

THE ASYMMETRIC EFFECT OF MACROECONOMICS
VARIABLES ON STOCK PRICES: AN EMPIRICAL
EVIDENCE OF ASEAN-4

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- (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.
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LIST OF ABBREVIATIONS

ADF	Augmented Dickey Fuller
APT	Arbitrage Pricing Theory
ARCH	Autoregressive
ASEAN	Association of South East Asian Nations
CDC	Central Depository System
CNX	CRISIL NSE Index
CUSUM	Cumulative Cum
ECM	Asymmetric Error Correction
FTSE	Financial Times Stock Exchange
GARCH	Generalized Autoregressive Model
GDP	Growth Domestic Product
IPI	Industrial Production Index
IPO	Initial Public Offerings
KLCI	Kuala Lumpur Composite Index
KLSE	Kuala Lumpur Stock Exchange
KPSS	Kwiatkowski, Phillips, Schmidt and Shin
LM	Lagrange multiplier
MTAR	Momentum-Threshold Autoregressive
OLS	Ordinary Least Square

S&P	Standand and Poor
TAR	Threshold Autoregressive
US	United States
VAR	Vector Autoregressive Model
VECM	Vector Error Correction Model

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PREFACE

Stock market plays a pivotal role in each country as it acts in response to the country's economy. It signifies the importance of a stock market. Therefore, the studies on the determinants of stock prices have been more and more popular. The determinants of stock prices such as interest rate, exchange rate, inflation rate, money supply, and crude oil price have been determined to have significant influence towards the stock price.

Nevertheless, this has induced the researchers to study the relationship between macroeconomic variables and stock prices. But, these studies are normally done on a symmetric perspective. In spite of this common perspective, this study intends to determine the relationship between macroeconomic variables and stock prices from the asymmetric perspective as the stock market is believed to be asymmetry.

The asymmetric information of the stock market is useful for different parties such as investors, organizations, government, and researchers. With this information, investors tend to react precisely to the positive and negative shock since the real stock market is actually asymmetry in order to maintain the economy. While organizations and governments can stipulate better management strategy to act in accordance with the asymmetric stock market and yet, researchers can apply asymmetric model instead of symmetric model in studying the integration between macroeconomic variables and stock prices.

ABSTRACT

Previous researchers have assumed the market to be symmetric during their research on the topic of stock prices. However, it is found that the stock market actually respond asymmetrically to the news. Therefore, the purpose of this research is to study the asymmetric relationship of macroeconomic variables and the stock prices for the ASEAN-4 countries, which are Malaysia, Thailand, Indonesia and Philippines. In order to capture the asymmetric effect of macroeconomic variables on the stock prices, the test of Asymmetric Error Correction Model (AECM) is employed in this research. As a result, both TAR and M-TAR shows that the stock market of ASEAN-4 countries react to macroeconomic variables asymmetrically in short run and long run integration.

CHAPTER 1: INTRODUCTION

1.1 Background of Study

Stock markets have always been one of the main concentrations for investors as stock markets play an important role in the economy. The performance of the stock market can affect investor's wealth and it can affect a country's economy wealth too. Hence, the studies regarding the determinant of stock return has been more and more significant. Among all of the determinants, macroeconomic variables are the most frequent subject of interest due to its importance in determining the stock return.

However, many of them use symmetry view when observing the market. It is relatively inappropriate since the market is actually functioning under an asymmetric impact. The results obtained might be different from one another since symmetric method was employed while determining the relationship between macroeconomic variables and stock prices.

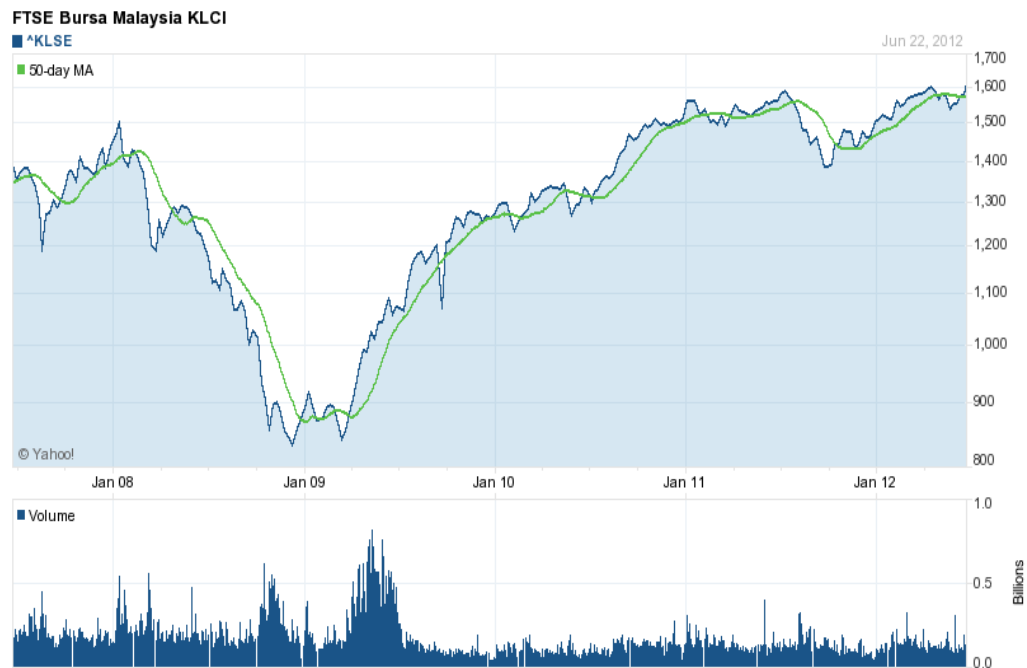
However, in real situation, investors will react differently to the news released and most of the time, investors will react too much towards bad news while lesser on good news (Campbell & Hentschel, 1992). Therefore, symmetric method may not be a good approach on stock analysis. As shown in the journal, only 20 percent of the S&P index increased after the outbreak of World War II. In addition, research of Suleman (2012) stated that both good and bad political news affects the stock return. In the light of this study, Suleman (2012) found that bad news increase the volatility of stock prices while good news the other way round. The effect of bad news towards volatility of stock price is even more than good news, and sometimes, even doubles the effects! According to Murugiah (2012), the research also provides evidence to the theory that had been mentioned previously. As refer to Appendix, it is observed that Japan's Nikkei (Figure 1.1), Hong Kong's Hang Seng index (Figure 1.2), Shanghai composite index (Figure 1.3), South Korea's KOSPI (Figure 1.4) and Singapore's Straits Times index (Figure 1.5) has dropped

dramatically after the occurrence of Euro Debt Crisis in year 2012. The effect of the crisis is overstretched to regions beyond Europe boundaries and there are vast amount of industries affected. Furthermore, Zhao, Yang, Zhao, and Li (2011) also proposed that different news will bring different impact to China.

Prediction of stock return is not constant over time since it will be affected by the economic condition; no matter it is a positive condition or the opposite situation. Thus, many researchers have conducted research on this topic in order to have a clearer picture of the effect of macroeconomic variables towards stock return. However, some researchers attained fraud results in their studies and this is the main motivation that urges the conduction of a research on this topic.

As shown in Figure 1, the figure is plotted to enable us to review the trend of the stock price in Malaysia's stock market. From the figure, it is observed that the market responses to both negative shocks and positive shocks. However, it is observed that investors tend to overreact when negative shocks arise, causing the stock prices to decrease drastically. The stock market only requires relatively shorter time to reflect the decrease in stock prices while, in contrast, the stock market require longer time to reflect the increment in stock prices. Figure 1 has then proved that the stock market is asymmetrically affected by macroeconomic variables.

Figure 1: FTSE Bursa Malaysia

KLCI

Source: Yahoo Finance (2013) *FTSE Bursa Malaysia KLCI*. Retrieved March 20, 2013, from

<http://finance.yahoo.com/q/ta?s=%5EFTSE&t=1y&l=on&z=l&q=l&p=m50%2Cv&a=&c=>

The recent case that shows asymmetric effect on stock prices has occurred in Malaysia on 21st of January 2013. The stock market, KLSE, has experienced a drastic fall on that day due to the announcement of prime minister, Dato' Sri Haji Mohammad Najib bin Tun Haji Abdul Razak, that the date of election has come near. Due to the recent politic instability, the public is unsecure with the outcome of coming election and thus, they started to sell off the shares that they are holding to reduce the risk. Most of them are afraid that the share price of the companies will drop if there are changes in the leading politic party since changes in regulatory rule can greatly affect companies' profit. The rapid increase in the supply of shares in the market has lead to the most drastic fall in Malaysia's stock market for the past 16 months (Wen Lung, 2013).

On the same newspaper on 21st of January, the reporter also stated that the drastic fall in share prices might due to the leak of personal information from the central

depository system (CDC). Some investors lost their confidence in the CDC and fear that their personal information will be leaked out and thus, selling off the shares that they are holding to protect their privacy. Nevertheless, the incident was still under investigation process when the fall of share prices occur. It is to believe that the announcement of Malaysia's Prime Minister is the major reason that contributed to the drastic fall of share price on that particular day.

The next day, 22nd of January 2013, KLSE has another market crash after the market has opened for 9 minutes. It has a drastic fall to only 2.05% and KLSE has made a loss of RM 41.41 billion in this two days. The statistics are taken from Lee (2013). The fall of the share prices are in such a rapid pace that it induce panic among the investors and hence, triggering more shares selling from investors.

