THE RELATIONSHIP BETWEEN MACROECONOMIC VARIABLES AND STOCK MARKET PERFORMANCE IN THAILAND

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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 17,056 words.

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DEDICATION

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TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
AFC	Asian Financial Crisis
ARCH	Autoregressive Conditional Heteroscedasticity
APT	Arbitrage Pricing Theory
ASEAN	Association of Southeast Asian Nations
BLUE	Best Linear Unbiased Estimator
BSE	Bangkok Stock Exchange
CAPM	Capital Asset Pricing Model
CPI	Consumer Price Index
DCC	Dynamic Conditional Correlation
DW	Durbin -Watson
EMH	Efficient Market Hypothesis
E-view 7	Econometric View 7
GDP	Gross Domestic Product
HK	Hong Kong
IPI	Industrial Production Index
JB	Jarque-Bera
KLCI	Kuala Lumpur Composite Index
OLS	Ordinary Least Square
REER	Real Effective Exchange Rate

RESET	Ramsey's Regression Equation Specification Error Test
RMB	Ren Min Bi (currency of People's Republic of China)
SET	Stock Exchange of Thailand
SIC	Schwarz Information Criterion
TOL	Tolerance
US	United States
VAR	Vector Autoregressive
VECM	Vector Error Correction Model
VIF	Variance Inflation Factor

LIST OF APPENDICES

PREFACE

Nowadays, the study about stock market performance in developing country is a popular and interesting topic for many researchers. The effects the macroeconomic variables can be investigate by using the multiple linear regression model.

This research could provide useful information or guidelines to several parties who tend to get more understanding about stock market performance in Thailand such as investors.

ABSTRACT

This research examines the relationship between macroeconomic variables and the stock market performance in Thailand from year 2003 to 2016. From the 56 quarterly data observations, this research applied several empirical tests to determine the impact of selective variables on stock market performance. From the empirical test, gross domestic product has the negative relationship with stock market performance in Thailand while money supply, real effective exchange rate, consumer price index and industrial production index have the positive relationship with the stock market performance in Thailand. The Normality Jarque-Bera (JB) Test showed that the error terms are not normally distributed and the model is significant at 5% significance level. Result from unit root test indicated that all variables except consumer price index are not stationary at level while all variables except money supply is stationary at first difference. Lastly, Granger Causality Test and Johansen Co-integration Test have been carried out to discover the short and long run relationship between the variables. Granger Causality Test found that the causality between the stock market performance and real effective exchange rate is no existed in this research.

CHAPTER 1: RESEARCH OVERVIEW

1.0 Introduction

This chapter enables the reader to get a brief understanding on the overview of the research topic which is the relationship between macroeconomic variables and stock market performance in Thailand. The objective of the study is to identify the relationship between the stock market performance and the macroeconomic variables such as gross domestic product (GDP), money supply (M2), real effective exchange rate (REER), inflation rate (CPI) and industrial production index (IPI) while also explains the research problem of this research topic. This chapter is the combination of several content parts which included research background, problem statement, research objectives, research questions, significance of the study, and chapter layout.

1.1 Background of Research

Stock market is one of the critical parts in the country economic development. The relationship between macroeconomic variables and stock market performance has been widely studied by the researchers in developed countries or developing countries. Stock market is crucial to the global economy due to the economy of the country will affected by the growth of the industry and also the commerce of the country. It is because that the government, industry and central banks of the country concerns on the movement of the stock market. The stock market is important for the industry's viewpoint as well as the investor's viewpoint.

Thailand selected in this research study to examine the relationship between macroeconomics variables and the stock market performance in this country. The macroeconomics variables used in this study are included gross domestic product (GDP), money supply (M2), real effective exchange rate, inflation rate, and industrial production index. The Stock Exchange of Thailand (SET Index) is the stock market index for Thailand, and is also the dependent variables in this study.

The Stock Exchange of Thailand (SET Index) is the national stock market in Thailand. In the year 1975, the collapse of Bangkok Stock Exchange (BSE) has established the Stock Exchange of Thailand (SET) which represented their secondary market situated at Bangkok. On the exact date of 30 April 1975, this national stock market of Thailand officially started the trading under the name of Securities Exchange of Thailand. The name of Stock Exchange of Thailand (SET Index) was officially used after the name changing in 1991. The main index of Stock Exchange of Thailand (SET Index) is named after SET index which included eight main industries company securities from agro and food industry, consumer product, financials, industrials, property and construction to resources, services and lastly technology ("The Stock Exchange of Thailand", 2017).

Initially, Thailand is one of the Asia countries with favourable economic level back in 1990s. Stock Exchange of Thailand (SET Index) at that time provided a system that enable the resource to be reallocate within the sectors available in Thailand economy. This movement of SET Index had significantly affected the economic development of Thailand. SET Index as a developing emerging market plays a vital role in the international context as it affect the international capital flows. Thailand stock market is probably similar or rather typical with other Asian stock market in general based on the manageable size and multiple characteristic. The understanding of the system of this stock market development is very important (Bos, Ding and Fetherston, 1998). However this is pre-financial crisis period.

Thailand appeared as one of the main victims from the financial crisis attack named as Asian Financial Crisis (AFC) back in 1997-98 periods. The meltdown of economic began in Thailand first out of other Asia countries involved. At first with a Thai property developer announced the failure to make an interest payment worth $3.1 million on the $80 million Eurobond loan in February 5, 1997 at Somprasong Land. The Thailand stock market which already declined at a large percentage of 45% in 1996, fell another 2.7% based on the bankruptcy news but that not the end. One of the largest financial institution in Thailand, Finance One bankrupt due to the debtor unable to repay the debt which initially cause Finance One unable to do repayment to its creditors (Lauridsen, 1998). Indeed, the fall on the economic status of Thailand due to Asian Financial Crisis in 1997 affected its stock market performance.

As a matter of facts, Asian Financial Crisis (AFC) in 1997 affected the stock market together with macroeconomic variables. Thailand Gross Domestic Product (GDP) was at healthy level with an average of 8% annually before AFC strike. Ever since AFC hit the Asia region, Thailand average GDP dropped to around 3% in year 1998 to 2006 according to the data from World Bank. According to Montesano (2001), Thailand economic level in year 2000 appeared to be at a lower point due to Thailand politics issue as in one of Thailand most powerful politician was being brought down from the politic stage. The reformations of Thailand politics bring direct impact into its economic level. Money supply (M2) hit the lowest growth rate of 0.4% in year 2000 since post AFC. Thai Baht, the exchange currency of Thailand depreciate dramatically in term of exchange rate against U.S dollar during post AFC period. The exchange rate of Thai Baht against U.S dollar decline drastically from time to time during that crisis period where from 25 Thai Baht into $1 dollar to in earlier period to 55 Thai Baht into $1 dollar in July 1997 (Lauridsen, 1998). However consumer price index (as measure of inflation) does not fluctuate much even before or after AFC strike.

1.2 Problem Statement

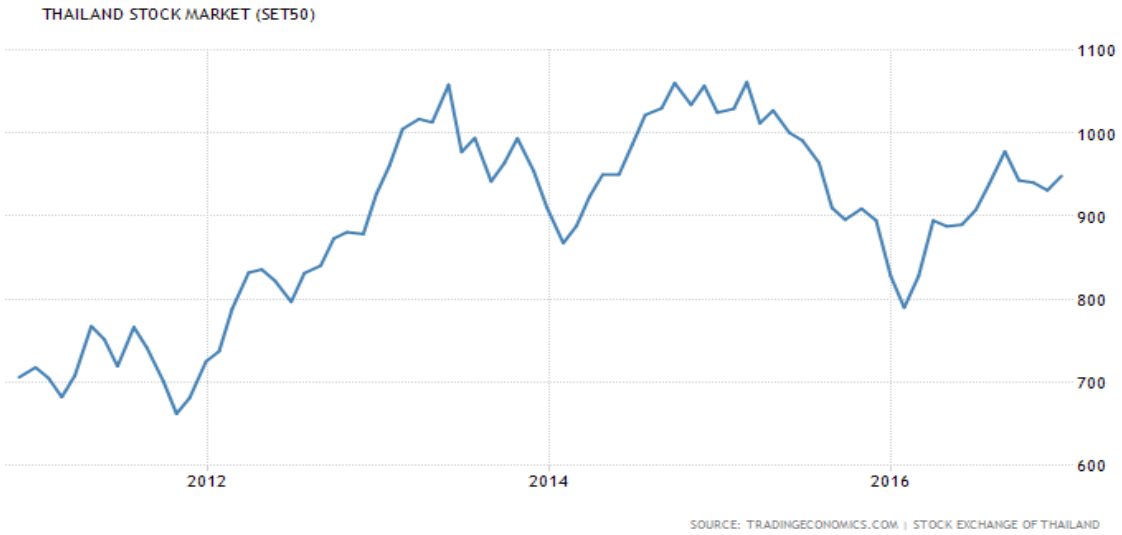
Stock market provides the opportunity for company to raise the capital through exchange the company ownership with investor. Stock market is a significant part of the financial system and act as a source of financing a new venture based on its expected profitability (Kalim and Shahbaz, 2009). Stock market index is the benchmark and measurement of stock market performance. Stock market index always being used as the indicator of the economy performance (Nordin, Nordin and Ismail, 2014).

Garcia and Liu (1999) proved that the stock markets are one of the most important topics around the globe. Besides, a theoretical model which contains a huge arrangement of the determinants of stock market development might be hard to settle so more research should be conduct in forward for the future studies purpose (Ho and Lyke, 2016).

Most research in this area has focused on stock markets in the United States (Flannery, 2002) and other developed countries, such as Japan (Mukherjee and Naka, 1995), Poland (Okon, 2012), China (Zhao, 1999) and Singapore (Maysami and Koh, 2000). Although some studies have analysed the relationships between macroeconomic variables and stock market movements in developing countries, including Pakistan (Nishat and Shaheen, 2004), the United Arab Emirate (Al-Tamimi, Alwan, and Abdel Rahman, 2011), Turkey (Çagli, Halac, Taskin, 2010) and Malaysia (Rahman, Mohd Sidek and Tafri, 2009), little research has been conducted in Southeast Asia and in Thailand in particular (Kwanchanok, 2000). The motivation arose after a review of the existing literature regarding the relationship between selected macroeconomic variables and stock market performance. Although the relationship has been well established in other countries, only limited research has been conducted in Thailand. As similar with most of the countries, macroeconomic indicators play a significant role in driving the stock market in Thailand. According to Forson and Janrattangul (2014), there are limited researches

that had been done in Thailand while little studies are in English as well. They indicated that macroeconomic variables in Thailand could be affected by further research on policies making regarding the selected variables.

Figure 1.1: Thailand stock market movement trend



Source: Trading Economics (Periods: 2012-2016)

When most of the researchers focus on determining developed countries stock market performance in relationship with macroeconomic variables such as United States (Patro, Wald and Wu, 2014), Thailand as a developing nation is not the priorities by the researchers. Therefore it is motivated to study on the stock market trend of Thailand as there are very limited sources or studies that have been done on it. Research can be done to concern about the reason that influences the trend of Thailand stock market. As such, studies on comparison between trend of other countries especially main stream developed countries with many researches generated and the market trend of Thailand may able to be done in future.

Ross (1976) and Fama (1981) indicated that stock prices may have been influenced by several factors such as interest rate, exchange rate and money supply. However, not all of the macroeconomic variables being examined in term of the impact on the stock price fluctuation. In majority rare macroeconomic variables have less research

done on its influence toward the stock market movement. Therefore, it is motivated to conduct the research in Thailand to determine the macroeconomic variables that significantly affect stock market performance in Thailand since there are few factors examined in past research. The main purpose of this paper is to examine the relationship between the selected macroeconomic variables and the performance of the Thailand stock market (SET Index).

1.3 Research Objectives

1.3.1 General Objective

This research tends to improve current knowledge associated with the influence of the five macroeconomic factors which include gross domestic product (GDP), money supply (M2), real effective exchange rate, consumer price index, and industrial production index on the stock market performance in Thailand and to examine the relationships of these five factors with the stock market performance.

1.3.2 Specific Objectives

The specific term of the objectives of this paper are:

a) To examine whether there is significant relation between gross domestic product (GDP) and stock market performance in Thailand (SET Index).
b) To examine whether there is significant relation between money supply (M2) and stock market performance in Thailand (SET Index).

c) To investigate whether there is significant relation between real effective exchange rate and stock market performance in Thailand (SET Index).
d) To investigate whether there is significant relation between consumer price index and stock market performance in Thailand (SET Index).
e) To identify whether there is significant relation between the industrial production index and stock market performance in Thailand (SET Index).

1.4 Research Questions

With the research objectives above, the research questions of this study are the followings:

a) Is stock market performance in Thailand (SET Index) has a significant relationship with gross domestic product (GDP)?
b) Is stock market performance in Thailand (SET Index) has a significant relationship with money supply (M2)?
c) Is stock market performance in Thailand (SET Index) has a significant relationship with real effective exchange rate?
d) Is stock market performance in Thailand (SET Index) has a significant relationship with consumer price index?
e) Is stock market performance in Thailand (SET Index) has a significant relationship with industrial production index?

1.5 Significance of the study

In this study, this paper intends to investigate the relationship between dependent variable (SET Index) and five macroeconomic variables as the independent variables which are gross domestic product (GDP), money supply (M2), real effective exchange rate, inflation rate, and industrial production index in Thailand. The main contribution of this study goes to evaluate the relationship between the five macroeconomics variables and the stock market performance in Thailand in quarterly basis from year 2003 to 2016.

This paper tends to combine the idea of previous researchers with current study in order to newly create a research paper that is useful for the stock market participants including policy makers, investors and such. This paper could serve as reference for policy makers for future policies making purpose. This paper could also provider information that useful for the investors. Plus, this paper updates the information from the pass to current. In order to contribute to this line of study into Thailand, this paper extends the existing studies on the five macroeconomics effects such as gross domestic product (GDP), money supply (M2), real effective exchange rate, inflation rate (CPI), and industrial production index on the Stock Exchange of Thailand (SET Index).

This research helps the investors for knowing the better inside of the impact of macroeconomic factors on stock market performance in Thailand. It also provides the current knowledge of the stock market performance. This research help on investigating the relationship between the different macroeconomic variables with the stock market performance and also present that which variables have significant relationship with the stock market performance in Thailand. Similarly, investor's capabilities will be enhanced which helps in improving decision making by knowing the effects of macroeconomic variables on stock market performance in Thailand.

Moreover, this research could be served as a base for the future researcher. It helps the future researcher on getting an idea of the influence done by the five macroeconomic factors chosen toward the performance of Thailand stock market. This research could be a material needed for reference by the policy maker as well. In future, policy maker could study on this research regarding the effect of macroeconomic variables on stock market to produce a new policy or revise the existing policies.

1.6 Chapter Layout

This research involves five chapters as follows:

Chapter 1 – This chapter provides a description on the background of study, and explain the problem statement, research objectives, research questions, and significance of the study.

Chapter 2 – This chapter focuses on the literature review, and discussed the five independent variables and the previous studies on the stock market.

Chapter 3 – This chapter describe the methodology use in this study, as well as the data sources. Besides that, the research design is also explained which talks about this research is performed and the methods of data analysis.

Chapter 4 – This chapter presents the results of the research that obtained from those methods used from the previous chapter. The analysis is carried out to obtain the

findings for the research questions and hypothesis for the main purpose of this research.

Chapter 5 – This chapter will conclude the major findings of this research. Other than that, it also discussed the implications and limitations. In this chapter, the recommendations for future researchers are suggested.

