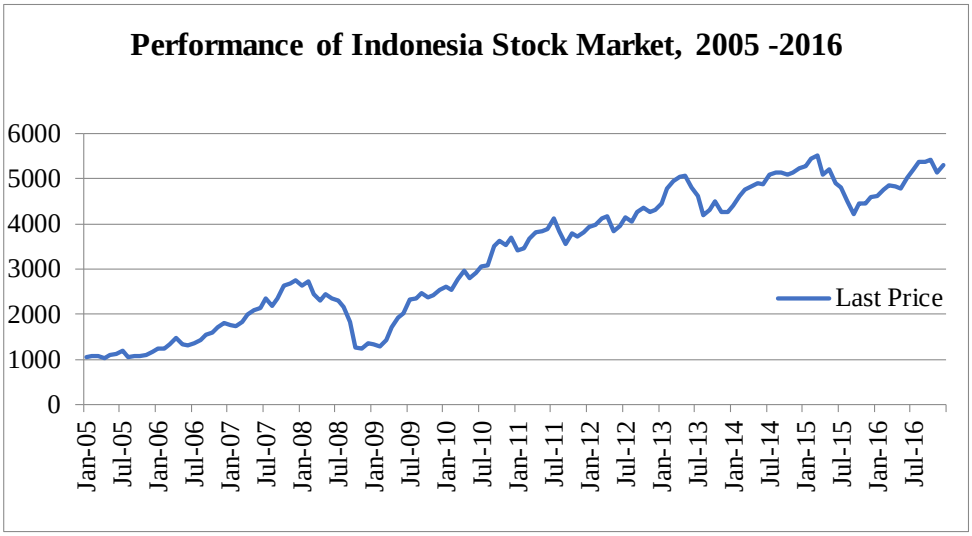
1.1.3 Background of Indonesia's Stock Market

Jakarta Stock Exchange was established in 1912 by Dutch colonial government to provide a place for stock brokers and investors to trade their securities in a more secured way. Jakarta Stock Exchange is based in Jakarta, Indonesia. During World War I and World War II, Jakarta Stock Exchange had experienced several closures and it had been reopened in 1977. Jakarta Exchange Inc. had privatised the Jakarta Stock Exchange under their ownership in 1992. In September 2007, Jakarta Stock Exchange was merged with Surabaya Stock Exchange to form the Indonesian Stock Exchange (Ho, 2009). In September 1989, Indonesian Stock Exchange officially undergone stock market liberalisation (Bekaert & Harvey, 1998, as cited in Lee & Goh, 2016).

Jakarta Stock Exchange Composite Index (JCI) is the capitalisation-weighted index which is modified from stocks of the companies listed on the Indonesia Stock Exchange (Yang & Pangastuti, 2016). JCI plays the role as the benchmark index of Indonesia stock market.

The stock market return performance of Indonesia is measured using the monthly last price of the stock market. Stock market return of Indonesia was increased with a few fluctuations from 2005 to 2007. Stock market return of Indonesia in year-end 2007 performed a good result and this result continue until beginning of 2008. However, the stock market return started to decrease from February 2008 and dropped to the bottom in year-end of 2008 due to the global financial crisis (Lee & Goh, 2016). The recovery period of Indonesia stock market started from March 2009. The stock market return increase rapidly within year 2009 and continue to increase with fluctuation in the following years.

Figure 1.1.3: Performance of Indonesia Stock Market, 2005 – 2016



Source: Developed for research

1.1.4 Background of Thailand's Stock Market

In general terms, there are two stages in the modern Thailand capital market, which are the Bangkok Stock Exchange (BSE) and the Securities Exchange of Thailand. BSE, which was a limited partnership with private owners, initiated the trading of stocks in July 1962. Due to scarcity of investors and shortage of support from governments, BSE failed to succeed. "The Securities Exchange of Thailand", name of the Thailand stock market was recognised publicly and had started trading on 30 April 1975 (Sutheebanjard & Premchaiswadi, 2010). Thai stock market was renamed to Thai Stock Exchange of Thailand on 1 January 1991. Furthermore, Thailand began to expose themselves to international stock markets and the Official Liberalisation Date of Thai was embedded on September 1987.

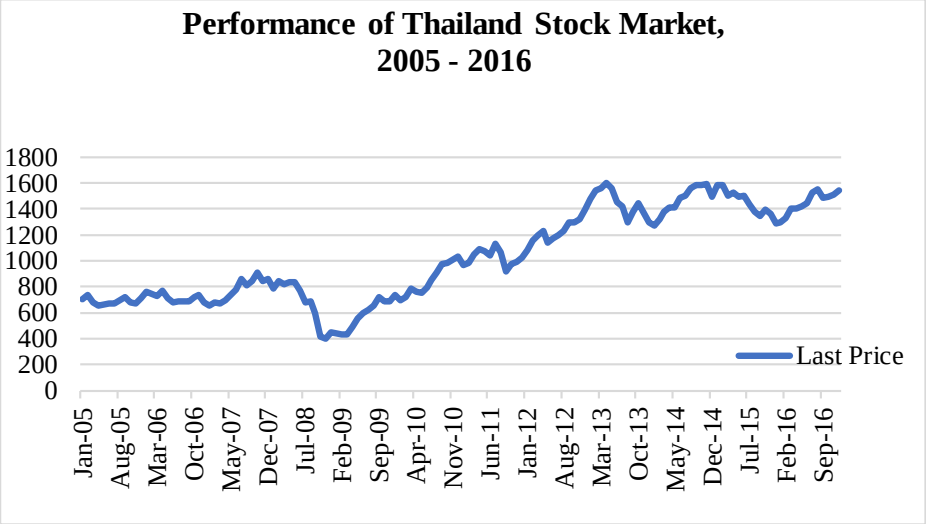
Chancharat, Valadkhani and Havie (2008) stated that SET index plays vital role as the index of the Stock Exchange of Thailand. In fact, the SET Index which make comparison between all listed common stocks current market value (CMV)

and their base market value (BMV). The formula for computing the SET index is as follows:

$$\text{SET index} = \frac{\text{Current Market Value} \times 100}{\text{Base Market Value}}$$

From 2005 to 2007, the performance of stock returns was roughly the same. Thai stock market performance collapsed in 2008 due to the financial crisis 2007-2008 (Lee & Goh, 2016). After the year of 2009, the graph of stock market performance had been climbed up steadily with some moderate ups and downs.

Figure 1.1.4: Performance of Thailand Stock Market, 2005 – 2016



Source: Developed for research.

1.1.5 Background of The Philippines's Stock Market

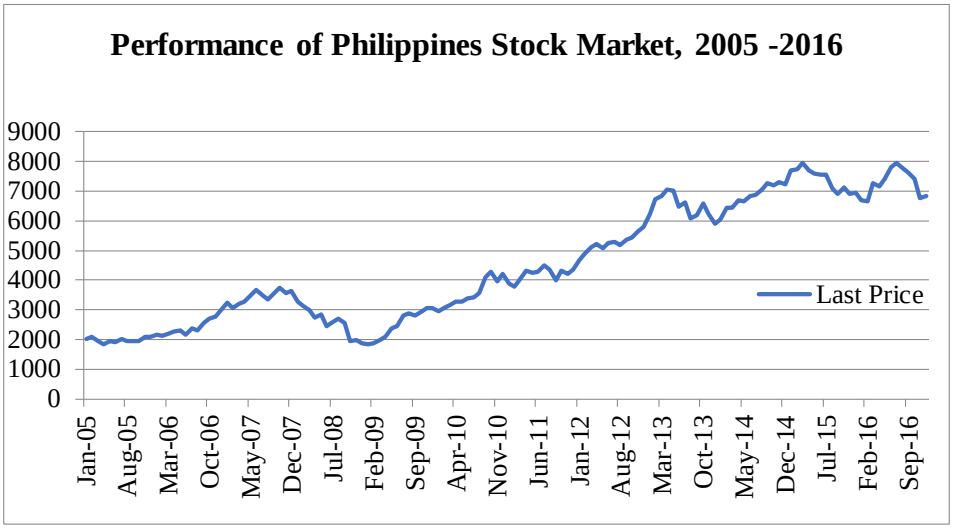
The Philippines Stock Exchange, formerly named as The Manila Stock Exchange, Inc. (MSE), was established in1927. During World War II, MSE had stop operating and the trading operating resumed in 1946. In 1992, The Philippines Stock Exchange, Inc. was incorporated and the MSE and the Makati

Stock Exchange, Inc. (MkSE) were unified under The Philippines Stock Exchange, Inc. to strengthen logistics and boost the development of capital market (Dioquino, 2014). The Philippines Stock Exchange is the first and longest stock exchange because it started operating since 1927. It also is one of the major stock exchanges in Southeast Asia (Ho, 2009). The Philippines Stock Exchange, Inc. officially undergone liberalisation on June 1991 (Bekaert & Harvey, 1998 as cited in Lee & Goh, 2016).

The Philippines Stock Exchange Composite Index (PSEi) is the capitalisation-weighted index which calculated using the stock returns of 30 companies listed on the Philippines Stock Exchange, Inc. from different sectors (Dioquino, 2014). PSEi is the benchmark of the performance of stock market return of the Philippines (The Philippines Stock Exchange, Inc, 2012).

Monthly last price of the Philippines was used to measure the performance of the stock market return from 2005 to 2016. Generally, the stock market return of the Philippines shown a rising trend from 2005 to October 2007. The stock market return started to fall during year-end of 2007. This is because the global financial crisis started to affect the stock market of the Philippines. This declining trend continue and drop to the valley at the beginning of 2009. However, the recovery of the stock market also started in 2009. The performance of stock market in the Philippines after the recovery period, shows a better result after the global financial crisis compare to that before crisis.

Figure 1.1.5: Performance of Philippines Stock Market, 2005 – 2016



Source: Developed for research.

1.2 Problem statement

The capital market liberalisation in ASEAN stock markets had opened opportunities of cross-border investment for investors (Wong, Penm, Terrell & Ching, 2004). Such market liberalisation, accompanied by the trend of globalisation brought forth by technological advances, gave investors opportunities to tap into the global stock markets in order to create more wealth. The incentive for investors to invest in global stock markets is the ability to formulate an internationally diversified portfolio that is capable of attaining greater return at minimal risk.

The integration between stock market is the main determinant of the feasibility of international portfolio diversification. According to Schmukler (2004), when a country's stock market is integrated with international market, it increases investment alternatives to investors. However, high or perfect integration between stock market deemed international portfolio diversification ineffective (Wong et al., 2004). This is due to the fact that highly integrated financial markets are more prone to external shocks and financial crisis from contagion effects (Schmukler, 2004). On the contrary, lower integration between stock market enables better prospects for investors to form a

well-diversified international portfolio (Abd Karim & Gee, 2008; Caporale & Spagnolo, 2012). Therefore, the stock market linkages between ASEAN countries should be studied for investors that are interested in formulating a portfolio of ASEAN stocks.

In the past decade, a few notable events that may affect the stock market integration between ASEAN member nations had occurred, rendering past studies irrelevant to provide a true picture of the interrelationship between ASEAN stock markets. These events not only impact the prospects of international portfolio diversification, but create more uncertainties towards recent linkages between stock markets in the ASEAN region.

Firstly, the 2008 Global Financial Crisis, also known as the subprime loan crisis, had struck the world stock market into a slump. Singapore stock market, for example, had suffered a fall by 49.2% following the subprime loan crisis (Record stock market falls in 2008, 2008). In fact, contagion effect was found to be inevitable during period of this subprime loan crisis (Celik, 2012). Next, ASEAN member nations have agreed upon the ASEAN Economic Community as a regional economic integration goal to be achieved by year 2015 (Thanh, 2015). For example, the ASEAN exchanges collaboration was initiated as a key initiative under the ASEAN Economic Community to integrate 7 stock exchanges in the ASEAN member nations, namely Vietnam, Indonesia, Malaysia, the Philippines, Thailand and Singapore (Sia, Hsu & Teo, 2016). Besides that, the ASEAN stock trading link, capable of enhancing stock liquidity between ASEAN countries, was launched in September 2012 by the ASEAN exchanges had been recognised as an accelerating pace of stock market integration within the ASEAN region (Hayashi, 2013; Jarungkitkul & Sukcharoensin, 2016). Such advances in technological components can be a factor of stock market integration (Hyde, Bredin & Nguyen, 2007; Phylaktis & Ravazzolo, 2005).

In addition, ASEAN member nations demonstrated large diversity in their degree of economic development (Thanh, 2015). According to Asian Development Bank (2016), the GDP Growth rate varies from 2.0% to 5.8% in 2015. Singapore GDP growth recorded 2.0%, while Thailand 2.8%, Indonesia 4.8%, Malaysia 5.0% and Philippines 5.8% (Asian Development Bank, 2016). Moreover, there were political instability that

occurred in the ASEAN-5 countries in the past decade. For instance, political unrest in Thailand since the decease of King Bhumibol Adulyadej; democratic win in Indonesia's last presidential election; Malaysia's general election; retirement of former Singapore Prime Minister Lee Kuan Yew; and call for resignation of Philippine president Benigno Aquino (The Economist, 2015). These political events could pose an impact in the integration between ASEAN-5 stock markets due to policy changes and market perception.

Regardless the above recent economic and political changes, previous studies have their limitations in addressing the above issues. First of all, previous studies had mainly focused on investigating the cointegration between ASEAN collectively, to external countries, such the United States and other developed countries (Ho, 2009; Loh, 2013; Wong, et al., 2004). Even though there were studies on the linkage or cointegration relationships between ASEAN countries, they had yielded mixed results. Most researchers found cointegration between ASEAN stock markets after the 1997 Asian Financial Crisis (Karim & Karim, 2012; Lim, 2007). While Narayan and Narayan (2012) found no cointegration between Malaysia, the Philippines, Thailand and Singapore for the period during the 2008 Financial Crisis. Most importantly, literatures on ASEAN stock market cointegration covered the period up to 2010 (Karim & Karim, 2012; Narayan & Narayan, 2012). As such, the linkage between ASEAN stock market should be revisited to cater to more recent developments in the stock market.

In this era of globalisation and capital liberalisation, it is crucial to investigate the stock market in a cross-country context because investors began to expand their investment horizon to foreign countries due to technological conveniences. It is also important to obtain more information on the most recent development of the linkage between stock market so that international investors could take advantage of global stock markets accessibility to increase their wealth. This is because, given the developments and events that happened to the stock market in the past decade, there is a need to reinvestigate the linkage between ASEAN-5 stock market in the most recent context and fill up the period gap.

Although linkages between the stock markets of all ASEAN-5 countries are of interest, the Singapore stock market was the focus of the research project. Ho (2009) had referred Singapore as a developed nation. Moreover, in 2013, Singapore was the only country in ASEAN which by its economy was recognised by the International Monetary Fund (IMF) as a developed economy (Goh, Annuar & Zariyawati, 2014). Over the years, Singapore had grown into an established finance hub in the ASEAN region while engaging extensively in investments throughout the ASEAN region (Chancharat et al., 2008). Thus, Singapore investors may have concerns on their portfolio risk and seek for a broader market to diversify away the risk. The issue is that, given the recent outlook, whether they could target the stock markets of neighbouring fellow ASEAN-5 countries, all of which are developing nations. It was also rarely investigated how the Singapore stock market was affected by those of other ASEAN-5 countries. Therefore, this project seeks to cater to the linkage between ASEAN-5 stock markets from a Singaporean perspective.

In short, this research project mainly focuses on finding the linkages and cointegration between ASEAN-5 stock markets and how Singapore stock market is affected by stock markets of its fellow ASEAN-5 countries. To do so, regression analysis, cointegration analysis and granger causality approach was employed.

1.3 Research Questions

1. What is the relationship between the Malaysian stock market return and Singapore stock market return?

2. What is the relationship between the Indonesian stock market return and Singapore stock market return?

3. What is the relationship between the Thailand stock market return and Singapore stock market return?

4. What is the relationship between the Philippines stock market return and Singapore stock market return?

5. Does granger causality relationship exist between variables?

1.4 Research Objectives

1.4.1 General Objectives

The purpose of this project is to investigate the relationship between stock market returns of Singapore and other ASEAN-5 countries (Malaysia, Indonesia, Thailand and Philippine) from the period of January 2005 to December 2016.

1.4.2 Specific Objectives

Objective 1 : To study the effect of Malaysian stock market return on the Singapore stock market return.

Objective 2 : To explore the effect of Indonesian stock market return on the Singapore stock market return.

Objective 3 : To observe the effect of Thailand stock market return on the Singapore stock market return.

Objective 4 : To study the effect of Philippines stock market return on the Singapore stock market return.

Objective 5 : To examine granger causality relationship between variables.

1.5 Hypotheses of the Study

The stock market return of ASEAN-5 countries are chosen as variables for this research project. The Straits Times Index (STI) is represented as a Singaporean stock market return which is dependent variable. Moreover, the stock market return of other ASEAN-5 countries (Malaysia, Indonesia, Thailand and Philippine) will be selected as independent variable in this research project which are Kuala Lumpur Composite Index (KLCI), Jakarta Composite Index (JCI), Stock Exchange of Thailand Index (SETI) and Philippine Stock Exchange Index.

1.5.1 Malaysian stock market return (Kuala Lumpur Composite Index, KLCI)

H_0 : The Malaysian stock market return has an insignificant effect on Singaporean stock market return.

H_1 : The Malaysian stock market return has a significant effect on Singaporean stock market return.

Kuala Lumpur Composite Index (KLCI) has been selected as proxy for Malaysian stock market return for this research project. According to Lim (2009), the changes in stock market returns between domestic countries and foreign countries will bring significant impact on output growth. During the year 1997 financial crisis, stock markets are found to be sensitive towards negative or positive news. Thus, a country who encounter negative shock could bring negative effect to other neighbouring countries. Furthermore, Roca, Selvanathan and Shepherd (as cited in Azman-Saini, Azali, Habibullah & Matthews, 2002) found that the Malaysian stock market is the most influential market and it showed significant interactions with other stock markets in the short run. Hyde et al. (2007) claimed that geographically and economically

close markets will result in high correlations. As Malaysia and Singapore are in the region where the geographic and economic are similarly to each other, the result shows a highest correlation coefficient between them. Hence, it is expected that H_1 statement is supported.

1.5.2 Indonesian stock market return (Jakarta Composite Index, JCI)

H_0 : The Indonesian stock market return has an insignificant effect on Singaporean stock market return.

H_1 : The Indonesian stock market return has a significant effect on Singaporean stock market return.

Jakarta Composite Index, JCI is selected as Indonesian stock market return. Karim and Karim (2012) research showed that during the post subprime crisis, Singapore has the highest correlation with Indonesia among the ASEAN-5 countries. There is another study found that the stock market returns between Indonesia and Singapore have a closer linkage across the period (Ng, 2002). Based on the explanation from Kearney and Lucey (2004), the world's economic and financial systems are highly integrated due to the expansion of international trade in commodities, services and financial assets. Therefore, the Indonesian stock market return is expected to have a significant effect on Singaporean stock market return.

1.5.3 Thailand stock market return (Stock Exchange of Thailand Index, SET)

H_0 : The Thailand stock market return has an insignificant effect on Singaporean stock market return.

H_1 : The Thailand stock market return has a significant effect on Singaporean stock market return.

In this research project, Stock Exchange of Thailand Index, SETI is referring to Thailand stock market return. According to Roca, Selvanathan and Shepherd (1998), the results showed that there is a bidirectional causality between Singapore stock market return and Thailand stock market return as the result of contagion. This can be explained by the fact of Financial Crisis in 1997 was initiated in Thailand with the sharp attack on Thai baht. The crisis leads to the depreciation of Thai baht, followed by a serious attack on the Indonesian rupiah and then spread to Singapore. Furthermore, Chancharat et al. (2008) had proved that there is a relationship between Thailand and one of its close trading partner Singapore in the long run and short run. Their results also proved that the stock returns in Thailand and Singapore possess a bidirectional granger causality. The result should be expected that the Thailand stock market return has a significant effect on Singaporean stock market return.