The index in KLSE did not rise to its initial position at 1,676.44 after 22nd of January 2013. The market has closed at only 1,630.75 on 21 March 2013 (FTSE Bursa Malaysia KLCI (^KLSE) - Historical price, 2013). This shows the asymmetric effect of stock market since the market only takes two days to drop 2.85% but it takes more than two days for the market to rise to its original position (FTSE Bursa Malaysia KLCI (^KLSE) - Historical price, 2013).

The similar case happened on 10 March 2008 too but it is much more severe than the incident above. KLSE is threatened by the rumor saying that the Prime Minister of that time, [Tun](#) Abdullah bin Haji Ahmad Badawi, is forced to pass the position to the successor after the 308 election. In the mentioned election, the ruling party that ruled Malaysia for the past 52 years, Barisan National, has lost one third of their parliamentary seats to the opposition party. It is uncommon in Malaysia's political history and hence, it induced panics among the investors. Many investors sold off the shares on hand to reduce risk and most of the shares that have sudden surge in supply were shares of government-related company (Finance, 2008).

On 10 March 2008, KLSE suffered a drastic fall of 7.65% in the morning session. It turns from bad to worse when the afternoon session begins. The statics was taken from Finance (2008). According to "Bursa Malaysia halts trading after

KLSE falls 10% limit” (2008), the trading in KLSE has been halted at 2.58 in the evening to prevent market crash. The market then resumes its normal working procedures at 3.58pm.

As shown in FTSE Bursa Malaysia KLCI (^KLSE) - Historical price (2008), KLSE only takes a working day to drop from 1296.33 to 1173.22 but it takes way more than a working day for the stock prices to rise back to their original position. Again, it shows that there are asymmetric relationship between macroeconomic variables and stock prices. Therefore, this study will focus on the study of asymmetric impact of macroeconomic variables on stock prices in ASEAN-4, namely, Malaysia, Thailand, Philippines and Indonesia.

1.2 The Raise of Asean-4 Countries (Indonesia, Malaysia, Thailand and Philippines)

The reasons that contributed to the selection of these countries are their excellent economy performance and their economy is gradually improving. According to “Southeast Asia Following the Economy Train” (2013), these four countries’ GDP will exceed the Four Asian Tigers, namely Singapore, China, Hong Kong and Korea, by the year of 2014. These countries have a great leap in their economy growth thanks to their massive supply of labour. Besides, the active involvement in investments of their respective governments and citizens play an important role too. As these ASEAN 4 countries have been the concern for the investors, so this study aims to provide a highlight on how the stock price movement in these countries being affected.

One of the evidence of their rise in economy is that Philippines’ growth rate is nearing to Singapore’s. It is a great achievement for Philippines as Singapore is one of the Four Asian Tigers. On the other hand, Indonesia, Thailand and Malaysia’s real per capita has increased as compare to the previous year. Thus, the poverty level of these countries has decreased marginally from time to time with the help from the government. Furthermore, these countries have very unique

features that enable them to react to the change in economic situation efficiently and effectively. The unique features also enable these countries to have a rapid transformation when any changes occur in the economy to maintain the strong macroeconomic fundamental. With the combination of fiscal and monetary policy in ASEAN countries, the review of the process has been increased. It has successfully reduced the risks and maintains their excellent performance in the countries. It helps in strengthening the banking system, increasing the domestic saving rates, reducing the burden on monetary policy, increasing the flexibility in exchange rate policy, and many other areas. These are the reason suggested by Hicklin, Robinson, and Singh (1997). Therefore, this study is determined to identify the asymmetric relationship between macroeconomic variables and stock return.

1.3 Problem Statement

Referring to the studies that are done by other researches, Azizan and Sulong (2011), Petelis (1997) and Ewing, Forbes, and Payne (2003), they assume the market to be symmetrically affected by macroeconomic variables when they carry out the investigation of the relationship between macroeconomic variables and stock returns. This is because most of the researchers use Vector Autoregressive (VAR) model, Vector Error Correction Model (VECM), Generalized Autoregressive Model (GARCH) or Autoregressive Model (ARCH) to determine the relationship between the macroeconomic variables and stock returns. However, in the real world the market is respond asymmetrically. The investor may overreact on negative shock, and under react on positive shock, which this study can view from the example provided at previous section. Therefore, the assumption that they employed are relatively inappropriate and it may lead to misspecification problem.

1.4 Objectives

The objectives of the study are shown as below:

- The general objective of this study is to determine the relationship between macroeconomic variables and stock prices in Asean-4 countries namely Thailand, Indonesia, Malaysia and Philippines.
- The more specific objectives are as followed:
 - i. To examine the long run relationship between macroeconomic variables and stock prices in Asean-4.
 - ii. To determine the asymmetric integration between macroeconomic variables and stock prices in Asean-4.
 - iii. To study the momentum of asymmetric integration between macroeconomic variables and stock prices in Asean-4.

1.5 Significance of Studies

As mentioned previously, this study is important because every investor wants to maximize their return in stock market. This can be done if the investors have better understanding of the trend of the stock market and take advantage of it. This study helps investors to increase their insights to stock market returns in the four stock markets by understanding the asymmetric relationship of macroeconomic variables towards stock return. It helps investors to make much more accurate market analysis and they will then, avoid suffering from grievous losses. In addition, it can help investors to gain extra profit by investing in the right time too.

Furthermore, not only investors benefit from this study. This study provides knowledge to the management in various organizations that operates or owns a business. It helps management to review the market and hence, polish their decision making skills that will affect the company's position in the competitive market. Managements who can master the knowledge of stock market can take advantage over their competitors too.

This study also significantly provides related information and framework for regulators to enforce relevant rules and regulation. This can help the policy makers to be innovative in forming a better country and most importantly, it helps regulators to hinder moral hazard and adverse selection problems. Such benefits will then lead to sound and efficient financial system that then, improve the countries' position in the global market.

Last but not least, researchers can benefit from this study too as it helps them to better understand the asymmetric effect of macroeconomic variables towards stock market. It can act as a reference in providing related information for further investigations as this topic is rather new in finance field of study. The further investigations will then benefits investors, various organizations and the regulators.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

As this study uses Arbitrage Pricing Theory (APT) as the theoretical framework, Roll and Ross (1984)'s study has been used as one of the reference while this study was carried out. The detail of APT will be further explained in Appendix II. As stated in Roll and Ross (1984), the stock market is mainly affected by systematic risk since unsystematic risk can be diversified to near riskless. This is because the effect of unsystematic risk is not directly related to the economic activities as a whole but affected the individual firms or particular industries. Roll and Ross (1984) also stated that APT concerns about the main factors that affected the aggregates of assets of large portfolios. Since stock market is a large portfolio, macroeconomic variables are employed to determine the factors affecting the stock market instead of microeconomic variables.

Many researchers such as Wu (2000), Kuwornu and Owusu-Nantwi (2011) and Zhang (2012), have uses macroeconomic variables to determine the changes in stock market. However, some of these researches proposed relatively different findings; the possible explanation for the difference finding may due to symmetric assumption on the method applied. Therefore, this study aimed to understand the subject of interest better by studying and reading the past researches done.

2.1.1 Interest Rate and Stock Prices

Kyereboah-Coleman and Agyire-Tettey (2012), Menike (2006), Yahyazadehfar and Babaie (2012), Abdullah and Hayworth (1993), Rehman, Yousaf, Ejaz, and Sardar (2011) and Kuwomu (2011) have determined a negative relationship between the interest rates and stock prices in their respective researches. Although the researches listed have been done through different methodologies, their findings are supported by similar reasons. The determined negative relationship is

supported from a cost perspective where the increase in interest rates will lead to a higher lending rate and thus, higher cost of production. This will cause the profit of the firm to decrease and then, the amount of dividend paid out will decrease too. As investors normally demand higher dividend, they will logically sell out or reduce the demand of the shares as it offers relatively lower return. The increase in supply and the decrease in demand of the shares has then, causes the share price to shoot down, which again, proved the negative relationship between the two variables. On the other hand, Mohammad, Hussain, and Ali (2009) have determined a similar relationship too. The research done by these authors are slightly different from the researches that have been discussed previously. Alternative investment opportunity arises when the interest rates increase. Investors are open to more investment choices when the interest rates are looking good and some of the investments may even offer higher rate of return. For instance, investors would prefer to transfer their investments into saving account or interest-bearing security to enjoy higher rate of return from the increment of interest rates. The supply of the shares in the market will then increase as investors have to sell their shares to channel their investments to the new investment opportunity. Besides, the demand of the shares will decrease too, as most investors are now investing in other instruments or market that offers relatively higher return. All of these opportunity cost that manipulate the investment decision making affects the supply and demand of the shares in the market and thus, threatening the prices of the shares.

The negative relationship between the interest rates and stock prices is further supported by the researches done by Kandir (2008), Gan, Lee, Au Yong and Zhang (2006), Alam and Uddin (2009) and Mashayekh, Muradkhani, and Jafari (2011). Kandir (2008)'s finding is similar with Mohammad et al. (2009)'s findings as the negative relationship between the two variables are affected by the opportunity cost, where investors will tend to invest in interest-bearing securities when the interest rate rises and thus, causing the share price to decrease. To add on, Mohammad et al. (2009)'s result is tally with the research done by Mukherjee and Naka (1995). The research did show the negative relationship between the interest rates and stock return.

In contrast to the findings as stated above, Hussain and Khan (2011) and Olowe (2007) also found positive relationship between interest rates and stock prices. As the interest rate increases, the risk free rate will increase. It lead to lower risk premium and attracted the risk averse investors to enter into the stock market. The increase in the demand for stocks in the market will drive up the stock prices and hence, proving the positive relationship between interest rates and stock prices.