1.7 Conclusion

This chapter had carried out the research background of the study, problem statement, research objectives and research question which help other researcher to understand the purpose of conducting this research. Moreover, the significance of the study which has also been covered in this chapter on how this research contributes to the public. Other than that, it involved the chapter layouts in this chapter to provide more understanding in the outline of every chapter in this research. In the followings of chapter 2, there will be discussion on the literature review, theoretical framework based on the past research on this relationship between macroeconomics variables and the stock market performance in Thailand.

CHAPTER 2: LITERATURE REVIEW

2.0 Introduction

In this chapter, the main theoretical foundation used in this study the stock market performances in Thailand, and the observation of literature review in every variables. Proposed conceptual framework helps the readers' acknowledged and also develops hypotheses which are used to clarify the influences between variables. This research macroeconomics variable that influence the stock index are generally. In short, we may proceed our research with some methodologies to provide few outcome that influence the variables.

2.1 Theoretical Foundation

2.1.1 Stock Market Performance

A stock is a share on ownership of a corporation. Whereas a share on ownership gives the owner of stock participants in that company. As a result, those owners have voting rights over the decision of that corporation made and also the right over the profits the corporation earned. According to Garcia and Liu (1999), stock market is an essential presence in the overall economy. Generally, stocks characterized as experiencing an upward trend over the long term. However, this is not guaranteed in whatsoever way

especially when the investors consider individual stocks. They will enjoy profits from stocks only if the index increases.

Furthermore, it is also one of the major factors that influence the choice of individual or household to contribute their capital. In investigating the relation of stock market prices in different countries, the investigators from various countries selected their macroeconomic variables as well as the observation period. According to those past research, Fama and Schwert (1977), Jeffe and Mandelker (1976), and Nelson (1977), all affirming that macroeconomic variables affect stock market performance. Besides, stock market is a marketplace that exchanges the stock between buyer and seller. There have several different stock exchanges, including the Stock Exchange of Thailand (SET Index) that may influence by several of macroeconomics variables. Furthermore, stock market also is a very useful financial tool for companies to raise fund. For example, Malaysia used KLCI as an indicator for the performance of Malaysia stock market as well as Malaysia's economy condition.

According to Caporale, Howell and Soliman (2004), stock market may foster economic growth through capital accumulation with a well-functioning. However, a number of studies have been done between gross domestic product, money supply, real broad effective exchange rate, consumer production index and industrial production index and stock market, either these variables have significant or insignificant relationship. According to Pilinkus (2009), the studies on relation between various macroeconomic variables ad the Lithuanian stock returns. Another investigation which including inflation rate (CPI), GDP and exchange rate (REER) in explaining the relationship between stock return in Palestine (Harasheh & Abu-Libdeh, 2011). Besides, Pearce (1983) also make his own studies on the relation of stock market with the economy. Thus, by acquiring the relevant information on those variables and economic or financial

market conditions, investors can make a better choices in a right way about stock market performance.

2.1.2 Gross Domestic Product (GDP)

The gross domestic product (GDP) affect the stock market fundamentally influence by financial conditions and consumer certainty. When stocks are in a good market, there has a tendency to be a great deal of optimism encompassing the economy and the possibilities of different stocks. For example, when GDP getting low, it negatively affects stock market through the similar channels. Companies are compelled to cut expenses and workers. It is because of these components and the pessimistic atmosphere, investing in new projects is improbable.

In spite of the fact that business sectors were uneven all week, stocks shut down somewhat higher after comments by Janet Yellen, Federal Reserve Chairperson supported investors that the best approach to higher interest rates would be continuous and data driven. Investors likewise observe the GDP for fourth quarter reading, which demonstrated that the economy turned out to be only 2.2% over the most recent three months of the year. Economic growth cooled essentially from the 5.0% growth found in the second from last quarter while this isn't a terrible number by any had expanded. In general, the economy grew 2.4% of every 2014, up from 2.2% out of 2013 (Ken, 2015). Reddy (2012) investigated the linkage of macroeconomic factor like GDP will affect the overall return in the stock market. Stock Market value index represented in stock prices of the model.

Furthermore, even during periods of economic growth markets positively that can behave unpredictably in temporarily as we can have seen. Since they give the overall scorecard about the general strength of the economy, investors alert about GDP reports. It is because of the good economic growth helps to boost corporate profits, as time goes on stock market performance

tends to reflect economic performance. Ademola (2014) cited in Osamwonyi and Evbayiro-Osagie (2012) examined that the GDP affects the growth rate of the economy positively. The higher the growth rate of GDP, the better for stock market and stocks' prices.

Moreover, more researcher reference that whether an economy GDP growth rate is an antecedent stock market return. For example, over the period 2000-2013 the Chinese stock market has exhibited poor performance regardless the fact that the Chinese economy has been the fastest developing economy globally for the past three decades. Besides that, over year 1900–2002, the real stock returns and per capita GDP growth for 16 countries is negatively correlated (Mugambi and Okech, 2016).

2.1.3 Money supply (M2)

Basically, monetary policies play an important role in response to money supply. According to the review studies of Haitsma, Unalmis and Haan (2016), the changes of monetary policies unexpected might affected the stock market return that approaches by Rigobon-Sack heteroscedasticity. The Euro STOXX 50 index (stock market) affected unexpected conventional and unconventional monetary policy surprises. Moreover, this statement also brings the European Central Bank's unconventional monetary policies cut down the intra-euro area sovereign explored. Besides, the releasing of monetary policy related during times of bubbles may signal economic conditions getting worse to investors. On the off chance that the conventional policy rates lower is no longer considered a productive venture by investors, but economic problems not in a good condition and it may prompt to stock returns reduced. This situation will cause money supply increase and stock market to be lower.

Sulaiman, Adam, Anwar and Adnan (2009) resulted M2 have significantly or negatively affect to stock market. For example when M2 increased affect inflation happens consequently people will sell shares and other assets which affect the share prices decrease. Moreover, stock price that are influenced by the changes of money supply might be thought to be considered to be the casual effect of money supply since it will be modify the expectation of future monetary policy. They discovered that US interest rate has a direct effect on ASEAN stock market in bull market due to money supply of financial disturbance transferred to foreign countries through US home ground and stock price dynamics. Bull market which means the share prices are increase, encourage people to buy more. The review have discovered that US stock market have positive and critical return in both market since high development of growth rate in money supply supports excess of liquidity by pushing the asset price up effectively.

Furthermore, Yang and Hamori (2014) by using Markov-switching model have utilized 3-month Treasury bill rate in the ASEAN countries to observe the relationship of money supply and stock market performance. This model influence the time period of the economic goes down. Besides, spillover or overflow effect of US monetary policies during tranquil have generally higher stock return and low volatility period in ASEAN stock market. During recession, this effect does not make any difference in light of fact that the authority during the crisis periods may close down through transmission channels. In short, the stock market are not easily affected by US dollar especially during economies crisis.

Zare, Azali and Habibullah (2013) have examined the connection of good and bad which also means bull and bear market with Markov-switching model grouping to study stock market performance. This review is to prove that skew reaction of unpredictable stock market to monetary policy towards

various market in ASEAN5 countries which included Malaysia, Indonesia, Singapore, the Philippines and Thailand. This result has demonstrated that there is happened low money supply that fostered a solid long-run response in bear market than bull market on stock market volatility. Comparative this review of study which examine of Thorbecke (1997) and Yang and Hamori (2014) stated stock market volatility is moderately lower in expansion of economy, implies when the money supply are positively trending in the bull market. It is very important that monetary policies in economy by government in federal discount rate that also caused the high and low of interest rate which will bring impact to stock market.

Lastly, Maskay (2007) anticipated changes in money supply might affect stock price thus this statement upheld by the efficient market hypothesis. The changes on money supply of money demand in the market accumulated details to affected high cash flow among stock market and stock price. Likewise, Maskay (2007) discovered that adjustment in stock performance because of changes in money supply not simply happens in the long run, however rather occur in the short run which indicated stock market effectiveness cannot exclusively be clarified by money supply. Other than that, Thorbecke (1997) demonstrated that anticipated money supply matters acquire more the share market system than unexpected money supply.

2.1.4 Real Effective Exchange Rate (REER)

Based on the theory, real effective exchange rate (REER) is the common measurement of changes in relative price levels that both domestic and foreign prices stated in one currency unit (Brixiova, 2013). REER viewed as an important macroeconomic variable because it contributed to the economic growth and used by policymakers to formulate new strategies.

When a country able to affect REER positively by the way of rapid productivity growth, it might actually benefit the country while boosting the value of exchange rate in stock market.

Griffin, Nardari and Stulz (2004) conducted a research in Thailand, Indonesia, Korea, Taiwan and India. They convinced that the foreign flows will significantly related to stock market, as the foreign investors are likely to make investments in the stock market which provides higher returns, and move out from the stock market which performed negatively. In the other hand, Katechos (2011) recognized that the stock market and exchange rate are significantly related, he conducted his investigation by using new approach and found that high yielding currencies are significantly related to stock market, while the low yielding currencies are negatively related to stock market.

According to Vejzagic and Zarafat (2013), exchange rate does significantly affect the stock market. The volatility in price changes of exchange rates affected the company as it will leads to an impactful movement of the index. More foreign capital will be attracted when stock price increases which lead to healthy exchange rate, however fall in stock prices will resulted in company health which lead to country wealth reduction. Basically when stock index vary from the equilibrium, exchange rate will be negatively affected.

Dimitrova (2005) identified that the stock price relative to the REER which resulted in stock prices predicted to react uncertainly to exchange rate. Depreciation on exchange rate could go both way where might increase or decrease the value of the companies based on the main activities on either imports or exports. Furthermore, Dimitrova (2005) examined that there appears a linkage between exchange rate and the stock market. The linkage between foreign exchange and stock markets could go both end where either go positive when stock price is lead variable or possibly go negative when

exchange rate is the lead variable. He also stated that depreciation of exchange rate by less than one percent to one percent could bring impact to stock market while appreciation on exchange rate could improve stock market as well.

Wong (2017) investigated the relation between the stock market and real exchange rate in Asian and European economies. He concluded his research by saying that the stock market and real exchange rate are mostly negatively related. He also identified the exchange market is the good predictor the behaviour of stock market especially in the Asian economies. After the Asian financial crisis 1997, it demonstrated the devaluation of Thai baht makes the reduction of value for other currencies that eventually resulted the slowdown of stock markets in Asian region eventually. Liang, Lin and Hsu (2013) supported the exchange rate negatively affect the stock market by using monthly data over the period of 2008 to 2011 for five ASEAN countries which including Indonesia, Thailand, Philippines, Malaysia and Singapore.

Moreover, Tian and Ma (2010) proved that exchange rate together with another macroeconomic variable, money supply affect the stock price in a positive relationship. They noticed that after local currency appreciate together with the increasing money supply, it help boost the market into a higher level. They also identified the China stock market securities prices are co-integrated with the foreign exchange rate where RMB (Ren Min Bi, China currency) against U.S. dollar and H.K. dollar. According to their research, 32 percentage of changes in Shanghai stock market index in long run affected by the one percentage of change in exchange rate of RMB against U.S. dollar. The one percent changes of RMB against H.K. dollar causes 38 percent changes in Shanghai stock market index.

According to Moore and Wang (2014), U.S. stock market influences the Asian market by bringing together the local stock market and exchange rate. They suggested that dynamic conditional correlation (DCC) approach could be one of the most appropriate method in examining the relationship between the stock returns and foreign exchange. Asian countries integrate with U.S. economically is suggested as an increase in trade balance which could tighten the relationship between stock market and foreign exchange for the Asian economies. The stock market of the Asian integrated with US stock market rapidly, it could possibly push up the market to a higher level that cause stock interest rate to change which could be used by policymakers in setting the interest rate.

2.1.5 Consumer Price Index (CPI)

In theoretical, Consumer Price Index (CPI) is one of the measure price index for inflation. CPI is one of the important variables to investigate the stock market performance. According to the prior studies, Wongbangpo and Sharma (as cited in Hussainey & Ngoc, 2009) believed that CPI is the factor which representing inflation rate, they also examined the relationship between CPI and stock market in five Asian countries which are Philippines, Malaysia, Indonesia, Thailand and Singapore. From this investigation, they concluded that CPI negatively influenced the stock prices and they also explained the higher prices level will lead to increase cost of production which makes the reduction in future profitability.

When the price level for goods and services keep increasing, this situation usually defined as the inflation that meaning the loss of purchasing power and also the drop in value of money (Singh, Mehta & Varsha, 2011). According to Geetha, Mohidin, Chandran & Chong (2011), the inflation can

be categorized into two classes which are unexpected inflation and expected inflation. Firstly, unexpected inflation is out of the control by economists, regulators and consumers. Typically, the impact of unexpected inflation is more harmful than expected inflation. Whereas the expected inflation is resulted from a plan created by economists, regulators and consumers, while fewer people are likely to hold the cash and the money value will be depreciated over the time.

There are various investigations on the link between inflation and stock market returns. As stated by Geske and Roll (1983), the stock returns negatively related both expected and unexpected inflation. However, they have to struggle with traditional theory, Fisher theory which described the significant relationship between the stock returns and both expected and unexpected inflation. They recognized that higher inflationary expectations will make a decrease in economic activity and resulting the monetary expansion. Solnik (1983) provided evidence to support Geske and Roll (1983), he proved by using data from year 1971 to 1980 for nine countries, and concluded that stock market is negatively related to inflationary expectations.

There are various views from other researchers that unexpected inflation has a significant negative effect on stock prices. This negative relationship can be explained based on the negative association between inflation and real activity as well as the real cost of inflation, which applied to Israeli setting (Amihud, 1996). An unexpected increment in expected inflation could lead to changing monetary or fiscal policy by the government policymakers in order to tackle higher inflation. Imposition of price controls would be the strategy implemented by the policy makers. The price controls will negatively impact on the value of firms if optimal production-investment plan being distorted. Consequently, the stock prices will fall in response to this new information where the unexpected inflation increase the probability of price controls (Schwert, 1981).

Besides, Boudoukh and Richardson (1993) concluded their research by mentioned that there is a positive relationship between inflation and stock market in the long run. They examined this relationship by using a long period of data for the long term movement in stock market returns, such as the data from year 1820 to 1988 for United Kingdom (U.K.) and 1802 to 1990 for United States (U.S.). A research completed by Tiwari, Dar, Bhanja, Arouri and Teulon (2015) and mentioned that the inflation and stock returns are positively related for a long period. They proved by analyzing the data from year 1961 to 2012 based on the CPI which conducted in Pakistan.

However, Ray and Sarkar (2014) indicated the inflation and stock market are negatively related in the short run as the stock market activities slow down resulted from the high inflation. They analyzed the monthly data for the period from 1991 to 2008 in India. On the other hand, Naik and Padhi (2012) identified that inflation is negatively related to stock market in the short run by using data over the period from year 1994 to 2011 for Indian stock market. Adusei (2014) also explained that there is negative relation between inflation and stock market in the short run, however positively related in the long run, by using monthly data over period 1992 to 2010 for Ghana Stock Exchange (GSE) and analyzing it through Autoregressive Distributed Lag (ARDL).

Moreover, a research done by Lee (2010) in observing the different period will carry different result. He investigated the large sample data in U.S. from 1927 to 2007 and make two regime hypothesis which are the relationship between inflation and stock market during pre-war and post-war period. He make his conclusion by saying that the inflation is positively related to stock market in the pre-war period, however negatively related to stock market in the post-war period.