1.5.4 Philippines stock market return (Philippine Stock Exchange Index, PSEI)

H_0 : The Philippines stock market return has an insignificant effect on Singaporean stock market return.

H_1 : The Philippines stock market return has a significant effect on Singaporean stock market return.

The study had investigated that the Singapore stock market will be affected by the Philippines. In addition, the study also observed that the Philippines are leading the Singapore markets (Phuan, Lim, & Ooi, 2009). Azman-Saini, et al. (2002) found that the Philippines would affected the Singapore equity market in the long run. Tan (2012) had examined that the Philippines is highly correlated with Singapore. This result explained that the country in the same region will hold a strong relationship. Furthermore, there is a more substantial relationship between the economies in the same area. Thus, it should be expected that H_1 statement is supported.

1.6 Significance of the Study

This research project focused on the interrelationship between the ASEAN-5 countries stock market return and Singapore stock market return. The countries included Singapore, Malaysia, Indonesia, Thailand and Philippines from the period of 2005 to 2016. This research project may be useful for academician and provide some indicators to the policymakers, government and international investors.

1.6.1 Stock investors

According to Click and Plummer (2005), with the implication of co-integration of stock markets from researchers, investors from various countries were able to recognise the benefit from the diversification and thus aid their decisions on investing in different ASEAN countries' stock market. Hence, by studying the integration between the stock market return, investors able to identify which of the foreign securities to choose as part of their portfolio asset in order to achieve a maximum return with lowest risk. In addition, the study of the research also helps to link the information of the world stock market and provide the opportunities for investor to bring more capital from abroad as well as expand one's shareholder base.

1.6.2 Fund managers

This research project may also be significant to institutional investors such as fund managers especially in making their financial decisions. They need the information of the linkage between markets to recognise the risk existence, stock return, and finalise financial decisions in relation to investment and risk management (Lim, 2007). This is such that they could ultimately develop

investment portfolio which is well-diversified on behalf of their clients or fund owners.

1.6.3 Government and policy makers

Besides, understand the interrelationship between stock markets is important for policy makers. With the knowledge of the influence of stock market return of the selected country, policy makers able to make a better prediction about the stock market behaviour. This study will assist them to justify the international diversification of portfolios.

According to Masoud (2013), the study's finding stated that there was a positive relationship between the performance of stock market and economic growth of country. Hence, it is vital that government need to ensure a vibrant financial performance to encourage economic growth and stability of a country. Hence, other than policy makers, this research also useful for governments on regulating the co-movement among international stock markets. Some intervention and policies of government may use to apply on local stock market in order to boost the nation's economic growth, for instance fiscal and monetary policies (Chatziantoniou, Duffy & Filis, 2013; Ioannidis & Kontonikas, 2006).

In short, for academic researchers as well as practitioners in the industry, this research project will be useful to discover the integration between the stock market of the member nations of the ASEAN-5 and investigate the impact on the prospects of international portfolio diversification.

1.7 Chapter Layout

Chapter 1 is the introductory chapter to this research project. This chapter covers research background, problem statement, research questions, research objectives, hypotheses, significance of the study and chapter layout of the research project.

Chapter 2 consists of the review of past studies which are associated with stock market return and the performances. Besides that, the connection between independent and dependent variables will also be reviewed in the literature review.

Chapter 3 comprises of the methodology for this research project. All the methodologies applied such as co-integration analysis, regression analysis and granger causality approach will be more specifically explained in this chapter. A conclusion is written so as to connect to the next chapter.

Chapter 4 proceeds with diagnostic checking, statistical tests as well as data analyses. This chapter outlines the analyses for all outcomes and results related to the highlighted research questions and hypotheses for this project. Interpretation of the result will be expressed in this chapter as well.

Chapter 5 summarises the statistical analyses and discusses the major findings and the implications of this research project. Other than summarising and concluding this paper, this chapter will identify the limitations for this research and thus provide some recommendations for future research.

1.8 Conclusion

This chapter had carried out an overview of background of Singapore and other ASEAN-5 countries' stock market. This chapter also developed the problem statement and objectives of the research. Besides that, the importance and contribution for this research has been discussed in this chapter. A review on other empirical studies related to the impact on the prospects of international portfolio diversification will discuss in the following chapter.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

In the previous chapter, research background, problems statement, research questions, objectives, hypotheses and significance of the study have been presented. Next, the review of literature, theoretical models and theoretical conceptual framework will be discussed. Basically, literature review is about an overview of research project's topic based on scholar articles, survey books, different past empirical researches and other relevant sources. By doing so, it provides description, summarisation, assessment and critical evaluation in relation to the research project. Furthermore, the literature review can assist future researchers in deciding the nature of the study topic with a better understanding and guidelines to strengthen their research, while addressing the limitations in previous researches. In addition, review of the literature give evidence to determine whether dependent variables will be affected by independent variable using various methodologies.

2.1 Review of the Literature

The literature review is a critical analysis and logical presentation by gathering the related empirical or theoretical researches conducted by previous researchers. It also shows the limitation or gaps from the previous researches. By comparing previous researches and summarising the major contributions from the researches, it helps to ensure that no other relevant or significant variables are omitted. The literature review contributes the basis for developing a better theoretical framework to proceed with further exploration and hypothesis testing.

2.1.1 Singapore Stock Market (DV)

According to Ibrahim and Musah (2014), stock market refers to a place of the aggregation of buyers and sellers of shares or stocks. In addition, it acted as a major role by channelling the excess resources from surplus unit to deficit unit. Other than that, it allowed trading and issuing of bonds, stocks and other types of securities for the purpose of raising capital and expansion of businesses. However, stock returns refer to the rate of return of a stock market.

Singapore Straits Times Index (STI) is calculated by FTSE Russell, Singapore Press Holdings (SPH) and the Singapore Exchange (SGX). STI is also known as the main index and stock market indicator in Singapore. It provided general information and idea of the stock return of Singapore to investors. Other than this, STI provided a direction as well as tracked the market performance of top 30 and largest companies listed on Singapore Exchange (Bloomberg L.P, 2017). FTSE Russell also managed to create a wide series of index for the Singapore market. Those indices are useful for benchmarking and production of financial products including derivatives contracts (FTSE Russell, 2016).

There are some previous studies carried out by the researchers about the performance and development of Singapore stock market. For example, Sukcharoensin and Sukcharoensin (2013), they studied the development of stock market among ASEAN-5 by considering the four aspect of development. Those aspects of development included size, stability, access and efficiency. In overall, Singapore stock market had achieved a higher level of development and concluded that Singapore stock market is a well-developed equity market.

Singapore is recognised as one of the major and oldest international financial hub in the world. Their economy is closely related to foreign multinational investment. Singapore attracted large population investors from different foreign country due to political stability and good corporate governance. Other than this, Singapore as a major hub also acted as a price leader and major information provider in Asian market. It will lead to the fluctuation of Asia region's equity

market. Investors from different countries always put less attention on the information from Asian Countries except the news from Singapore market (Kung & Wong, 2009).

2.1.2 Malaysia Stock Market

Kuala Lumpur Composite Index (KLCI) plays role as the proxy of Malaysia's stock market index. KLCI is being used as main stock market index especially for those stock which listed in Bursa Malaysia Stock Exchange. Measurement of the stock market value is the main function of KLCI. Abd Karim and Gee (2008) reported that there was a substantial progress and development in the Bursa Malaysia Stock Exchange in both the market capitalisation and the numbers of companies listed over the year.

Click and Plummer (2005) declared that during ASEAN-5 countries came to a fruitfulness decision to constitute the Federation of ASEAN Stock Exchanges in 1978, there had a comfortable and smooth linkages between Singapore and Malaysia stock market. This statement can be proved as numerous organisations which were registered under Malaysia were involving international trade on the Stock Exchange of Singapore (SES).

Azizan and Sulong (2011) stated that Singapore stock market have a vital impact on variability of stock price in Malaysia. On the same time, Malaysia stock market quick to respond to the slightly changes of Singapore stock market. The increasing of stock price and bi-directional relationship being proved in the post Asian financial crisis, it is probably due to mutuality among neighbouring countries of member of Asia. Malaysia stock return ranked as the highest integration with Singapore stock return as comparing among member of ASEAN-5 (Karim & Karim, 2012). Tse and Tan (2001) pointed out that there still had a strong correlation relationship being hold by Singapore and Malaysia stock market. There were few factors that could support such as linkages of economic between Malaysia and Singapore, structural symmetry and close

proximity of geographic. Malaysia stock index (KLCI) which being influenced positively by Singapore stock index (STI) (Click & Plummer, 2005).

In conversely, Malaysia and Singapore stock market returns influenced each other weakly was recorded at the period of post-crisis (Lim, 2007). Yi and Tan (2009) depicted that the correlation between equity markets of Malaysia and Singapore in a very small portion by using data from MSCI Malaysia, MSCI Singapore and MSCI AC Far East index.

After taking past researches into account, most researches have the same view with hypothesis which stated that stock markets of Malaysia and Singapore are highly correlated. By contrast, there is only a few researches stating that there the stock markets of Malaysia and Singapore are weakly correlated. Stock market of Malaysia acts as one of the most influential stock market, facilitate and influence the Singapore stock market. Due to the close geographical distance between Singapore and Malaysia, the linkages and integration of stock market between these two countries will be always linked together.

2.1.3 Indonesia Stock Market

Jakarta Composite Index (JCI) is represented as an Indonesian stock market return. All stocks traded at Indonesia Stock Exchange (ISX) are included under the JCI Index. The JCI index act as the important indicator for investors to decide whether to buy or sell their stocks based on Indonesian stock market performance. Currently, there are more industries carrying out transactions on the Indonesia Stock Exchange (ISX) as the Indonesian industries grow rapidly and the index has reached over 4000 (Adam, Gubu & Cahyono, 2014).

One of the study that attempt to examine the relationship between the JCI and other selected markets as the researchers believe that Indonesia is a potential market. However, the result turned out to be that Indonesian stock market do not

have relationship between both Malaysia and the US stock markets (Beik & Wardhana, 2011). According to Roca et al. (1998), Indonesian stock market is not significantly linked to Singapore stock market in the long run and short run by using Granger Causality test. The result had explained that the Indonesian stock market is only significant with its own past price rather than other stock markets. By using the same method as Roca et al. (1998), the result proved that Indonesian stock market has no significant influence or long run relationship on Singapore stock market (Azman-Saini et al., 2002). Another study found that the Indonesian stock market do not have Granger-causal relationship with the other ASEAN stock markets in the short-run. The Indonesian stock market is independent from other ASEAN stock markets since Indonesians had experienced continuing political and economic uncertainties during the crisis period, which causes the international investors perceived it as a separate market from ASEAN (Shabri Abd. Majid, Kameel Mydin Meera, Azmi Omar, & Abdul Aziz, 2009).

By contrast, there are several empirical studies showing that Indonesian stock market return has a relationship with the other countries stock markets return. According to Royfaizal et al. (2009a), the results show that the Indonesian stock market has a unidirectional causal effect to U.S stock market by using Granger-causality test. Karim and Karim (2012) found that Singapore stock market has the highest correlation with the Indonesian stock market, which indicated that there is a short-term movement among markets. Furthermore, it will benefit investors to make short-term diversification or speculative activities. Another researcher had proved that the Indonesia stock market show closer linkages with Singapore stock market across the period as measured by the co-movement of the stock market returns (Ng, 2002). According to Janor and Ali (2007), there is a long-run relationship between Indonesian stock market and Singapore stock market determined by Cointegration test. Thao and Daly (2012) had examined the long run relationships between stock markets in the Southeast Asia region which include Indonesia and Singapore. The results proved that there is a correlation amongst the market indices. Therefore, the Indonesian stock market is expected to have positive relationship against Singapore stock market.

2.1.4 Thailand Stock Market

Stock Exchange of Thailand (SET) index is denoted as the equity market index of Thailand. All of the listed companies will use SET index as proxy index while undergo trading in Thailand stock market. SET index which emphasised two main components, which are current market value (CMV) and base market value (BMV), and compare these two components among all of the listed common stock.

Chancharat et al. (2008) found that in the period of both the pre- 1997 crisis and post-1997 crisis, relationship between Thailand stock market and Singapore stock market was positively related. Moreover, the stock market return of Singapore had influenced in a flash on Thailand stock market. There is a high correlation between Thai stock market returns and Singapore stock market returns during the period of post-1997 crisis (Karim & Karim, 2012).

Aumeboonsuke (2012) investigate the hypothesis of weak form efficiency among six stock market indices of the ASEAN and research demonstrated that during the period from 2001 to 2012, stock market of Thailand and Singapore have been enhanced efficiency of stock market, excluding other ASEAN member countries. After the period of 1997 financial crisis, Singapore and Thailand stock markets improved to more efficient (Kim & Shamsuddin, 2008).

By contrast, there is unfavourable relationship between Thai and Singapore stock market which indicate negative relationship between these two countries stock market. Click and Plummer (2005) examined the feasibility of stock market returns integration between five countries of ASEAN-5 and stated that there is negative correlation between Singapore and Thailand stock market. A one percent raise in stock market returns of Thailand collaborated with one percent drop in Singapore stock market returns.

Bidirectional Granger causality had been discovered between Thailand and Singapore stock market returns (Chancharat et al., 2008). In short run, the movement of stock returns of Thailand will be affected by stock returns performance in Singapore. On the same time, performance of stock returns in Singapore also will being influenced by Thailand stock returns.

There are more researches holding that there is positive correlation of stock market returns between Singapore and Thailand than researches which indicate negative relationship. During the financial crisis 1997, the floating or fluctuation of Thai baht had a greater impact on neighbour countries, Singapore was also impacted and resulted in depreciation of currency and posed small damage to Singapore stock market. In such cases, a positive relationship between Thailand and Singapore could be discovered.

2.1.5 Philippines Stock Market

The Philippines stock market return (Philippine Stock Exchange Index, PSEI) is the national stock exchange index in Philippines, which is the product of merging of the Manila Stock Exchange and Makati Stock Exchange. PSEI is the most effective indicators to determine Philippines market condition. The high potential of the Philippines economy is being recognised as the top 16 economies of the world. Thus, the stock market movement in Philippine has become important prediction or forecast to the international investors (Chen & Diaz, 2014).

There are a few studies found that the Philippines stock market is less correlated to the Singapore stock market. According to Karim and Karim (2012), the Philippines stock market is the lowest correlated market return among ASEAN markets against the Singapore stock market. The Singapore stock market is unaffected by the others stock markets, which include the Philippines, whereas the Singapore stock market is highly influenced to the Philippines (Phuan et al., 2009).

According to Ng (2002), Philippines stock market has a stronger linkage towards the Singapore stock market. This result is due to the reformation of the country and foreign investors are confident about investing in Philippines. Kabigting and Hapitan (2013) also found that the Philippines stock market have significant relationships with Indonesia, Singapore and Thailand which is examined by regression and co-integration model. The finding from Roca et al. (1998) found that there is a unidirectional causality linkage between Philippines and Singapore stock market, measured by Granger Causality test. These results occurred could be due to the Singapore has greater investment in the Philippines, but the Philippines does not do same as Singapore. Hence, the Philippines market would affect the Singapore stock market (Roca et al., 1998). In the contrast, Azman-Saini et al. (2002) found that there is a bidirectional causality between Philippines and Singapore. The Philippines stock markets have significant influence on the Singapore stock markets in the long run. The researcher's result is consistent with Azman-Saini et al. (2002) as there is some evidence of bidirectional relationship of the stock market between Philippine and Singapore (Thao & Daly, 2012). From past studies, majority of studies found that the Philippines stock market has significant relationship towards Singapore stock market. Hence, the result is expected to be consistent with the majority researchers.

2.2 Review of relevant theoretical models

2.2.1 International portfolio diversification

International portfolio diversification is one way of management of investment risk by allocation of investment portfolio which consist of a few types of international securities in different market. International portfolio diversification able to minimise the exposure of portfolio risk towards investors and increase the return. To diversify the portfolio risk efficiently, the changes of international

securities in different markets should be less than perfectly correlated. According to Hakeem, Tsoho and Dogara (2016), international portfolio theory was derived from the study of Modern Portfolio Theory.

International portfolio diversification works because the international monetary and capital market had become more integrated (Royfaizal et al., 2009b). The more integrated international money and capital market shows that the international financial markets are highly correlated and interdependent. Therefore, by analysing the integration of international stock market, international portfolio diversification able to help the investors to hedge the risk exposed and increase return. When the changes of stock price of securities in different market are less than perfectly correlated, the stock price will not move in exactly same direction thus diversification function (Siklos & Ng, 2001). The loss of investors in a security able to be covered by the gain from investing in other securities which the changes is move in opposite direction with the respective security thus the loss of the investor will be minimised or offset by the gain.

Royfaizal et al. (2009b) stated that the investors will be benefited from their portfolio investment if they obtain the knowledge of international portfolio diversification and the equity market linkages across countries. These knowledges enable the investors to allocate and manage their asset more intelligently and efficiently.

2.2.2 Modern Portfolio Theory

Modern Portfolio Theory is the theory introduced by Harry Markowitz in 1952. Modern Portfolio Theory stated that all investors are allowed to diversify their portfolio internationally to minimise the systematic risk level in portfolio to a level lower than the systematic risk in their home country (Bashiri & Zadeh, 2014). Markowitz (1952) stated that Modern Portfolio Theory examine the

relationship between beliefs and choice of portfolio by investors based on the "expected returns - variance of returns" rule geometrically.

The choice of portfolio is based on the level of risk and return. The investors select investment portfolio based on two rules which are maximise the discounted value of future returns and minimise the investment risk (Markowitz,1952). However, the maximum expected return portfolio not necessary comes with the minimum risk. Investors can minimise their portfolio risk by diversify it.

There are a few fundamental assumptions stated in Modern Portfolio Theory. First, Markowitz assume that all investors are seeking to formulate portfolio with maximum return and minimum risk. Second, if the expected returns are low, investors are not willing to accept portfolio with high level of risk. He also assumes that investors will receive all relevant and appropriate information which will affect their investment decision regularly in timely basis. Fourth, there are unlimited amount of capital allowed for the investors to borrow or lend at risk free rate of interest. Next, the financial markets also assume to be perfectly efficient and there are no transaction costs or taxes included in the market. Lastly, investors are possible to choose the securities whose individual performance is independent from another portfolio investment (Markowitz, 1952).

2.2.3 Asset pricing models

Asset pricing model is an important theory in the word of finance, given its significant role in the valuation of a financial asset. The purpose of asset pricing model is to determine required rate of return of investor on a financial asset, taking into account the risk-return component.

Asset pricing models can be classified into a few main categories. The first category assumes perfect integration of world capital markets and that risk of an

asset can be purely associated with the covariance of local returns in the world market portfolio (Chen, 2012). Some models that exemplify this category of asset pricing theories are the international capital asset pricing model (ICAPM) and the international arbitrage pricing model. There are also asset pricing models on another extreme category, which assume perfect segmentation of a market from the world market. In other words, the market can serve as an adequate proxy to the world market (Chen, 2012).

2.2.3.1 International capital asset pricing model

The theory of international capital asset pricing model (ICAPM) was an extension to the capital asset pricing model to include factors that may affect required rate of return and overcome some unrealistic assumptions of the original CAPM. The CAPM assumes no exchange risk hedge incentive to investors because every consumer in a country translates investment return into consumption like everyone else in the world, meaning that the investor diversity was ignored (Dumas, 1994).

On the other hand, the ICAPM can account for stochastic inflation of countries and deviations from the principle of purchasing power parity, assuming a constant investment opportunity set (Stulz, 1995). This theory acknowledges the fact that cross-border investment is subjected to the following two exposures, namely the sensitivity of a nation's index to a global portfolio and the exchange rate of the nation's currency relative to another currency (Fernandez, 2005). The ICAPM, therefore, can predict the required rate of return by considering both market risk and exchange rate risk.