Pal and Mittal (2011) also did researches on BSE Sensex market but to no avail, there is no significant relationship existing in between the two variables in the particular market. Kurihara and Nezu (2006) also found that there are no significant relationships between the interest rates and Japanese stock market. However, the relationship may cause by Japan's policy as their interest rates are nearing to zero due to the zero interest rate policy in year 1999. In addition, another research done by Alam and Uddin (2009) also found that there is no significant relationship between interest rate and stock prices in Malaysia and Philippines. However, no further explanations were given by the authors.

As the researches draws to details, Frimpong (2009) has determined a short term negative relationship between the two variables in his research. However, the interest rates are defined as the Treasury rates in the research. In this context, the negative relationship roots from the asset shifting theory, which similar with the reason that has been discussed in Mohammad et al. (2009)'s research. In this particular research, Frimpong (2009) suggest that investors tend to invest in investment that carries relatively lower risks when the Treasury rates increases. This is because investors that invest in Treasury securities are normally risk adverse investors. They will try to minimize risk through diversification or shift their investment pattern as the risk of Treasury securities increases along with its rates. The long run relationship is unable to determine in this research and it serves as the implication for future researches. Maysami, Lee, and Hamzah (2004) also did further research on the relationship between the interest rates and stock prices in the short run and long run but their researches focus on the Singapore's all S-sector indices. In the research done, it found a positive short run relationship among the variables, which contrasting with the result of Frimpong (2009). However, Maysami et al. (2004)'s research is able to determine the long run

relationship among the variables and it is shown to have a negative relationship in the long run. The reason that causes such findings was mainly because long term interest rates may serve as a better proxy for nominal interest rates component and thus, better determining the discount rate effect in valuing the stocks.

2.1.2 Exchange Rate and Stock Prices

Wu (2000) and Pilinkus and Boguslauskas (2009) detected a positive relationship between exchange rates and stock prices even though different methodology is employed in the respective researches. In their researches, it is stated that the depreciation in domestic currency can lead to inflationary shocks. This will then decrease the profit as the input for production will become much more expensive than usual. Thus, the company will suffer from unfavorable news, which causes the demand for the stocks to decrease. These situations will eventually cause the stock price to step-down.

Moreover, Gay (2008) and Kyereboah-Coleman and Agyire-Tettey (2012) have determined a similar relationship between the exchange rates and stock prices too. However, there are slight differences in between their researches with those that discussed earlier. The positive relationship is mainly supported by the impact towards the investments made by the investors. The depreciation in domestic currency is an unfavorable change in exchange rate for investors. This is because their investment returns are now reducing as they have to convert their returns at a lower exchange rate. Most investors will leave the market to avoid further decrease in earnings or losses. Thus, the demand of the stocks will decrease and leading to a decrement in stock prices.

Maysami et al. (2004) and Frimpong (2009) also found a positive relationship between exchange rates and stock prices too. One of the reasons that contribute to this relationship is due to the export market competency. As the domestic currency strengthens, the cost of import will be relatively cheaper than before. Thus, local producers will be able to bring in much advanced technology or other inputs to improve all aspects of business. This can help enhance the firms'

position in the international market and thus, creating favorable news to attract more investors to purchase the firm's equity. The demand of the stocks will increase and hence, increasing the stock prices too. Mohammad et al. (2009)'s research also further supported the positive relationship between the two variables. In the particular research that are done by Mohammad et al. (2009), the appreciation of domestic currency will eventually lead to an increase in stock price because government will try to increase its foreign reserve, in order to counter the appreciation level of the currency.

Further on, Kandir (2008), Masih, Peters, and Mello (2011), Puah and Jayaraman (2007), Sohail and Hussain (2009), and Granger, Huang, and Yang (1998) has proved the existence of negative relationship among the exchange rates and stock prices in their respective researches. The relationship was explained with the volume of exports in the country. The volume of exports will increase as the domestic currency depreciates. This is because the domestic goods are now relatively cheaper and entrepreneurs will tend to import more of the goods from the depreciating country, in order to reduce cost of production. Of course, the transportation cost, storing cost and other relevant costs are assumed to be constant. The increase in exports also signals the increase in the sales of the firm. This will then, increases the profit of the firm, leading to a higher dividend payout and better company performance. All of this, in turn, causes the stock prices to increase as investors are now demanding more of the stocks.

Pal and Mittal (2011) found a similar relationship among the variables too. BSE Sensex was found to have the negative relationship among the exchange rates and stock prices because when the domestic currency depreciates, investors requires more funds to convert into foreign currency if they want to invest in the international market. Therefore, they will tend to invest locally to prevent extra foreign exchange cost that may threaten the net profit of the company. Thus, the stock prices will increase as the demand for the stock increases. Unfortunately in S&P CNX Nifty, exchange rate is found to be insignificant in explaining the relative difference of the stock prices.

As this study further review into the relationship between the exchange rate and stock prices in detail, Gan et al. (2006)'s research has determined the relationship in the short run and long run. The results had shown a negative relationship existing in between the variables in the short run while on contrary, exchange rate is positively affecting the stock prices in the long run. This is because the appreciation of a domestic currency can attract more investors in the long run as they realize they can gain more return by investing in the country. They will be able to convert more of their own currency if the domestic currency appreciated. Therefore, the demand for the stocks will increase and so do the price of the stocks.

Furthermore, Asmy, Rohilina, and Hassama (2009) have examined the relationship between the exchange rates and stock prices in detail that covers the range from before crisis (year 1987 until year 1995) and after crisis (from year 1999 until year 2007) by using monthly data. In this research, it is stated that there are positive relationship between the two variables before the crisis strikes Malaysia. The supporting theory is similar with researches done by Kandir (2008), Puah and Jayaraman (2007), Sohail and Hussain (2009), and Granger et al. (1998). While for the stock prices in Kuala Lumpur Composite Index (KLCI) after the crisis stroke, the relationship between the variables then change to negative. This may due to the arising uncertainty regarding the inflation rate that resulted from unstable exchange rate movements. As investors are less confidence and unsecured with their returns, they tend to move out from the market and thus, causing the stock demand to decreases. Besides, the negative effect towards the KLCI is much more dominant and thus, causing a downward pressure towards the stock prices.

Futhermore, Guo and Huang (2010) also states that hot money did contribute to the volatilities in stock market due to its short term characteristics of investing. Such cases normally occur in developing countries as they have relatively higher interest rates than the other countries. Investors will tend to invest in the country to earn the spread between the interest rates difference. These investment funds are normally addressed as hot money. However, such sudden surge of hot money into the country will causes the domestic currency to shoot up drastically. The

appreciation of domestic currency is relatively dangerous for exporting countries as it will increase the price of the goods and services. The profit will be relatively lesser than the other countries and investors will tend to reduce their investments in the country. As the demand for the stocks decreases, the price of the stocks will follow suit and thus, showing a negative relationship between the exchange rates and stock prices.

2.1.3 Inflation and Share Prices

The next variable that will be discussed in this study is inflation rate. Kandir (2008), Kuwomu (2011) and Asmy et al. (2009) have determined a positive relationship between the variables. It is mainly due to the hedging role of stocks in the market. Normally, investors would prefer to hedge against inflation risk as unanticipated inflation rate can bring disastrous losses. If investors are to anticipate inflation in the near future, they will tend to increase their investments since stocks are very good hedging securities in the market. It could help investors to minimize risks and losses, and thus, causes the increase in stock demand. This will in turn, lead to an increment in stock prices.

Hosseini, Ahmad and Lai (2011)'s research supported the positive relationship between the two variables as stated above. Different from the theories mentioned previously, Hosseini et al. (2011) believe that the positive relationship was caused by the investor's inflation expectation and thus, they demand higher rate of return to compensate the high risk assumed. To add on, Pal and Mittal (2011)'s researches showed that S&P CNX Nifty in Indian capital market has positive relationship between the two variables too. In the market, the relationship was resulted from the changes in interest rates. An increment in interest rate can boost the increase of stocks demand and thus, the elevation in stock prices too. As the interest rate changes are positively correlated with inflation rates, the growth in inflation rate will indirectly causes the stock price to increase. Maysami et al. (2004)'s research supported the theory mentioned above too. It also states that the increase in inflation rates may increase stock price because the increase in

inflation rates may show potential growth in real activity. Hence, investors may invest more to capture the opportunities that bring greater earnings since they may be able to get higher profit from the increase in real activity.

In contrary to the findings above, Pilinkus and Boguslauskas (2009) and Kyereboah-Coleman and Agyire-Tettey (2012) has discovered a negative relationship in between inflation rates and stock prices. This relationship might be cost related as the increase in inflation rates leads to higher prices of materials. This will in turn, causes the cost of production to elevate. The increase in cost will corrode the net profit of the firms, causing the dividend payout to be relatively low too. Such situation give rise to lower demand of stock and thus lower stock prices as investors would not want to invest in low pay off investments. The increase in cost of production contributed to shaken the investors' confidence too. Similarly, Frimpong (2009) has determined a negative relationship between the variables in Ghana but it is supported by different theoretical point of view. In the research done by Frimpong (2009), increase in inflation rate will promote economic tightening policy as government would normally try their best to restore the economy back into its good shape. Investors will also face difficulties in forecasting future cash flows as the inflation rate give rise to the uncertainty in the market. Therefore, investors tend to channel their investment to other investment alternatives to restrict losses. This will then, lead to a decrease in stock demand and thus lower stock prices.