2.1.6 Industrial Production Index (IPI)

Industrial production index (IPI) indicated the measurement of output integrated in the industrial sectors such as mining and manufacturing in the economy (Amarasinghe, 2016). IPI playing as an important variable in influencing the stock market performance which also influencing the decision of investors and policymakers. However, there is a questionable linkage between the industrial production index and stock prices. Sahoo, Sahoo and Sahu (2014) identified that the growth in industrial production will boost domestic economy since it might increase exports to other countries and increase the country's national income eventually. They also strongly believed that the positive relation between stock market and IPI in the long run for India.

Goswami and Jung (1997) demonstrated the positive relation between the industrial production and stock market for Korea, they analyzed the monthly data from January 1980 to June 1996 which published by the Bank of Korea. In addition, Filis (2009) examined the relationship between industrial production and stock markets and supported the industrial production positively affect the stock market for the Greek stock market by using data from 1996 to 2008 and analyzing it by using vector autoregression (VAR). Corradi and Distaso (2009) recognized that the industrial production significantly influence the stock market from analyzing the data from 1990 to 2006 which published by the Chicago Board of Exchange.

However, a study done by Errunza and Hogan (as cited in Subeniotis, Papadopoulos, Tampakoudis & Tampakoudi, 2011) specified the industrial production insignificantly affect the stock market especially in Germany and France. They examined the data from 1959 to 1993 for European stock market by using VAR approach. Moreover, Gjerde and Sattem (as cited in Filis, 2009) stated the influences of industrial production delayed response

to stock market, they completed their investigation in numerous countries which are Norway, Sweden, Canada and Australia, by using VAR approach as well.

Besides, Fama (1990) identified there is difficult to measure the short term industrial production data in predicting the returns of stock market, therefore he agreed in using the long term industrial production data for predicting the future returns of stock market, he used the data from 1953 to 1987 in examining the relation between industrial production and stock returns. In addition, Balvers, Cosimano and McDonald (1990) supported to use the data after year 1947, due to the contamination of data, they used the data they have collected to forecast the stock market performance in the near future because they believed the current economic condition is the rational prediction for the stock market in the subsequent period.

2.2 Review of Relevant Theoretical Models

2.2.1 Efficient Market Hypothesis (EMH)

This theory is presented by Professor Eugene in year 1970 which is an investment theory. In the stock market this theory defined as stock prices completely reflect the whole data. For example, buying stocks at undervalued prices or selling stocks at inflated prices, however stocks always traded at their fair value on stock exchanges by making it unpredictable for those investors in EMH. Furthermore, the main way an investors earn higher returns by buying high-risk investments and it ought to be difficult to outperform the general market through expert in buying or

selling stock Altin (2015) which investigated an efficient stock is the place that stock price reflects all the general data. Mishkin (2015) as cited in this research said that the level of efficiency to the investors is rely upon the data exposed.

Husain and Mahmood (1999) and Maskay (2007) stated that money supply is correlated with stock market might upheld by using efficient market hypothesis. As Maskay (2007) proved that anticipated change affect more than unanticipated change in money supply. The evaluated comes about demonstrated that money supply exert any correlated of the stock prices. It outcome also approaches by efficient market hypothesis about the policy implication of the results is clarified. It also proved that this monetary policy from this research performed in the period of 1978 to 2000 by applied bootstrap stimulation technique (Hatemi-J, 2002).

2.2.2 Capital Asset Pricing Model (CAPM)

CAPM has been frequently used by previous researchers because of simple framework since it is established by Sharpe (1964), Black (1972) and Lintner (1965). The mainly hypothesis of CAPM is to gauge the systematic risk and the relationship between the expected risk and return for the assets. It is extensively utilized for evaluating the cost of capital and also to judge the performance of a portfolio. According to Hur (2017), in view of Korea's lead rising of stock market and discovered empirical evidence to bolster these theoretical implication. The CAPM will affect the relationship between macroeconomics variables and stock market performance.

Formula:

$$\mathbf{CAPM = Rf + \beta a\ (Rm - Rf)}$$

Where:

Rf = Risk free rate

βa = Beta of the security

Rm = Market risk premium

Besides, there are three parts in the model, which stated as the formula above. It caught the possibility that higher beta cause high risk and high return. There are four assumptions worked under this model (Perold, 2014). Firstly, most of the investor are risk adverse or price takers. Secondly, the capital market is immaculate without tax offering, short selling and transactions costs. Every investors can get loan and lend at the risk free rate. Besides, investors can also get the similar investment opportunities in the market. At last, the investors make same estimation on asset expected returns, correlation and standard deviation of return.

2.2.3 Dynamic Conditional Correlation (DCC)

DCC is a multivariate model which assessing relation between exchange rate and stock prices. Moore and Wang (2014) suggested this model in investigating the relation between stock market performance and foreign exchange, since they believed this model might be the most appropriate approach. They collected the monthly data of closing stock prices for various emerging countries such as Malaysia, South Korea, Indonesia, Philippines, Thailand and Singapore. They examined whether stock prices related exchange rate by using the data from the January of 1979 to December of 2006.

2.2.4 Arbitrage Pricing Theory (APT)

Firstly, APT built up by Stephen Ross in the year of 1976. Whereas APT predicts the relationship of both returns through a combination of independent variables that are money supply, gross domestic product and industrial production and shifts in risk premiums. Based on Kuwomu and Owusu-Nantwi (2011), APT attended to cautious that more flexible assumption requirements, it is regularly to refer as derivation to capital pricing model (CAPM). CAPM is accepting the risk premium and an independent variable of the market. The researcher found out that the when assessed by explanatory power on stock returns APT seems to be outperform the conventional CAPM. During year 1963-1978, the researcher investigated stocks using daily return data from the New York Stock Exchange and differentiate the empirical performance of the APT with that of the CAPM (Chen, 1983).

Furthermore, APT is an alternate way to deal with determinant asset process. It is also derives its basis from the 'law of one price' demonstrating markets in two different countries, the goods and services will be priced in different currency base, but the value of the product should be the same. If the two same product sell at different prices, an arbitrage opportunity would exists. This two way different testing method for the APT are mostly alike and the explanatory factor also approaches indicates governing stock return performing relatively (Iqbal and Haider, 2005).

2.3 Proposed theoretical framework

Figure 2.3: Relationship between stock market performance and independent variables in Thailand.

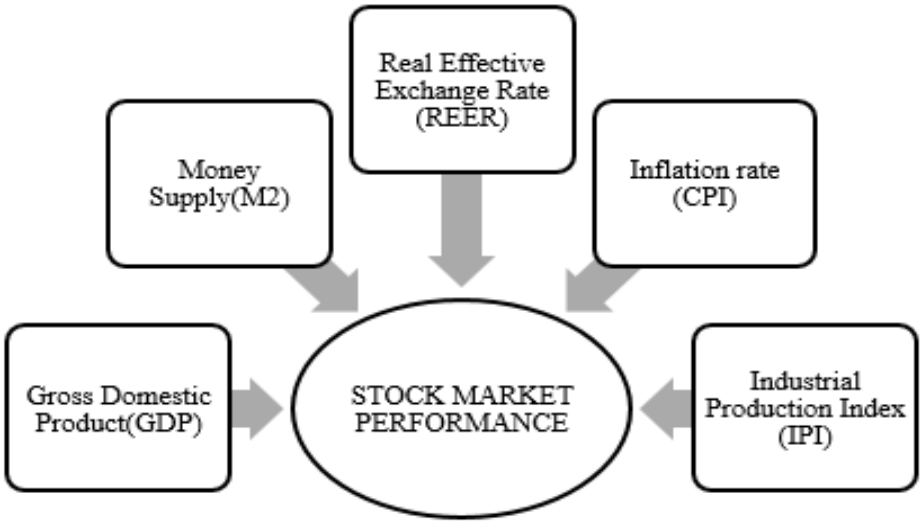


Figure 2.3 above shows the influences in stock market index such as gross domestic product (GDP), money supply (M2), real effective exchange rate (REER), inflation rate (CPI) and industrial production index (IPI). This framework was form in the basis form in order to provide a better illustration on the particular independent and dependent variables. The independent variable will affect dependent variables. This research concentrates on the time period from 2003 to 2016 on quarterly basis.

2.4 Hypothesis Development

Based on the previous empirical studies, there are five (5) hypothesis have been written as shown below:

2.4.1 Hypothesis of GDP

H_0: There is insignificant relation between GDP and stock market index.

H_1: There is a significant relation between GDP and stock market index.

According to the past researcher, there is some article that cited GDP is significantly affect to stock market to enhance the economic well. According to Ken (2015), Reddy (2012) proved that there is significant relationship between GDP and stock market. Ademola (2014) and Mugambi and Okech (2016) also indicated that the gross domestic product (GDP) affect the stock market fundamentally influence by financial conditions and consumer certainty.

2.4.2 Hypothesis of Money Supply M2

H_0: There is insignificant relation between money supply M2 and stock market index.

H_1: There is a significant relation between money supply M2 and stock market index.

Haitsma, Unalmis and Haan (2016), Sulaiman, Adam, Anwar and Adnan (2009) are the changes of monetary policies unexpected affected the stock market return. Furthermore, Yang and Hamori (2014), Zare, Azali and Habibullah (2013) have significantly or negatively affect to stock market. The review of study which examine of Thorbecke (1997) and Yang and Hamori (2014) stated stock market volatility is moderately lower in expansion of economy Maskay (2007) anticipated changes in money supply might affect stock market.

2.4.3 Hypothesis of REER

H_0: There is insignificant relation between REER and stock market index.

H_1: There is a significant relation between REER and stock market index.

Real effective exchange rate viewed as a macroeconomic variable because it contributed to the economic growth and used by policymakers to formulate new strategies. Based on Griffin, Nardari and Stulz (2004), they supported that the relationship between real effective exchange rate and stock market returns. Katechos (2011) and Vejzagic and Zarafat (2013) also supported that this significant relationship between these two variables. However, Dimitrova (2005) recognized that the linkage between exchange rate and stock market depends on the appreciation and depreciation on domestic currency.

2.4.4 Hypothesis of CPI

H_0: There is insignificant relation between CPI and stock market index.
H_1: There is a significant relation between CPI and stock market index.

As investigation completed by Wongbangpo and Sharma (as cited in Hussainey & Ngoc, 2009), they believed CPI (as measure of inflation) is the factor which representing inflation rate. According to Geske and Roll (1983), stock returns negatively related with both expected and unexpected inflation. Boudoukh and Richardson (1993) and Tiwari, Dar, Bhanja, Arouri and Teulon (2015) concluded their research by mentioned that inflation positively related to stock market in the long run. However, Ray and Sarkar (2014), Naik and Padhi (2012) and Adusei (2014) indicated the inflation and stock market are negatively related in the short run as the stock market activities slow down resulted from the high inflation.

2.4.5 Hypothesis of IPI

H_0: There is insignificant relation between IPI and stock market index.
H_1: There is a significant relation between IPI and stock market index.

Industrial production index playing as an important variable in influencing the stock market performance. According to Sahoo, Sahoo and Sahu (2014), the growth in industrial production will boost domestic economy due to it will increase the national income eventually. Goswami and Jung (1997), Filis (2009) and Corradi and Distaso (2009) demonstrated the positive relation between the industrial production and stock market index. In the other hand, Errunza and Hogan (as cited in Subeniotis, Papadopoulos, Tampakoudis & Tampakoudi, 2011) and Gjerde and Sattem (as cited in Filis, 2009) believed that the industrial production is insignificantly affect the stock market index.

2.5 Conclusion

There are numerous variables might influence the stock market index, which are gross domestic index, money supply M2, real effective exchange rate, inflation rate (CPI) and industrial production index. These variables viewed as independent variables for testing whether the stock market index is significant influenced by the independent variables stated in Chapter 2. Moreover, the theories and models that previous researchers applied to their research in investigating relationship between the stock exchange and each of the independent variables. Even though these theories and models applied in different variables, the results also different. However, the further investigation will be continue in the following chapters.

CHAPTER 3: METHODOLOGY

3.0 Introduction

Through this research methodologies might be developed and discussed in this chapter. In this research, we are used the secondary data. There are five independent variables which include gross domestic product (GDP), money supply (M2), real effective exchange rate (REER), inflation rate (CPI), and industrial production index (IPI) and the Stock Exchange of Thailand (SET Index) as our dependent variable. The research will cover quarterly from year 2003 to 2016 and included 56 observations for the sample size. In addition, this chapter describes the design and methodologies of this research and some methods that used for this research.

3.1 Research Design

This part defines as a methods and procedures were collected and analysed to measures the variables that specified in this research and it is a kind of procedures which aims to collect the data that related to the research purpose. Besides, research design is also known as the design and setup of investigation used to acquire the answers to those questions in this research (Kerlinger, F.N., 1986).

3.1.1 Quantitative Research

In this particular phenomenon, findings expressed or evaluated in numerical form to explain is called as quantitative research. By looking from different or another angle, to identify the relationship between the dependent variable and those independent variables it applies in method on mathematically based. Generally, ordinary least square (OLS) is applied as quantitative research in this study which is using to determine the impact of fundamental variables against stock market performance.

Quantitative research based on the historical data, it is necessary to explain the changes of data from its pasts (North, 1963). It is also the tools for those researchers to provide their hypothesis in examine their investigation.

3.2 Data Collection Methods

All the variables are using secondary data derived from Bloomberg. The data collected are quantitative and time series data.

3.2.1 Secondary data

The data of all variables collected based on quarterly basis from year 2003 to 2016. This data in detailed as shown as in the table below:

Table 3.1: Sources of Data

Variables	Proxy	Units	Explanation	Data Sources
Stock Market Performance	SET	Index	Stock Exchange of Thailand	Bloomberg
Gross Domestic Product	GDP	Current prices	Gross domestic product in Thailand	Bloomberg
Money Supply	M2	Thai baht	Money of category 2 in Thailand's stock market	Bloomberg
Real effective exchange rate	REER	Percent (%)	Real effective exchange rate in Thailand with broad	Bloomberg
Consumer price index	Inflation	Index	Consumer price index in Thailand (as measure of inflation)	Bloomberg
Industrial Production Index	IPI	Index	Industrial production index in Thailand	Bloomberg

3.3 Sampling Design

3.3.1 Target Population

The goal of this research to investigate the relationship between the macroeconomic variables and the stock market performance in Thailand. This studies targeted on Thailand stock market in examining the relationship between the dependent variable which is Stock Exchange of Thailand (SET

Index) and the independent variables chosen which are gross domestic product (GDP), money supply (M2), real effective exchange rate (REER), inflation rate (CPI), and industrial production index (IPI) in the period from year 2003 to 2016. Besides that, all the data used is based on quarterly basis in this research.

3.3.2 Sampling Method

Nonprobability sampling method and probability sampling method are two major types of sampling methods. The probability sampling is a portion or sample of the population. There is an equal probability of being selected in every element of the population being sampled. While non-probability does not involve random selection, it comes in various shapes and sizes. Selection of non-probability are generally according to the researcher personal judgement.

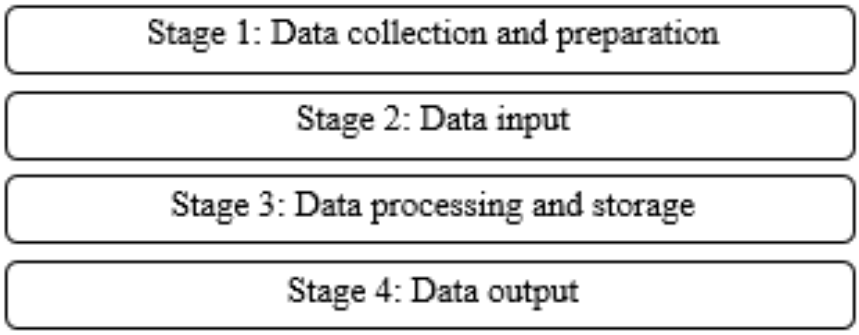
All the diagnostic checking and hypothesis testing in this research will be tested by using E-views 7 which is the foremost function is to perform econometrical and statistical analysis. Many econometric tests that carry out in this research can be completed in this research. Other than that, Ordinary Least Square (OLS) is advisable in this studies for testing in E-view because E-view consists the feature for OLS method and its results is suitable in another testing such as t-statistic test and f-statistic test for the purpose of testing the significance of this model and even the variables.