Based on generalisations done by Sercu (1980), the ICAPM can be generally expressed in the following terms, taking into account the foreign currency exchange rate exposure:

$$\mathbf{E(R_i) = R_f + \beta_1(R_m - R_f) + \beta_2(R_{FC})},$$

where $\mathbf{E(R_i)}$ = Expected rate of return.

$\mathbf{R_f}$ = Risk-free rate in domestic market.

$\boldsymbol{\beta_1}$ = Beta accounting for systematic risk in the market.

$\mathbf{R_m - R_f}$ = Risk premium for global market measured in terms of investor's local currency.

$\boldsymbol{\beta_1}$ = Beta accounting for systematic risk in foreign currency exchange.

$\mathbf{R_{FC}}$ = Risk premium for foreign currency exchange.

There were a few assumptions underlying the model, namely joint log-normal distribution of asset price and exchange rate; presence of single consumption good or a common basket of consumption goods; continuous and costless trading of consumption goods; absence of transaction costs, tariffs, transportation costs, taxes or other barriers to investment trading; risk-averse investors as price takers (Stulz, 1995).

Past literatures had been testing on the validity of the ICAPM in predicting international investors' required rate of return. Engel and Rodrigues (1989) have rejected the ICAPM. De Santis (2010) found that the ICAPM only partially correct in predicting the return and that the ICAPM only partially influence the geography of an international portfolio held by an investor. However, the ICAPM demonstrated superiority to CAPM in predicting the required return of international portfolio. In his study, Dumas (1994) found that while classical CAPM was rejected using business cycle indicators as instrumental variables, the ICAPM holds.

Given the limitations of the ICAPM, many authors attempted to derive or improve the original ICAPM (Arouri, Nguyen, & Pukthuanthong, 2012; Lauterbach & Reisman, 2004).

2.2.3.2 International arbitrage pricing model

The international arbitrage pricing model, similar to that of the ICAPM, accounts for the differences in investor consumption preferences across borders, however, the international arbitrage pricing theory does not require the portfolio of the original assets to be a factor of the model (Solnik, 1982). As such, the technical limitation caused by aggregation and currency exchange will not be present when an international arbitrage pricing model is applied.

Subsequent literatures recorded effort to improve the applicability of the international arbitrage pricing model. For example, while the international arbitrage pricing model proposed by Solnik (1982) assumed fluctuation in currency had the same factor structure as the return of assets, it can be improved in a way that it accounts for the exchange rate risks that may affect international portfolio returns (Ikeda, 1991).

Some literatures had tested the feasibility of the international asset pricing theory in predicting the international returns. The study carried out by Cho, Eun and Senbet (1986) had turned out to reject the international arbitrage pricing model but did not rule out the possibility that the international arbitrage pricing theory may hold true for a regionally integrated capital market. Bansal, Hsieh and Viswanathan (1993) made a comparison between linear, conditional linear and nonlinear international arbitrage pricing models and found that only the nonlinear arbitrage pricing model can adequately explain the behaviour for cross-sectional international returns.

2.2.4 Law of One Price

Moffett, Stonehill and Eiteman (2011) stated that Law of One Price refer to the fact that for similar products, the price should be same even the product was sold in different markets, different countries and different currencies provided there were no restrictions existed and transaction cost incurred. Lee and Goh

(2016) also define Law of One Price as the valuation of similar securities should be the same if the securities have the same risk characteristics even they trade in different markets in different countries.

If Law of One Price holds, the Purchasing Power Parity exchange rate can be obtained from the relative prices of identical products in different markets and different currencies and the spot exchange rate when the markets are efficient.

The formula is as follows:

$$\mathbf{P_a = P_b * S}$$

Where:

$\mathbf{P_a}$ = Price of product in country A

$\mathbf{P_b}$ = Price of product in country B

S = Spot exchange rate

The principle of Law of One Price is the prices of products in different markets will move to the equilibrium if no restrictions exists and transaction costs incur and thus the competitive market exist (Moffett et al., 2011). When the Law of One Price not holds, arbitrage profits will exist. However, after the arbitrager taken the arbitrage actions, the price differences will the eliminated then equilibrium of price achieved provided that the markets are efficient and no restrictions and transaction costs exist. The stock markets are proved to be integrated if the prices of shares in different markets show the common equilibrium path in long run (Lee & Goh, 2016). The investors may make a better and more efficient investment decision based on the integration of markets.

2.2.5 Efficient Market Hypothesis

Efficient Market Hypothesis (EMH) stated that a capital market is said to be liquid and efficient when the participants in the market are exposed to all

available information and the stock price responded and fluctuated rapidly when any new information announced (Reily & Keith, 2012). EMH theory is developed by Professor Eugene Fama during 1970. Kelikume (2016) further explain that in an efficient capital market, moral hazard problem such as asymmetric information will not exist. Every capital market participant should have equal rights to ensure that they are provided with the latest and most updated information at the same time.

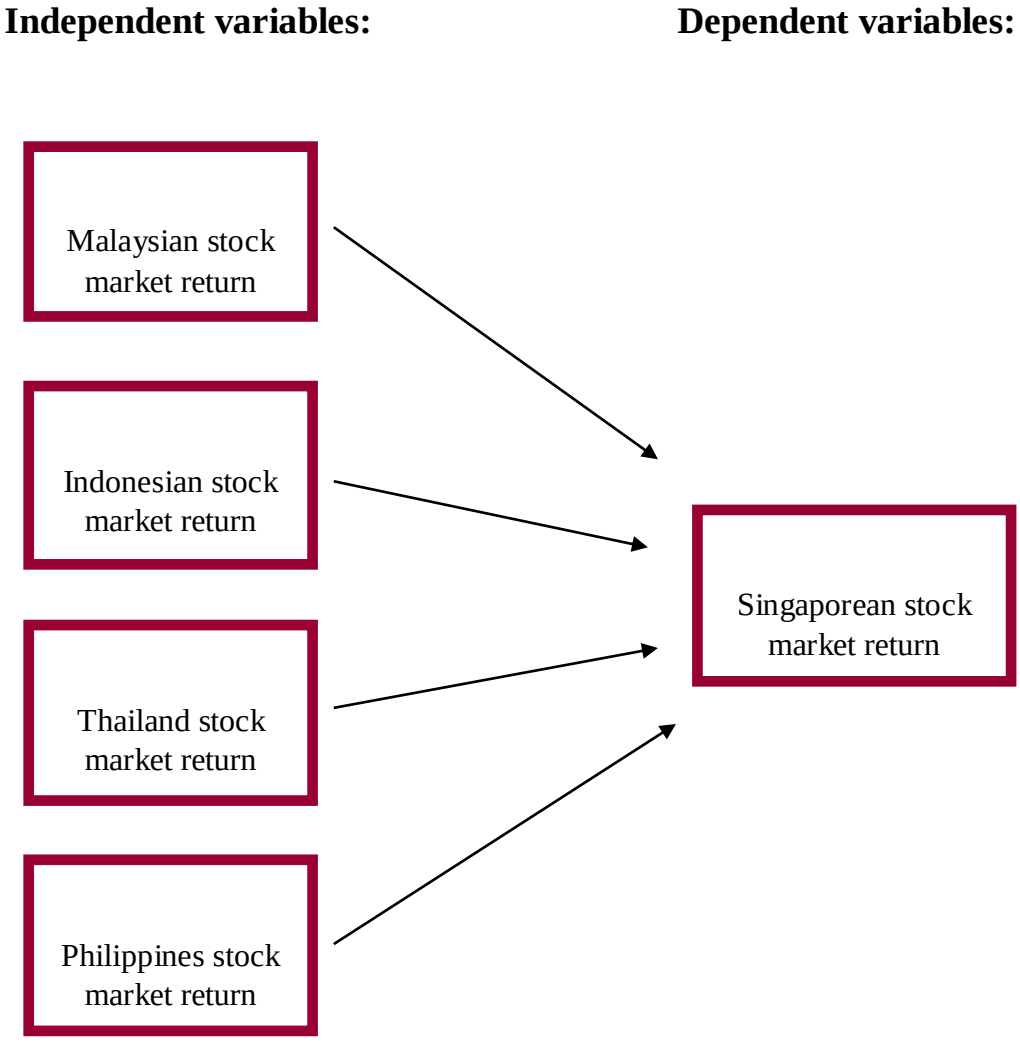
According to Bisen and Pandey (2013), efficient market provides all available information to the investors create an efficient way for the investors to analyse the movement of asset price reflect and thus forecast and make a investment decision based on the information obtained in efficient capital market. However, Soon, Baharumshah and Chan (2015) suggested that if market efficiency exists, the price of an asset is unpredictable since it change rapidly.

According to Reily and Keith (2012), Professor Fama had divided the EMH to three sub-hypotheses based on the degree of information exposed to the investors. Three sub-hypotheses include weak form EMH, semi-strong form EMH and strong form EMH.

Weak form EMH stated that the asset price only reflects the past or historical information in the capital market. Future movement of an asset price cannot be predicted in weak form EMH. On the other hand, semi-strong form EMH refer to the asset price affected by all current and publicly material information in the capital market. An arbitrage profit will exist in the capital market under the condition of weak form EMH and semi-strong form EMH (Bisen & Pandey ,2013). The asset prices are affected rapidly by all public and private material information under the strong form EMH theory. A capital market under the condition of strong form EMH is consider as an efficient market which asymmetric of information will not occur and that arbitrage profit opportunity is not possible (Bisen & Pandey ,2013).

2.3 Theoretical framework

Figure 2.3: Theoretical framework



The figure above illustrates the basic framework demonstrating the relationship between Singaporean stock market returns and the independent variables selected. It was proposed that the Singapore stock market return (STI) has either unilateral or bilateral relationship with stock market returns of Malaysia (KLCI), Indonesia (JCI), Thailand (SET) and Philippines (PSEi).

The dependent variable is expected to be influenced by the independent variables. This research project determines the relationship by using monthly data for stock market returns for the time period from January 2005 to December 2016.

2.4 Conclusion

This chapter has discussed the relationship of the Singapore stock market return and the stock markets return of other ASEAN-5 countries literally based the previous studies. Most of the studies stated that the Singapore stock market is integrated with the others stock markets. Some relevant theoretical models also discussed in this chapter to support our study. Next, theoretical framework has showed a clearer picture of the relationship between the dependent variable and independent variables.

CHAPTER 3: METHODOLOGY

3.0 Introduction

This chapter discusses the overview of research methodology. Research design, data collection methods, sampling design, data processing and data analysis will be included in this chapter. This research project is trying to study the interrelationship between the ASEAN-5 countries stock market return, including Singapore, Malaysia, Thailand, Philippines and Indonesia. This research project also studies how the stock markets of these countries affected Singapore stock market return. Singapore stock market return act as dependent variable while other countries as independent variables in this research project. All the data from January 2005 to December 2016 were obtained from Bloomberg Terminal.

3.1 Research Design

In this research project, quantitative study is carried out in order to conduct the objective of the research project. According to Muijs (2010), quantitative study is a social research that is used to identify the problems by collecting data in which the data can transform into numbers or statistics. In other words, it is a statement which is expressed in numerical terms. Other than that, it also can generalise results from large sample population and the method of data collection is more structured. Quantitative study also focuses in testing a specific hypothesis and make prediction based on the cause and effect (Sukamolson, 2010). For further investigation, E-views 8 is applied and needed in this research project to compute the variables data into empirical results. The variables data is collected from Bloomberg Terminal of University Tunku Abdul Rahman (UTAR).

3.2 Data collection methods

All the variables in this research project were secondary data obtained from Bloomberg Terminal provided by the main library of Universiti Tunku Abdul Rahman (UTAR) Kampar campus. The Bloomberg Terminal can provide information about the historical prices of stock market indices selected as proxies for stock market prices for the purpose to this project. The stock market indices in which data were retrieved include Singapore Straits Time Index (STI), Malaysia Kuala Lumpur Composite Index (KLCI), Indonesia Jakarta Composite Index (JCI), Stock Exchange of Thailand index (SET), and Philippines Stock Exchange index (PSEi).

3.2.1 Secondary data

As mentioned in the previous section, secondary data was the preferred data source for this research project. Tasic and Feruh (2012) defined secondary data as a type of data collected by a party for their own purpose, in which can serve a useful purpose to other researches as well. Nevertheless, secondary data can also be collected for no specific research purposes (Sorensen, Sabroe & Olsen, 1996). For example, governmental agencies could collect certain data to fulfil multiple objectives like management and planning; controlling; monitoring; and research.

There are advantages in using a secondary data in an analysis. Firstly, it is less time consuming and less expensive (Rew, Koniak-Griffin, Lewis, Miles & O'Sullivan, 2000). It is time consuming for a researcher to collect data in which is difficult to get, especially when there is limited resource to approach a large random sample. Besides, the secondary data can be advantageous in terms of sample size and reduced tendency to bias (Sorensen et al., 1996). Nonetheless, the use of secondary data in a research analysis has its drawback. A researcher has no control over the selection, quality and the methodology of data collection (Rew et al., 2000).

This research project collects data from for all variables on a monthly basis from January 2005 to December 2016. The details for the data collected are summarised in tabular form as below.

Table 3.2.1 Sources of data

	Variable	Proxy	Unit of measurement	Formula	Source
Dependent variable	Singapore stock market return	STI index return	Index	$\frac{P_1 - P_0}{P_0}$	Bloomberg Terminal
Independent variables	Malaysia stock market return	KLCI index return	Index	$\frac{P_1 - P_0}{P_0}$	Bloomberg Terminal
	Indonesia stock market return	JCI index return	Index	$\frac{P_1 - P_0}{P_0}$	Bloomberg Terminal
	Thailand stock market return	SET index return	Index	$\frac{P_1 - P_0}{P_0}$	Bloomberg Terminal
	Philippines stock market return	PSEi index return	Index	$\frac{P_1 - P_0}{P_0}$	Bloomberg Terminal

Apart from the abovementioned data collection, this research project also referred to other sources such as journals, articles and textbooks for additional reference. These additional references can act as a guidance in producing a more precise analysis of the data.

3.3 Sampling Design

3.3.1 Target Population

3.3.1.1 Singapore

Investigation on the integration between stock market return of Singapore with stock markets return of remaining four ASEAN-5 countries is the objective of this research project. In other words, this research project target on whether the dependent variable which is Singapore stock market performance will be affected by independent variables which included the others four ASEAN-5 countries (Malaysia, Indonesia, Thailand and Philippines) stock markets performance. This research project using the 12-year time series data which is from January 2005 to December 2016 and the data used is in monthly basis. The Straits Times Index (STI) is chosen as proxy to Singapore's stock market performance. STI index acts as the market barometer and benchmark index in Singapore stock market. STI index is capitalisation-weight index which capture the performance of top 30 most liquid and public listed companies in Singapore Exchange. Therefore, STI index is the index which is suitable to proxy the Singapore stock market performance.

3.3.1.2 Malaysia

To determine the integration between the Singapore stock market return and Malaysia stock market return is one of the goal of this research project. According to that, this research project focus on how the Singapore stock market returns (as independent variable) is being influenced by Malaysia stock market performances (as dependent variable). 12 years monthly time series data which from January 2005 to December 2016 is used in undergoing this research project. Kuala Lumpur Stock Exchange (KLCI) as stock market indices of

Malaysia is selected to measure the performance of Malaysia stock market while Straits Time Index (STI) as proxy of Singapore stock market returns. As a major stock market index, the FTSE Bursa Malaysia KLCI Index (Kuala Lumpur Composite) traces the 30 of largest companies' stock market performance with full market capitalisation recorded on the Bursa Malaysia's Main Board. Thus, KLCI index can be ranked as top index which is most appropriate as base index of Malaysia.

3.3.1.3 Indonesia

This research project targets on the interrelationship between stock market returns between Singapore and Indonesia. The aim of the research project is to investigate whether independent variable, Indonesia stock market performance will affect dependent variable, Singapore stock market and the significance of the effect from January 2005 to December 2016. A monthly data is used to conduct this research project. The stock market performance are proxy using the stock index value. Indonesia stock market performance is proxy using Jakarta Stock Exchange Composite Index (JCI) and Singapore stock market performance is proxy using Straits Time Index(STI). JCI index is the capitalisation-weighted index which capture the performance of all stock of the company listed in Indonesia Stock Exchange. Therefore, JCI also acts as the benchmark index and market barometer of the Indonesia stock market and this index is reliable to use to proxy the stock market performance of Indonesia.

3.3.1.4 Thailand

The aim of this research project is focus on the connection of the stock market performances between two countries, which are Singapore and Thailand. This research project is carried out to verify whether the dependent variables, Singapore stock market returns, will be influenced by Thailand stock market returns which act as independent variable. A monthly time series data which

consists of 12 years from January 2005 to December 2016 is being chose to go through this research project. The Stock Exchange of Thailand (SET) Index and Singapore Straits Time Index (STI) are selected as proxies of stock market returns for Thailand and Singapore respectively. SET acts as vital roles as stock market index of Thailand as SET index will dispute the comparison between all listed common stocks current market value (CMV) with their base market value (BMV). Therefore, the most suitable index to measure stock market performance of Thailand will belong to SET.

3.3.1.5 Philippines

The research project purpose is to find out whether the Philippines stock market return will have significant impact to Singapore stock market return from January 2005 to December 2016. This research project aims to determine the relationship between dependent variable which is Singapore Straits Time Index (STI) and the chosen independent variable which is Philippines Stock Exchange index (PSEi) from the year 2005 to 2016. Philippines Stock Exchange index (PSEi) act as a benchmark to determine the Philippines market performance. It is a capitalisation-weight index that make up of stock representative of the Industrial, Properties, Services, Holding Firms, Financial and Mining & Oil Sector of Philippine Stock Exchange. In other words, it comprises of 30 listed company which represent the general movement of stock market in Philippines. These listed companies must fulfil the standards under the revised policy which is the minimum free-float level must be 12%, it must be rated among the top 25% in terms of median daily value, and the ranking of Top 30 qualified companies from full market capitalisation. Hence, the PSEi has become an essential indicator for local and international investor to construct a decision or plan in portfolio (Chen & Diaz, 2014). The data is in monthly basis in order to conduct this research project.

3.3.2 E-views 8

E-views 8 will be used in this research project for the purpose of running all the hypothesis testing and diagnostic checking. E-Views 8 is a statistical software package that is useful for researchers to conduct study for data analysis, regression and forecasting. E-views 8 provides many efficient tools for researchers such as useful data management, econometric analysis tools, and high-quality graphical and tabular output. Moreover, it is able to support Microsoft Excel file. As E-Views 8 was created by economists and most of its function are in economics, it is used for time series data, cross-section or longitudinal data. E-Views 8 is a useful software since it is designed with convenient and consumer-oriented technology and easy-to-use interface (Van den Bossche, 2011).

On top of that, E-views 8 is the most suitable software as it supports the handing of time series data and complex date which is important and useful for this research project. E-views 8 will be used to find out whether there is any econometric problem such as Multicollinearity, Heteroscedasticity, Autocorrelation, Model Specification and Normality Test. In addition, the econometric problem can be solved by using the appropriate remedial test. The unit root test will be used to determine the stationary of the model. Furthermore, E-views 8 will be used to run the Johansen Co-integration test and Granger Causality test as well. Moreover, the Multiple Linear Regression Model will also be run by using this software to test the relationship between these variables. E-views 8 is used to test Ordinary Least Square (OLS) model given that the OLS method is one of its functions. The T-test and F-test from the result of OLS can be used to examine the significance of the model.

3.4 Data processing

Literature review was carried out on a minimum of 40 journals related to the title of this research project, which is 'The Linkage between Stock Market Returns of Singapore and other ASEAN-5 Countries'. A summary was done so that analysis can be conducted more efficiently on the findings and results of the journals reviewed. The next step was data collection whereby data was retrieved from the Bloomberg terminal for monthly closing prices for STI, KLCI, JCI, SET and PSEi from January 2005 to December 2016.