To add on, Kandir (2008) also states that the increase in inflation rate implies higher rate of return. Thus, investors will be less willing to invest in the country that is currently experiencing growth in inflation rates. The increase in required rates of return indicates that investors may require longer time or greater amount of principal to obtain a certain level of profit. Thus, it is one of the reasons why negative relationship exists in between the inflation and stock prices.

2.1.4 Money Supply and Stock Prices

Variable that is equally important in explaining the relative changes in stock prices are money supply. Frimpong (2009), Asmy et al. (2009) and Hosseini et al. (2011) has determined a negative relationship among the money supply of the local government and stock prices. This is because the increase in the amount of the money supply promotes inflation. In detail, the increment of money supply causes a step-up in citizens' purchasing power. It will then causes the prices of the goods to increase since people are now able to afford much expensive goods. The increment in inflation rates reduces the return of the company due to the elevated cost of input. Thus, investors will be less confidence in investing those particular firms as lower net profit of the company indicates lower return for the investors. As the demand of the stock goes down, the price of the stocks deteriorate along with the demand too. Correspondingly, Asmy et al. (2009) also proposed that the growth in inflation rates promotes uncertainty towards the future outcome and thus, investors would channel their investment to other alternatives instead. Gan et al. (2006) also found a similar relationship among the two variables. However, Gan et al. (2006)'s research states that the increase in money supply will causes an increment in interest rates and thus, investors are much more willing in channelling their investments to saving account or interest-bearing securities. The negative relationship among the variables is then further supported by the research done by Rahman, Mohd Sidek, and Tafri (2009). In research of Rahman et al. (2009), it is studied that the increase in money supply is strongly related to the real foreign exchange rate. The hike in money supply causes the domestic currency to depreciate as the market is now supplying more of the currency. The depreciation of currency may reduce foreign investors' willingness in investing the stocks as they are now converting less into their currency when they receive their return.

In contrary to the findings above, Pilinkus and Boguslauskas (2009) and Menike (2006) have determined a positive relationship among the money supply and stock prices. Both of the research proposed that the increase in money supply signals injection of public funds or expansionary monetary policy. This action will boost the company earnings since more funds are available in the market now. Investors

will be attracted to the potential earnings in the stock markets and thus, invest more. All of this brings forth to the increase in stock prices when the demand of the stocks increases.

Apart from the major macroeconomic variables that determine the changes in stock prices, several researchers also suggested other explanatory variables that may be significant in explaining stock prices. For example, Sohail and Hussain (2009), Maysami et al. (2004) and Hosseini et al. (2011) has suggested that industrial production index (IPI) is positively correlated with stock prices. This is because the increase in IPI will increase the sales of the products and therefore, attaining higher profit. A firm with higher profit is a very prospectus opportunity for investors and thus, investors will tend to demand more of the stocks, driving the stock prices to go up. In light of the reason that contribute to the positive relationship between the variables mentioned above, increase in IPI may help forecast future real activity and thus, help investors in forecasting future cash flow. This can help reduce the uncertainty for the investors and therefore, they will be more attracted to the stocks and invest more on it. This will drive the stock prices up too.

2.1.5 Crude Oil Prices and Stock Prices

Crude oils are one of the main resources around the globe as it is crucial in business cycles. The crude oil prices can easily determine the cost of the products and hence, affecting the profit of the company. Thus, this study has taken the initiative to include crude oil prices as one of the independent variables.

According to Masih et al. (2011) and Babatunde, Adenikinju, and Adenikinju (2012), they have reach to similar conclusion even though their researches are conducted in different country. Masih et al. (2011)'s study focuses on South Korea's market while Babatunde et al. (2012) focuses on Nigeria market. Both researches have found a negative relationship between the crude oil prices and stock prices. The reason behind this negative relationship is mainly contributed by

the cost effect. The increase in crude oil prices causes the transportation cost to increase and hence, elevating the cost of production for the company. The increase in the production cost will then lead to an increment in the price of the products, causing the sales to decrease since it will attract lesser customers. The profit will then decrease and thus, investors will demand lesser stocks from the company. As the demand for the stock holdings are relatively lesser than the supply of stocks in the market, the price of the stocks will then decrease marginally. On the other hand, Masih et al. (2011) also stressed that many investors speculated that the increase in cost of production will decrease the profit of the company, and thus, reduces their stock holdings to minimize risks. Since the supply of the stocks in the market exceeds the demand of the stocks in the market, the stock price reduces. The investigation by Masih et al. (2011) was supported by Kuwomu (2011) too.

Besides, Cong, Wei, Jiao, and Fan (2008) have found a similar relationship between the variables too. However, the cause of negative relationship between the crude oil prices and stock prices in China is different from those that have mentioned in the paragraph above. Since China is an oil importing country, the increase in crude oil prices will lead to an increment in outflow of fund from the country, causing the decrease in China's growth domestic product (GDP) level. Investors are normally not attracted to invest in countries that have relatively lower GDP level as it may indicate that the country is having decrease in economy growth.

In contrast to the researches shown above, Basher, Haug, and Sadorsky (2012) and Cong et al. (2008) has found a positive relationship between crude oil prices and stock prices. However, both researches shown that the effect is generally weak and will only last for the first 3 months after the crude oil price shocks. Basher et al. (2012) also states that the positive effect will only occur in oil exporting countries as the unanticipated increase in the demand of crude oils will cause an increment in crude oil prices and hence increase the profit of the company. It will then lead to an increase in share prices as investors will be attracted to the increase in profit. In addition, Babatunde et al. (2012) also found a similar relationship between the two variables since Nigeria is an oil exporting

country. The relationship between the crude oil prices and stock prices in Nigeria are very much dependent on the nature of the oil price shocks.

2.2 Proposed Theoretical/ Conceptual Framework

From the detailed studies stated in previous section, interest rates, exchange rates, inflation rates, money supply and crude oil price deemed to be one of the macroeconomic explanatory variables that will affect the stock prices. Interest rates, money supply, and crude oil price tend to have negative effect towards the stock prices while exchange rates and inflation rates are normally positively affecting the stock prices. However, all of these relationships are with opposing findings from other researchers. Therefore, this study is deemed to find out the true relationship among the variables stated above and try to justify which is the optimal relationship towards the relative changes in stock prices. Besides, this study also aims to determine if the methodology employed is appropriate in studying the relationship among the chosen variables.

This study aims to provide a clear study of the stock price movement that in turn, helps various parties in the society to better understand the stock market. To add on, this study will enable various investors to better capture the opportunity available in the market and reducing the chances of loss.

2.2.1 Arbitrage Pricing Theory

APT is the asset pricing model that was developed to overcome the weakness of Capital Asset Pricing Model (CAPM). This is because APT does not only assume the expected return to be affected by market risk but also affected by various type of risk. APT stresses the change of every macroeconomic variable is represented by a beta coefficient since the stock return is modeled as a linear function. This is because APT states that the stock market return can be expected with the relationship between the assets and macroeconomic variables (Ross, 1976).

In addition, some of the assumption of APT is that investors have the same beliefs when it comes to investments and investors are normally risk averse in nature. APT also assumes the market to be perfect and returns can be calculated with the model (Roll & Ross, 1984).

Based on the intuitive theory stated in Roll and Ross (1984), the variables that were chosen in this study are relatively important in determining the relationship between the macroeconomic variables and stock price. From the research done by Wu (2000), stock market has always been affected by various reasons.

This study has employed a total different approach while determining the relationship between macroeconomic variables and stock return, although the macroeconomic variables that were chosen in this study were similar with the studies done by Kuwornu and Owusu-Nantwi (2011) and Zhang (2012). Both of this studies has provides direction to this study on which variables to determine and the policy implications that are needed to work on. This is because both studies have assumed the market to be symmetrically affected by macroeconomic variables but in contrast, this study has employed an asymmetric approach that was proposed by Enders and Siklos (2001), using the same variables employed by Kuwornu and Owusu-Nantwi (2011) and Zhang (2012).

This study would not want to lose the reality that is occurring in the market, hence, this study force to give out the efficiency between on the macroeconomic variable and stock return. The use of all five macroeconomic variables while determining the relationship between the endogenous and exogenous variables can help in investigating the efficiency of the stock markets too.

2.3 Conclusion

As to conclude chapter two, a total of five variables are chosen to be studied in the upcoming research in this study which is interest rates, exchange rates, inflation rates, money supply and crude oil prices. The significant effect of these five variables towards the relative changes in stock prices is found to be vastly supported by past research. However, the findings are contradicting and therefore, this study aims to determine the ultimate relationship between these variables, in order to help investors to better understand the stock price movements. A better financial system can be created as a stable and profitable financial system brings financial sound to the society. As stated in the literature review section, the theoretical reason that contributed to the relationship among the independent and dependent variables are different in nature. Therefore, this study aims to better identify the reason that causes these relationship to occur asymmetrically and hence, improve the stability of the financial system. This study wants to determine the asymmetric effect of the macroeconomic variables towards stock prices because it is the reality in the market.