3.3.3 Sampling Size

The number of observations to be studied in a population is called as sampling size. Generally, detect a real difference between the independent variables and dependent variable, the sample size should be big enough. It is important to determine the sample size because the large samples may waste time, money and resources, while the small samples may cause the results to be inaccurate. In this research paper, the sample size of 56 is chosen to measure on how the stock market performance influenced by the various macroeconomic variables.

3.4 Data Processing

Figure 3.4: Data processing cycle



Stage 1: Data collection and preparation. Data is collected in secondary sources from Bloomberg.

Stage 2: Data input. Review all the data have collected as well as the journals and summarize the data and methodologies used by the past researchers. Afterwards,

decide the type of data and methodologies that we are going to use in this study. Then, run the data by using E-Views 7.0 to get the result.

Stage 3: Data processing and storage. Run various tests by using the E-Views 7.0 with the data collected which include T-test, F-test, Normality test (Jarque Bera), Model Specification Error Testing (Ramsey RESET), Autoregressive Conditional Heteroscedasticity (ARCH) test and Breusch-Godfey serial correlation LM test. Then, save and keep certain result for the further interpretation and explanation.

Stage 4: Data output. The empirical results are ready for analyse and interpret.

3.5 Multiple Linear Regression Model

A technique to examine and understand the relationship between one dependent variable and several independent variables is called as multiple regression (Berger, 2003). The component of the multiple regression is using at least two independent variables and explaining the relationships by using simple calculation (Pedhazur, 1974). Multiple regression is the technique commonly used by researchers in analysing and testing the scientific theory.

Econometric Function

SETI= *f* [Gross Domestic Product (GDP), Money Supply (M2), Real Effective Exchange Rate (REER), Inflation Rate (CPI), Industrial Production Index (IPI)]

Econometric Model in Logarithm Form

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

$$LOGSETI_t = \beta_0 + \beta_1 LOGGDP_t + \beta_2 LOGM2_t + \beta_3 LOGREER_t + \beta_4 CPI_t + \beta_5 LOGIPI_t + \varepsilon_t$$

N = 56 observations

Where,

LOG $SETI_I$ = Natural logarithm of the Stock Exchange of Thailand at month t.

LOG GDP = Natural logarithm of gross domestic product (GDP) at month t.

LOG M2 = Natural logarithm of money supply of category 2 at month t.

LOG REER = Natural logarithm of real effective exchange rate (REER) at month t.

CPI = consumer price index (CPI) as measure of inflation rate at month t.

LOG IPI = Natural logarithm of industrial production index (IPI) at month t.

ε_t = the error term

3.6 Analysis of Data

Data analysis is carried out to identify those problems that might occur during the test and is a process of evaluating the data by using different types of methods to make sure the whole model are significant.

3.6.1 Diagnostic Checking

We are using the Ordinary Least Square (OLS) approach to run the regression model. It is necessary to provide a diagnostic checking for the model before we move to model estimation. According to Kramer, Sonnberger, Maurer and Havlik (1985), the diagnostic checking is the process to prevent the adverse effects caused by wrong measurement from the regression model. Hence, most econometricians used the diagnostic checking for their researches in order to obtain the more accurate results.

3.6.1.1 Multicollinearity

Multicollinearity is one of the econometric problems which occurs when the independent variables are perfectly correlated with each other in the regression model (Gujarati & Porter, 2009). The degree of multicollinearity typically is determined the number of measurements in a regression model.

Variance Inflation Factor (VIF) or Tolerance (TOL) are used in order to identify the seriousness of the presence of multicollinearity. If the value of VIF is equal or more than 10 or TOL near to 0, it means the model has serious multicollinearity.

$$\mathbf{VIF} = \frac{\mathbf{1}}{\left(\mathbf{1} - \mathbf{r_{ij}^2}\right)} \qquad \mathbf{TOL} = \frac{\mathbf{1}}{\mathbf{VIF}}$$

There are some consequences if the model has serious multicollinearity problem. If the multicollinearity problems existed,

the variances of the independent variables might become lager (Mansfield & Helms, 1982). The larger variances brought the adverse effects to that model such as the estimation usually larger and resulted the results are incorrect.

For example, the t-ratio of one or more coefficients tends to be statistically insignificant even though t-ratio of one or more coefficients is statistically insignificant, R^2 can be very high the in overall measure of goodness of fit. Besides that, in the data the OLS estimators and standard errors can be sensitive to tiny changes.

3.6.1.2 Heteroscedasticity

Heteroscedasticity means that the variances of the residuals are not constant but they are different for different observations. Based on a basic assumption of the classical model, normality of error terms to be valid is necessary for the statistical tests. As a result, heteroscedasticity leads to inefficient estimators and biased standard errors, rendering the t-tests and confidence intervals not reliable. Thus, hypothesis testing will cause incorrect result in conclusion. White test and ARCH test are normally used as a test for heteroscedasticity. In White test, a regression of the square of the residuals is run on the variables suspected of causing the heteroscedasticity, their squares and cross products. ARCH test is used to characterize and model observed time series.

3.6.1.3 Autocorrelation

When the model has correlation between the error terms, the autocorrelation problem will definitely occurred. Autocorrelation possible to underestimates the standard errors of coefficient that make the t-statistics become insignificant and also the result is unreliable. Estimators no longer have minimum variance yet they still constantly to be unbiased. Autocorrelation problem can be estimated by Durbin-Watson (DW) statistic and Breusch-Godfrey Serial Correlation LM test. The DW statistic test is for the autocorrelation of the first order and is not valid in dynamic models. The LM test is a general test of serial correlation.

3.6.1.4 Model Specification Test

Model specification test is applied to make sure whether the regression created or designed is correctly specified and is one of the first steps in regression analysis. If an estimated model is incorrect specified, it will lead to biased and inconsistent results. In other words, it could mean that there are not relevant of independent variables are included in the model or the model is in not correct functional form. Ramsey RESET test is applied in order to learn more about model specification test.

3.6.1.5 Normality Test (Jarque-Bera)

Jarque-Bera (JB) normality test is to investigate how likely the data is to be normally distributed. At the same time, the classical skewness and kurtosis coefficient are uses in JB normality test. The formula of the test is shown as below:

$$JB = \frac{n}{6}(S^2 + \frac{1}{4}k - 3)^2$$

In the procedure, null hypothesis (H_0) and alternative hypothesis (H_1) are used as the assumption in the test which is shown as below:

Assume μ is error term:

H_0 = μ is distributed normally

H_1 = μ is not distributed normally

Based on the value of probability, reject H_0 if the p-value is less than 0.05, which means that μ is not distributed normally. In contrast, do not reject H_0 if the p-value is larger than 0.05, which means that μ is distributed normally.

3.6.1.6 T-statistics test

The hypothesis for this test are shown:

H_0 : The independent variables insignificantly related dependent variable ($\beta_i = 0, i = 1, 2, 3, 4$)

H_1 : The independent variables significantly related dependent variable ($\beta_i \neq 0, i = 1, 2, 3, 4$)

Reject H_0 if the value of test statistic is less than low critical value or exceed the upper critical value. Besides, H_0 can be rejected if the probability value (p-value) is less than significance level at 5%, α =0.05. Otherwise, do not reject H_0.

3.6.1.7 F-statistic test

F-test statistic developed by Ronald Aylmer Fisher (1924) which measure the significance of the whole model. The outcome of F-stat and p-value can be testing by using the E-views 7.

The hypothesis for this test are shown as below:

H_0 : $\beta_1 = \beta_2 = \beta_3 = \beta_4 = 0$

H_1 : Not all slope coefficients are simultaneously zero

H_0 will be rejected if F-test value is less than the low critical value or exceed the upper critical value. Besides, H_0 can be rejected if the p-value is smaller than the significance level of 5%, α =0.05. Otherwise, do not reject H_0.

3.6.2 Unit Root Test

Unit root test can be named as stationary test that has a tendency to investigate whether an arrangement contains of unit root and the integrated order which steadiness of the properties of the variables (Hosseini, Ahmad & Yew, 2011). A time series is viewed as stationary if it has no unit roots and has a tendency to fluctuate around its mean value. In another words, means and variance for this type of time series are time independent and consistent for the duration of the time (Gujarati, 2004).

The hypothesis as shown below:

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

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

The H_0 will be rejected if its p-value of unit root test is smaller than the significance level of 5%, $\alpha = 0.05$. Otherwise, do not reject H_0.

3.6.3 Johansen Co-integration test

The Johansen co-integrating test is a test that decided the number of co-integration that takes into account more than one co-integration relationship. Furthermore, this test is used to look at whether the co-integration vectors hold the long run equilibrium relationship. Johansen co-integration test takes its beginning point in the Vector Autoregressive Model (VAR) and it will be change over in the model into Vector Error Correction Model (VECM) when the error correction term that included (Hjalmarsson & Osterholm, 2007).

The hypothesis of this test are stated as below"

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

H_1 : There is long run relationship between variables.

The decision rule is the H_0 will be rejected if the p-value is lower than the significance level, $\alpha = 0.05$. Otherwise, do not reject H_0.

3.6.4 Granger Causality Test

This Granger Causality test is investigation for looking at the short run causality impact between the variables whether appropriate in time series data analysis. An independent variable said to granger in short run analysis causes the dependent variable through a series of t-test and F-test on lagged values of the independent variable. Consequently, this test is reasonable or suitable for the research to study the causal relationship between the dependent variable and independent variables individually (Gujarati & Porter, 2009).

This test is able to get rid of the limitation of co-integration test which is it does not indicate any related information on the direction of causality, it only estimate or measure the variables whether are correlated (Guisan, 2001).

The hypothesis of this test are stated as below:

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

H_1 : Variable X does granger causes the variable Y.

Reject H_0 if the value of test statistic is exceed the critical value or the p-value is smaller than the significance level of 5%, $\alpha = 0.05$. Otherwise, do not reject H_0.

3.7 Conclusion

In this chapter, relevant measurements and statistical tests have been determined. Data will be collected based on the discussions of the sampling design and data collection methods. Sample size of data is determined and data are collected from Bloomberg.

In the data processing, the raw data will be transformed into useful information. For the following part, data analysis, the diagnostic checking of data is determined to check for any econometric problems exist. Data will be run and analysed by the E-views. The results will be shown in next chapter.

CHAPTER 4: DATA ANALYSIS

4.0 Introduction

As mentioned in the previous chapter, the Ordinary Least Square (OLS) model is key of method to investigate the relationship between the dependent variable which is Stock Exchange of Thailand (SET) and various independent variables which are GDP, money supply M2, REER, CPI, and IPI. In chapter 4, there are numerous sections which including descriptive statistic, JB normality test (Jarque-Bera), model specification test (Ramsey's RESET test), Heteroscedasticity Test (White's test), Autocorrelation test (Breusch-Godfrey LM test) and the multicollinearity test as well.

4.1 Ordinary Least Square (OLS) Method

$$LOGSETI_t = \beta_0 + \beta_1 LOGGDP_t + \beta_2 LOGM2_t + \beta_3 LOGREER_t + \beta_4 CPI_t + \beta_5 LOGIPI_t + \varepsilon_t \quad (1)$$

$$LOGSETI_t = -17.30758 - 2.304287\, LOGGDP_t + 2.506348\, LOGM2_t + 0.009044\, LOGREER_t + 0.034119\, CPI_t + 1.153036\, LOGIPI_t \quad (2)$$

Where,

LOGSETI = Natural logarithm of the Stock Exchange of Thailand at month t.

LOGGDP = Natural logarithm of gross domestic product (GDP) at month t.

LOGM2 = Natural logarithm of money supply of category 2 at month t.

LOGREER = Natural logarithm of real effective exchange rate (REER) at month t.

CPI = consumer price index (CPI) as measure of inflation at month t.

LOGIPI = Natural logarithm of industrial production index (IPI) at month t.

Table 4.1: E-views result

Independent variable	Actual sign	Coefficient	p-value	Significance level
LOGGDP	Negative	-2.304287	0.0057	0.05
LOGM2	Positive	2.506348	0.0000	0.05
LOGREER	Positive	0.009044	0.9904	0.05
CPI	Positive	0.034119	0.0096	0.05
LOGIPI	Positive	1.153036	0.0121	0.05
R^2 = 0.843262		Adjusted R^2 = 0.827588		

R^2 measures the portion of the variation in the dependent variable examined in a linear regression model by the independent variables. Whereas based on the number of independent variables the adjusted R^2 adjusts the statistic in the model. Refer to table 4.1, R^2 = 0.843262 showed that 84.33% of variation in stock return in Thailand is explained by the total variation in gross domestic product (GDP), money supply (M2), real effective exchange rate (REER), inflation rate (CPI), and industrial production index (IPI).

Besides that, adjusted R^2 = 0.827588 that meaning 82.76% of the sum of variation in stock market performance in Thailand is described by the sum of variation in gross domestic product (GDP), money supply (M2), real effective exchange rate (REER), inflation rate (CPI), and industrial production index (IPI) after take into account the degree of freedom.

4.2 Model Estimation

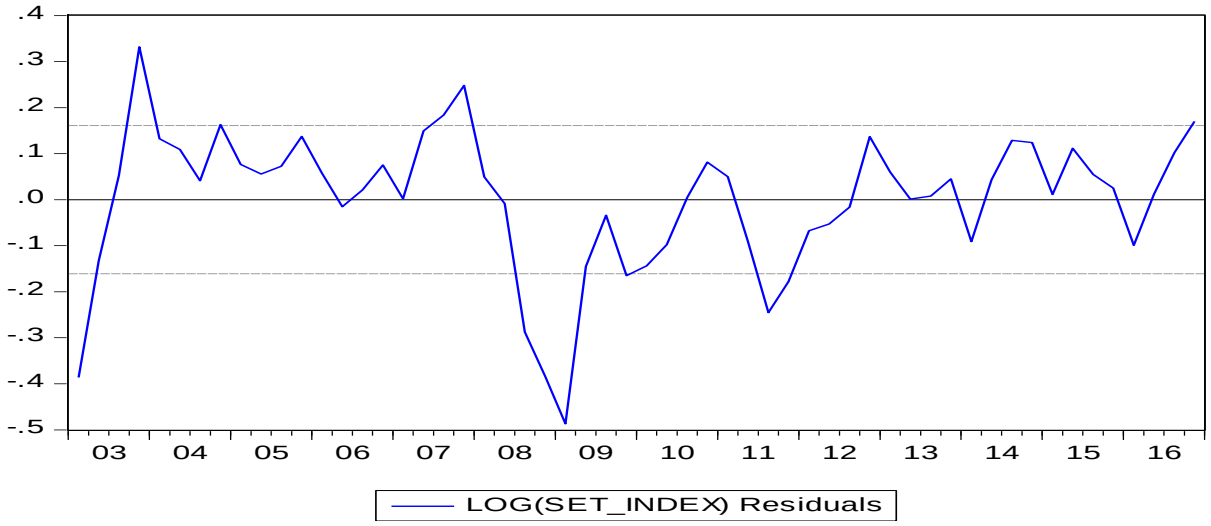
The dependent variable is the Stock Exchange of Thailand (SETI), while the independent variables are gross domestic product (GDP), money supply M2, real effective exchange rate (REER), inflation rate (CPI), and industrial production index (IPI) in this regression model. The regression model is generated according to E-view results.