Then, the raw data underwent processing using Microsoft Excel to calculate the return and transform the returns into logarithmic form. Quigley and Ramsey (2008) pointed out that log returns tend to show normal distribution than simple returns. This is important since normality assumption is required in following empirical deductions. The transformation undergone by the data are as follows

$$R = \frac{P_1 - P_0}{P_0}$$

where R = stock market return

P_0 = initial price

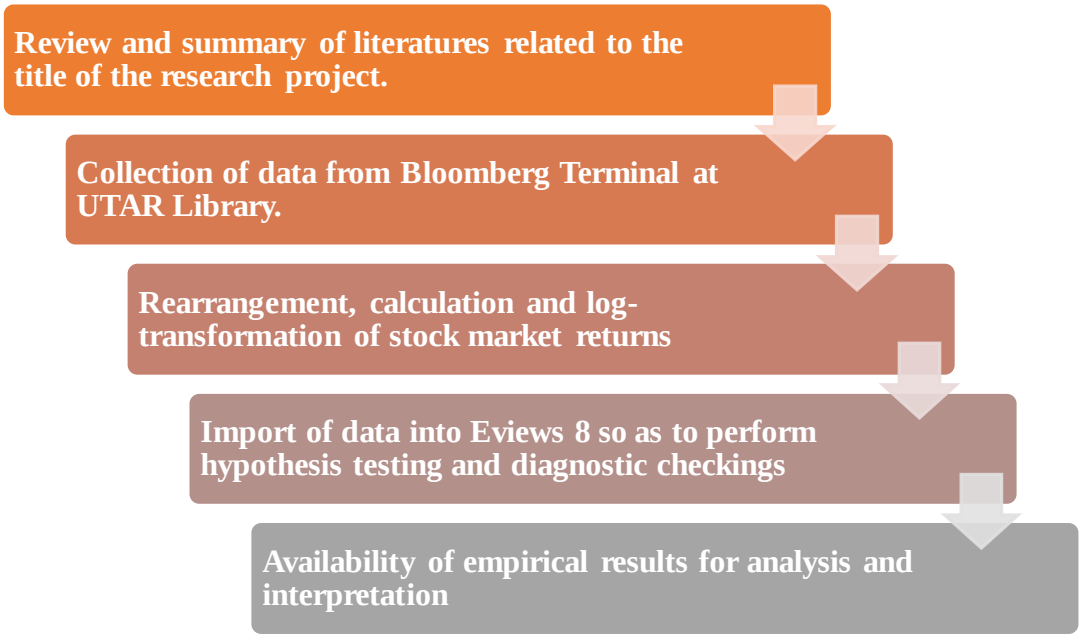
P_1 = final price

Logarithmic transformation of stock market return is given by:

$$\begin{aligned} \text{log return} &= \log(P_1) - \log(P_0) \\ &= \log(P_1/P_0) \\ &= \log\left(1+\frac{P_1 - P_0}{P_0}\right) \\ &= \log(1+R) \end{aligned}$$

The processed data was then imported to Eviews 8 for further empirical results. Finally, econometrical analysis can be carried out after the empirical results for hypothesis testing and diagnostic checking were obtained from Eviews 8.

Figure 3.4: Diagram of data processing flow



3.5 Data Analysis

3.5.1 Diagnostic checking

3.5.1.1 Multicollinearity

Multicollinearity problem exists when there are some independent variables highly correlated to one another in a multiple regression model (Farrar & Glauber, 1967). The model that consists of multicollinearity problem will lead to misleading results and it will be challenging to find out which independent variables affect the dependent variables (Vatcheva, Lee, McCormick, & Rahbar, 2016).

The high multicollinearity will encounter several problems in this model (Gujarati & Porter, 2009). Firstly, it will cause a wider confidence interval which result in likely to accept the "zero null hypothesis". Secondly, it will have large variances and covariances of Ordinary Least Square (OLS) estimators even the OLS estimators are still Best, Linear, Unbiased and Efficient (BLUE). It will make the precise estimation difficult. Thirdly, as the confident intervals become wider which lead to the t-ratio of the coefficients tends to be insignificant. In addition, R-square, the overall measure of goodness of fit in this model will be high which will lead to invalid hypothesis testing. However, the OLS estimators will remain (BLUE) because the collinearity will not influence the OLS property and assumptions.

Unfortunately, there is no standard way to detect multicollinearity problem in a model. However, there are some rules of thumb to find out the existence of multicollinearity problems (Farrar & Glauber, 1967). Firstly, the high "R-squared" but few significant of t-ratios can detect the existence of multicollinearity in the model. Secondly, another suggested rule of thumb is the high pair-wise correlation coefficients between independent variable which able

to detect multicollinearity problem. Thirdly, multicollinearity can be detected by the variance inflation factor (VIF) method. Based on the rule of thumb, if the VIF of the variable is more than 10 or the R-square is more than 0.90, it can be concluded that the variable is highly collinear. Lastly, the tolerance method (TOL) is also one of the indicators to detect multicollinearity. The chance of having multicollinearity problem is high, if the TOL is nearest to the zero.

The following shows the formula for VIF and TOL:

$$VIF_j = \frac{1}{1-R_j^2} \qquad TOL_j = \frac{1}{VIF_j}$$

According to Gujarati and Porter (2009), the most common way to solve multicollinearity problem in the model is to identify the collinear independent variables and remove all collinear variables until there is left one remaining. When the model detected multicollinearity, one of the common ways is to drop one of the variable from the model. Another method to measure multicollinearity problem is increasing the sample size of the model. Furthermore, it is possible to reduce the multicollinearity by adding new data in a model that consist of the same variable collinearity that may not be so serious as in the previous model. The transformation of variables able to reduce the collinearity in the original variable.

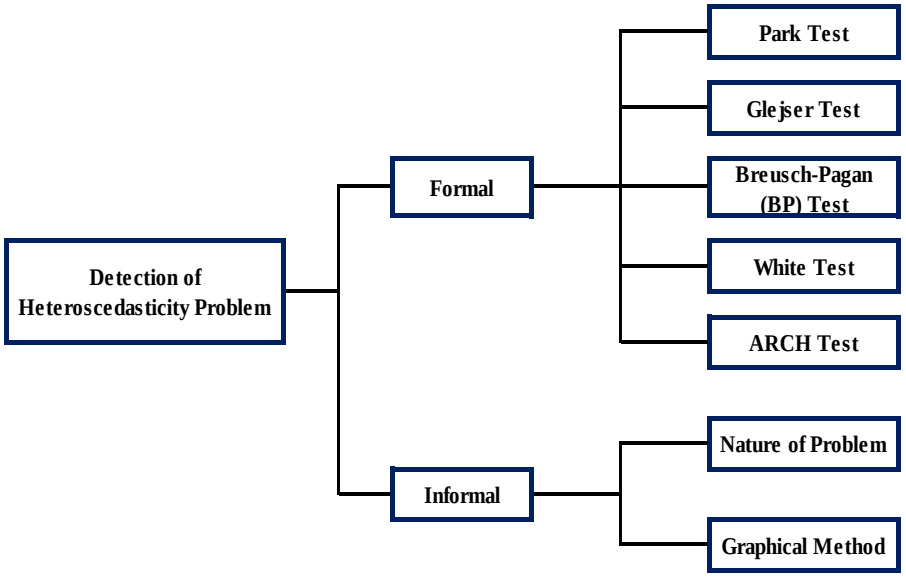
3.5.1.2 Heteroscedasticity

The Heteroscedasticity problem can be referred to the non-constant variances of the error term in the model (William, 2002). Classic Linear Regression Model assumes that the disturbance should have a constant variance independent of observations. Nevertheless, the variance of the error is no longer assumed to be constant when the unequal spread of variance exists. There are a few reasons why the heteroscedasticity problem occurred such as human behaviour, different data collecting techniques, outliers, misspecification of models and incorrect functional form (Gujarati & Porter, 2009).

According to Long and Ervin (2000) the heteroscedasticity problem exists in the model will have three consequences on OLS estimators. First, OLS estimators still can be considered as unbiased and consistent, even though there is a heteroscedasticity problem because the independent variables are uncorrelated with the error terms. Second, the variance of the estimators is higher, therefore it will lead to inefficiency of OLS estimators. Thirdly, the variances and standard errors will be underestimated. Hence, confidence intervals and hypothesis test based on t-statistics and F-statistic are unreliable due to misleading of conclusion.

There are several methods to detect heteroscedasticity in the model. According to Michael (2015), the detection of heteroscedasticity problem can be examined in two approaches, categorised as formal approach and informal approach. Informal approach refers to the graphical method whereas the formal approach refers to the ARCH test, White test, Breusch-Pagan-Godfrey test, Glesjer test and Park test. ARCH test which can only be applied to detect heteroscedasticity problem in time series data was developed by Engle (1982).

Figure 3.5.1.2: Detection of Heteroscedasticity Problem



There are two remedial measures for heteroscedasticity problem in the model (Long & Ervin, 2000). First, the model can be re-estimated by applying the Generalised Least Squares method and produce a new set of parameter estimates which would be more efficient than the OLS ones. The estimators obtain by new set model become BLUE by dividing standard deviation of error term. Secondly, the White's Heteroscedasticity can be used when the error variance for observations is unknown.

The following is the hypotheses for ARCH test:

H_0 : There is no heteroscedasticity problem.

H_1 : There is heteroscedasticity problem.

Based on the decision rule, if the value of probability is less than significant level which is $\alpha = 0.01$, the H_0 can be rejected. Otherwise, H_0 cannot be rejected.

3.5.1.3 Autocorrelation

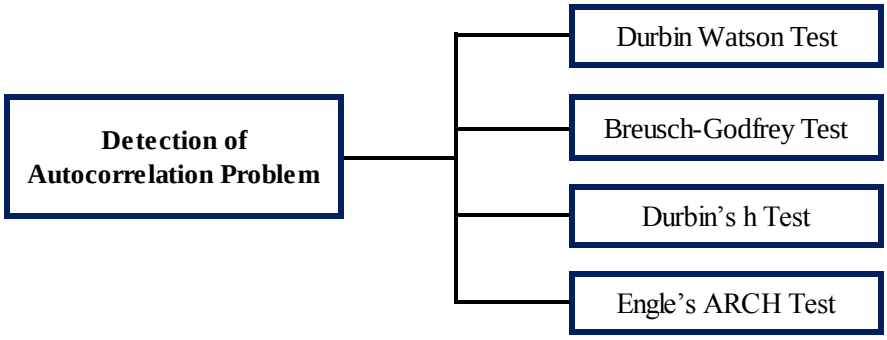
Gujarati and Porter (2009) argued that autocorrelation problem can be explained that the random variable, ordered over time that show nonzero covariance, the problem may be occurred in the model. It can be explained as there is a relationship among error terms. Besides, a model that occurs the autocorrelation problem is the violation of CLRM's assumption. There are several consequences if autocorrelation problem happened in a model (Greene, 2003).

a) OLS Estimators are still unbiased and linear. However, minimum variance property is not satisfied.
b) Confidence intervals and hypothesis test based on t and F distributions are unreliable. There is a possibility of drawing wrong conclusion which lead to the hypothesis testing invalid.
c) If the disturbance terms, u_i are autocorrelated then the OLS estimate are non-asymptotic. The variance of random term is may be seriously underestimated.
d) The presence of autocorrelation in the model may due to dependencies within the data.

Pure serial correlation and impure serial correlation are the two types of autocorrelation. The pure autocorrelation exists in the model because of the underlying distribution of the error term of the true specification of an equation (passed Model Specification Ramsey Reset Test). The model that suffered for the impure autocorrelation problem is due to the specification bias like an incorrect functional form and omitted variables (Gujarati & Porter, 2009).

According to Gujarati and Peter (2009), there are a few ways to detect auto correlation problems in the model which are Durbin-Watson test, Breusch-Godfrey LM test Durbin's h test and Engle's ARCH test. These tests are listed below:

Figure 3.5.1.3: Detection of Autocorrelation Problem



There are remedies that can be used to overcome the autocorrelation problem. Firstly, if the model is pure autocorrelation and it is not the result of misspecification of the model. The most common way is using appropriate transformation of the original model to eliminate the problem of (pure) autocorrelation in the transformed mode. Secondly, the Newey-West method can be applied for large samples in order to obtain autocorrelation-corrected standard errors of OLS estimators. Thirdly, if the model is incorrectly specified, the way to solve or minimise the impure autocorrelation problem is adding the relevant independent variables that play an important role to dependent variable. This helps the model to become a less serious problem in autocorrelation as well as heteroscedasticity because it would be better to include more independent variables than omitted the important independent variables as it will lead to serious problems (Pollitt, Reece, Mideo, Nussey & Colegrave, 2012).

This following specifies the hypotheses for the test:

H_0 : There is no autocorrelation problem.

H_1 : There is autocorrelation problem.

According to decision rule, H_0 can be rejected if the significant value, $\alpha = 0.01$ is greater than the probability value. Otherwise, the H_0 cannot be rejected.

3.5.1.4 Model Specification

There is various type of model specification errors whereby a model has meet any of the combination of the conditions such as the omission of a relevant variable, addition of irrelevant variables, wrong functional form and errors of measurement bias in the model (Gujarati & Porter, 2009). Sometimes it will be difficult to collect all important data on variables which is significant to explain the model. Hence, it will result in model specification bias happened in the model.

There are a few consequences if existing of autocorrelation problem. Firstly, the OLS estimators become biased and inconsistent if both of the omitted variable and included variable is correlated with each other. Secondly, the disturbance variance of estimators also incorrectly estimated and resulted in the hypothesis testing and confidence interval become unreliable. Thirdly, the omitted relevant variables will come after than including of irrelevant variables. However, another problem will arise if including irrelevant variables such as loss of efficiency of estimators, loss of degree of freedom and the problem of multicollinearity.

In order to detect whether there is a model specification problem in the model, Ramsey Reset Test which designed by Ramsey can be used to examine the stability of specification error. According to Wooldridge (2013), RESET is referred as Regression Specification Error Test, and it is used to test whether the non-linear combinations of the fitted values help to explain the response variable.

The remedies for model specification problem are often not easy. Theoretically, the use of instrumental or proxy variables can be attractive. However, it will not always practical. Therefore, it is important to state the sources of research data, how the data were collected and what definitions were used.

The following are the stated hypotheses for RESET test:

H_0 : The model is correctly specified.

H_1 : The model is not correctly specified.

Based on the decision rule, if the probability value is less than significant level, $\alpha = 0.01$, the H_0 can be rejected. Otherwise, do not reject the H_0.

3.5.1.5 Normality Test

A normality test is to determine whether a sample data is drawn from a normal distributed population (Ul-Islam, 2011). Since there are a number of statistical procedures such as regression, correlation, t test, one-way and two-way ANOVA test required the assumption of normally distributed of error term in order to ensure the test is reliable. Thus, the normality test is considered vital and should be taken seriously.

There are several tests can be used to test for normality, one of the most popular normality test is Jarque-Bera (JB) test. The JB test also known as goodness-of-fit test which highlights two derivatives which are skewness and kurtosis estimates (Jarque & Bera, 1987).

The formula for Jarque-Bera (JB) test-statistic is provided as below:

$$JB=n\left[\frac{S^2}{6}+\frac{(K-3)^2}{24}\right]$$

Where,

n = Sample Size

S = Skewness

K= Kurtosis

The Jarque-Bera (JB) Test hypotheses is shown as below:

H_0 : Error terms are normally distributed.

H_1 : Error terms are not normally distributed.

According to decision rule, if the significant level, $\alpha = 0.01$ is greater than the probability value, the H_0 will be rejected. Otherwise, H_0 cannot be rejected.

3.5.2 Multiple Linear Regression Model

Tranmer and Elliot (2008) stated that Multiple Linear Regression is a statistical tool to examine or predict a set of independent variables related to a dependent variable. In order to predict the relationship or impact on dependent variable, output and informations of a set of estimated independent variables is needed. Gujarati (2004) stated a few assumptions that need to fulfil.

1. Linear regression model
2. Fixed *X* values or *X* values independent of the error term
3. Zero mean value of the disturbance
4. Homoscedasticity
5. No autocorrelation between the disturbances
6. The number of observations (*n*) must be larger than the number of parameters (*k*)
7. The nature of *X* variables
8. No specification bias
9. No exact co-linearity between the *X* variables

The model is said to be BLUE if the assumptions above hold where the estimators in linear form, expected value close or equal to the true value and the model has minimum variance.

The Economic Function:
logSING = f[Malaysia(MAL), Thailand(THAI), Philipines(PHI), Indonesia(IND)].

Economic Model in Logarithm Form:

$$\mathbf{Y_t = \beta_0 + \beta_1 X_t + \beta_2 X_t + \beta_3 X_t + \beta_4 X_t + \varepsilon_t}$$

$$\mathbf{logSING_t = \beta_0 + \beta_1\ logMAL + \beta_2\ logTHAI + \beta_3\ logPHI + \beta_4\ logIND + \varepsilon_t}$$

Where:

$\mathbf{logSING_t}$ = the logarithm form of Singapore stock market return (SING) at year t.

$\mathbf{logMAL_t}$ = the logarithm form of Malaysia stock market return (MAL) at year t.

$\mathbf{logTHAI_t}$ = the logarithm form of Thailand stock market return (THAI) at year t.

$\mathbf{logPHI_t}$ = the logarithm form of Philippines stock market return (PHI) at year t.

$\mathbf{logIND_t}$ = the logarithm form of Indonesia stock market return (IND) at year t.

$\boldsymbol{\varepsilon_t}$ = Error term

3.5.3 Ordinary Least Square (OLS)

According to Gujarati (2004), the method of ordinary least squares (OLS) or linear least square is credited by Carl Friedrich Gauss in late 1700's. It is a measuring tool that is used for estimate the unknown parameters in linear regression model. In addition, according to Craven and Islam (2011) the OLS is one of the simplest and major techniques that used to analyse data and form Generalised Linear Models, Analysis of Variance (ANOVA) and many other techniques. OLS also used to analyse data that useful for classification and hypothesis testing. Other than that, OLS regression is one of the most powerful regression analysis as it able to traced the model assumptions easily. Those model assumptions including the constant variance, the effect of outliers using simple graphical methods and linearity.

However according to Gujarati (2004), there are 7 assumptions must be satisfied in order to compute the OLS estimator.

1. The regression model is linear in the parameters.
2. Fixed X values or X values independent of the error term.
3. Disturbance has a zero mean value.
4. Homoscedasticity
5. There is absence of autocorrelation between disturbances.
6. The nature of X variables.
7. The number of observation (n) have to be greater than the number of parameter to be measured.

If the OLS meet the above assumptions, it will provide a minimum variation of unbiased estimation.

3.5.3.1 T-test

In 1908, T-statistic had been introduced by William Sealy Gosset (Box, 1987). Commonly, T-statistic could be applied appropriately when sample size is small which less than 30 and the number of parameter is less or equal to 5. A T-test will show significance of a single variable. Besides, the statistic also needs to assume that the error term follows the normally distributed but it is unable to check the overall significant of the model (Massey & Miller, 2006).

This research project used this statistic to examine whether the independent variables which including Malaysia, Indonesia, Thailand, Philippines stock market returns have individually significant impact on the dependant variable, which is Singapore stock market return. In order to conduct the T-test, this research project will use E-view 8. By using E-view 8, each parameter's p-values can be obtained from the output.

The following gives the hypotheses for T-test:

H_0 : $\beta_i = 0$, (i = 1,2,3,4) / There is no significant relationship between the independent and dependent variable.

H_1 : $\beta_i \neq 0$, (i = 1,2,3,4) / There is a significant relationship between the independent and dependent variable.

The test statistic for T-test stated:

$$t = \frac{\hat{\beta}i - \beta i}{se(\hat{\beta}i)}$$

The decision rules are provided as follows.

- H_0 is rejected if the t-statistic is lower than critical value or greater than upper critical value. Otherwise, H_0 is not rejected.
- H_0 is rejected if significant value $\alpha = 0.01$ is higher than the value of probability. Otherwise, H_0 is not rejected.