CHAPTER 3: METHODOLOGY

3.1 Introduction

In this study, time series analysis is used to detect the asymmetric impact of macroeconomic variables on stock prices. Several methodologies that are often employed by previous researchers have been included in this study such as Augmented Dickey Fuller (ADF) Unit Root Test, Kwiatkowski, Phillips, Schmidt and Shin test (KPSS), Threshold Autoregressive (TAR) Model, Momentum-Threshold Autoregressive (M-TAR) Model, and Asymmetric Error Correction Model in order to further analyze the data collected. The unit root test plays a pivotal role as it is used to test the stationarity of time series data. The estimated result will be spurious and inaccurate if the variables are non-stationary (Gujarati & Porter, 2009). Therefore, ADF and KPSS unit root test have to be applied in order to identify the number of integrated order before carried on with other tests. Furthermore, TAR Model has been employed in this study with the aim to detect the changing of investor's behavior due to changing of stock price once positive or negative news arise. However, M-TAR Model has similar function as TAR Model just that it estimates the momentum speed of adjustment of stock price. Lastly, Asymmetric Error Correction Model is a vital test that has to be employed in this study. The purpose of this test is to capture the asymmetric effect on the relationship between macroeconomic variables and stock prices. Nevertheless, the final result has to undergo diagnostic checking in order to assure that the model adopted is appropriate so that robust result can be obtained. In short, this chapter will provide an overview on the statistical models and examine the asymmetric effect between macroeconomic variables and stock prices. Nonetheless, the theoretical framework in this research is Arbitrage Pricing Theory (APT). As according to Ross (1976), APT stems from the intuitive theory where any variables that can affect the expected return in stock markets can be added into the model. Thus, APT does not have a fixed model (Cuthbertson & Nitzsche, 2004).

3.2 Scope of Study

The data employed in this study has included the data for ASEAN-4 countries, namely, Indonesia, Malaysia, Thailand and Philippines. All these data has been obtained from DataStream, Yahoo Finance, Bursa Malaysia, Federal Prime Rate, and United Nations Statistics Division. The range for the period of data is different across the country due to limitation of data as show in Table 3.1 and the frequency of the data is in monthly.

Table 3.1: Date description

Country	Sample Period (Monthly)
Malaysia	- November year 1997 to October year 2012
Philippines	- April year 2001 to November year 2012
Thailand	- April year 2000 to October year 2012
Indonesia	- December year 1990 to November year 2012

3.3 Theoretical Framework

3.3.1 Introduction

As mentioned in the previous chapter, the main objective of this study is to investigate the asymmetric relationship between macroeconomic variables and stock prices. There are a lot of macroeconomic variables that can affect the stock prices but in this study, only five macroeconomic variables are included. The macroeconomic variables that are included are interest rate, inflation rate, exchange rate, crude oil price and money supply. The reason behind the selection will be explained in detail in this chapter. Furthermore, this study has restricted the area of study to ASEAN-4 countries, in order to better understand their stock performance.

Model Specification:**Asymmetric Error Correction Model**

$$\Delta SP = \alpha + \beta I ECM + \beta(1 - I)ECM + \sum_{i=1}^n \beta \Delta SP_{t-i} + \sum_{i=1}^n \beta \Delta INT_{t-i} + \sum_{i=1}^n \beta \Delta ER_{t-i} + \sum_{i=1}^n \beta \Delta INF_{t-i} + \sum_{i=1}^n \beta \Delta MS_{t-i} + \sum_{i=1}^n \beta \Delta COP_{t-i} + \varepsilon_t$$

Equation 3.1

- SP** = Log of Stock Price (Stock market index)
INT = Interest Rate (Treasury bill rate)
ER = Log of Real Exchange Rate (Local currency against US Dollar)
INF = Log of Consumer Price Index (Consumer price index)
MS = Log of Money Supply (M2)
COP = Log of Crude Oil Prices in US Dollar
I = Positive Shock

The variables have been transformed into logarithm form as this is to measure the elasticity of dependent variable with respect to the independent variables. It can be interpreted as the percentage change in dependent variable for a given percentage change in the independent variables (Gujarati & Porter, 2009). Nonetheless, the inclusion of lag variables in Equation 3.1 is essential. This is because investors' behavior will change slowly and its current change depends on the changes in the previous period. It indicates that they are strongly correlated. In the case that the lagged variables are not taken into consideration, the error term will signify a significant trend that constitutes autocorrelation (Gujarati & Porter, 2009).

As shown by Equation 3.1, α is the constant algebraic while β is the coefficient for the macroeconomic variables (interest rate, real exchange rate, inflation rate, money supply and crude oil prices). Then, ε_t is the error term in the equation to capture any vagueness of theory, unavailability of data, and intrinsic randomness in human behavior, as refer to Gujarati and Porter (2009). The endogenous variable in this study is set to be stock price (**SP**). It is the closing price of the day, taken from the stock market of each country of study.

Among the macroeconomic variables that are included in this study are interest rate, real exchange rate, inflation rate, money supply and crude oil price. Interest

rate is the amount charged over the lending principal and it is paid by the borrower to the lender for using lender's assets or funds. In another words, the lender receive interest rates as a reward for a delay in consumption. The interest rates that this study investigated is Treasury bill rates or commonly known as T-bill rates (Cagnetti, 2002). T-bill is usually issued by the federal government through the central bank. It is normally a short term debt securities where its maturity is less than one year. The reason behind the T-bill rates selection is that T-bill rates are commonly known as the risk-free interest rates as they are backed by the federal government. It is easier to study the movements of the stock prices in response to the changes in interest rates without the influences of other factors, such as inflation, changes in government policy or economic growth.

Further into other macroeconomic variables that are chosen, exchange rate is the price of one currency of a country in terms of another country's currency. It is also expressed as the price of one currency required to buy another currency (Roll & Ross, 1984). In this study, the exchange rates that are included are real exchange rates against US Dollar. Real exchange rate is the nominal exchange rate that is adjusted with the inflation differential among the comparing countries. Similar with the reason stated above, real exchange rate is chosen as the subject of interest because it is easier to investigate the relationship between exchange rate and stock prices, without the interference of other potential determinant that might affect the results. It also helps in reducing the error that may occur during analysis of data.

Inflation rate is the rising level of the prices of goods and services in a country (McEachern, 2006). It is also known as the consumer price index (Cagnetti, 2002). This is because the rise in the inflation rates indicates that the consumers' purchasing powers are reducing. Consumers are required to use additional unit of currency to purchase a unit of goods or services if the inflation rate rises. It also means that the particular currency is losing its value and therefore, consumers require more currency to purchase a goods or services. It is included as one of the independent variable in this study because inflation rate plays an important role in determining the number of stocks hold by the stockholders, and thus, influencing the stock price in the economy.

Besides, money supply also plays an important role in affecting the stock prices. Money supply is the amount of currency or other liquid instruments circulating in an economy for a given period of time. There are several categories in money supply, namely M1, M2, M3 and M4. However, M4 only exist in certain countries. This study has employed M2 as the measure of money supply. M1 is not employed because it is relatively illiquid to be the measurement of liquidity (Demetriades & Hussein, 1996). On the other hand, as refer to the research done by Rioja and Valev (2003), M3 is suitable to be the determinant of stock market since it is liquid. However, Kidwell, Blackwell, Whidbee and Peterson (2008) states that M2 is better determinant than M3 as it is proven by Governors of Fed.

Then, the last macroeconomic variables that are included in this study are crude oil price. According to Maghyreh (2004), crude oil is one of the main resources in the globe that fuel most of the daily activities today. It is essential in every business cycle and industries that it will be included as transportation cost even though it is not one of the materials of the particular goods or services. Therefore, it impacts greatly towards the profit of the company since the cost of production will increase along side with the increase in crude oil prices. In this study, the crude oil prices are denominated against US Dollar, in order to have a much aligned results. It is included in the studies to show the ultimate asymmetric effects of stock prices towards the changes in crude oil prices.

3.4 Econometric Methods

With the intention to study the relationship between stock prices and macroeconomic variables, time series analysis has been adopted in this study. Meanwhile, this study will be conducted by applying Unit root test of Augmented Dickey-Fuller (ADF) test and Kwiatkowski, Phillips, Schmidt and Shin (KPSS) test, Threshold Autoregressive model, Momentum-Threshold Autoregressive model, Asymmetric Error Correction Model, and diagnostic checking.

3.4.1 Some Properties of Time Series Data, Consequences and Their Treatment

Stationarity of time series data is an essential element and will be tested before proceeding with the estimation of other time series economic models as these data often inbuilt a seasonally unadjusted form and display clear trends over the time. Besides, a model with non-stationary variables will cause many standard results to be voided and hence, special treatment is required. Due to this reason, it has provided most of the economists with an incentive to examine the presence of unit roots. In the case that unit roots exist in the model, they will carry on with appropriate modeling procedures.

Nonetheless, it is against the assumption of Classical Linear Regression Model and the problem of spurious regression problem will occur once the model contains non-stationary variables. This has led the series to have high significant t-statistic and high value for coefficient of determination. Subsequently, the variables in the regression model are found to be statistically significant by means of the results acquired whereas priori it should be none. Meanwhile, the results obtained do not only provide meaningful causal relations whereby it shows that the existence of contemporaneous correlations.

The problem of spurious regression can be solved by first differencing the time series data if the variables are found to be non-stationary at the level form. Although non-stationary trend can be eliminated through the aforementioned method, this is only part of the solution. With the use of differenced variables, spurious regression problem tend to be avoided, however, this approach prod to eliminate much of the low-frequency (long run) characteristics while retain only high-frequency (short run) characteristics of data. The spurious regression problem can also be solved by applying deterministic trend or stochastic trend.

In the meantime, long run (low-frequency) information is important in modeling the time series data, therefore, the effects of lag variables have to be taken into account. This is because most of the macroeconomic time series follow random

walk components. If the time series follow random walk, the spurious results will be reported when a regression of one variable against another.

In order to determine the long run relationship between two or more series variables, a co-integration test has been constructed. The economic interpretation of co-integration is that if two or more series are linked to form an equilibrium relationship spanning in the long run, then even though the series themselves may contain non-stationary, they will move closely together over the time and the difference between them is constant which bring a stationary. Then, the series are considered as co-integrated. Thus, the concept of co-integration mimics the existence of a long run equilibrium to which the economic system converges over time among non-stationary variables which are integrated to the same order.