As the econometrics model showed above and the result from Table 4.1, parameters estimates can be performed by interpreting the model. Assuming that all independent variables are zero, on average, the SET index will go down at -17.30758 points. Meanwhile, independent variables applied the same things. If the gross domestic product (GDP) increases by 1 Thai Baht million, on average, the SET index will decreases by 2.304287 points, holding other variables constant. Furthermoer, if the money supply (M2) increases by 1 Thai Baht Billion, on average, the SET index will increases by 2.506348 points, holding other variables constant. Next, if the real effective exchange rate (REER) increases by 1 point, on average, the SET index will increases by 0.009044 points, holding other variables constant. Moreover, if the consumer price index (as measure of inflation) increases by 1 percent, on average, the SET index will increases by 0.034119 points. In addition, if the industrial production index (IPI) increases by 1 Thai Baht billion, on average, the SET index will increases by 1.153036 points, holding other variables constant.

4.3 Descriptive Statistics

According to the Table 4.2, it indicates the descriptive statistics for both dependent variable and independent variables which typically describe the basic features for the data studied. For studying the large sample size of data, the descriptive statistic is the useful technique to simplify the large data in a practical way. However, refer to the p-value above, all of the independent variables are normally distributed with the dependent variables at significant level, 5% as the p-value of all independent variables are exceed the significance level of 5%.

Figure 4.3: SET Index Residual Graph from 2003 to 2016



Based on the figure 4.1, this residual graph indicated the mean reversion that the highest and lowest data observed tend to move around zero. In this residual graph, it indicates the lowest of SET index in the year 2008 and 2009 due to the gloomy economic performance resulted from the global financial crisis (Bank of Ayudhya, 2009).

4.4 Hypothesis Testing

The major objective of this part is to investigate the relationship between the dependent variable and various independent variables. Firstly, the t-statistic carried in order to exam the significance of each independent variable, whereas the F-test examines the significance of estimated regression model. All t-test and F-test value are taken from Table 4.1.

4.4.1 T-statistics test

This part using the simple and efficient method which is the probability value (p-value) which can easily test the significant relationship between dependent variable and various independent variables at significance level of 5%.

4.4.1.1 Gross Domestic Product (GDP)

H_0: There is insignificant relation between GDP and SET index. ($\beta_1 = 0$)

H_1: There is significant relation between GDP and SET index. ($\beta_1 \neq 0$)

Decision Rule:

Reject H_0 if the probability value (P-value) of test statistic is lesser than the significance level of 5%. Otherwise, do not reject H_0.

P-value = 0.0057

Decision Making:

Reject H_0 since the P-value (0.0057) is lesser than the significance level of 5%.

Conclusion:

There is sufficient evidence to conclude that the gross domestic product is significantly related to SET index at significance level of 5%.

4.4.1.2 Money Supply (M2)

H_0: There is insignificant relation between money supply M2 and SET index.

($\beta_2 = 0$)

H_1: There is significant relation between money supply M2 and SET index.

($\beta_2 \neq 0$)

Decision Rule:

Reject H_0 if the probability value (P-value) of test statistic is lesser than the significance level of 5%. Otherwise, do not reject H_0.

P-value = 0.0000

Decision Making:

Reject H_0 since the P-value (0.0000) is lesser than the significance level of 5%.

Conclusion:

There is sufficient evidence to conclude that the money supply M2 is significantly related to SET index at significance level of 5%.

4.4.1.3 Real Effective Exchange Rate (REER)

H_0: There is insignificant relation between REER and SET index. ($\beta_3 = 0$)

H_1: There is significant relation between REER and SET index. ($\beta_3 \neq 0$)

Decision Rule:

Reject H_0 if the probability value (P-value) of test statistic is lesser than the significance level of 5%. Otherwise, do not reject H_0.

P-value = 0.9904

Decision Making:

Do not reject H_0 since the P-value (0.9904) is larger than the significance level of 5%.

Conclusion:

There is no sufficient evidence to conclude that the real effective exchange rate significant related to SET index at significance level of 5%.

4.4.1.4 Consumer Price Index (as measure of inflation)

H_0: There is insignificant relation between CPI and SET index. ($\beta_4 = 0$)

H_1: There is significant relation between CPI and SET index. ($\beta_4 \neq 0$)

Decision Rule:

Reject H_0 if the probability value (P-value) of test statistic is lesser than the significance level of 5%. Otherwise, do not reject H_0.

P-value = 0.0096

Decision Making:

Reject H_0 since the P-value (0.0096) is smaller than the significance level of 5%.

Conclusion:

There is sufficient evidence to conclude that the consumer price index significantly related to SET index at significance level of 5%.

4.4.1.5 Industrial Production Index (IPI)

H_0: There is insignificant relation between IPI and SET index. ($\beta_5 = 0$)

H_1: There is significant relation between IPI and SET index. ($\beta_5 \neq 0$)

Decision Rule:

Reject H_0 if the probability value (P-value) of test statistic is lesser than the significance level of 5%. Otherwise, do not reject H_0.

P-value = 0.0121

Decision Making:

Reject H_0 since the P-value (0.0121) is lesser than the significance level of 5%.

Conclusion:

There is sufficient evidence to conclude that the industrial production index significantly related to SET index at significance level of 5%.

4.4.2 F-Statistics test

F-test is a statistic conducted by including the variables which are gross domestic product (GDP), money supply (M2), real effective exchange rate (REER), consumer price index (CPI), and the industrial production index (IPI) in order to test overall significant of the whole model. The result is showed in the following:

H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$

H_1: As a minimum one of the independent variable (β_i) is different from zero, i=1, 2, 3, 4, 5

Decision Rule:

Reject H_0 if the probability value (P-value) of F-statistic is less than the significance level of 5%. Otherwise, do not reject H_0.

P-value = 0.0000

Decision Making:

Reject H_0 since the P-value (0.0000) is lesser than the significance level of 5%.

Conclusion:

There is sufficient evidence to conclude that the model is significant to explain the stock exchange of Thailand (SET) at significance level of 5%.

4.5 Diagnostic Checking

There are five diagnostic checking will be conducted is wanted to test whether this model is facing the problem of multicollinearity, heteroscedasticity, autocorrelation, model specification and normality of the error term. The result of these tests are showed as below:

4.5.1 Multicollinearity

Multicollinearity is a problem arise when the independent variables are highly correlated with one another. If the multicollinearity existed, the model is difficult to indicate which one independent variable is the most influencing the dependent variable. However, there are several methods to determine the multicollinearity problem.

4.5.1.1 High R^2 but few significant t-ratio

Refer to the table 4.1, the R^2 is 0.843262 which considered as relatively high. Moreover, there have four independent variables are significant t-ratio which are consumer price index (as measure of inflation), gross domestic product (GDP), money supply (M2) and industrial production index (IPI). However, only one independent variable which is real effective exchange rate (REER) is insignificant t-ratio. Based on this method, this model might has multicollinearity problem but it is not a serious problem.

4.5.1.2 High Pair-Wise Correlation among Independent Variables

Table 4.2: Pair-Wise Correlation Coefficients

	LOGGDP	LOGM2	LOGREER	CPI	LOGIPI
LOGGDP	1.000000	0.977055	0.903117	-0.310617	0.871021
LOGM2	0.977055	1.000000	0.851405	-0.409192	0.775324
LOGREER	0.903117	0.851405	1.000000	-0.240489	0.873164
CPI	-0.310617	-0.409192	-0.240489	1.000000	-0.101548
LOGIPI	0.871021	0.775324	0.873164	-0.101548	1.000000

Based on the table 4.4.1.2, the pair-wide correlation between independent variables of gross domestic product (GDP) and money supply (M2) is recorded as 0.977055 which is the highest. The second higher pair-wide correlation between independent variables of gross domestic product (GDP) and real effective exchange rate (REER) is showed as 0.903117. Thus, this study will conduct the regression analysis for the high pair-wide correlation between those independent variables in order to get R^2 and detect the multicollinearity problems. The results of calculation of Variance Inflation Factor (VIF) and Tolerance (TOL) are showed as below:

4.5.1.3 Variance Inflation Factor (VIF) and Tolerance (TOL)

Table 4.3: VIF and TOL Results

	R^2	VIF = 1 / (1 - R^2)	TOL = 1 – R^2
LOGGDP LOGM2	0.954636	22.04391147	0.045364
LOGGDP LOGREER	0.815620	5.423581733	0.18438
LOGGDP CPI	0.096483	1.106786037	0.903517
LOGGDP LOGIPI	0.758677	4.143823838	0.241323
LOGM2 LOGREER	0.724890	3.634909672	0.27511
LOGM2 CPI	0.167438	1.201111749	0.832562
LOGM2 LOGIPI	0.601127	2.507063652	0.398873
LOGREER CPI	0.057835	1.061385214	0.942165
LOGREER LOGIPI	0.762415	4.20901993	0.237585
CPI LOGIPI	0.010312	1.010419445	0.989688

The multicollinearity problem considered as serious when the variance inflation factor (VIF) is near to 10 or more than 10, and the tolerance (TOL) is near to zero. Based on the result from table 4.3, it found out that the VIF between the gross domestic product (GDP) and money supply (M2) has the highest VIF which is 22.04391147 and the lowest TOL which is 0.045364. In addition, the VIF between the independent variables of gross domestic product (GDP) and real effective exchange rate (RERR) has the second highest VIF which is 5.423581733 and the second lowest TOL which is 0.18438. Therefore, this model has the serious multicollinearity problem since the degree of VIP is near to and more than 10 and TOL is close to zero.

4.5.2 Heteroscedasticity

Table 4.4: Autoregressive Conditional Heteroscedasticity (ARCH) Test

ARCH Test	
Value of probability = 0.0623	$\alpha = 0.05$

H_0: Homoscedasticity

H_1: Heteroscedasticity

Decision Rule:

Do reject H_0 if the estimated P-value is lesser than the significance level of 5%. Otherwise, do not reject H_0.

Decision Making:

Do not reject H_0 since the P-value (0.0623) is larger than the significance level of 5%.

Conclusion:

There is sufficient evidence to conclude that there is no heteroscedasticity problem at significance level of 5%.

4.5.3 Autocorrelation

Table 4.5: Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test	
Value of probability = 0.0000	$\alpha = 0.05$

H_0: This model has no autocorrelation

H_1: This model has autocorrelation

Decision Rule:

Do reject H_0 if the estimated P-value is lesser than the significance level of 5%. Otherwise, do not reject H_0.

Decision Making:

Reject H_0 since the P-value (0.0000) is smaller than the significance level of 5%.

Conclusion:

There is sufficient evidence to conclude that there has autocorrelation problem at significance level of 5%

4.5.4 Model Specification Test (Ramsey's RESET test)

Table 4.6: Ramsey's Regression Equation Specification Error Test (RESET) Test

Ramsey's RESET Test	
p-value = 0.0896	$\alpha = 0.05$

H_0: No model specification error

H_1: Model specification error

Decision Rule:

Do reject H_0 if the estimated P-value is lesser than the significance level of 5%. Otherwise, do not reject H_0.

Decision Making:

Do not reject H_0 since the P-value (0.0896) is exceed the 5% significance level.

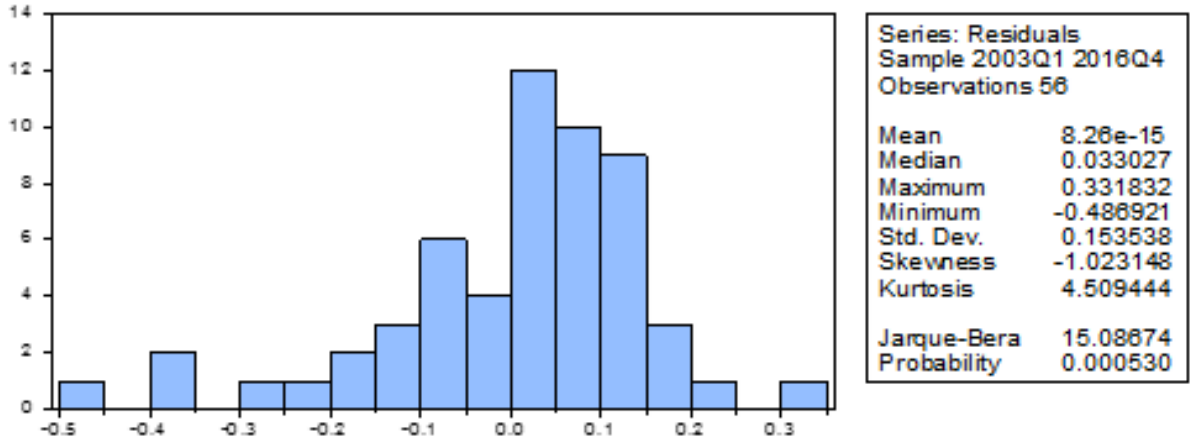
Conclusion:

There is sufficient evidence to conclude that the model specification is correct at significance level of 5%.

4.5.5 Normality Test (Jarque-Bera Test)

Jarque-Bera (JB) is a test of normality for large sample data based on the OLS residual, this test examines the normality of error terms in the model.

Table 4.7: Jarque-Bera Test



Assume μ is error term:

H_0: μ is distributed normally

H_1: μ is not distributed normally

Decision Rule:

Reject H_0 if the estimated P-value is lesser than the significance level of 5%. Otherwise, do not reject H_0.

P-value = 0.000530

Decision Making:

Reject H_0 since the P-value (0.000530) is lesser than the significance level of 5%.

Conclusion:

There is sufficient evidence to conclude that the error term is not normally distributed at significance level of 5%.

4.6 Unit Root test

H_0 : LOGSETI/ LOGGDP/ LOGM2/ LOGREER/ CPI/ LOGIPI are not stationary and have a unit root.

H_1 : LOGSETI/ LOGGDP/ LOGM2/ LOGREER/ CPI/ LOGIPI are stationary and do not have a unit root.

Decision Rule:

Do reject H_0 if the p-value is smaller than the significance level. Otherwise, H_0 will not be rejected.

4.6.1 Augmented Dickey-Fuller (ADF) test

Table 4.8: Results of Augmented Dicky Fuller (ADF) – Level form

	Log_setindex	**Log_gdp**	**Log_m2**	**Log_reer**	**cpi**	**Log_ipi**
Intercept	-1.642562 (1)	-2.159848 (3)	-0.863334 (4)	-1.783870 (0)	-4.374213 (1)***	-2.711733 (5)
Intercept & Trend	-3.424102 (1)	-3.186248 (0)	-2.664620 (4)	-2.558156 (1)	-5.237599 (1)***	-2.125486 (5)

Note: *, **, *** shown that the rejection of the null hypothesis at 10%, 5%, and 1% of significance levels. The value in parentless is the number of lags. The lengths of lag in ADF unit root test are based on Schwarz Information Criterion (SIC).

Level phases:

Intercept: The H_0 for all variables is not rejected at the significance level except consumer price index (as measure of inflation). It is conclude that all variables except consumer price index are not stationary at level phases.

Trend and intercept: The H_0 for all variables is not rejected at the significance level except consumer price index. It is conclude that all variables except CPI are not stationary at level phases.

Table 4.9: Results of Augmented Dicky Fuller (ADF) – First difference form

	Log_setindex	Log_gdp	Log_m2	Log_reer	cpi	Log_ipi
Intercept	-5.313315 (0)***	-7.042053 (2)***	-1.609143 (3)	-6.310223 (0)***	-6.296651 (3)***	-4.473502 (0)***
Intercept & Trend	-5.239187 (0)***	-7.457228 (2)***	-1.600704 (3)	-6.303452 (0)***	-6.343787 (3)***	-5.22681 (0)***

Note: *, **, *** shown that the rejection of the null hypothesis at 10%, 5%, and 1% of significance levels. The value in parentless is the number of lags. The lengths of lag in ADF unit root test are based on Schwarz Information Criterion (SIC).