3.5.3.2 F-test

R.A. Fisher, an English statistician had developed F-test statistic. According to Gujarati (2004), the f statistic used to measure the overall significance of the entire model which is different with the t-test. The F-statistic value and p-value can be obtained through the E-view 8's output.

The hypotheses for F-test stated:

H_0 : $\beta_i = 0$ (or $\beta_i = \beta_j = 0$) / The overall model is insignificant.

H_1 : $\beta_i \neq 0$ (or at least one β is different from 0)

3.5.4 Unit Roots Test

Unit root test is an important test to examine the univariate properties or in other word, stationarity property of the time series data before undergo Johansen-Juselius cointegration test (Penm, Terrell and Lim, 2004; Royfaizal et al., 2009b; Wong et al., 2004). Unit root test also known as stationary test. A time series data with time invariant property means the data is constant on its mean, variance and autocovariance at various lag which shows a stationary time series (Gujarati, 2004). Gujarati (2004) suggest that a stationary time series data tends has constant mean reversion and variance. Therefore, non-stationary time series data tends to have time varying mean or time varying variance or both. The property of time invariant of variable can be shown by equation terms as the following:

Constant mean : $\mathbf{E\ (yt) = \mu}$

Constant Variance : $\mathbf{var\ (yt) = \sigma^2}$

Time series stationary is important during forecasting time period behaviour for long term (Gujarati, 2004). This is because each set of non-stationary time series data only able to forecast the time period behaviour for the particular periods only. It cannot forecast the behaviour of time period of other period for a time series non-stationary data. Besides, a non-stationary time series data may come out misleading and questionable result during estimating the relationship between variables when applying ordinary least squares regressions (Mahadeva & Robinson, 2004). The questionable and misleading result in ordinary least squares regressions will causes the hypothesis testing results in t-test and F-test invalid thus the model formed will be not accurate. In short, a stationary time series data is necessary to ensure the accuracy and reliability regression model. Therefore, a stationary test or unit root test should be carry out before develop the regression model (Mahadeva & Robinson, 2004).

There are two type of unit root test which are Augmented Dickey-Fuller (ADF) test introduced by David Dickey and Wayner Fuller in 1979 and Phillips-Perron (PP) test introduced by Phillips and Perron in 1988 (Abd Karim & Gee, 2008; Click &

Plummer, 2005; Siklos & Ng, 2001). The ADF test is the test which use more commonly by most of the researchers to test the stationary of time series data (Abd Karim & Gee, 2008; Click & Plummer, 2005; Royfaizal et al., 2009a; Siklos & Ng, 2001; Wong, et al., 2004).

The hypothesis of unit root test is as follows.

H_0 : All variables are not stationary and have unit root.

H_1 : All variables are stationary and do not have unit root.

Based on the decision rule, H_0 can be rejected when the probability value in the unit root test is smaller than the significant level ($\alpha = 0.01$). Otherwise, do not reject H_0.

Gujarati (2004) stated that ADF test is used when the error terms are correlated. ADF test is carrying out by adding the dependent variable's lagged values. According to Abd Karim and Gee (2008) and Gujarati (2004), adding the lagged values of dependent variable able to obtain a pure white noise error term. The idea of number of lagged difference terms to add is determine by the number of terms added so that the error terms are serially uncorrelated. The Akaike info criterion (AIC) and Schwarz criterion (SC) can be used to determine the number of lags to be included (Abd Karim & Gee, 2008).

Limitation of the ADF test is the ADF test is limited by the number of lagged difference terms (Gujarati, 2004). The degree of freedom of the regression model will reduce with the increases of the number of lagged difference terms. The reduce in the degree of freedom will causes the biased standard error and test statistic value thus the hypothesis testing results invalid. This limitation of ADF can be solved by using PP test since the PP test taking into account the serial correlation of the error term by using the non-parametric statistical method without included the lagged difference terms (Gujarati, 2004).

A time series data which has unit root is consider as non-stationary. If the time series data is stationary and do not have unit root, then cointegration test can be proceed.

3.5.5 Granger Causality Test

Granger causality test is a test used to investigate the capability of prediction of a time series' future values by applying the past values of another time series based on linear regression modelling of stochastic processes (Granger, 1969). Granger and Joyeux (1980) had simplified the definition of Granger causality as one variable causes another variable, if and only if total probability of two variables on its own past histories is not exactly same as the probability of the variable being caused on its own alone past history (Maziarz, 2015). Proper definitions of information sets are critical significance in the case of Granger causality test. The model may become biased if neglecting the notion of information sets (Baumöhl & Výrost, 2010).

In fact, Granger causality test does not support the argument of possible instantaneous correlation between dependent variable and independent variable. If both variables are coincidentally correlated with each other, instantaneous causality presence (Sørensen, 2005). Regarding to Lin (2008), there is exists of two assumptions of this Granger causality test. First assumption is only the past can cause the present or future but the future cannot gives any effect towards the past. Secondly, there is always extraordinary relevant information about an effect which cannot applies on somewhere else is being consists in a cause.

In generally, Granger causality test can be generated into two main categories, which are unidirectional causality and bilateral causality. According to that, unidirectional causality happens when there is only a single way of cause and effect between independent variable (IV) and dependant variable (DV). There is either IV causes the DV or DV influences the IV. Bilateral causality refers to

two-way relationship between two variables which stated that IV causes the DV and on the same time DV also has impact on IV.

The hypothesis for the Granger causality test are structured as follows.

H_0 : Variable X does not granger causes the variable Y.

H_1 : Variable X does granger causes the variable Y.

The Wald F test being uses in test statistic noted as follows.

$$F=\frac{(SSE_{reduced}-SSE_{full})/(K_{full}-K_{reduced})}{SSE_{full}/(n-K_{full}-1)}$$

The Granger Causality test decision rule is reject the null hypothesis (H_0) if the probability value is less than the significance level (α) of 0.01 or test statistic value is greater than the critical value. Otherwise, do not reject H_0.

3.5.6 Johansen cointegration test

Cointegration refers to a situation whereby two or more non-stationary time series, when linearly combined, can result in a stationary combination (Gujarati & Porter, 2009). According to Gujarati and Porter (2009), two variables are cointegrated if there is existence of equilibrium, long term relationship between them.

To investigate the cointegration relationships between variables, the Johansen cointegration test can be applied. The Johansen cointegration test is a maximum likelihood method capable of determining the number of cointegrating vectors in a non-stationary time series model (Skerman & Della Maggiora, 2009). Thus, for a Johansen cointegration test to be applicable, the variables must not be stationary at level yet stationary at first difference. As such, unit root test can be a preceding procedure to the Johansen method. The advantage to the Johansen cointegration test is that it can determine cointegration relationships on a

multivariate level rather that a bivariate level. This is because cointegration relationship between more than two variables can be investigated using the Johansen method.

The two tests under the Johansen cointegration test are the Trace test and the Maximum Eigenvalue Test, all of which are classified as likelihood ratio tests (Österholm & Hjalmarsson, 2007).

The hypothesis for the Johansen cointegration test for both the Trace test and the Maximum Eigenvalue test are as follows.

H_0 : There is no long-term relationship between the variables.

H_1 : There is long-term relationship between the variables.

The decision rule involved is to reject the null hypothesis (H_0) if the probability value of the Trace statistic or the Maximum Eigenvalue statistic is less than the significant level of 0.01. Otherwise, H_0 is not rejected.

In addition, the Eviews 8 application provides the normalised resulting cointegration relationship between variables. This provide more empirical support on the inference made respective to the cointegration relationship (Skerman & Della Maggiora, 2009).

3.6 Conclusion

This chapter has discussed the interrelationship between the dependent variable, stock market return of Singapore and the independent variables, stock markets return of the others ASEAN-5 countries. The data are collected from Bloomberg Terminal provided by University Tunku Abdul Rahman (UTAR). In this research project, a few tests are conducted to identify the relationship between the dependent and independent variables. Those tests comprise of Multiple Linear Regression Model, Diagnostic Checking, Ordinary Least Square (OLS) which include T-test and F-test, Unit root test, Granger

causality tests and Johansen Co-integration test. In this research project, all the tests will be used to solve and detect the multicollinearity, heteroscedasticity, auto correlation and model specification.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

This chapter will explain the empirical results applied in this research project that examined by several methodologies. First method will be conduct in this research project is diagnostic checking which involves multicollinearity, heteroscedasticity, autocorrelation, model specification and normality tests. Secondly, the Ordinary Least Squares (OLS) Test will also be used in this research which involves t-Test and F-Test. Thirdly, the Unit Root Tests, including the Augmented Dickey-Fuller (ADF) Test and Phillips-Perron (PP) Test will be carried out. Fourthly, the Granger Causality Test will be one of the methodologies for the test. Lastly, Johansen Cointegration Test is conducted.

4.1 Diagnostic Checking

4.1.1 Multicollinearity

If there is an existence of significantly correlated between independent variables in the model, it can be concluded that there is a multicollinearity problem (Sinan & Alkan, 2015). There are a few methods to identify the multicollinearity problem.

First method: The high "R-squared" but few significant of t-ratios

Table 4.1.1(a): The R-squared and t-ratios of the model

The R^2 of the model is 0.670236	
logMAL	P-value = 0.0003
logTHAI	P-value = 0.0053
logPHI	P-value = 0.0066
logIND	P-value = 0.0010

According to Gujarati and Porter (2009), if R^2 is greater than 0.80 and the t-test of each variable are mostly insignificant, it shows a symptom of multicollinearity problem in this model. From the Table 4.1.1(a), the R^2 of the model is consider low, which is 0.670236. It can be indicated that the changes in independent variables (logMAL, logTHAI, logPHI and logIND) could explain 67.02% of the changes in dependent variable (logSING). Moreover, the p-value of the overall model is significant according to the table 4.1.1(a). The results indicated that the p-value of logMAL = 0.0003, logTHAI = 0.0053, logPHI = 0.0066 and logIND = 0.0010 which is less than significant level at 0.01. Overall, the R^2 of the model is low and the t-test of each independent variable are significant to dependent variable. Therefore, the multicollinearity problem in the model does not exist because the result does not fulfil the high R^2 but few significant of t-ratios.

Second method: High pair-wise correlation coefficients

Table 4.1.1(b): Pair-wise Correlation Coefficients

	logIND	**logMAL**	**logPHI**	**logTHAI**
logIND	1.000000	0.689524	0.683194	0.732340
logMAL	0.689524	1.000000	0.584946	0.585973
logPHI	0.683194	0.584946	1.000000	0.593558
logTHAI	0.732340	0.585973	0.593558	1.000000

Based on the Table 4.1.1(b) showed that the correlation between each independent variable is more than 0.50 which is considered as high correlation coefficients. Hence, the model is suspected to have multicollinearity problem.

Third method: Variance Inflation Factor (VIF) / Tolerance (TOL)

Table 4.1.1(c): VIF and TOL Results

	R^2	VIF = $1/(1 - R^2)$	TOL = $1 - R^2$
logMAL	0.508103	2.032946 < 10	0.491897 > 0
logIND	0.682036	3.145010 < 10	0.317964 > 0
logTHAI	0.560084	2.273161 < 10	0.439916 > 0
logPHI	0.504154	2.016755 < 10	0.495846 > 0

Based on the rule of thumb, if the VIF of variable is more than 10 and the TOL is near to zero, the multicollinearity problem is serious (Gujarati & Porter, 2009). However, the calculations from Table 4.1.1(c) has showed that all the VIFs are less than 10 and TOLs were not close to zero. Thus, the results showed that the model does not have a serious multicollinearity problem.

In conclusion, there is no existence of multicollinearity problem in the model. As the high R^2 but few significant t-ratios and both the VIF and TOL indicated that there is no multicollinearity problem even though the results from pair-wise correlation coefficient method is suspected that the model is having multicollinearity problem. As explained by Gujarati and Porter (2009), although the high pair-wise correlation coefficient shows the existence of multicollinearity problem, yet it is not considered as a specific condition for the detection of the serious multicollinearity problem.

4.1.2 Heteroscedasticity

Heteroscedasticity problem is defined as the disturbance variances are not constant (Mehmet, 2008). The Autoregressive Conditional Heteroskedasticity

(ARCH) Test will be used to determine whether there is heteroscedasticity problem in the model.

Table 4.1.2: Autoregressive Conditional Heteroscedasticity (ARCH) Test

Result for Autoregressive Conditional Heteroscedasticity (ARCH) Test	
P-value of chi-square statistic = 0.8425	The significance level is 1% (α = 0.01)

H_0 : There is no heteroscedasticity problem.

H_1 : There is heteroscedasticity problem.

Decision rule: When the significance level is higher than the probability value, H_0 is rejected. Otherwise, H_0 is not rejected.

Conclusion: H_0 is not rejected since the p-value of chi-square statistic (0.8425) is more than significance level (0.01). Hence, there is insufficient evidence to conclude that the model consists of heteroscedasticity problem.

4.1.3 Autocorrelation

Autocorrelation problem occurs in the model when there is a correlation among error term observations. It is also a tool which allows to identify repeating patterns such as the presence of periodic signals or specific frequencies (Rei, Chicea & Olaru, 2016). The Breush-Godfrey Serial Correlation LM Test is applied for the purpose of detecting the autocorrelation problem.

Table 4.1.3: Breush-Godfrey Serial Correlation LM Test

Result for Breush-Godfrey Serial Correlation LM Test	
P-value of chi-square statistic = 0.1260	The significance level is 1% (α = 0.01)

H_0 : There is no autocorrelation problem.

H_1 : There is autocorrelation problem.

Decision rule: H_0 is rejected if the p-value is less than the level of significance, α. Otherwise, H_0 is not rejected.

Conclusion: H_0 is not rejected since the p-value of chi-square statistic (0.1260) is more than significance level (0.01). Hence, there is insufficient evidence to conclude that there is autocorrelation problem.

4.1.4 Model Specification

The model is incorrectly specified means that the important variables is omitted, the nonrelated variables is included, wrong functional form is applied and the error of measurement bias (Russo, 2012). To detect the existence of model specification problem in the model, Ramsey Regression Equation Specification Error Test (RESET) Test is applied.

Table 4.1.4: Ramsey Regression Equation Specification Error Test (RESET) Test.

Result for Ramsey Regression Equation Specification Error Test (RESET) Test	
P-value of F-statistic = 0.6611	The significance level is 1% (α = 0.01)

H_0 : The model is correctly specified.

H_1 : The model is not correctly specified.

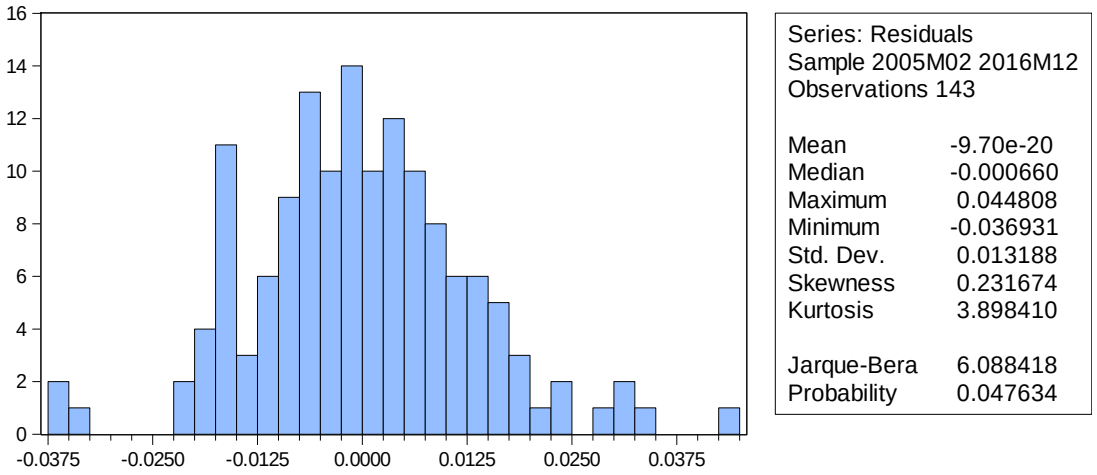
Decision rule: H_0 is rejected if the p-value is less than the level of significance, α. Otherwise H_0 is not rejected.

Conclusion: H_0 is not rejected since the p-value of F-statistic (0.6611) is more than significance level (0.01). Thus, there is sufficient evidence to conclude that the model is correctly specified in this research project.

4.1.5 Normality Test

To examine whether the sample data is drawn from a normally distributed population, the normality test is used in this research project (Ning & Ngunkeng, 2013). Thus, the Jarque-Bera Test is conducted to test the normality of the model.

Figure 4.1.5: Jarque-Bera Test



H_0 : Error terms are normally distributed.

H_1 : Error terms are not normally distributed.

Decision rule: H_0 is rejected if the probability value is less than the level of significance, α. Otherwise, H_0 cannot be rejected.

Conclusion: H_0 is not rejected since the probability value (0.047634) is more than significance level (0.01). Hence, there is insufficient evidence to conclude that the error terms in the model are not normally distributed.

4.2 Ordinary Least Square Method

$$\log SING_t = \beta_0 + \beta_1 \log MAL + \beta_2 \log THAI + \beta_3 \log PHI + \beta_4 \log IND + \varepsilon_t \textbf{ – (1)}$$

$$\log SING_t = -0.001954 + 0.385464 \log MAL + 0.178661 \log THAI + 0.191826 \log PHI + 0.246308 \log IND + \varepsilon_t \textbf{ – (2)}$$

Where:

$\log SING_t$ = the logarithm form of Singapore stock market return(SING) at year t.

$\log MAL_t$ = the logarithm form of Malaysia stock market return (MAL) at year t.

$\log THAI_t$ = the logarithm form of Thailand stock market return (THAI) at year t.

$\log PHI_t$ = the logarithm form of Philippines stock market return (PHI) at year t.

$\log IND_t$ = the logarithm form of Indonesia stock market return (IND) at year t.

ε_t = Error term

Table 4.2 E-view result

Independent Variable	**Expected Sign**	**Actual Sign**	**Coefficient**	**P-value**
LOG(MAL)	Positive	Positive	0.385464	0.0003
LOG(THAI)	Positive	Positive	0.178661	0.0066
LOG(PHI)	Positive	Positive	0.191826	0.0053
LOG(IND)	Positive	Positive	0.246308	0.0010
R^2= 0.670236			Adjusted $\overline{R}^2$= 0.660677	

R^2 is applicable in measuring the variation percentage in dependent variable which is explained by the total variations of independent variables. In order to measure fitted regression line, $\overline{R}^2$ is used after taking regressors and sample size into consideration.

According to Table 4.2, the result provided R^2 = 0.670236. It showed that 67.02% of variation in Singaporean stock market return is explained by total variation of stock market return of Malaysia, Thailand, Philippines and Indonesia. Adjusted $\overline{R}^2$= 0.660677 indicated that 66.07% of the total variations in the stock market return of Singapore is clarified by the total variation of stock market of Malaysia, Thailand, Philippines and Indonesia after considering the degree of freedom.

4.2.1 T-test

H_0 : There is no significant relationship between the variables (β_i = 0, i=1,2,3,4)

H_1 : There is a significant relationship between the variables ($\beta_i \neq 0$, i=1,2,3,4)

Decision Rule: H_0 is rejected if the significant level, α is larger than the probability value. Otherwise, H_0 is not rejected.

Table 4.2.1: Result of t-test

Independent Variable	Significant level, α	P-value	Decision Making	Conclusion
Log MAL	0.01	0.0003	Reject H_0.	Significant
Log THAI	0.01	0.0066	Reject H_0.	Significant
Log PHI	0.01	0.0053	Reject H_0.	Significant
Log IND	0.01	0.0010	Reject H_0.	Significant

Based on Table 4.2.1, stock market returns of Malaysia, Thailand, Philippines and Indonesia are influencing the stock market return in Singapore significantly. The result of E-views in this research study stated that the stock market return of Malaysia, Thailand, Philippines and Indonesia is significant and positively affects the Singapore stock market return. The relationship stated is similar with the outcome of the previous studies (Abd Karim & Gee, 2006; Chancharat et al., 2008; Click & Plummer, 2005; Ding, 2010; Karim & Karim, 2012; Narayan & Narayan, 2012; Royfaizal et al., 2009a; Yi & Tan, 2009). The reason is the ASEAN 5 stock markets become more integrated with each other due to the global financial crisis. The financial crisis has contributed volatility and contagion in the international markets. Financial crisis also pressed some pressure on the emerging market. In addition, due to the rapid expansion of international trading, the financial systems and economic of the ASEAN countries become more integrated.