3.5 Unit Roots

Unit root test is an essential tool in estimating econometric regression models. This test is used to examine the stationarity of the time series variables. Stationary movement indicates that the series has constant mean, variance and covariance (time invariant) over the time period. Likewise, changes in mean and variance across different periods indicate that the variable is non-stationary. Correspondingly, non-stationary variable implies that it has unit root while stationary variable does not have unit root. In order to maintain the trustworthiness of the result, all variables have to be in stationary form so that the economic relationship between the time series variables in the regression model is said to be appropriate. In other words, the spurious estimated regression results can be avoided but it will arise if the dependent and independent variables are non-stationary.

For time series data that are stationary, it implies that they are time invariant and its fluctuation will not be apart from its mean and variance. On the contrary, non-stationary data indicates that they are time variant and its mean and variance will fluctuate irregularly. Each value of observation will far apart from its mean value

as the series do not have long run equilibrium mean value. Nevertheless, the variances will getting larger over time as it approaches infinity as well as the sample period when the variables are non-stationary (Gujarati & Porter, 2009). Normally, mean is used to forecast the data but if the data are non-stationary, forecasting could not be conducted on an appropriate basis.

Furthermore, hypothesis testing will be conducted for the unit root tests as long as there is no structural break exists in the series across the time. Else, the result obtained will be biased. In addition, sample size of the time series data should be large so that result obtained from hypothesis testing is more reliable. If time series are non-stationary, the variable have to be differentiated d times in order to obtain stationary time series.

In this study, all variables as mentioned earlier should obtain one unit root $I(1)$ in order to study the relationship between the independent and dependent variables and the presence of long run relationship. If this result is obtained, the variables are meant to be co-integrated and they will meet each other in long run. This has proved that there is a significant relationship between the macroeconomic variables and stock prices and then, the existence of asymmetric effect can be examined in this context.

As to obtain robust result, two approaches will be employed to detect the stationarity of time series data since each unit root test has its own limitation. These approaches are known as Augmented Dickey Fuller (ADF) Unit Root Test and Kwiatkowski, Philips, Schmidt and Shin (KPSS) test.

3.5.1 Augmented Dickey Fuller (ADF) Test

Augmented Dickey Fuller (ADF) Test is a test to determine the stationarity of time series data whether it has a unit root or not. It is developed by Dickey and Fuller (1979). This test is normally applicable for estimating time series data.

In this test, a model has been created. ADF Test is suitable for higher order correlation and assume the y series follows an AR(p) process. With this assumption, the p lagged differenced terms of the dependent variable y will be included in the right hand side of the regression. The model indicates the changes of dependent variable is regressed by the independent variables which include the lagged level of the variables, αY_{t-1} , optional exogenous regressors which may consist of constant and with trend, $x_t' \delta$, p lagged changes in variables, $\beta_p \Delta Y_{t-p}$, and the white noise disturbances, v_t . The equation is as follow:

$$\Delta Y_t = \alpha Y_{t-1} + x_t' \delta + \beta_1 \Delta Y_{t-1} + \beta_2 \Delta Y_{t-2} + \dots + \beta_p \Delta Y_{t-p} + v_t \quad \text{Equation 3.2}$$

Where $\alpha = \rho - 1$, ρ , δ , β_1 , β_2 , and β_p are parameters to be estimated. An important result obtained by Fuller is that the asymptotic distribution of t-ratio for α is independent of the number of lagged first differences included in the ADF regression.

The null and alternative hypothesis for unit root tests is:

$$H_0: \alpha = 0 \text{ (} Y_t \text{ has unit root/non-stationary), I(1)}$$

$$H_1: \alpha < 0 \text{ (} Y_t \text{ has no unit root/stationary), I(0)}$$

The null hypothesis will be rejected when t-statistic is negatively less than the critical value (Gujarati & Porter, 2009). In brief, the series is said to be stationary or has no unit root. In this study, the result obtained should be in non-stationary, I(1) as mentioned earlier. In order to obtain non-stationary result in the level form, the null hypothesis should not be rejected with the t-statistic greater than critical value. The greater is the t-statistic, the lesser the chance that the null hypothesis will be rejected.

$$H_0: \text{Unit roots of 2, I(2)}$$

$$H_1: \text{There is a unit root/non-stationary, I(1)}$$

This study has to obtained a result of non-stationary, I(1) which means one unit root in the first difference form of ADF unit root test. In short, t-statistic is negatively less than the critical value which causes the null hypothesis to be rejected. Thus, the optimal result can be obtained. If the t-statistic is greater than critical value, the null hypothesis will not be rejected. In other words, the series will contain unit roots of 2. Consequently, smaller t-statistic will have greater chance to reject the null hypothesis.

3.5.2 Kwiatkowski, Phillips, Schmidt and Shin (KPSS) Test

Kwiatkowski, Phillips, Schmidt and Shin (KPSS) Test is an alternative unit root test. This test is also used to examine the time series data whether it is stationary (no unit root) or non-stationary (has unit root). However, it is opposed to other unit root tests as the null hypothesis is that the series is stationary or does not have unit root, I(0). The alternative hypothesis is that the series is non-stationary or has a unit root, I(1) (KPSS, 1992).

Residuals from the Ordinary Least Square (OLS) regression of Y_t on the exogenous variables x_t form the KPSS statistic. The regression is as follow:

$$Y_t = x_t' \delta + \mu_t \quad \text{Equation 3.3}$$

The LM statistic will be described as follow:

$$LM = \sum_T S(t)^2 / (T^2 f_0) \quad \text{Equation 3.4}$$

Where f_0 is an estimator of the residual spectrum at frequency zero and $S(t)$ is a cumulative residual function based on the residuals $\hat{\mu}_t = Y_t - x_t' \hat{\delta}(0)$,

$$S(t) = \sum_{r=1}^t \hat{\mu}_r \quad \text{Equation 3.5}$$

In this formula, estimator for δ is derived from regression that involves original data. This test provided that the alternative hypothesis is that Y_t has a unit root or non-stationary in the level form whereas the alternative hypothesis for first differencing is Y_t more than one unit root.

3.5.3 Threshold Autoregressive (TAR) Model

The Threshold Autoregressive (TAR) Model is defined as:

$$\Delta\mu_t = I_t\rho_1\mu_{t-1} + (1 - I_t)\rho_2\mu_{t-1} + \sum_{i=1}^{p-1} \gamma_i \Delta\mu_{t-1} + \varepsilon_t \quad \text{Equation 3.6}$$

Where $\varepsilon_t \sim \text{I.I.D.}(0, \sigma^2)$. However, I_t indicates the Heaviside indicator and the function is as follow:

$$I_t = \begin{cases} 1, & \text{if } \mu_{t-1} \geq \tau \\ 0, & \text{if } \mu_{t-1} < \tau \end{cases}$$

As from the above, the Heaviside indicator, I_t relies on the level of μ_{t-1} . When stock price more than τ , investor's behavior will change. For instance, investor will start to enter into the market and buy stock once positive news arises. Moreover, Heaviside indicator with dummy of 1 indicates the behavior of investor will change whereby dummy of 0 indicates investor will not change his/her behavior. The purpose of this test is to detect the changing of investor's behavior whether they have positive or negative discrepancies towards the stock price changes when positive or negative shocks arise.

The null and alternative F-joint tests are as follow:

$$H_0 : \rho_1 = \rho_2 = 0$$

$$H_1 : \rho_1 \neq \rho_2 \neq 0$$

F-joint test is to determine whether the macroeconomic variables and stock prices have long run relationship or co-integration. The alternative hypothesis indicates that long run relationship does exist. In other words, the macroeconomic variables and stock prices are co-integrated.

$$H_0 : \rho_1 = \rho_2$$

$$H_1 : \rho_1 \neq \rho_2$$

Furthermore, the above is the null and alternative hypothesis for F-equal test whereby the alternative hypothesis shows that it has asymmetric adjustment (Enders & Siklos, 2001).

3.5.4 Momentum-Threshold Autoregressive Model (M-TAR)

The Momentum-Threshold Autoregressive Model is defined as follow:

$$\Delta\mu_t = I_t\rho_1\mu_{t-1} + (1 - I)\rho_2\mu_{t-1} + \sum_{i=1}^{p-1} \gamma_i \Delta\mu_{t-1} + \varepsilon_t \quad \text{Equation 3.7}$$

Where $\varepsilon_t \sim \text{I.I.D.}(0, \sigma^2)$. However, the Heaviside indicator, M_t and its function is differ from TAR Model:

$$M_t = \begin{cases} 1, & \text{if } \Delta\mu_{t-1} \geq \tau \\ 0, & \text{if } \Delta\mu_{t-1} < \tau \end{cases}$$

The Heaviside indicator is also depends on the level of μ_{t-1} . In this context, M-TAR model is able to detect the fluctuation of data and yet, it can be smooth out sooner. Comparatively, M-TAR Model is almost similar with TAR model which has been mentioned earlier. The change of stock price is measured in TAR Model, conversely, M-TAR Model comprises of momentum speed of adjustment in stock price. For instance, investor will change his/her behavior based on the percentage change in stock price. Nevertheless, the dummy of 1 and 0 have similar meaning as in TAR Model. M-TAR Model is used to determine the momentum change of stock price when investor tends to change his/her behavior due to the arising of positive and negative shocks.