First difference:

Intercept: The H_0 for all variables is rejected at the significance level except LOGM2. It is conclude that all variables except LOGM2 are stationary at first difference.

Trend and intercept: The H_0 for all variables is rejected at the significance level except LOGM2. It is conclude that all variables except LOGM2 is stationary at first difference.

4.7 Johansen Co-integration test

The long run effect between the variables is tested by using Johansen Co-integration test. The results are reported in the figure below.

Table 4.10: Results of Johansen Co-integration test

Hypothesized No. of CE(s)	Trace			Max-Eigen		
	Statistic	Critical Value (%)	p-value	Statistic	Critical Value (%)	p-value
r = 0	112.6400	95.75366	0.0021	38.89614	40.07757	0.0675
r ≤ 1	73.74382	69.81889	0.0235	31.01380	33.87687	0.1058
r ≤ 2	42.73002	47.85613	0.1393	20.14085	27.58434	0.3315
r ≤ 3	22.58917	29.79707	0.2669	17.04957	21.13162	0.1697
r ≤ 4	5.539603	15.49471	0.7491	3.986363	14.26460	0.8608
r ≤ 5	1.553240	3.841466	0.2127	1.553240	3.841466	0.2127

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

H_1 : There is long run relationship between the variables.

Decision Rule: Reject H_0 if the probability value is lower than the significance level, α. Otherwise, do not reject H_0.

Conclusion: Reject H_0 because the p-value for Trace statistic (0.0021) is less than the significance level, 0.05. Do not reject H_0 since the value of probability for Max-Eigen (0.0675) is more than the significance level, 0.05.

4.8 Granger Causality test

This testing method is used to investigate the direction of causality relationships between the selected independent variables and Stock Exchange of Thailand (SET index) in this research. In the figure below are summarized and the result shown in the table.

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

H_1 : Variable X does granger causes the variable Y.

Decision Rule:

Reject H_0 if the p-value is lower than the significance level. Otherwise, do not reject H_0.

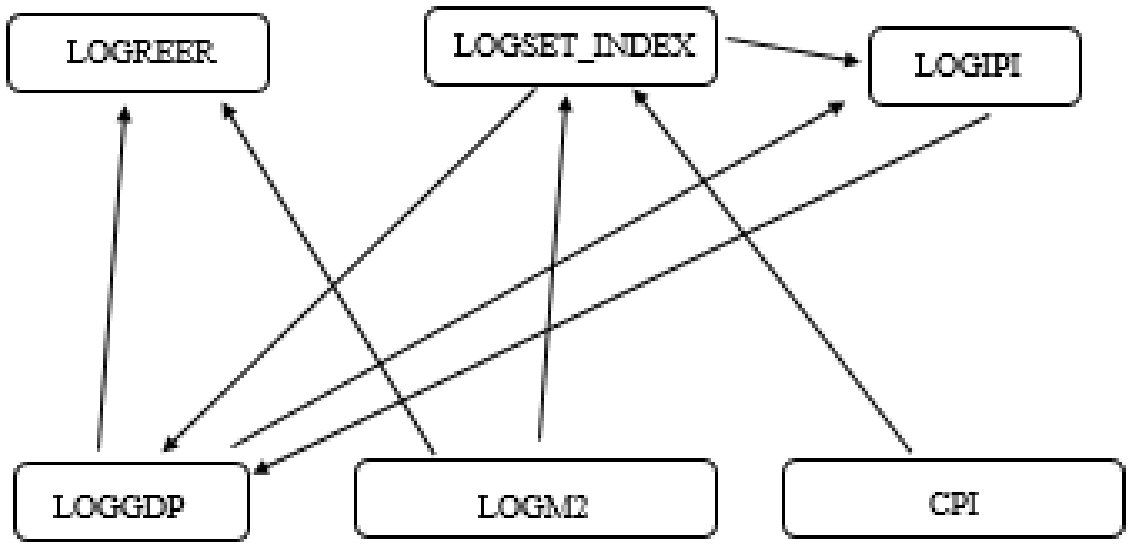
At the significance level, $\alpha = 0.05$,

Table 4.11: Results of Granger Causality Test

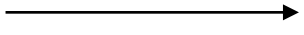
Variable X	**Variable Y**	**p-value**	**Decision**	**Conclusion**
LOGGDP	LOGSET_INDEX	0.0699	Do not reject H_0.	No granger cause.
LOGSET_INDEX	LOGGDP	0.0456	Reject H_0.	Granger cause.
LOGM2	LOGSET_INDEX	0.0028		
LOGSET_INDEX	LOGM2	0.7728	Do not reject H_0.	No granger cause.
LOGREER	LOGSET_INDEX	0.3067		
LOGSET_INDEX	LOGREER	0.7737		
CPI	LOGSET_INDEX	0.0238	Reject H_0.	Granger cause.
LOGSET_INDEX	CPI	0.1513	Do not reject H_0.	No granger cause.
LOGIPI	LOGSET_INDEX	0.4584		
LOGSET_INDEX	LOGIPI	0.0266	Reject H_0.	Granger cause.
LOGM2	LOGGDP	0.0847	Do not reject H_0.	No granger cause.
LOGGDP	LOGM2	0.6332		
LOGREER	LOGGDP	0.2314		
LOGGDP	LOGREER	0.0235	Reject H_0.	Granger cause.
CPI	LOGGDP	0.0647	Do not reject H_0.	No granger cause.
LOGGDP	CPI	0.1067		
LOGIPI	LOGGDP	0.0339	Reject H_0.	Granger cause.
LOGGDP	LOGIPI	0.0069		

LOGREER	LOGM2	0.0753	Do not reject H_0.	No granger cause.
LOGM2	LOGREER	0.0439	Reject H_0.	Granger cause.
CPI	LOGM2	0.2690	Do not reject H_0.	No granger cause.
LOGM2	CPI	0.0539		
LOGIPI	LOGM2	0.1312		
LOGM2	LOGIPI	0.0624		
CPI	LOGREER	0.8874		
LOGREER	CPI	0.2322		
LOGIPI	LOGREER	0.0955		
LOGREER	LOGIPI	0.2087		
LOGIPI	CPI	0.5112		
CPI	LOGIPI	0.0519		

Figure 4.8: The relationship between each variables for Granger Causality Test



Indicator:



One way causal relationship

According to the table 4.17, the granger causality relation exists between LOGSET_INDEX, LOGGDP, LOGM2, CPI and LOGIPI does granger causes the LOGSET_INDEX, LOGGDP, LOGREER, and LOGIPI. The result shows that some of the macroeconomic variables do granger causes the stock market performance in Thailand.

4.9 Conclusion

The diagnostic checking, unit root test, Johansen co-integration test and Granger Causality test have been conducted in this chapter. Entire of empirical results are expressed in figure form or table form by using the methodologies chosen in this research. The results have been obviously and accurately interpret by using the detailed explanation. The following chapter will summarised and discussed for the entire research.

CHAPTER 5: DISCUSSION, CONCLUSION AND IMPLICATIONS

5.0 Introduction

For the research this chapter carried out several of methodologies to analyse the data. It included major outcomes discussion in Chapter 4. Besides, the results will consistent with the earlier studies come with an interpretation, implication of the study, limitation and recommendations for future research. Lastly, the overall research will ended up a conclusion to summarize the contents.

5.1 Summary on Statistical Analysis

Based on the results completed in the chapter 4, it's summarized in the table 5.1 and table 5.2.

Table 5.1: Major Findings of OLS Model

Independent Variables	**P-value**	**Description of Results**
LM2	0.0000	Significant
LGDP	0.0057	Significant
LIPI	0.0121	Significant
LREER	0.9904	Insignificant
CPI	0.0096	Significant

Table 5.2: Diagnostic Checking of OLS model

Types of Problems	**Results**
Variance Inflation Factor	The highest VIF is 22.04391147 which between GDP and M2, it is more than 10 and it is a serious multicollinearity problem
Tolerance Factor	The lowest TOL is 0.045364 which between GDP and M2, it is near to zero and considered a serious multicollinearity problem
Heteroscedasticity	Not existed.
Autocorrelation	There exists autocorrelation problem.
Model Specification Error	Not existed.
Normality	The model is not normally distributed

In this study, there has 56 quarterly data sample size as the observations and inclusion of logarithms in all the variables except CPI. Based on the table 5.1.1, almost all of the independent variables are significantly influence the dependent variable. However, only one independent variable which is real effective exchange rate is not significantly affect the Stock Exchange of Thailand. Furthermore, this paper is for diagnostic checking in order to have a clearer picture on the real relationship between the variables and further carries out different statistical. Therefore, the tests that have been conducted are Jarque-Bera normality test, model specification test (Ramsey's RESET test), Heteroscedasticity Test (ARCH test), Autocorrelation test (Breusch-Godfrey LM test) to check whether that the problem exist.

From table 5.2 of diagnostic testing, the autocorrelation problem existed in the model, it might causes the OLS estimators are unbiased and inefficient since there is no longer BLUE that is best linear unbiased estimator. Thereby the OLS will underestimate the variance of estimator which produced the larger t-statistic, resulted the significant variable becomes insignificant variable, therefore the hypothesis testing is no longer reliable. In addition, there is no heteroscedasticity

problem and model specification error. Besides, a serious multicollinearity problem existed between gross domestic product and money supply M2 after testing the three detection of multicollinearity. Moreover, the error term of this model is not normally distributed.

There founded a highly correlation between gross domestic product and money supply M2, which are 0.871214 and 0.89308 respectively. Hence, VIF is carrying out between these two variables in order to determine the seriousness multicollinearity problem. Unfortunately, money supply M2 has the highest VIF which is 4.968055404, however it is not relatively serious since it not exceed 5. Through this paper tests, the reason might be due to time-series data.

Table 5.3: Summary of Independent Variables on Dependent Variables

Independent Variable	Hypothesis Testing	Conclusion	Hypothesized result
GDP	H_0: GDP insignificant related to stock market index. H_1: GDP significant related to stock market index.	Reject H_0 Gross domestic product has significant relationship with stock market performance.	Positive
Money supply M2	H_0: Money supply M2 insignificant related to stock market index.	Reject H_0. Money supply M2 has significant relationship with	Positive

	H_1: Money supply M2 significant related to stock market index.	stock market performance.	
REER	H_0: REER insignificant related to stock market index. H_1: REER significant related to stock market index.	Do not Reject H_0. REER has no significant relation with stock market performance.	Negative
CPI	H_0: CPI insignificant related to stock market index. H_1: CPI significant related to stock market index.	Reject H_0 Consumer price index has significant correlated to stock market performance.	Positive
IPI	H_0: IPI insignificant related to stock market index. H_1: IPI significant related to stock market index.	Reject H_0 IPI has significant relation with stock market index.	Positive

Source: Developed for the research

5.2 Discussions of Major Findings

Over the past decade, ever since the Asian financial crisis in the 1990s the trend in Thailand's stock market, Stock Exchange of Thailand (SET) slope has been dropping, yet starting from recent years, the stock exchange trend has been accelerating slowly ever since . In fact, around the range in the near future either good market or bad market, both among Asian stock market stock markets have been doing well in the past 5 years which can be assumed contagion effect that is existed would bring a positive impact to other existing stock market.

5.2.1 Gross Domestic Product (GDP)

Based on the outcome in this research, it shows that gross domestic product related positively with the stock market performance while GDP fundamentally influence by financial conditions and consumer certainty. Based on past researcher, Ademola (2014) as cited in Osamwonyi and Evbayiro-Osagie (2012) examined that the GDP affects the growth rate of the economy positively. It also means that the higher the growth rate of GDP, the better for stock market and stocks' prices. According to Ritter (2005) as cited in Mugambi and Okech (2016) found that the inflation is negatively related to stock market performance. According Thailand Economic Monitor in year 2016, Thailand's economy during last year it is up from 2.8% then the economy also expected to grow at 3.1% in 2016 and 3.2% in 2017, this news reported by today in the World Bank. Besides that, with the ASEAN Economic Community Thailand by offering a supportive regulatory environment can strengthen its service sector for deepening trade trading, business purpose and fostering competition (World Bank, 2016).

5.2.2 Money supply (M2)

Money supply is directly proportional to stock market performance Thailand. Therefore, there is also a positive relationship between money supply with the stock market performance in this researcg project. According to the review studies Thorbecke (1997) and Maskay (2007) are positively relationship with the stock market performance. In extension, Wongbangpo and Sharma (2002) have suggested that stock prices in Thailand, Malaysia positively related to money supply. Thus, Thailand stock market should carry a level of significance for money supply, however, it is indicated to be insignificant to explain their stock market performance. Another explanation stated that to access to financial market the money supply higher will giving advantages or beneficial the firms in the market by giving them more chances to contribute and also to growth (Babak, M. et al, 2012). Nevertheless, Sulaiman, Adam, Anwar and Adnan (2009), Yang and Hamori (2014), Zare, and Azali and Habibullah (2013) resulted money supply have negatively affect to stock market. Besides, Haitsma, Unalmis and Haan (2016), the changes of monetary policies unexpected might affected the stock market return that approaches by Rigobon-Sack heteroscedasticity. This will cause money supply increase and stock market to be lower.

5.2.3 Real effective exchange rate (REER)

This result of real effective exchange rate that insignificant and also positively related with stock market performance. Griffin, Nardari and Stulz (2004), Vejzagic and Zarafat (2013), Wong (2017) and Liang, Lin and Hsu (2013) stated that the real effective exchange rate is related negatively with stock market performance. To withdraw their investment real effective

exchange rate will lower by force of the foreign investors and looking for a preferably option. Besides that, in local stock market decrease it will cause the aggregate demand and pull down stock prices. The domestic currency will depreciate in value when the exchange rate going up. Therefore, foreign product will expensive that the local products. The reason of that so the foreign investors boost up its stock market performance therefore they will come and do invest their capital in domestic country's in the stock market. Furthermore, Tian and Ma (2010) proved that exchange rate together with another macroeconomic variable, money supply affect the stock price in a positive relationship. There were also some previous researchers on this issue have different viewpoint due to everyone also have their own perspective. Katechos (2011) examined that using new approach and found that yield is high of currencies are highly connection to stock market, while the low yielding currencies are negatively related to stock market. Dimitrova (2005) identified that the stock price relative to the REER which resulted in stock prices predicted to react uncertainly to exchange rate. While using this data, we can infer that stock market in Thailand would react all the while with global stock market. Even though they could not compete in the same level with other developed country, yet from the standards business management and market investor can be guaranteed that their investment will not fall off the track too far away.

5.2.4 Consumer Price Index (CPI)

The economy policy restricted if the raise of consumer price index with the increase the discount rate and bring to the increment in the stock market performance. According to Wongbangpo and Sharma (as cited in Hussainey & Ngoc, 2009), Geske and Roll (1983), Amihud (1996) Schwert (1981), Ray and Sarkar (2014) proved that CPI has a negative relationship with stock price as if a country has a high CPI, it will lead to the decline of stock

market performance. Besides that, stock price index has a negative but insignificantly impact on inflation during financial crisis (Naghdi, Kaghazian & Kakoei, 2012). However, these studied does not consistent with this research paper where based on this research paper during pre-crisis the inflation having positive relationship with share price, and it is significant affect the share price during crisis and post crisis period. However, there are still a couple of researches that have a tally results with this thesis, whereby there is a connection between CPI and stock price. (Boudoukh and Richardson, 1993) (Naik and Padhi, 2012) (Adusei, 2014). While Lee (2010) prove that the inflation is positively related to stock market in the pre-war period, however negatively related to stock market in the post-war period.