4.2.2 F-test

H_0 : The overall model is insignificant.

H_1 : The overall model is significant.

Decision Rule: H_0 is rejected if probability value is lower than significant level, α. Otherwise, H_0 is not rejected.

Table 4.2.2 Result of F-test

Significant level, α	**P-value**	**Decision Making**	**Conclusion**
0.01	0.0000	Reject H_0.	Significant.

The F-test is applicable in measuring the overall significance of the model. Table 4.2.2 showed that the p-value (0.0000) is less than the significance level. Hence, H_0 is being rejected meaning that the entire model in this research project is crucial in explaining the stock market return.

4.3 Unit Root Test

H_0 : Singapore/ Malaysia/ Indonesia/ Thailand/ Philippines have a unit root and non-stationary

H_1 : Singapore/ Malaysia/ Indonesia/ Thailand/ Philippines not have a unit root and stationary

Significance level: 0.01 / 1%

Decision Rule: H_0 is rejected if probability value less than significant level, α = 0.01. Otherwise, H_0 is not rejected.

4.3.1 Augmented Dickey-Fuller (ADF) test

Table 4.3.1: Augmented Dickey-Fuller test result

Variables	Probability Value (p-value)	t-Statistic
Singapore	0.0000	-9.710794 (0)

Malaysia	0.0000	-10.17477 (0)
Indonesia	0.0000	-9.379497 (0)
Thailand	0.0000	-5.303441 (2)
Philippines	0.0000	-11.08000 (0)

Note: The figure in parenthesis represents optimal lag length based on Schwarz criterion (SC) in first difference and without trend phase.

Conclusion: The p-value of Singapore, Malaysia, Indonesia, Thailand and Philippines are less than 1% significant level, $\alpha = 0.01$. Therefore, reject H_0. These results indicate that, at 1% significant level, $\alpha = 0.01$, there are not sufficient evidence to prove that Singapore, Malaysia, Indonesia, Thailand and Philippines are non-stationary and have unit root at first difference and without trend using ADF test.

4.3.2 Phillips-Perron (PP) test result

Table 4.3.2: Phillips-Perron test result

Variables	Probability Value (p-value)	Adjusted t-Statistic
Singapore	0.0000	-9.864524 (5)
Malaysia	0.0000	-10.52009 (5)
Indonesia	0.0000	-9.470687 (5)
Thailand	0.0000	-9.861669 (6)
Philippines	0.0000	-11.28256 (6)

Note: The figure in parenthesis represents the bandwidth using Bartlett kernel based on Newey-west bandwidth criterion in first difference and without trend phase.

Conclusion: The p-value of Singapore, Malaysia, Indonesia, Thailand and Philippines are less than 1% significant level, $\alpha = 0.01$. Therefore, reject H_0. These results indicate that, at 1% significant level, $\alpha = 0.01$, there are not sufficient evidence to prove that Singapore, Malaysia, Indonesia, Thailand and Philippines are non-stationary and have unit root at first difference and without trend using PP test.

Based on the results shown using ADF test and PP test, the time series data of all variables in this research project are stationary and do not have unit root in first difference phase.

4.4 Granger Causality Test

The relationship between five countries of ASEAN-5 (Singapore, Malaysia, Indonesia, Thailand and Philippines) stock markets and the orientation of causality among them could be verified by applying the Granger causality test. The result is responded as table and figure below.

H_0 : Variable X does not granger cause Variable Y.

H_1 : Variable X does granger cause Variable Y.

Significance level, α: 0.01

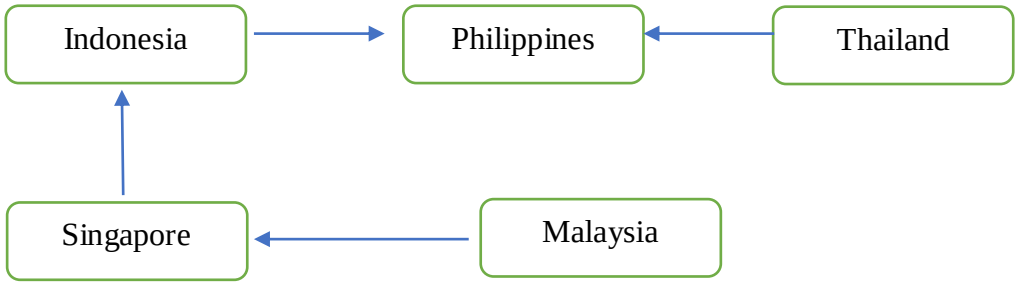
Decision rule: H_0 is rejected if the level of significance, α is greater than the probability value. Otherwise H_0 is not rejected.

Table 4.4 : Results for Granger causality test

Variable X	Variable Y	P-value	Decision Making	Conclusion
Malaysia	Indonesia	0.0505	Do not reject H_0	No granger cause
Indonesia	Malaysia	0.8087	Do not reject H_0	No granger cause

Philippines	Indonesia	0.0305	Do not reject H_0	No granger cause
Indonesia	Philippines	0.0016	Reject H_0	Granger cause
Singapore	Indonesia	0.0016	Reject H_0	Granger cause
Indonesia	Singapore	0.1119	Do not reject H_0	No granger cause
Thailand	Indonesia	0.0831	Do not reject H_0	No granger cause
Indonesia	Thailand	0.4619	Do not reject H_0	No granger cause
Philippines	Malaysia	0.8430	Do not reject H_0	No granger cause
Malaysia	Philippines	0.3457	Do not reject H_0	No granger cause
Singapore	Malaysia	0.1910	Do not reject H_0	No granger cause
Malaysia	Singapore	0.0050	Reject H_0	Granger cause
Thailand	Malaysia	0.7590	Do not reject H_0	No granger cause
Malaysia	Thailand	0.3664	Do not reject H_0	No granger cause
Singapore	Philippines	0.1363	Do not reject H_0	No granger cause
Philippines	Singapore	0.1115	Do not reject H_0	No granger cause
Thailand	Philippines	0.0009	Reject H_0	Granger cause
Philippines	Thailand	0.2809	Do not reject H_0	No granger cause
Thailand	Singapore	0.0872	Do not reject H_0	No granger cause
Singapore	Thailand	0.4437	Do not reject H_0	No granger cause

Figure 4.4 : Relationship among ASEAN-5 stock markets for Granger causality test



Indicator:

One way causal relationship

This finding indicates existence of granger causality relationship among all of the ASEAN-5 stock markets. However, there are only exist of unidirectional causality

relation and absence of bidirectional causality relation in this research project. The stock market of Singapore is affected by Malaysia stock market due to the Malaysian stock market is the most influential markets among ASEAN-5 (Roca et al., 1998). Purnomo and Rider (n.d.) found that the shock of Singapore stock market index influences the response of Indonesian stock market index. On the same time, the Indonesian stock index have great impact on the Philippines stock index also reported in this research. Phuan et al. (2009) declared that there is unidirectional causality relation presents in Thailand stock market to Philippines stock market. Other than the combinations of countries stock markets mention above, there is absence of causality relationship among them.

4.5 Johansen Cointegration test

The Johansen cointegration test was used to test the long run relationship between the variables. The result is recorded as follows.

Table 4.5: Results for Johansen cointegration test

Hypothesised number of cointegrating equation(s), r	Trace test			Maximum Eigenvalue Test		
	Statistic	Critical value (5%)	Probability value	Statistic	Critical value (5%)	Probability value
r = 0	323.6265	69.81889	0.0001*	85.90520	33.87687	0.0000*
r ≤ 1	237.7213	47.85613	0.0001*	77.97313	27.58434	0.0000*
r ≤ 2	159.7481	20.79707	0.0001*	67.25167	21.13162	0.0000*
r ≤ 3	92.49645	15.49471	0.0000*	55.00861	14.26460	0.0000*
r ≤ 4	37.48784	3.841466	0.0000*	37.48784	3.841466	0.0000*
Note: * denotes significant at 1% level of significance.						

H_0 : There is no long run relationship between the variables.

H_1 : There is long run relationship between the variables.

Decision rule: H_0 is rejected if the probability value is less than the level of significance, α. Otherwise H_0 is not rejected.

Conclusion: The probability value for both Trace statistics (0.0000) and Maximum Eigenvalue statistics are less than α (0.01). Thus, the H_0 is rejected. There is sufficient evidence to conclude that the variables are cointegrated, hence exhibits long run relationship.

This finding indicates existence of cointegration between ASEAN-5 stock markets, which is consistent with several previous researches that examined the cointegration between stock markets of the ASEAN-5 countries. Lim (2007) found stock market of Philippines had long run relationship with stock markets of Indonesia, Malaysia and Singapore. On top of that, there were also researchers who found cointegration between the stock markets of ASEAN-5 countries (Karim & Karim, 2012; Narayan & Narayan, 2012; Royfaizal et al., 2009a).

4.6 Conclusion

In this chapter, several tests such as diagnostic checking, OLS test, unit root tests, Granger-causality test, and Johansen co-integration test has been carried out to improve the accuracy and reliability of the result in this research project. A multiple linear regression model also has been formed based on the ordinary least square method in this chapter. All the empirical result of this research project are presented in both table from and figure form and supported by findings of others researchers.

CHAPTER 5: DISSCUSSION, CONCLUSION AND IMPLICATIONS

5.0 Introduction

In this chapter, the summary of statistical analyses will be presented which included the detail results that had been examined from the previous chapter. The next section of this chapter will briefly summarise the major findings of the linkages between Singapore stock market return and ASEAN-5 stock market return. Moreover, the implication of study will be discussed in this chapter that will provide some useful practices for policy makers, governments or investors. Another section will highlight the limitation of this research project and followed by some detail recommendations and suggestion for this research as well as future researchers.

5.1 Summary of Analysis

5.1.1 Summary of Diagnostic Checking

Table 5.1.1 Summary of Diagnostic Checking

Test	Decision Rules	Results
Multicollinearity	1. Suspects multicollinearity problem exits if R-square value is high but few t-ratios are significant. 2. Suspects multicollinearity problem exits if pair-wise correlation coefficient value is high.	No serious multicollinearity problem.

	3. Suspects multicollinearity problem exits if VIF value is more than 10 and TOL value is near to 0.	
Heteroscedasticity - ARCH Test	Heteroscedasticity problem exist if probability value less than the significant level.	No heteroscedasticity problem.
Autocorrelation - Breush-Godfrey Serial Correlation LM Test	Autocorrelation problem exist if probability value less than the significant level.	No autocorrelation problem.
Model Specification Test - Ramsey RESET Test	The model is not specified correctly if probability value less than the significant level.	No model specification problem.
Normality Test - Jarque-Bera Test	Error terms are not normally distributed if probability value less than the significant level.	No normality problem.

The summary of diagnostic checking of this research project had been presented in the table 5.1.1. From the table, a conclusion of no serious multicollinearity problem exist and there is no heteroscedasticity, autocorrelation, model specification and normality problem exist in this model at significant level of 1%. Since all the econometrics problems are not exist in this model, this model is Best Linear Unbiased Estimator. Hence, the hypothesis testing results in this research project are accurate and valid.

5.1.2 Summary of Ordinary Least Square

Table 5.1.2 Summary of Ordinary Least Square

t-Test

Variables	Decision Rules	Results	Consistency
Malaysia	Singapore stock market is significantly affected by Malaysia stock market if probability value greater than significant level of 1%.	Malaysia stock market is a significant variable.	• Chancharat, et al. (2008) • Karim and Karim (2012) • Narayan and Narayan (2012) • Royfaizal et al. (2009b)
Indonesia	Singapore stock market is significantly affected by Indonesia stock market if probability value greater than significant level of 1%.	Indonesia stock market is a significant variable.	• Chancharat, et al. (2008) • Karim and Karim (2012) • Royfaizal et al. (2009b)
Thailand	Singapore stock market is significantly affected by Thailand stock market if probability value greater than significant level of 1%.	Thailand stock market is a significant variable.	• Chancharat et al. (2008) • Karim and Karim (2012) • Narayan and Narayan (2012) • Royfaizal et al. (2009b)
Philippines	Singapore stock market is significantly affected by Philippines stock market if probability value greater than significant level of 1%.	Philippines stock market is a significant variable.	• Chancharat, et al. (2008) • Karim and Karim (2012) • Narayan and Narayan (2012) • Royfaizal et al. (2009b)

F-Test			
Significance of overall model	The overall model is significant if probability value greater than significant level of 1%.	The overall model is significant.	

Table 5.1.2 indicates the summary of Ordinary Least Square results which include the t-test which test the significant of each independent variable (Malaysia, Indonesia, Thailand and Philippines) individually and F-test which test the significant of overall OLS model. The results shown that the stock market of Singapore will be significantly affected by the performance of stock markets of Malaysia, Indonesia, Thailand and Philippines individually. The stock market performances of the independent countries are positively affected the stock market performance of Singapore. These results are consistent with the findings of Chancharat et al. (2008); Karim and Karim (2012); Narayan and Narayan (2012) and Royfaizal et al. (2009b). The result from F-test has been proven that all the stock market returns of ASEAN-5 are significant to affect stock market return of Singapore in this research project.

5.1.3 Summary of Unit Roots Test

Table 5.1.3 Summary of Unit Roots Test at First Difference and Without Trend

Variables	Decision Rules	Results	Consistency
Singapore	Singapore has unit root problem and non-stationary if probability value more than significant level of 1%.	Singapore stock market return does not have unit root problem and is stationary at first difference and without trend phase.	• Lim (2009) • Royfaizal et al. (2009b)

Malaysia	Malaysia has unit root problem and non-stationary if probability value more than significant level of 1%.	Malaysia stock market does not have unit root problem and is stationary at first difference and without trend phase.	• Lim (2009) • Royfaizal et al. (2009b)
Indonesia	Indonesia has unit root problem and non-stationary if probability value more than significant level of 1%.	Indonesia stock market does not have unit root problem and is stationary at first difference and without trend phase.	• Abd Karim and Gee (2008) • Abidin et al. (2013) • Lim (2009) • Royfaizal et al. (2009b)
Thailand	Thailand has unit root problem and non-stationary if probability value more than significant level of 1%.	Thailand stock market does not have unit root problem and is stationary at first difference and without trend phase.	• Abd Karim and Gee (2008) • Abidin et al. (2013) • Lim (2009) • Royfaizal et al. (2009b)
Philippines	Philippines has unit root problem and non-stationary if probability value more than significant level of 1%.	Philippines stock market does not have unit root problem and is stationary at first difference and without trend phase.	• Abd Karim and Gee (2008) • Lim (2009) • Royfaizal et al. (2009)

From table 5.1.3 above, which summarised the results of unit roots test of each variable, a conclusion that all variables used in this research project are

stationary at first difference and without trend phase can be made. This result is consistent with the results of previous researches (Abd Karim & Gee, 2008; Abidin et al., 2013; Lim, 2009; Royfaizal et al., 2009b) which stated that the stock indices of ASEAN-5 countries are stationary at first difference. This result indicates the stock indices of these five countries are integrated in order one. A stationary variable must be obtained before proceeding to the next test which are Granger Causality test and Johansen Cointegration test in order to ensure the accuracy and validity of the test results (Gujarati, 2004).

5.1.4 Summary of Granger Causality Test

Table 5.1.4 Summary of Granger Causality Test

Variables		**Results**	**Consistency**
Malaysia	Singapore	Malaysia stock market granger cause Singapore stock market.	• Click and Plummer (2005) • Lim (2007) • Yi and Tan (2009)
Singapore	Indonesia	Singapore stock market granger cause Indonesia stock market.	• Ding (2010) • Jiang, Nie and Monginsidi, (2017) • Purnomo and Rider (2012) • Lim (2007)
Indonesia	Philippines	Indonesia stock market granger cause Philippines stock market.	• Shabri et al. (2009) • Nezky (2013)
Thailand	Philippines	Thailand stock market granger cause Philippines stock market.	• Malesky and Samphantharak (2011) • Inquirer (2017)

			• Heydarian (2013)

The summary results of Granger Causality tests between all the variables (Singapore, Malaysia, Indonesia, Thailand, Philippines) had been shown in Table 5.1.4. Granger causality test shows the short run relationship between the stock markets of two countries. Several researchers pointed out that Malaysia stock market had granger caused the Singapore stock market (Click & Plummer, 2005; Lim, 2007; Yi & Tan, 2009). The past researchers stated that Singapore stock market has granger cause the Indonesia stock market in short run which the result is consistent with the result obtained in this research project (Ding, 2010; Jiang, Nie & Monginsidi, 2017; Lim, 2007; Purnomo & Rider, 2012). The granger causality between Singapore and Indonesia is unidirectional. Nezky (2013) and Shabri et al. (2009) results is consistent with this research where the Indonesian stock market granger caused to Philippines stock market. The Thailand stock market granger cause to Philippines stock market result are consistent with a few past researchers (Heydarian, 2013; Inquirer, 2017; Malesky & Samphantharak, 2011).

5.1.5 Summary of Johansen Cointegration Test

Table 5.1.5 Summary of Johansen Cointegration Test

Variables		**Decision Rules**	**Results**	**Consistency**
Singapore	Malaysia	Long run relationship exists if probability value more than significant level of 1%.	Singapore stock market has long run relationship with Malaysia stock market.	• Click and Plummer (2005) • Royfaizal et al. (2009b)
Singapore	Indonesia	Long run relationship	Singapore stock market	• Click and Plummer

		exists if probability value more than significant level of 1%.	has long run relationship with Indonesia stock market.	(2005) • Royfaizal et al. (2009b)
Singapore	Thailand	Long run relationship exists if probability value more than significant level of 1%.	Singapore stock market has long run relationship with Thailand stock market.	• Click and Plummer (2005) • Royfaizal et al. (2009b)
Singapore	Philippines	Long run relationship exists if probability value more than significant level of 1%.	Singapore stock market has long run relationship with Philippines stock market.	• Click and Plummer (2005) • Lim (2007) • Royfaizal et al. (2009b)

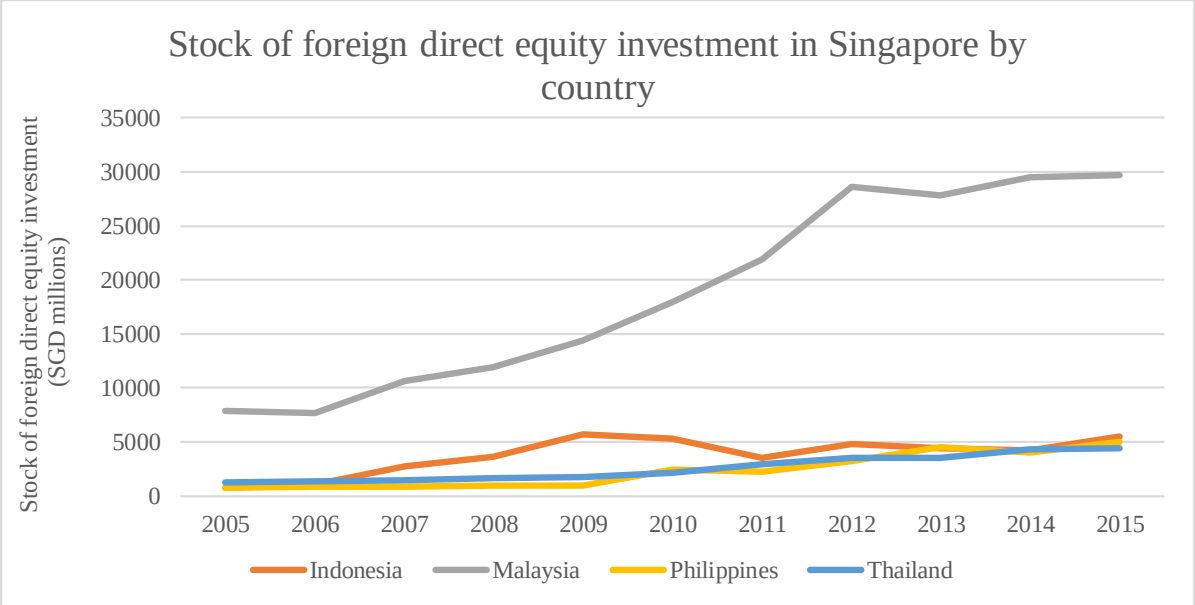
Summary results of Johansen Cointegration test was presented in Table 5.1.5. From the table, Singapore stock market has long run relationship with the stock markets of other countries (Malaysia, Indonesia, Thailand and Philippines) respectively. Click and Plummer (2005) and Royfaizal et al. (2009b) had found out that the stock markets of ASEAN-5 countries has long run relationship between each other which is consistence with the result obtained in this research project. Lim (2007) had further proved that there is long run relationship exist between Philippines and Singapore.