F-joint and F-equal test are also comprised in M-TAR model. The null hypothesis and alternative hypothesis for F-joint are as follows:

$$H_0 : \rho_1 = \rho_2 = 0$$

$$H_1 : \rho_1 \neq \rho_2 \neq 0$$

The rejection of null hypothesis indicates that macroeconomic variables and stock prices are co-integrated or have long run relationship.

While for the null and alternative hypothesis for F-equal are:

$$H_0 : \rho_1 = \rho_2$$

$$H_1 : \rho_1 \neq \rho_2$$

In accordance with Enders and Siklos (2001), alternative hypothesis is viewed as the existence of asymmetric adjustment whereas it is in opposed to the null hypothesis.

3.6 Conclusion

Referring to the paragraphs above, all of the tests and methods that will be employed in this study has been explained in detail. These tests and methods will be utilized to determine the asymmetric effect of stock prices due to changes in the macroeconomic variables, namely, interest rates, exchange rates, inflation rates, money supply and crude oil prices. To add on, the macroeconomic variables that are included in this study have been introduced in this chapter. While on the other hand, the data that is required while implementing the tests has been collected from Datastream too. The prior expectation that have been noted down in detail earlier in this chapter has also deemed to be similar with those stated in literature review. Thus, the study will continue with the examination of the asymmetric impact on stock prices with all the necessary data and methodology.

CHAPTER 4: INTERPRETATION

4.1 Introduction

In this chapter, each and every result for the unit root tests (ADF and KPSS test), Threshold Autoregressive Model (TAR), Momentum-Threshold Autoregressive Model (MTAR), Asymmetric Error Correction Model (ECM) and diagnostics checking (CUSUM and CUSUM of Squares tests) for the four countries that has mentioned earlier will be reported.

4.2 Unit Root Tests

Before carrying on with the study, Augmented Dickey-Fuller test (ADF) and Kwiatkowski, Phillips, Schmidt and Shin test (KPSS) have to be conducted in order to reveal the stationarity for both independent and dependent variables. This is an essential requirement to avoid spurious result to arise. For Augmented Dickey-Fuller test, all the variables should obtained non-stationary result in which the null hypothesis should not be rejected in level form but rejected in first difference form so that those variables consist of one unit root $I(1)$. Besides, KPSS test indicates that the variables are stationary in level form if the null hypothesis is not rejected. Therefore, null hypothesis should be rejected in this case but it should not be rejected in the first difference form.

Table 4.1 Result of Unit Root Test (ADF – Level Form)

NOTE: *, **, *** indicates the rejection of null hypothesis at 10%, 5%, and 1% of significance level. Number in parentheses is the number of 1 bandwidth. Lag length for the

Result of Unit Root Test (ADF- Level Form)								
LEVEL	INTERCEPT				INTERCEPT AND TREND			
COUNTRIES	Thailand	Indonesia	Malaysia	Philippines	Thailand	Indonesia	Malaysia	Philippines
Variables								
LER	-1.0671 (1)	-1.5371 (10)	-2.0115 (9)	-1.4163 (2)	-3.0485 (1)	-2.0479 (5)	-3.0029 (9)	-2.9699 (3)
LINF	-0.2122 (1)	-1.1649 (8)	-0.5457 (1)	-0.3819 (8)	-3.0022 (2)	-1.2278 (8)	-2.7218 (1)	-2.8091 (17)
LOIL	-1.7114 (2)	-0.8709 (0)	-0.9203 (0)	-1.3399 (2)	-2.8707 (2)	-2.8979 (0)	-3.1227 (3)	-3.0504 (2)
LSP	-1.5335 (3)	0.1069 (2)	-1.5095 (1)	-0.7338 (12)	-2.6089 (3)	-2.5411 (2)	-3.1425 (5)	-3.1219 (5)
INT	-2.4227 (2)	-2.5623 (13)	-2.2822 (2)	0.4098 (36)	-2.3991 (2)	-3.1269 (7)	-2.2111 (2)	-2.0807 (36)
MS	-	-1.8557 (17)	0.3963 (2)	-0.8142 (15)	-	-1.6508 (17)	-2.9017 (12)	-1.9918 (15)

ADF unit root test are based on Akaike Information Criterion. The bandwidth for the KPSS unit test is based on the Newey-West estimator using the Default (Barlett Kernel). The unit root tests include a constant and linear time trend. The null hypothesis under ADF test is the presence of a unit root while KPSS test is stationary.

Table 4.2 Result of Unit Root Test (ADF – First Difference)

Result of Unit Root Test (ADF- First Difference)								
LEVEL	INTERCEPT				INTERCEPT AND TREND			
COUNTRIES	Thailand	Indonesia	Malaysia	Philippines	Thailand	Indonesia	Malaysia	Philippines
Variables								
LER	-8.2866 (0)***	-5.3516 (9)***	-4.8881 (8)***	-7.6261 (1)***	-8.2510 (0)***	-5.5902 (10)***	-4.8213 (8)***	-8.0523 (1)***
LINF	-8.1393 (0)***	-5.2174 (7)***	-9.9380 (0)***	-4.5915 (7)***	-8.1147 (0)***	-5.3056 (7)***	-9.9131 (0)***	-4.5714 (7)***
LOIL	-7.2835 (1)***	-14.9383 (0)***	-12.7586 (0)***	-7.9818 (1)***	-7.2709 (1)***	-14.9247 (0)***	-12.7247 (0)***	-7.9541 (1)***
LSP	-5.3583 (2)***	-11.5071 (1)***	-11.2491 (0)***	-21.2107 (0)***	-5.3392 (2)***	-11.6406 (1)***	-11.3461 (0)***	-21.1426 (0)***
INT	-4.4226 (2)***	-5.9035 (12)***	-6.8997 (1)***	-2.6312 (36)***	-4.4090 (2)***	-5.8937 (12)***	-6.9383 (1)***	-3.2951 (36)***
MS	-	-3.0029 (16)**	-8.3690 (1)***	-3.8127 (14)***	-	-3.3889 (16)**	-8.3771 (1)***	-3.8641 (14)**

NOTE: *, **, *** indicates the rejection of null hypothesis at 10%, 5%, and 1% of significance level. Number in parentheses is the number of 1 bandwidth. Lag length for the ADF unit root test are based on Akaike Information Criterion. The bandwidth for the KPSS unit test is based on the Newey-West estimator using the Default (Barlett Kernel). The unit root tests include a constant and linear time trend. The null hypothesis under ADF test is the presence of a unit root while KPSS test is stationary.

Table 4.3 Result of Unit Root Test (KPSS – Level Form)

Result of Unit Root Test (KPSS- Level Form)								
LEVEL	INTERCEPT				INTERCEPT AND TREND			
COUNTRIES	Thailand	Indonesia	Malaysia	Philippines	Thailand	Indonesia	Malaysia	Philippines
Variables								
LER	1.3288 (10)***	1.5292 (14)***	0.5413 (10)***	0.6779 (10)**	0.1691 (9)**	0.3365 (14)***	0.2652 (10)***	0.2406 (10)***
LINF	1.3796 (10)***	1.9032 (14)***	1.6699 (11)***	1.5059 (10)***	0.1200 (9)*	0.3080 (14)***	0.1978 (10)**	0.1549 (10)**
LOIL	1.2756 (9)***	1.6593 (14)***	1.5367 (11)***	1.3123 (10)***	0.2153 (9)**	0.3388 (13)***	0.1197 (10)*	0.1569 (9)**
LSP	1.0782 (9)***	1.5598 (14)***	1.3454 (10)***	1.4307 (8)***	0.1567 (9)**	0.3645 (14)***	0.1311 (10)*	0.1235 (1)*
INT	0.3838 (9)*	0.5209 (13)**	0.6466 (11)**	1.2618 (9)***	0.1366 (9)*	0.1258 (13)***	0.2263 (10)***	0.1219 (9)*
MS	-	1.8847 (14)***	1.6824 (11)***	1.5019 (10)***	-	0.4144 (14)***	0.2534 (11)***	0.1255 (9)*

NOTE: *, **, *** indicates the rejection of null hypothesis at 10%, 5%, and 1% of significance level. Number in parentheses is the number of 1 bandwidth. Lag length for the ADF unit root test are based on Akaike Information Criterion. The bandwidth for the KPSS unit test is based on the Newey-West estimator using the Default (Barlett Kernel). The unit root tests include a constant and linear time trend. The null hypothesis under ADF test is the presence of a unit root while KPSS test is stationary.

Table 4.4 Result of Unit Root Test (KPSS – First Difference)

Result of Unit Root Test (KPSS- First Difference)								
LEVEL	INTERCEPT				INTERCEPT AND TREND			
COUNTRIES	Thailand	Indonesia	Malaysia	Philippines	Thailand	Indonesia	Malaysia	Philippines
Variables								
LER	0.0570 (2)	0.1177 (9)	0.3328 (5)	0.3328 (5)	0.0553 (2)	0.0539 (8)	0.1114 (4)	0.1104 (3)
LINF	0.0646 (2)	0.1733 (12)	0.0521 (3)	0.0822 (5)	0.0503 (2)	0.0766 (12)	0.0517 (3)	0.0818 (5)
LOIL	0.0499 (3)	0.0993 (10)	0.0521 (3)	0.0432 (3)	0.0406 (3)	0.0481 (10)	0.0536 (3)	0.0347 (3)
LSP	0.0591 (6)	0.1804 (3)	0.1854 (3)	0.3000 (152)	0.0596 (6)	0.0337 (2)	0.0626 (5)	0.1100 (152)
INT	0.0749 (7)	0.0320 (5)	0.1103 (8)	0.0586 (8)	0.0720 (7)	0.0250 (5)	0.0433 (8)	0.0372 (8)
MS	-	0.3284 (9)	0.1785 (4)	0.0894 (15)	-	0.1160 (8)	0.1105 (4)	0.0672 (16)

NOTE: *, **, *** indicates the rejection of null hypothesis at 10%, 5%, and 1% of significance level. Number in parentheses is the number of 1 bandwidth. Lag length for the ADF unit root test are based on Akaike Information Criterion. The bandwidth for the KPSS unit test is based on the Newey-West estimator using the Default (Barlett Kernel). The unit root tests include a constant and linear time trend. The null hypothesis under ADF test is the presence of a unit root while KPSS test is stationary.