5.2.5 Industrial Production Index (IPI)

When the index of industrial production boost up, to this economy it shown that the country of the production has an hopeful viewpoint or optimistic through the development and also positive effect. In Thailand stock market reacted significantly to Industrial Production Index and the stock market will reflect the current market condition (Goswami and Jung, 1997; Sahoo, Sahoo and Sahu, 2014; Culter et al., 1989). In other words, in turn striking up their stock price industrial production will trigger sales and profit earnings performance. Thus, market investors are stacked with high certainty towards the investment they have made on this issue. Past studies demonstrate that there is insignificantly between index of industrial production and stock market index (Errunza and Hogan, as cited in Subeniotis, Papadopoulos, Tampakoudis & Tampakoudi, 2011) especially in Germany and France. However, Fama (1990) distinguished there is hard to measure the short term industrial production data in predicting the returns of stock market. Balvers, Cosimano and McDonald (1990) used the data they have collected to forecast the stock market performance in the near

future because they believed the current economic condition is the rational prediction for the stock market in the subsequent period. Industrial production rate will positively affect its stock price when Thailand is a developing business sector which implies a countries do not rely on industrial production index because they are considered that as a developed economy. According to Ozbay (2009) indicate that the developing countries and emerging markets normally kept a good relationship between industrial production rate and stock market performance.

In short, it will discuss further on it in all those findings had a strongly tools in the implications of study and recommendations for the following part.

5.3 Implication of the study

5.3.1 Managerial Implication

Through on this research study, GDP is found to be positively related to stock market. There is positively related when stocks are in a good market condition, there has a tendency to be a great deal of optimism encompassing the economy and the possibilities of different stocks. It is because GDP influence the stock market performance by financial conditions and consumer certainty. According to Hsing (2013), because of decrease in purchasing power exorbitant in money supply with respect to GDP would prompt to increase inflation in the future when something happen and it will damage the stock market and also social activities as well. Bank can also play a vital role to have an appropriate monetary policy in order to cut down the inflation risk. In this way, the investors are proposed to make choices

which lower down the risk such as obtain funds through debt market so as order to source fund.

From the outcome of study, money supply is observed to be related positively with stock market. Consequently, government able to expand the money supply to support up stock market performance. This is because investors will have tendency to have more funds to make their investments in stock market when money supply in the market expand by making the stock market to be more dynamic and in well perform.. Government or policy maker is recommended to diminish the required reserve with the goal that banks are permitted in providing loans to public by broaden money supply. One final catalyst to highlight is flow of funds in the economy, monetary policy in Thailand does not depends on money supply excessively to achieve stock market performance. Eventually, this determines the choices on contractionary fiscal policies or expansionary monetary implementation in order to help to boost up the stock market performance.

Consumer price index (CPI) assumes a crucial role in determining stock market performance. In previous research, when inflation goes up, assuming value estimation of stock should drop and consequently set of diminishing on stock price. For the situation in Thailand, by taking advantage on the rising CPI, organisation wish to expand their capital by issuing stocks at a higher cost for here and now. In the case of Thailand since rising CPI is not any more news, CPI vulnerability drops and consequently output growth higher. Thus, they might be aware that the stock offered ought to be remunerated with a higher return to hedge inflation rate risk. According to Langner (2017), Straits Time Index (STI) is the second best performing stock benchmark in Asia. Furthermore, it generally comes down to preference on risk of investors. They might be invest a large amount of stock that offers a higher yield during inflation if the investor is risk seeker. This research study infers that inflation could be settled by policy maker through

implementing economic policy to modify the costs of goods since stock price are related to inflation.

In fact, industrial production index has been demonstrated to clarify stock market performance in Thailand. According to Trading Economics (2017) arranged industrial production rate has been moving relentlessly throughout the last 30 years in Thailand respectively. Since unpredictability in industrial production rate will bring negative impact to the stock market they have remain under the radar from the beginning. As from the research study since the fluctuation is not as high as other variable, industrial production rate should be the variable that policy maker worry the least.

5.4 Policy Implication

Results displayed are helpful for business administration, policy makers, and market investors for decision making to maximize their profit to beneficial them when revelling into the stock market performance in Thailand. Besides, this part of the research empower business administration, policy makers and market investors to understand more on how these independent variables works to make a different on the stock market performance in Thailand.

Other than that, government can purchase the treasury securities in the open market. It is government bring down the interest rate to attract more investor start borrowing from them. Government can through the monetary policy and fiscal policy to alter interest rate and level of money supply to alleviation inflation in the nation or country. Furthermore, to protect the stock market by expanding money supply is one of the best ways from being weak and inactive. In our research study, by manipulating macroeconomic variables with better understanding through the policies implementation for policy- makers is imperative. Therefore, the real

effective exchange rate will be steadier. At the point, the country's investment rating will be increasing when the risk premium reducing.

The policy implication will give benefit to the whole market members or participants, for example, corporate, investor, government, bank institution and etc. Government's policy maker is utilizing reasonable and suitable economic policy such as fiscal policy to influence and adjust of installment which also called as balance of payment. Nonetheless, from the spread between ask prices and bid prices, the vast international bank frequently goes about as market producers to earn the profit. Corporate will possibility get profit when new opportunities arise if the government changes in limitation or restriction from evacuation of government barriers. Policy maker should be able to forecast and hedge risk against any financial crisis in the future, given that data trend as a reference.

In the fact, for experts who make the economic policy Efficient Market Hypothesis (EMH) in especially semi-strong form effectiveness in stock prices must involve every pertinent data including publicly achievable data and has basic impact (Fama, 1970). Moreover, between macroeconomic variables and stock market performance concluded the co-integrating relationship with inefficient market hypothesis. On opposite, to assess whether the undergoing economic policies are legitimate it is urgent for policy-makers or producer like government needs.

As Thailand remained as first among the most dynamic leading stock market in Asia, economic integration might be also get related to neighboring countries. Advancement and development advance in Thailand could be seen as an indicator which decide pattern in Asian stock market. According Chancharat et al. (2007), fundamentally to other countries' stock market performance by physical implementations will be applied pressure in the locale. Malaysia, Philippines, Thailand, Korea and Singapore make the capital controls improvements after the incident of financial crisis in 1997 in respectively.

5.5 Limitation of Study

For this study, there are limited data and information could be retrieved due to the lack of researches on developing country as in Thailand. Basically, most of the studies are done on those developed countries for example like United State, China. Some of the journals might be applicable or referable in this study, however due to lack of resource of these journals could not be study through as access fees is required. In other word, the finding retrieved from some of the journals might not be able to apply in explaining stock market and macroeconomic variables had been selected in Thailand because mostly the journals are based on developed countries performance and trend.

Originally, the macroeconomic variables chosen for this topic are different as it is now. The macroeconomic variable of unemployment was in the list before. However due to lack of information and data that to be collected to apply in this study, unemployment has been taken out from the chosen variables and replaced it with consumer price index and industrial production index which included more data and information available.

The frequency of the data affected the accuracy of the research, which in other word the more frequent the data is the clearer the data is. Through this research study, quarterly data had been chosen as the based to run tests. The macroeconomic variables selected able to standardize only in quarterly data. Even though quarterly data is quite a frequent period data which have high accuracy, there are still better accuracy data as in weekly and daily data. However, not every data of the macroeconomic variables selected are recorded in weekly or daily data. Therefore, quarterly data are retrieved for the econometric tests purpose.

5.5 Recommendation for future research

Future researchers stimulated to research wider into the relationship between stock market performance and macroeconomic variables of few developing countries rather than focus on one country for comparison purpose between countries. So, future researchers could help generate more information on the performance and trend of few countries at once which bring ease for others parties like policymakers, investors and etc. as a reference purposes. With the help of this study, the information generated on Thailand stock market and macroeconomic variables could help future researchers as a reference in comparing Thailand with other countries. Moreover, a research could be done in comparing developing countries and developed countries with the reference of this study.

The higher frequency of the data is recommended for the future researchers. Weekly and daily data could be used to generate a better result in studying the relationship of stock market and macroeconomic variables. Future researchers are encouraged to do selection on the variables with higher frequency data available to enhance the accuracy of the result to be generated in the data analysis part.

Other than that, future researchers are suggested generate result by employing more type of data analysis test to enhance the comprehension the relation between stock market performance and macroeconomic variables. For example, Granger causality test and co-integration test could boost the understanding between the dependent variable and independent variables. VECM test could be employed as well to strengthen the result of the relationship between dependant variable and independent variables.

5.6 Conclusion

In short, this research has found the result of significance between stock market performance and macroeconomic variables in Thailand. Most of the macroeconomic variables included gross domestic product (GDP), money supply (M2), inflation rate (CPI) and industrial production index (IPI) proved that they are significantly related with stock market performance of Thailand. The one and only macroeconomic variable that failed to prove the significant relationship between itself and stock market performance is real effective exchange rate. All of the independent variables have no serious multicollinearity problem. However, there is autocorrelation problem in this research.

Other than that, there are several limitation experienced in this research which bring some problem in studying the topic. Last but not least, recommendation are discussed in this research with the purpose of referencing for the future researchers.

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APPENDICES

APPENDIX 1: ORDINARY LEAST SQUARE (OLS) METHOD

Dependent Variable: LOGSET_INDEX
Method: Least Squares
Date: 07/11/17 Time: 20:50
Sample: 2003Q1 2016Q4
Included observations: 56

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-17.30758	5.768959	-3.000121	0.0042
LOGGDP	-2.304287	0.797029	-2.891096	0.0057
LOGM2	2.506348	0.495974	5.053388	0.0000
LOGREER	0.009044	0.746405	0.012117	0.9904
CPI	0.034119	0.012671	2.692677	0.0096
LOGIPI	1.153036	0.442957	2.603045	0.0121

R-squared	0.843262	Mean dependent var	6.808580
Adjusted R-squared	0.827588	S.D. dependent var	0.387819
S.E. of regression	0.161032	Akaike info criterion	-0.713466
Sum squared resid	1.296571	Schwarz criterion	-0.496464
Log likelihood	25.97705	Hannan-Quinn criter.	-0.629335
F-statistic	53.80070	Durbin-Watson stat	0.626061
Prob(F-statistic)	0.000000		

Sources: Developed for the research via E-views

APPENDIX 2: DESCRIPTIVE STATISTIC OF ALL VARIABLES

	LOGSET_INDEX	LOGGDP	LOGM2	LOGREER	CPI	LOGIPI
Mean	6.808580	0.929537	9.318835	4.563132	2.438929	2.408727
Median	6.722802	0.957856	9.280901	4.589447	2.500000	2.464319
Maximum	7.368762	1.311840	9.814080	4.688592	7.470000	2.652537
Minimum	5.898664	0.421994	8.819485	4.417152	-2.760000	2.026041
Std. Dev.	0.387819	0.256787	0.327240	0.074788	2.124103	0.149481
Skewness	-0.161053	-0.356103	0.053120	-0.683213	-0.047166	-0.782513
Kurtosis	2.077900	1.974571	1.562792	2.342882	3.329263	2.789140
Jarque-Bera	2.226049	3.637065	4.845990	5.364151	0.273730	5.818793
Probability	0.328564	0.162264	0.088656	0.068421	0.872088	0.054509
Sum	381.2805	52.05409	521.8548	255.5354	136.5800	134.8887
Sum Sq. Dev.	8.272212	3.626686	5.889744	0.307625	248.1497	1.228952
Observations	56	56	56	56	56	56

Sources: Developed for the research via E-views

APPENDIX 3: MULTICOLLINEARITY

- **Pair-Wise Correlation Coefficients**

	LOGSET_INDEX	LOGGDP	LOGM2	LOGREER	CPI	LOGIPI
LOGSET_INDEX	1.000000	0.871214	0.893708	0.767529	-0.250139	0.737712
LOGGDP	0.871214	1.000000	0.977055	0.903117	-0.310617	0.871021
LOGM2	0.893708	0.977055	1.000000	0.851405	-0.409192	0.775324
LOGREER	0.767529	0.903117	0.851405	1.000000	-0.240489	0.873164
CPI	-0.250139	-0.310617	-0.409192	-0.240489	1.000000	-0.101548
LOGIPI	0.737712	0.871021	0.775324	0.873164	-0.101548	1.000000

- **Regression Analysis**

Dependent Variable: LOGGDP
Method: Least Squares
Date: 07/16/17 Time: 21:29
Sample: 2003Q1 2016Q4
Included observations: 56

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-6.215216	0.212076	-29.30652	0.0000
LOGM2	0.766700	0.022744	33.70995	0.0000

R-squared	0.954636	Mean dependent var	0.929537

Dependent Variable: LOGGDP
Method: Least Squares
Date: 07/16/17 Time: 21:37

Sample: 2003Q1 2016Q4
Included observations: 56

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-13.22029	0.915639	-14.43832	0.0000
LOGREER	3.100903	0.200634	15.45554	0.0000

R-squared	0.815620	Mean dependent var	0.929537

Dependent Variable: LOGGDP
Method: Least Squares
Date: 07/16/17 Time: 21:38
Sample: 2003Q1 2016Q4
Included observations: 56

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.021122	0.050380	20.26831	0.0000
CPI	-0.037551	0.015638	-2.401342	0.0198

R-squared	0.096483	Mean dependent var	0.929537

Dependent Variable: LOGGDP
Method: Least Squares
Date: 07/16/17 Time: 21:39
Sample: 2003Q1 2016Q4
Included observations: 56

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.674619	0.277139	-9.650834	0.0000
LOGIPI	1.496291	0.114839	13.02946	0.0000

R-squared	0.758677	Mean dependent var	0.929537

Dependent Variable: LOGM2
Method: Least Squares
Date: 07/16/17 Time: 21:40
Sample: 2003Q1 2016Q4
Included observations: 56

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7.680677	1.425325	-5.388719	0.0000
LOGREER	3.725405	0.312316	11.92833	0.0000
R-squared	0.724890	Mean dependent var		9.318835

Dependent Variable: LOGM2
Method: Least Squares
Date: 07/16/17 Time: 21:41
Sample: 2003Q1 2016Q4
Included observations: 56

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.472586	0.061630	153.7005	0.0000
CPI	-0.063040	0.019129	-3.295461	0.0017
R-squared	0.167438	Mean dependent var		9.318835

Dependent Variable: LOGM2
Method: Least Squares
Date: 07/16/17 Time: 21:42
Sample: 2003Q1 2016Q4
Included observations: 56

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.230453	0.454055	11.51942	0.0000
LOGIPI	1.697320	0.188149	9.021166	0.0000
R-squared	0.601127	Mean dependent var		9.318835

Dependent Variable: LOGREER
Method: Least Squares
Date: 07/16/17 Time: 21:43
Sample: 2003Q1 2016Q4
Included observations: 56

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.583783	0.014983	305.9235	0.0000

CPI	-0.008467	0.004651	-1.820661	0.0742
R-squared	0.057835	Mean dependent var		4.563132

Dependent Variable: LOGREER
Method: Least Squares
Date: 07/16/17 Time: 21:43
Sample: 2003Q1 2016Q4
Included observations: 56

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.510863	0.080087	43.83799	0.0000
LOGIPI	0.436857	0.033186	13.16386	0.0000
R-squared	0.762415	Mean dependent var		4.563132

Dependent Variable: CPI
Method: Least Squares
Date: 07/16/17 Time: 21:44
Sample: 2003Q1 2016Q4
Included observations: 56

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.914667	4.642470	1.274034	0.2081
LOGIPI	-1.442977	1.923719	-0.750098	0.4565
R-squared	0.010312	Mean dependent var		2.438929