5.2 Discussion of Major Findings

The results for both the OLS and Johansen cointegration test indicates the existence of long run relationship between the stock market returns of Singapore and those of the other ASEAN-5 countries. The OLS also provided evidence of positive significant relationship between the independent variables (Malaysia, Thailand, Philippines and Indonesia stock market returns) and the dependent variable (Singapore stock market return).

This relationship could be explained by the fact that Singapore is one the top foreign direct investment destinations globally (Chuang, 2017). In other words, not only that Singapore investors having investors having extensive investments throughout the ASEAN-5 region, other ASEAN-5 nations have investments in Singapore as well. This can be attributable to the fact that Singapore is an established major finance hub on the regional level (Chancharat, Valadkhani & Havie, 2007).

Figure 5.2 (a): Stock of foreign direct equity investment in Singapore by country



Source: Developed for research

The Government of Singapore (2017) defined foreign direct equity investment as equity capital invested directly in Singapore companies by foreign investors. According to Table 5.1.2, Malaysia stock market return had the greatest impact on the Singapore

stock market return compared to Philippines, Thailand and Indonesia stock market returns. For every 1% increase in percentage point of Malaysia stock market return, the percentage point of Singapore stock market return increase by 0.385464%. This can be justified by the fact that Malaysia had the highest foreign direct equity investment in the Singapore market compared to Philippines, Thailand and Indonesia, based on the illustration in Figure 5.2 (a). Indonesia, Philippines and Thailand stock market return had subsequent effects to the Singapore stock market. This is also consistent with the data that these countries had lower foreign direct equity investments in Singapore compared to Malaysia, with Indonesia generally being the highest among them.

As such, it can be deduced that greater the equity investment of a country in Singapore can be associated with greater tendency that stock market returns of the country could affect the Singapore stock market in the long term. For example, when Malaysian stock market return improves, the investor from Malaysia earn more to be able to expand their stock or equities investment to other countries such as Singapore. Then, Singapore companies could gain capital from primary equity issues and invest on projects that increases company returns. Subsequently, the shareholder wealth is increased and returns on stocks increases (Arčabić, Globan & Raguž, 2013). In the secondary market, foreign direct equity investments enhance liquidity in the Singapore stock market as well.

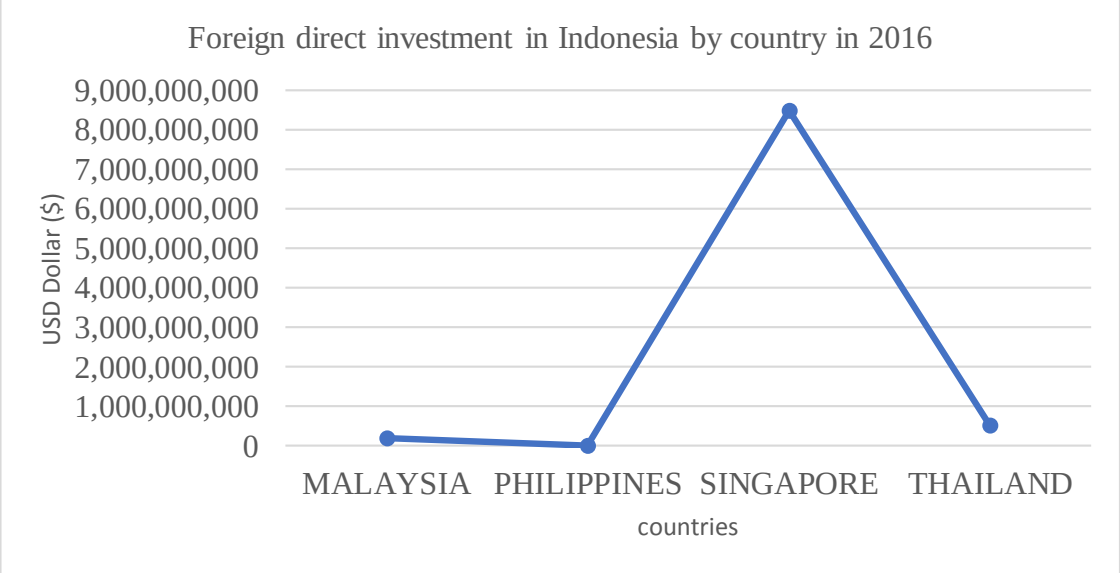
Nevertheless, the effects of trends that are in common that potentially drives stock market returns to move in the same way should not be neglected (Bashiri & Zadeh, 2014). Click and Plummer (2005) found that stock markets became gradually more integrated both in post crisis period. Additionally, the effort of the ASEAN Economic Community could play a role in enhancing the long run relationship between the ASEAN-5 countries as well.

From the Granger Causality test, a result that stock market return of Malaysia had granger cause the stock market return of Singapore had obtained. The causal relationship between stock market returns of Singapore and Malaysia is one way. Yi and Tan (2009) stated the level of integration of stock markets is affected by many factors such as liberalisation in financial sectors in the country, the financial control of

country and external factor such as financial crisis. Yi and Tan (2009) also point out that during the crisis, the volatility of Malaysia stock market increases due to several country-specific factors such as imposition of capital control, abolition of levy on the repatriation of profit from foreign investment, the scandal of 1 Malaysia Development Berhad and the poor performance of Malaysia Ringgit (Davies ,2017). These country-specific factors in Malaysia increased the uncertainty and volatility in the stock market and thus affected the confidence of both domestic and foreign investors towards Malaysia's stock market. As a result, the investors would like to invest in Singapore stock market rather than invest in Malaysia stock market thus Malaysia stock market granger caused Singapore stock market. Malaysia stock market took longer period to be integrated back into the major and regional stock market compared to Singapore stock market.

Furthermore, the reason of stock market return of Singapore granger cause to stock market return of Indonesia can be due to the Singapore are the largest trade partners relationship with Indonesia and the data are shown in Figure 5.2 (b). Purnomo and Rider (2012) found that the Indonesian stock market index is influenced by the advanced countries such as Singapore stock market which consist of close trade partner by using granger causality test. The establishment of ASEAN trading would be another reason of the short run relationship occurred between stock market of Singapore and Indonesia. According to Jiang et al. (2017), the stock market of Indonesia and Singapore showed the most significant results and high degree of comovement due to the effect of ASEAN trading link period.

Figure 5.2 (b): Foreign direct investment in Indonesia by country in 2016



Source: Developed for research

A result of Indonesia stock market granger caused Philippines stock market return being proved by external factor such US financial crisis. Based on Shabri et al. (2009), US financial crisis had affected Indonesia investors' investment volume trading and trade income tax. While on the other hand, investors may invest their fund to Philippines from Indonesia since Philippines imply long term equilibrium and diversification of portfolio which considered more effectively than Indonesia (Nezky, 2013). Furthermore, Philippines also provided many profitable investments attract investors to transfer their investment to Philippines. Phuan et al. (2009) also pointed out that there was an increasing of integration and influences between the countries after financial liberalization. Both countries have greater benefit toward each other due to relaxation of restriction on cross border capital flow.

Thailand stock market return granger caused Philippines stock market return can be prove by instability political occurred in Thailand have impact on stock market of Philippines. There is complexion and unsolvable of Thailand political, especially the 2006 coup Thailand, political crisis and risen of Red shirt and yellow shirt (Malesky & Samphantharak, 2011). The announcement regarding death of Thai King, Bhumibol Adulyadej lead to instable of political, share price of Thai have a sudden drop due to investors feel uncertainty and pull their funds out (Inquirer, 2017). Heydarian (2013)

stated that Thailand is one of the country which bring about external shocks toward Philippines Stock Exchange and lead to economy imbalances happen.

The formation of ASEAN free trade area and investment zone forming an integrated regional financial market which without transaction costs and trade barrier among the ASEAN members. This justifies the finding of positive significant relationships between Singapore stock market and other ASEAN-5 countries' stock market from the OLS method.

According to Loh (2012), the linkage between the stock markets of countries will change based on different time scale. This was demonstrated in the findings of this research project. The Granger causality test showed that short run relationship only exists between the stock markets of Singapore and Indonesia while there is no short run relationship exists between stock markets of Singapore and Malaysia. In addition, the stock markets of Thailand and Philippines do not have short run relationship with the stock market return of Singapore based on the result showed. However, there exists long run relationship between Singapore stock market and stock markets of all other ASEAN-5 countries.

From the above finding, it can be deduced that it takes time for these 5 markets to achieve long run relationship. Click and Plummer (2005) pointed out that the stock markets of ASEAN-5 are integrated but the integration taken long period to adjust to achieve complete integration. As such, the absence of short run relationship between Singapore stock market and Malaysia, Thailand and Indonesia stock market reflects the period of incomplete integration. This incomplete integration can be due to the difference in the capital market efficiency in each country. By applying EMH theory, the efficiency of capital markets of Malaysia, Thailand and Philippines can be categorised into weak or semi-strong form since they it requires longer period for market adjustments to complete the integration with Singapore stock market.

The absence of short run relationships between Singapore and Malaysia, Thailand and Philippines stock market imply arbitrage opportunities to occur due to market inefficiencies. This is because, although a positive and significant long run relationship

exists between Singapore stock market and Malaysia, Indonesia, Thailand and Philippines stock markets, the violations of law of one price may occur in the short term. The law of one price holds when the prices of the identical securities are the same in the ASEAN capital markets, assuming no transaction cost and other trade barriers and that ASEAN capital markets are efficient (Lamont & Thaler, 2003). When the violations of law of one price occurs, arbitrage opportunity exist to allow the investors to take the arbitrage profit. However, the violation of law of one price only exists in very short period and the law will hold again in the long run. Therefore, the investors of Singapore can have the arbitrage profit by investing in Malaysia, Thailand and Philippines stock markets when law of one price do not hold in the short run then the price of the securities will be move to the equilibrium in long run to maintain the market efficiency.

By applying the theory of international portfolio diversification which was derived from the Modern Portfolio Theory (Hakeem et al., 2016), investors in Singapore can diversify their short-term portfolio risk in Malaysia, Thailand and Philippines due to the financial market of Singapore is less related with the financial market of their countries in short run. The granger causality between Singapore and Indonesia indicates that Singapore financial market is more correlated with Indonesia financial market in short run. Therefore, the Singaporean investor does not have the incentive to diversify their portfolio risk internationally in Indonesian financial market in the short run.

The Johansen cointegration test showed that long run relationships exist between Singapore stock market and Malaysia, Indonesia, Thailand and Philippines stock markets. This can be due to the establishment of the ASEAN Economic Community (Sia, Hsu & Teo, 2016). This establishment is the effort of ASEAN to link all exchanges in ASEAN countries, and the integration between the 5 markets found in this research project showed that such efforts began to take effect. However, the existing of long run effect within Singapore, Malaysia, Indonesia, Thailand and Philippines stock markets causes the international portfolio diversification benefits within these five countries to be reduced but not eliminated. From the international portfolio diversification perspective, the existence of the long run relationship between the stock markets of ASEAN-5 countries indicates that investors from these 5 nations could not take advantage of long-run international portfolio diversification. When the markets are

cointegrated, risk are less likely to be diversifiable in a portfolio (Royfaizal et al., 2009b).

According to Karim and Karim (2012), the long run relationship between the markets implied the fact that the series of common stock prices for each market has information about the general stochastic movement of the integrated markets, following the Efficient Market Hypothesis. As such, stock prices of a country can be more easily predicted by looking into stock prices trend in another country that shared a long run relationship. However, arbitrage opportunity is possible to exist based on the market efficiency of each country. Arbitrage profit exists if investors could earn excess returns on top of the compensation for assuming additional risk (Karim & Karim, 2012). After all, it was not so clear cut in differentiating actual risk compensation and risk-adjusted excess return. This argument can be strengthened by the absence of short run relationship between stock markets of Singapore and Malaysia, Thailand and Philippines, meaning that market are less efficient in the short run enabling arbitrage opportunities, while slowly adjusting to achieve long-run equilibrium.

Overall, from this research project the relationship between stock markets returns of ASEAN-5 countries over long and short terms can be determined. Furthermore, such linkages are investigated from the perspective of Singapore, the only developed country among ASEAN-5.

5.3 Implications of the Study

5.3.1 Managerial Implications

Empirical findings above may bring significant implications to domestic investors as well as the investors from other countries who intend to invest or formed a diversified portfolio in ASEAN-5 markets. They have been provided a platform to acquire information of the integration and linkages among these markets, therefore risks exposure can be minimised. Based on empirical results,

investors could not gain benefit from diversifying their international portfolio within ASEAN-5 countries due to long-run relationship effect. However, investors may obtain arbitrage opportunities in short-run relationship due to inefficiencies of stock markets occur in ASEAN-5 countries.

Fund managers may have implication on decisions of company capital budgeting, investment strategies and consumption of investors. These businesses decisions being simply influenced by cross-border integration of stock markets. Fund managers from those multinational companies, mutual and pension funds, which have desire involve in cross-border investments are able to acquire deep knowledge to inspect on stock market relationship before making investments. Fund managers from Singapore companies are advised to involve international portfolio diversification with other than ASEAN-5 countries due to high integration among each other.

Policymakers may obtain implication on policy effectiveness from the empirical findings when making decisions for local policies involving ASEAN-5 countries. Policies will directly affect the development of a country. Therefore, policymakers are required to closely monitor on it. Those countries can move even more forward in the next decade of the new millennium, maintain the liquidity of the counties by design and implement proper policies. Therefore, linkages and integration of ASEAN-5 stock markets are vital for governments when implementing or making decision on policies. Government or policymakers can identify the stock market behavior with the presence of result from empirical findings. Therefore, empirical findings may give assistance to policymakers or regulators on financial performance to enhance economy growth and stability of stock market of a country.

5.4 Limitations of the study

This research project has some unavoidable limitations. Firstly, this research project limits and focuses in investigating the linkage between stock markets of Singapore and

other ASEAN-5 members because of the stock market developments within the region the past decade. In fact, there are a few financial assets that can be used for further investigating the true linkage of each ASEAN-5 countries such as bond market and other commodities. By adopting variety of financial assets to conduct similar research, it will provide a wider evidence of the linkage and better understanding of portfolio diversification strategies. For instance, if the volatility of stock market return in Malaysia is high, the Singapore investors can choose to invest in Malaysia bond market to diversify their portfolio risk.

On the other hand, the stock markets return of each ASEAN-5 were being measured by using such as STI, KLCI, JCI, SET and PSEi index return as proxies in this research project. There are other supplementary stock indexes can be used as proxies to conduct similar research. For instance, KLCI consist of 30 largest listed companies used as the benchmark of stock market return in Malaysia but there are other indexes from ace market such as FTSE Bursa Malaysia ACE (FTFBMMES) that this research does not discover yet by using the similar test. Furthermore, Indonesian stock market indices also included Jakarta Islamic Index which involved the listed companies that operate in line with Syariah business code. Therefore, this research project is unable to provide overall picture of the stock market return as there are variety of supplementary stock indexes can be studied. However, this research is conducted by using the main stock indexes of each ASEAN-5 to fulfil our objectives.

Moreover, this research project does not evaluate the linkage of stock market return between Singapore and ASEAN-5 according to each industries sector would be another limitation in this research. There are a few industries index can be used as the benchmark for similar research. For instance, FTSE ASEAN Sector Indices comprise of the large, mid and small cap that is evaluate based on industry and sector level from each ASEAN-5 countries. However, it is difficult to get a standardised industry index from each ASEAN-5 countries and the source of data is limited. Thus, this research is carried out by using the general benchmark index in order to meet our objective.

5.5 Recommendations for Future Research

Given the recent development in the ASEAN stock market, the stock market is the main focus of this research project. In the future, instead of using stock market index in the test, future researchers may focus or use different asset market such as bond market index or other commodities in order to broaden the evidence of the linkage of financial markets between Singapore and ASEAN-5. In addition, the foreign exchange market can also be focused in future researches. This will help investors to manage their portfolio diversification if the stock market volatility is high, they can invest at other asset markets.

On the other hand, this research was mainly used STI index return, KLCI index return, JCI index return, SET index return and PSEi index return as proxies to carry out this research project. Other than these indexes, there are many other indexes can be replaced or additionally used for future research. For instance, in Singapore there are FTSE ST All-Share Index, FTSE ST Mid Cap Index, etc. In Malaysia, the other indexes included in Bursa Malaysia such as FTSE Bursa Malaysia Large 30 Index, FTSE Bursa Malaysia 100 Index, etc. Asides to JCI index, Jakarta Islamic Index also can be used as Indonesia stock market index. Furthermore, Thailand stock market index also included SET50 Index and SET100 Index. In Philippines, the stock market consists of PSE All Shares Index, PSE Financials Index (FIN), etc. Hence, the future researchers can use different stock market index to enrich the similar research. The future researchers may further investigate a standard industries index from each country to carry out the test. This enable to examine which of the specific industries has the greatest influence to the stock market return between Singapore and ASEAN-5.

The investigation for the linkage of stock market return between Singapore and ASEAN-5 has been conducted in this research. The future researchers are encouraged to determine the relationship of stock market return between Singapore and other countries such as European countries or Latin America. By expanding the different countries data, the results will improve the understanding of portfolio diversification strategies and provide more information for future research.

5.6 Conclusion

In conclusion, this research project has studied the relationship between ASEAN-5 stock markets and the effect of towards Singapore stock market return. The results held that all selected independent variables, namely Malaysia, Indonesia, Thailand and Philippines stock market returns had positive significant effect towards Singaporean stock market. All in all, the general objective of investigating the relationship between stock market returns of Singapore and other ASEAN-5 countries (Malaysia, Indonesia, Thailand and Philippine) from the period of 2005 to 2016 on monthly basis had been achieved. The results from this project could be a useful reference to stock investors, fund managers, government and policymakers. Moreover, limitations of the research project were highlighted in this chapter while some recommendations were laid down to future researchers for a more improved study.

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APPENDICES

APPENDIX 1: MULTICOLLINEARITY

- **Pair-wise Correlation Matrix**

	logIND	**logMAL**	**logPHI**	**logTHAI**
logIND	1.000000	0.689524	0.683194	0.732340
logMAL	0.689524	1.000000	0.584946	0.585973
logPHI	0.683194	0.584946	1.000000	0.593558
logTHAI	0.732340	0.585973	0.593558	1.000000

- **Variance Inflation Factor (VIF) / Tolerance (TOL)**

	R^2	**VIF = $1/(1 - R^2)$**	**TOL = $1 - R^2$**
logMAL	0.508103	2.032946 < 10	0.491897 > 0
logIND	0.682036	3.145010 < 10	0.317964 > 0
logTHAI	0.560084	2.273161 < 10	0.439916 > 0
logPHI	0.504154	2.016755 < 10	0.495846 > 0

APPENDIX 2: HETEROSCEDASTICITY

- **Autoregressive Conditional Heteroskedasticity (ARCH) Test**

Heteroskedasticity Test: ARCH

F-statistic	0.038939	Prob. F(1,140)	0.8439
Obs*R-squared	0.039485	Prob. Chi-Square(1)	0.8425

Test Equation:

Dependent Variable: RESID^2

Method: Least Squares

Date: 03/23/17 Time: 15:04

Sample (adjusted): 2005M03 2016M12

Included observations: 142 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000171	2.89E-05	5.919478	0.0000
RESID^2(-1)	0.016661	0.084433	0.197331	0.8439

R-squared	0.000278	Mean dependent var	0.000174
Adjusted R-squared	-0.006863	S.D. dependent var	0.000296
S.E. of regression	0.000297	Akaike info criterion	-13.39326
Sum squared resid	1.23E-05	Schwarz criterion	-13.35163
Log likelihood	952.9218	Hannan-Quinn criter.	-13.37635
F-statistic	0.038939	Durbin-Watson stat	1.974867
Prob(F-statistic)	0.843855		

APPENDIX 3: AUTOCORRELATION

- **Breush-Godfrey Serial Correlation LM Test**

F-statistic	2.280561	Prob. F(1,137)	0.1333
Obs*R-squared	2.341462	Prob. Chi-Square(1)	0.1260

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 03/23/17 Time: 15:06

Sample: 2005M02 2016M12

Included observations: 143

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.91E-06	0.001136	0.005200	0.9959
LOGMAL	0.029798	0.105152	0.283383	0.7773
LOGIND	-0.014868	0.073501	-0.202284	0.8400
LOGPHI	-0.000931	0.067389	-0.013822	0.9890
LOGTHAI	0.011193	0.064950	0.172328	0.8634
RESID(-1)	-0.132214	0.087550	-1.510153	0.1333

R-squared	0.016374	Mean dependent var	1.23E-18
Adjusted R-squared	-0.019525	S.D. dependent var	0.013188
S.E. of regression	0.013316	Akaike info criterion	-5.758699
Sum squared resid	0.024291	Schwarz criterion	-5.634384
Log likelihood	417.7470	Hannan-Quinn criter.	-5.708183
F-statistic	0.456112	Durbin-Watson stat	1.995643
Prob(F-statistic)	0.808260		

APPENDIX 4: MODEL SPECIFICATION

- **Ramsey Regression Equation Specification Error Test (RESET) Test**

Ramsey RESET Test

Equation: UNTITLED

Specification: LOGSING C LOGMAL LOGPHI LOGTHAI LOGIND

Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.439378	137	0.6611
F-statistic	0.193053	(1, 137)	0.6611
Likelihood ratio	0.201366	1	0.6536

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	3.48E-05	1	3.48E-05
Restricted SSR	0.024695	138	0.000179
Unrestricted SSR	0.024661	137	0.000180
Unrestricted SSR	0.024661	137	0.000180

LR test summary:

	Value	df
Restricted LogL	416.5665	138
Unrestricted LogL	416.6672	137

Unrestricted Test Equation:

Dependent Variable: SING

Method: Least Squares

Date: 03/09/17 Time: 00:49

Sample: 2005M02 2016M12

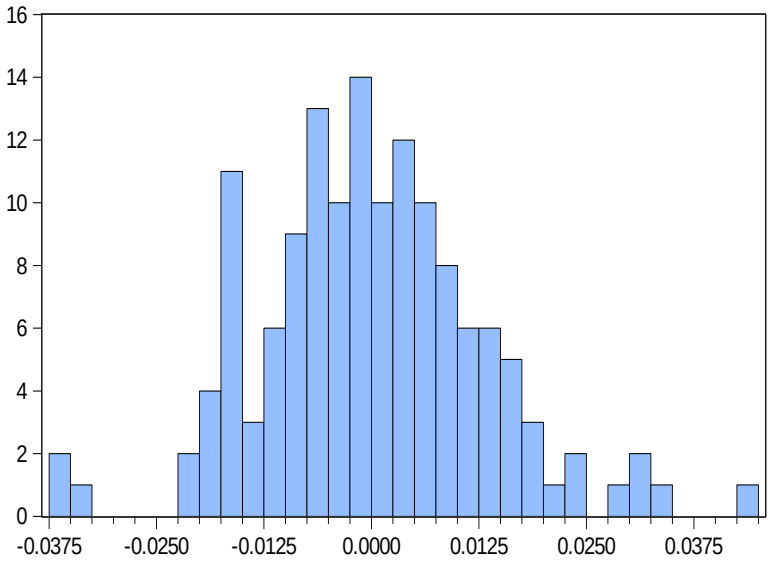
Included observations: 143

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.002163	0.001240	-1.744771	0.0833
LOGMAL	0.384343	0.104098	3.692126	0.0003
LOGPHI	0.194713	0.068214	2.854434	0.0050
LOGTHAI	0.185026	0.066609	2.777803	0.0062
LOGIND	0.251071	0.074187	3.384306	0.0009
FITTED^2	0.460899	1.048982	0.439378	0.6611

R-squared	0.670700	Mean dependent var	0.001081
Adjusted R-squared	0.658681	S.D. dependent var	0.022965
S.E. of regression	0.013417	Akaike info criterion	-5.743597
Sum squared resid	0.024661	Schwarz criterion	-5.619282
Log likelihood	416.6672	Hannan-Quinn criter.	-5.693082
F-statistic	55.80674	Durbin-Watson stat	2.236647
Prob(F-statistic)	0.000000		

APPENDIX 5: NORMALITY TEST

- **Jarque-Bera Test**



Series: Residuals	
Sample 2005M02 2016M12	
Observations 143	
Mean	-9.70e-20
Median	-0.000660
Maximum	0.044808
Minimum	-0.036931
Std. Dev.	0.013188
Skewness	0.231674
Kurtosis	3.898410
Jarque-Bera	6.088418
Probability	0.047634

APPENDIX 6: ORDINARY LEAST SQUARES (OLS) METHOD

Dependent Variable: LOGSING

Method: Least Squares

Date: 03/09/17 Time: 00:41

Sample (adjusted): 2005M02 2016M12

Included observations: 143 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.001954	0.001141	-1.712210	0.0891
LOGMAL	0.385464	0.103762	3.714881	0.0003
LOGPHI	0.191826	0.067698	2.833542	0.0053
LOGTHAI	0.178661	0.064824	2.756090	0.0066
LOGIND	0.246308	0.073176	3.365982	0.0010

R-squared	0.670236	Mean dependent var	0.001081
Adjusted R-squared	0.660677	S.D. dependent var	0.022965
S.E. of regression	0.013377	Akaike info criterion	-5.756175
Sum squared resid	0.024695	Schwarz criterion	-5.652579
Log likelihood	416.5665	Hannan-Quinn criter.	-5.714079
F-statistic	70.12018	Durbin-Watson stat	2.243801
Prob(F-statistic)	0.000000		

APPENDIX 7: UNIT ROOT TEST

- **Augmented Dickey-Fuller test**

Unit root for Log(1+IND)

Null Hypothesis: IND has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.379497	0.0000
Test critical values:	1% level	-3.476805	
	5% level	-2.881830	
	10% level	-2.577668	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(IND)

Method: Least Squares

Date: 03/09/17 Time: 00:27

Sample (adjusted): 2005M03 2016M12

Included observations: 142 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IND(-1)	-0.771839	0.082290	-9.379497	0.0000
C	0.003768	0.002274	1.657161	0.0997

R-squared	0.385897	Mean dependent var	4.60E-06
Adjusted R-squared	0.381511	S.D. dependent var	0.033914
S.E. of regression	0.026672	Akaike info criterion	-4.396457
Sum squared resid	0.099592	Schwarz criterion	-4.354825

Log likelihood	314.1484	Hannan-Quinn criter.	-4.379540
F-statistic	87.97496	Durbin-Watson stat	1.984291
Prob(F-statistic)	0.000000		

Unit root for Log(1+MAL)

Null Hypothesis: MAL has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.17477	0.0000
Test critical values:	1% level	-3.476805	
	5% level	-2.881830	
	10% level	-2.577668	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(MAL)

Method: Least Squares

Date: 03/09/17 Time: 00:29

Sample (adjusted): 2005M03 2016M12

Included observations: 142 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MAL(-1)	-0.849957	0.083536	-10.17477	0.0000
C	0.001552	0.001296	1.197279	0.2332

R-squared	0.425112	Mean dependent var	7.22E-05
Adjusted R-squared	0.421006	S.D. dependent var	0.020175
S.E. of regression	0.015351	Akaike info criterion	-5.501236
Sum squared resid	0.032993	Schwarz criterion	-5.459604

Log likelihood	392.5877	Hannan-Quinn criter.	-5.484318
F-statistic	103.5259	Durbin-Watson stat	2.044006
Prob(F-statistic)	0.000000		

Unit root for Log(1+PHI)

Null Hypothesis: PHI has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-11.08000	0.0000
Test critical values:	1% level	-3.476805	
	5% level	-2.881830	
	10% level	-2.577668	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(PHI)

Method: Least Squares

Date: 03/09/17 Time: 00:34

Sample (adjusted): 2005M03 2016M12

Included observations: 142 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PHI(-1)	-0.933885	0.084286	-11.08000	0.0000
C	0.003396	0.002009	1.690260	0.0932

R-squared	0.467207	Mean dependent var	-6.35E-05
Adjusted R-squared	0.463402	S.D. dependent var	0.032288
S.E. of regression	0.023652	Akaike info criterion	-4.636738
Sum squared resid	0.078320	Schwarz criterion	-4.595106

Log likelihood	331.2084	Hannan-Quinn criter.	-4.619820
F-statistic	122.7664	Durbin-Watson stat	1.990925
Prob(F-statistic)	0.000000		

Unit root for Log(1+SING)

Null Hypothesis: SING has a unit root

Exogenous: Constant

Lag Length: 0 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.710794	0.0000
Test critical values:	1% level	-3.476805	
	5% level	-2.881830	
	10% level	-2.577668	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(SING)

Method: Least Squares

Date: 03/09/17 Time: 00:35

Sample (adjusted): 2005M03 2016M12

Included observations: 142 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SING(-1)	-0.805063	0.082904	-9.710794	0.0000
C	0.000847	0.001906	0.444609	0.6573

R-squared	0.402474	Mean dependent var	-4.98E-05
Adjusted R-squared	0.398206	S.D. dependent var	0.029241
S.E. of regression	0.022684	Akaike info criterion	-4.720347
Sum squared resid	0.072038	Schwarz criterion	-4.678715

Log likelihood	337.1446	Hannan-Quinn criter.	-4.703429
F-statistic	94.29953	Durbin-Watson stat	2.026562
Prob(F-statistic)	0.000000		

Unit root for Log(1+THAI)

Null Hypothesis: THAI has a unit root

Exogenous: Constant

Lag Length: 2 (Automatic - based on SIC, maxlag=13)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.303441	0.0000
Test critical values:	1% level	-3.477487	
	5% level	-2.882127	
	10% level	-2.577827	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation

Dependent Variable: D(THAI)

Method: Least Squares

Date: 03/09/17 Time: 00:37

Sample (adjusted): 2005M05 2016M12

Included observations: 140 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
THAI(-1)	-0.677612	0.127768	-5.303441	0.0000
D(THAI(-1))	-0.068427	0.103896	-0.658607	0.5113
D(THAI(-2))	-0.245814	0.082017	-2.997120	0.0032
C	0.001828	0.002120	0.862289	0.3900

R-squared	0.447942	Mean dependent var	0.000171
Adjusted R-squared	0.435764	S.D. dependent var	0.033063

S.E. of regression	0.024835	Akaike info criterion	-4.524955
Sum squared resid	0.083883	Schwarz criterion	-4.440908
Log likelihood	320.7469	Hannan-Quinn criter.	-4.490801
F-statistic	36.78360	Durbin-Watson stat	2.012582
Prob(F-statistic)	0.000000		

- **Phillips-Perron (PP) test result**

Unit root for Log(1+IND)

Null Hypothesis: IND has a unit root

Exogenous: Constant

Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.470687	0.0000
Test critical values:	1% level	-3.476805	
	5% level	-2.881830	
	10% level	-2.577668	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000701
HAC corrected variance (Bartlett kernel)	0.000757

Phillips-Perron Test Equation

Dependent Variable: D(IND)

Method: Least Squares

Date: 03/28/17 Time: 20:12

Sample (adjusted): 2005M03 2016M12

Included observations: 142 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
IND(-1)	-0.771839	0.082290	-9.379497	0.0000
C	0.003768	0.002274	1.657161	0.0997

R-squared	0.385897	Mean dependent var	4.60E-06
Adjusted R-squared	0.381511	S.D. dependent var	0.033914
S.E. of regression	0.026672	Akaike info criterion	-4.396457
Sum squared resid	0.099592	Schwarz criterion	-4.354825
Log likelihood	314.1484	Hannan-Quinn criter.	-4.379540
F-statistic	87.97496	Durbin-Watson stat	1.984291
Prob(F-statistic)	0.000000		

Unit root for Log(1+MAL)

Null Hypothesis: MAL has a unit root

Exogenous: Constant

Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-10.52009	0.0000
Test critical values:	1% level	-3.476805	
	5% level	-2.881830	
	10% level	-2.577668	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000232
HAC corrected variance (Bartlett kernel)	0.000311

Phillips-Perron Test Equation

Dependent Variable: D(MAL)

Method: Least Squares

Date: 03/28/17 Time: 20:13

Sample (adjusted): 2005M03 2016M12

Included observations: 142 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MAL(-1)	-0.849957	0.083536	-10.17477	0.0000
C	0.001552	0.001296	1.197279	0.2332

R-squared	0.425112	Mean dependent var	7.22E-05
Adjusted R-squared	0.421006	S.D. dependent var	0.020175
S.E. of regression	0.015351	Akaike info criterion	-5.501236
Sum squared resid	0.032993	Schwarz criterion	-5.459604
Log likelihood	392.5877	Hannan-Quinn criter.	-5.484318
F-statistic	103.5259	Durbin-Watson stat	2.044006
Prob(F-statistic)	0.000000		

Unit root for Log(1+PHI)

Null Hypothesis: PHI has a unit root

Exogenous: Constant

Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-11.28256	0.0000
Test critical values:	1% level	-3.476805	
	5% level	-2.881830	
	10% level	-2.577668	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000552
HAC corrected variance (Bartlett kernel)	0.000718

Phillips-Perron Test Equation

Dependent Variable: D(PHI)

Method: Least Squares

Date: 03/28/17 Time: 20:14

Sample (adjusted): 2005M03 2016M12

Included observations: 142 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PHI(-1)	-0.933885	0.084286	-11.08000	0.0000
C	0.003396	0.002009	1.690260	0.0932

R-squared	0.467207	Mean dependent var	-6.35E-05
Adjusted R-squared	0.463402	S.D. dependent var	0.032288
S.E. of regression	0.023652	Akaike info criterion	-4.636738
Sum squared resid	0.078320	Schwarz criterion	-4.595106
Log likelihood	331.2084	Hannan-Quinn criter.	-4.619820
F-statistic	122.7664	Durbin-Watson stat	1.990925
Prob(F-statistic)	0.000000		

Unit root for Log(1+SING)

Null Hypothesis: SING has a unit root

Exogenous: Constant

Bandwidth: 5 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.864524	0.0000
Test critical values:	1% level	-3.476805	
	5% level	-2.881830	
	10% level	-2.577668	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000507
HAC corrected variance (Bartlett kernel)	0.000580

Phillips-Perron Test Equation

Dependent Variable: D(SING)

Method: Least Squares

Date: 03/28/17 Time: 20:15

Sample (adjusted): 2005M03 2016M12

Included observations: 142 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SING(-1)	-0.805063	0.082904	-9.710794	0.0000
C	0.000847	0.001906	0.444609	0.6573

R-squared	0.402474	Mean dependent var	-4.98E-05
Adjusted R-squared	0.398206	S.D. dependent var	0.029241
S.E. of regression	0.022684	Akaike info criterion	-4.720347
Sum squared resid	0.072038	Schwarz criterion	-4.678715
Log likelihood	337.1446	Hannan-Quinn criter.	-4.703429
F-statistic	94.29953	Durbin-Watson stat	2.026562
Prob(F-statistic)	0.000000		

Unit root for Log(1+THAI)

Null Hypothesis: THAI has a unit root

Exogenous: Constant

Bandwidth: 6 (Newey-West automatic) using Bartlett kernel

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-9.861669	0.0000
Test critical values:	1% level	-3.476805	
	5% level	-2.881830	
	10% level	-2.577668	

*MacKinnon (1996) one-sided p-values.

Residual variance (no correction)	0.000654
HAC corrected variance (Bartlett kernel)	0.000712

Phillips-Perron Test Equation

Dependent Variable: D(THAI)

Method: Least Squares

Date: 03/28/17 Time: 20:16

Sample (adjusted): 2005M03 2016M12

Included observations: 142 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
THAI(-1)	-0.808810	0.082771	-9.771645	0.0000
C	0.001793	0.002169	0.826478	0.4099

R-squared	0.405482	Mean dependent var	-0.000103
Adjusted R-squared	0.401236	S.D. dependent var	0.033273
S.E. of regression	0.025746	Akaike info criterion	-4.467052
Sum squared resid	0.092803	Schwarz criterion	-4.425421
Log likelihood	319.1607	Hannan-Quinn criter.	-4.450135
F-statistic	95.48505	Durbin-Watson stat	1.911981
Prob(F-statistic)	0.000000		

APPENDIX 8: GRANGER CAUSALITY TEST

Pairwise Granger Causality Tests

Date: 03/09/17 Time: 01:08

Sample: 2005M01 2016M12

Lags: 13

Null Hypothesis:	Obs	F-Statistic	Prob.
MAL does not Granger Cause IND	130	1.81322	0.0505
IND does not Granger Cause MAL		0.64723	0.8087
PHI does not Granger Cause IND	130	1.97108	0.0305
IND does not Granger Cause PHI		2.84815	0.0016
SING does not Granger Cause IND	130	2.84520	0.0016
IND does not Granger Cause SING		1.55143	0.1119
THAI does not Granger Cause IND	130	1.65156	0.0831
IND does not Granger Cause THAI		0.99475	0.4619
PHI does not Granger Cause MAL	130	0.60760	0.8430
MAL does not Granger Cause PHI		1.12664	0.3457
SING does not Granger Cause MAL	130	1.36156	0.1910
MAL does not Granger Cause SING		2.50957	0.0050
THAI does not Granger Cause MAL	130	0.70046	0.7590
MAL does not Granger Cause THAI		1.10135	0.3664
SING does not Granger Cause PHI	130	1.48311	0.1363
PHI does not Granger Cause SING		1.55266	0.1115
THAI does not Granger Cause PHI	130	3.02067	0.0009
PHI does not Granger Cause THAI		1.21286	0.2809

THAI does not Granger Cause SING	130	1.63538	0.0872
SING does not Granger Cause THAI		1.01407	0.4437

APPENDIX 9: JOHANSEN CO-INTEGRATION TEST

Date: 03/23/17 Time: 17:48

Sample (adjusted): 2005M04 2016M12

Included observations: 141 after adjustments

Trend assumption: Linear deterministic trend

Series: LOGSING LOGMAL LOGTHAI LOGPHI LOGIND

Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.456245	323.6265	69.81889	0.0001
At most 1 *	0.424779	237.7213	47.85613	0.0001
At most 2 *	0.379334	159.7481	29.79707	0.0001
At most 3 *	0.323032	92.49645	15.49471	0.0000
At most 4 *	0.233462	37.48784	3.841466	0.0000

Trace test indicates 5 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.456245	85.90520	33.87687	0.0000
At most 1 *	0.424779	77.97313	27.58434	0.0000
At most 2 *	0.379334	67.25167	21.13162	0.0000
At most 3 *	0.323032	55.00861	14.26460	0.0000
At most 4 *	0.233462	37.48784	3.841466	0.0000

Max-eigenvalue test indicates 5 cointegrating eqn(s) at the 0.05 level

* denotes rejection of the hypothesis at the 0.05 level

**MacKinnon-Haug-Michelis (1999) p-values