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

	R^2	**VIF = 1 / (1 - R^2)**	**TOL = 1 – R^2**
LOGGDP LOGM2	0.954636	22.04391147	0.045364
LOGGDP LOGREER	0.815620	5.423581733	0.18438

LOGGDP CPI	0.096483	1.106786037	0.903517
LOGGDP LOGIPI	0.758677	4.143823838	0.241323
LOGM2 LOGREER	0.724890	3.634909672	0.27511
LOGM2 CPI	0.167438	1.201111749	0.832562
LOGM2 LOGIPI	0.601127	2.507063652	0.398873
LOGREER CPI	0.057835	1.061385214	0.942165
LOGREER LOGIPI	0.762415	4.20901993	0.237585
CPI LOGIPI	0.010312	1.010419445	0.989688

APPENDIX 4: HETEROSCEDASTICITY

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

Heteroskedasticity Test: ARCH

F-statistic	2.167689	Prob. F(9,37)	0.0477
Obs*R-squared	16.22625	Prob. Chi-Square(9)	0.0623

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/16/17 Time: 22:56
Sample (adjusted): 2005Q2 2016Q4
Included observations: 47 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.014164	0.008227	1.721679	0.0935
RESID^2(-1)	0.608432	0.163140	3.729505	0.0006
RESID^2(-2)	-0.169468	0.190281	-0.890617	0.3789
RESID^2(-3)	-0.082678	0.191699	-0.431290	0.6688
RESID^2(-4)	0.082686	0.189598	0.436111	0.6653
RESID^2(-5)	0.173104	0.184687	0.937282	0.3547
RESID^2(-6)	-0.192020	0.168132	-1.142075	0.2608
RESID^2(-7)	0.044226	0.166503	0.265615	0.7920
RESID^2(-8)	-0.041146	0.162715	-0.252870	0.8018
RESID^2(-9)	-0.067319	0.133456	-0.504427	0.6170

R-squared	0.345239	Mean dependent var	0.020284
Adjusted R-squared	0.185973	S.D. dependent var	0.041730
S.E. of regression	0.037650	Akaike info criterion	-3.534675
Sum squared resid	0.052448	Schwarz criterion	-3.141027
Log likelihood	93.06487	Hannan-Quinn criter.	-3.386543
F-statistic	2.167689	Durbin-Watson stat	1.952824
Prob(F-statistic)	0.047702		

APPENDIX 5: AUTOCORRELATION

- **Breusch-Godfrey Serial Correlation LM Test**

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	37.44836	Prob. F(1,49)	0.0000
Obs*R-squared	24.25851	Prob. Chi-Square(1)	0.0000

Test Equation:
Dependent Variable: RESID
Method: Least Squares
Date: 07/16/17 Time: 22:50
Sample: 2003Q1 2016Q4
Included observations: 56
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.006719	4.387369	0.001531	0.9988
LOGGDP	0.173505	0.606813	0.285928	0.7761
LOGM2	-0.128615	0.377780	-0.340449	0.7350
LOGREER	0.390982	0.571235	0.684450	0.4969
CPI	-0.013171	0.009874	-1.333913	0.1884
LOGIPI	-0.298624	0.340390	-0.877300	0.3846
RESID(-1)	0.700721	0.114506	6.119506	0.0000

R-squared	0.433188	Mean dependent var	8.26E-15
Adjusted R-squared	0.363782	S.D. dependent var	0.153538
S.E. of regression	0.122467	Akaike info criterion	-1.245479
Sum squared resid	0.734912	Schwarz criterion	-0.992310
Log likelihood	41.87340	Hannan-Quinn criter.	-1.147326
F-statistic	6.241393	Durbin-Watson stat	1.568469
Prob(F-statistic)	0.000064		

APPENDIX 6: MODEL SPECIFICATION

- **Ramsey RESET Test**

Ramsey RESET Test
Equation: UNTITLED
Specification: LOGSET_INDEX C LOGGDP LOGM2 LOGREER CPI LOGIPI
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	1.732027	49	0.0896
F-statistic	2.999917	(1, 49)	0.0896
Likelihood ratio	3.327622	1	0.0681

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.074800	1	0.074800
Restricted SSR	1.296571	50	0.025931
Unrestricted SSR	1.221771	49	0.024934
Unrestricted SSR	1.221771	49	0.024934

LR test summary:

	Value	df
Restricted LogL	25.97705	50
Unrestricted LogL	27.64086	49

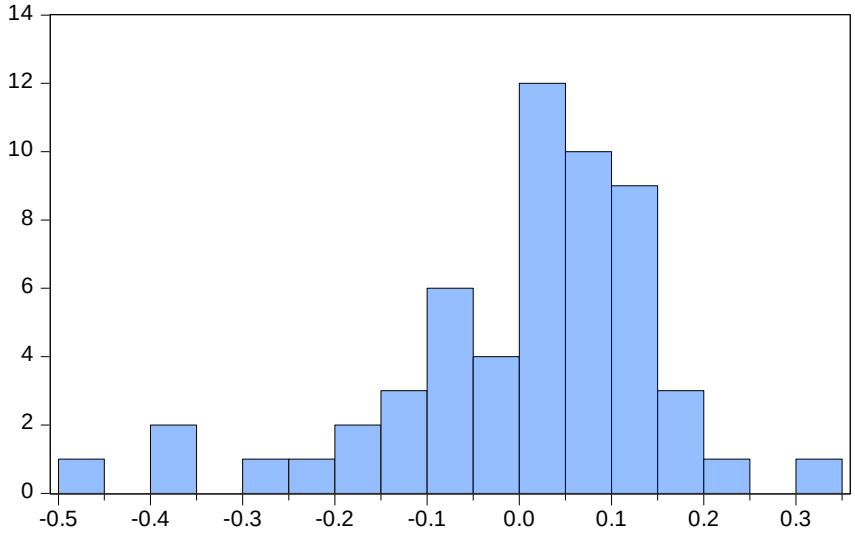
Unrestricted Test Equation:
Dependent Variable: LOGSET_INDEX
Method: Least Squares
Date: 07/16/17 Time: 23:22
Sample: 2003Q1 2016Q4
Included observations: 56

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	183.5199	116.0873	1.580878	0.1203
LOGGDP	20.37120	13.11519	1.553253	0.1268
LOGM2	-21.82961	14.05898	-1.552716	0.1269
LOGREER	0.012245	0.731913	0.016730	0.9867
CPI	-0.288179	0.186496	-1.545233	0.1287
LOGIPI	-9.857741	6.371985	-1.547044	0.1283
FITTED^2	0.692127	0.399605	1.732027	0.0896

R-squared	0.852304	Mean dependent var	6.808580
Adjusted R-squared	0.834219	S.D. dependent var	0.387819
S.E. of regression	0.157905	Akaike info criterion	-0.737174
Sum squared resid	1.221771	Schwarz criterion	-0.484005
Log likelihood	27.64086	Hannan-Quinn criter.	-0.639021
F-statistic	47.12719	Durbin-Watson stat	0.728051
Prob(F-statistic)	0.000000		

APPENDIX 7: NORMALITY TEST

- **Jarque-Bera Test**



Series: Residuals	
Sample 2003Q1 2016Q4	
Observations 56	
Mean	8.26e-15
Median	0.033027
Maximum	0.331832
Minimum	-0.486921
Std. Dev.	0.153538
Skewness	-1.023148
Kurtosis	4.509444
Jarque-Bera	15.08674
Probability	0.000530

APPENDIX 8: UNIT ROOT TEST

- **Augmented Dickey-Fuller (ADF) Test**

Level Form without trend

Null Hypothesis: LOGSET_INDEX has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.642562	0.4543
Test critical values:	1% level	-3.557472	
	5% level	-2.916566	
	10% level	-2.596116	

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

Null Hypothesis: LOGGDP has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.159848	0.2231
Test critical values:	1% level	-3.562669	
	5% level	-2.918778	
	10% level	-2.597285	

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

Null Hypothesis: LOGM2 has a unit root
Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.863334	0.7919
Test critical values:	1% level	-3.565430	
	5% level	-2.919952	
	10% level	-2.597905	

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

Null Hypothesis: LOGREER has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.783870	0.3845
Test critical values:	1% level	-3.555023	
	5% level	-2.915522	
	10% level	-2.595565	

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

Null Hypothesis: CPI has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.374213	0.0009
Test critical values:	1% level	-3.557472	
	5% level	-2.916566	
	10% level	-2.596116	

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

Null Hypothesis: LOGIPI has a unit root
Exogenous: Constant
Lag Length: 5 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-2.711733	0.0792
Test critical values:	1% level	-3.568308	
	5% level	-2.921175	
	10% level	-2.598551	

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

Level Form with trend

Null Hypothesis: LOGSET_INDEX has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.424102	0.0588
Test critical values:	1% level	-4.137279	
	5% level	-3.495295	
	10% level	-3.176618	

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

Null Hypothesis: LOGGDP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.186248	0.0978
Test critical values:	1% level	-4.133838	
	5% level	-3.493692	
	10% level	-3.175693	

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

Null Hypothesis: LOGM2 has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 4 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.664620	0.2551
Test critical values:	1% level	-4.148465	
	5% level	-3.500495	
	10% level	-3.179617	

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

Null Hypothesis: LOGREER has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.558156	0.3004
Test critical values:	1% level	-4.137279	
	5% level	-3.495295	
	10% level	-3.176618	

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

Null Hypothesis: CPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 1 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.237599	0.0004
Test critical values:	1% level	-4.137279	
	5% level	-3.495295	
	10% level	-3.176618	

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

Null Hypothesis: LOGIPI has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 5 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.125486	0.5193
Test critical values:	1% level	-4.152511	
	5% level	-3.502373	
	10% level	-3.180699	

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

First difference without trend

Null Hypothesis: D(LOGSET_INDEX) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.313315	0.0000
Test critical values:	1% level	-3.557472	
	5% level	-2.916566	
	10% level	-2.596116	

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

Null Hypothesis: D(LOGGDP) has a unit root
Exogenous: Constant
Lag Length: 2 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.042053	0.0000
Test critical values:	1% level	-3.562669	
	5% level	-2.918778	
	10% level	-2.597285	

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

Null Hypothesis: D(LOGM2) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.609143	0.4707
Test critical values:	1% level	-3.565430	
	5% level	-2.919952	
	10% level	-2.597905	

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

Null Hypothesis: D(LOGREER) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.310223	0.0000
Test critical values:	1% level	-3.557472	
	5% level	-2.916566	
	10% level	-2.596116	

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

Null Hypothesis: D(CPI) has a unit root
Exogenous: Constant
Lag Length: 3 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.296651	0.0000
Test critical values:	1% level	-3.565430	
	5% level	-2.919952	
	10% level	-2.597905	

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

Null Hypothesis: D(LOGIPI) has a unit root

Exogenous: Constant
Lag Length: 4 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.473502	0.0007
Test critical values:	1% level	-3.568308	
	5% level	-2.921175	
	10% level	-2.598551	

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

First difference with trend

Null Hypothesis: D(LOGSET_INDEX) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.239187	0.0004
Test critical values:	1% level	-4.137279	
	5% level	-3.495295	
	10% level	-3.176618	

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

Null Hypothesis: D(LOGGDP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 2 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.457228	0.0000
Test critical values:	1% level	-4.144584	
	5% level	-3.498692	
	10% level	-3.178578	

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

Null Hypothesis: D(LOGM2) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.600704	0.7790
Test critical values:	1% level	-4.148465	
	5% level	-3.500495	
	10% level	-3.179617	

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

Null Hypothesis: D(LOGREER) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.303452	0.0000
Test critical values:	1% level	-4.137279	
	5% level	-3.495295	
	10% level	-3.176618	

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

Null Hypothesis: D(CPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 3 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.343787	0.0000
Test critical values:	1% level	-4.148465	
	5% level	-3.500495	
	10% level	-3.179617	

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

Null Hypothesis: D(LOGIPI) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 6 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.522681	0.0002
Test critical values:	1% level	-4.161144	
	5% level	-3.506374	
	10% level	-3.183002	

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

APPENDIX 9: JOHANSEN CO-INTEGRATION TEST

Sample (adjusted): 2003Q3 2016Q4
Included observations: 54 after adjustments
Trend assumption: Linear deterministic trend
Series: LOGSET_INDEX LOGGDP LOGM2 LOGREER CPI LOGIPI
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 *	0.513393	112.6400	95.75366	0.0021
At most 1 *	0.436918	73.74382	69.81889	0.0235
At most 2	0.311320	42.73002	47.85613	0.1393
At most 3	0.270746	22.58917	29.79707	0.2669
At most 4	0.071163	5.539603	15.49471	0.7491
At most 5	0.028354	1.553240	3.841466	0.2127

Trace test indicates 2 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	0.513393	38.89614	40.07757	0.0675
At most 1	0.436918	31.01380	33.87687	0.1058
At most 2	0.311320	20.14085	27.58434	0.3315
At most 3	0.270746	17.04957	21.13162	0.1697
At most 4	0.071163	3.986363	14.26460	0.8608
At most 5	0.028354	1.553240	3.841466	0.2127

Max-eigenvalue test indicates no cointegration at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

APPENDIX 10: GRANGER CAUSALITY TEST

Pairwise Granger Causality Tests
Date: 07/17/17 Time: 02:42
Sample: 2003Q1 2016Q4
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
LOGGDP does not Granger Cause LOGSET_INDEX	54	2.81107	0.0699
LOGSET_INDEX does not Granger Cause LOGGDP		3.29086	0.0456
LOGM2 does not Granger Cause LOGSET_INDEX	54	6.64956	0.0028
LOGSET_INDEX does not Granger Cause LOGM2		0.25905	0.7728
LOGREER does not Granger Cause LOGSET_INDEX	54	1.21090	0.3067
LOGSET_INDEX does not Granger Cause LOGREER		0.25792	0.7737
CPI does not Granger Cause LOGSET_INDEX	54	4.03844	0.0238
LOGSET_INDEX does not Granger Cause CPI		1.96285	0.1513
LOGIPI does not Granger Cause LOGSET_INDEX	54	0.79258	0.4584
LOGSET_INDEX does not Granger Cause LOGIPI		3.90768	0.0266
LOGM2 does not Granger Cause LOGGDP	54	2.59757	0.0847
LOGGDP does not Granger Cause LOGM2		0.46121	0.6332
LOGREER does not Granger Cause LOGGDP	54	1.50824	0.2314
LOGGDP does not Granger Cause LOGREER		4.05549	0.0235
CPI does not Granger Cause LOGGDP	54	2.89743	0.0647
LOGGDP does not Granger Cause CPI		2.34342	0.1067
LOGIPI does not Granger Cause LOGGDP	54	3.63021	0.0339
LOGGDP does not Granger Cause LOGIPI		5.50908	0.0069
LOGREER does not Granger Cause LOGM2	54	2.72831	0.0753
LOGM2 does not Granger Cause LOGREER		3.33309	0.0439
CPI does not Granger Cause LOGM2	54	1.34869	0.2690
LOGM2 does not Granger Cause CPI		3.10213	0.0539
LOGIPI does not Granger Cause LOGM2	54	2.11781	0.1312
LOGM2 does not Granger Cause LOGIPI		2.93822	0.0624
CPI does not Granger Cause LOGREER	54	0.11971	0.8874

LOGREER does not Granger Cause CPI		1.50467	0.2322
LOGIPI does not Granger Cause LOGREER	54	2.46506	0.0955
LOGREER does not Granger Cause LOGIPI		1.61796	0.2087
LOGIPI does not Granger Cause CPI	54	0.68025	0.5112
CPI does not Granger Cause LOGIPI		3.14552	0.0519