Table 4.1 and Table 4.2 are the results for ADF test in level form and first difference form. According to the results of ADF tests in level form, the test-statistic of all variables for four countries are greater than α even at 10% of significant level. It indicates that all the variables are insignificant to reject null hypothesis for the level form. Therefore, the ADF test for first difference form had been carried out to test those variables' dynamic stationary. Test-statistic of those variables in ADF test for first difference is smaller than α at 10%, 5% and 1% of significant level which means that the null hypothesis is significantly being rejected. As a result, these have verified that all variables that are being used in this study are non-stationary at the level form and are integrated of order one, I(1) or a unit root in the first difference form.

Moreover, Table 4.3 and Table 4.4 are the results for KPSS test in level form and first difference form. KPSS test was carried out in order to acquire robustness results and to check the preciseness of ADF test since each unit root test has its own limitation as mentioned in the previous chapter. This is again to prove that the result obtained is reliable. In Table 4.3, it reports that all the variables are significant in rejecting null hypothesis whereby their test-statistics are greater than the critical value at 10%, 5% and 1% of significant level for the level form. While in Table 4.4, the results for first difference form show that all the variables are insignificant in rejecting null hypothesis due to their test-statistics are smaller than the critical value at 10%, 5% and 1% of significant level. Thus, all the variables either dependent or independent for the four countries are non-stationary at the level form. In other words, all variables are said to be integrated of order one, I(1) or a unit root in the first difference form.

4.3 Threshold Autoregressive Model (TAR) & Momentum-Threshold Autoregressive Model (M-TAR)

TABLE 4.5: Result of Threshold Autoregressive (TAR) Model

COUNTRIES	THAILAND	INDONESIA	MALAYSIA	PHILIPPINES
Above threshold	-0.0044*	-0.1999*	-0.2266*	-1.1462*
Below threshold	-0.1184*	-0.1102*	-0.3872*	-1.6226*
F-equal	3.0976*	1.9975*	3.9792*	1.4943*
F-joint	3.0158*	6.8109*	11.0251*	44.1137*
Threshold value (tau)	-0.1562	0	0	-0.2268

NOTE: *,**,*** indicates the rejection of null hypothesis at 10%, 5%, and 1% of significance level.

TABLE 4.6: Result of Momentum-Threshold Autoregressive (M-TAR) Model

COUNTRIES	THAILAND	INDONESIA	MALAYSIA	PHILIPPINES
Above threshold	-0.2435	-0.1904	-0.2991	-1.3548
Below threshold	-0.0149	-0.0815	-0.2990	-5.4488
F-equal	7.2822*	2.9676*	0.000005*	43.1761*
F-joint	5.1532*	7.3182*	8.8252*	78.0064*
Threshold value (tau)	0.07890	0	0	-0.0746

NOTE: *,**,*** indicates the rejection of null hypothesis at 10%, 5%, and 1% of significance level.

Based on the result above, F-equal and F-joint for each country are significant in rejecting the null hypothesis at 5% of significance level. This shows that the stock markets of these four countries are asymmetric. Nevertheless, the result of F-joint indicates that there is a long term relationship between the microeconomic variables and the stock returns whereas F-equal is to examine whether the market is asymmetry.

4.4 Asymmetric ECM Model

Table 4.7 Result of Asymmetric ECM Model

COUNTRIES	TAR			M-TAR		
	ZPLUS	ZMINUS	AIC	MPLUS	MMINUS	AIC
THAILAND	-0.0608	0.1310**	-2.5493	-0.1266*	0.0501	-2.4865
INDONESIA	-0.0878**	-0.0072	-2.1417	-0.0536*	-0.0410	-2.1090
MALAYSIA	-0.1163	-0.2593**	-2.6931	-0.0576	-0.2614***	-2.6708
PHILLIPINE	-1.3686***	-1.2450***	2.1242	-1.2334***	-1.7655***	2.0074

NOTE: *,**,*** indicates the rejection of null hypothesis at 10%, 5%, and 1% of significance level. Lag selections are based on parsimony. Zplus and mplus indicate positive shock when good news released where zminus and zplus indicate negative shock in response to the bad news. If zplus is not equal to zminus or mplus is not equal to mminus, the positive shock and negative shock are not equal.

The results of this study are presented as in the table above. Both zplus and zminus (mplus and mminus) are essential elements in conducting the asymmetric error correction model (ECM), this is because it helps to determine whether the macroeconomic variables will affect the countries' stock price asymmetrically. Based on the coefficient value of zplus and zminus, either one is negative and significant at the 10% significance level, the effect of the macroeconomic variables toward the stock prices is said to be asymmetry.

In the case of Thailand, its stock market is proved to have asymmetric impact by the macroeconomics variables. Given that zminus 0.1310 is significant at 5% significance level, it implies that the negative shock significantly influence the Thailand stock market, meanwhile the speed of adjustment to long run equilibrium is 13.10%. Conversely, the zplus -0.0608 which means that the speed of adjustment is 6.08% is insignificant at 10%. This indicates that positive shock on macroeconomic variables does not have sufficient evidence in affecting the Thailand's stock prices. Instead, the

stock price is found to be change at the speed of adjustment of 12.66% during positive shock in M-TAR model. This study also found that Thailand respond to negative shock is about 5.01% but fails to detect it is significantly affected by macroeconomic variables. Thus, from the aspect of momentum, the speed of adjustment shows that positive shock is more significant to the stock price, while negative shock is not significant.

Nevertheless, the z_{plus} value in TAR model for Indonesia is -0.0878, which is significant at 5% significance level. This indicates that Indonesia's stock market adjusts to long run equilibrium at the speed of 8.78% in responding to the positive shock. However, the z_{minus} of 0.72% is insignificant at 10% significance level. Hence, it proved that Indonesia stock market is more responsive to positive shock compared to negative shock. On the other hand, the results in M-TAR model also reported that the changes in stock price will adjust to long run equilibrium at the speed of 5.36% while the momentum changes in stock price only respond to the positive shock in macroeconomic variables, as m_{minus} of 4.10% is insignificant at 10% significance level. It is certified that market is asymmetry since the positive and negative shocks do not have similar impact on the stock price. In the final analysis, the TAR model and M-TAR model both provide similar result as the stock prices will be relatively responsive to the positive shock in the macroeconomic variables. In attribute of momentum, the speed of adjustment indicates that positive shock is more significant, but negative shock is insignificant.

While for Malaysia, its z_{plus} of 11.63% is insignificant at 10% significance level, but z_{minus} of 0.2593 is significant at 5% significance level. There is insufficient evidence to show that stock price is affected by positive shock on the macroeconomic variables. Nevertheless, it shows that Malaysia stock market's speed of adjustment during negative shock to long run equilibrium is 25.93%. Thus, asymmetric impacts takes place in Malaysia stock market since the negative shock is more significant than positive shock. Alternatively, m_{minus} in the M-TAR model is significant at 1% significance level, which denotes that the stock price will be changed at the speed of

adjustment of 26.14% during negative shock. This is similar to TAR model as they are more sensitive towards the negative announcement. In other words, stock price does not reveal any sufficient evidence that it is affected by positive announcement at the speed of adjustment of 5.76%. This is because from the momentum, speed of adjustment shows that only negative announcement is more significant in relative to positive announcement.

Besides, the z_{plus} -1.3686 and z_{minus} -1.2450 for Philippines are both found to be significant at 1% significance level in TAR model. This result explains that Philippines stock market responds to both positive shock and negative shock asymmetrically. However, the investors' behavior will tend to change more towards the positive shock in comparison to the negative shock since the value of z_{plus} is greater than z_{minus} . During positive announcement, the stock price will adjust to the long run equilibrium at the speed of 136.86%, while only 124.50% during negative shock. Similarly, the M-TAR result also shows parallel result, in which the stock price acts in response to both positive shock and negative shock. However, it reports the slightly different result as in TAR model since stock price changes corresponding to negative shock at higher speed which is 176.55% compared to positive shock at 123.34% in M-TAR model. In other words, from the momentum speed of adjustment, it shows that both positive and negative shocks are significant to affect the stock price asymmetrically, but stock price tends to respond to negative shock at higher speed.

4.5 Diagnostics Checking

CUSUM test and CUSUM of Square test are the diagnostic checking tests that will be employed in this study. This is to examine the asymmetric ECM model for Asean-4 countries namely Thailand, Indonesia, Malaysia and Philippines.

4.5.1 CUSUM Test for TAR model and M-TAR model

The results of the CUSUM test for TAR and M-TAR model are shown in the graphical form as below from Figure 4.1 to 4.8. The value of the cumulative sum of residuals is plotted against upper and lower bound of the 95% confidence interval at each point. Therefore, to obtain a significant result, the recursive estimate for cumulative sum of residual should be plotted in the range of upper and lower bound of 95% confidence interval. The results below shown that the overall asymmetric ECM model for the four countries studied in this study is significant at 5% significant level. It illustrated that the value of cumulative sum of residuals is fall within the confidence interval and thus, the asymmetric ECM models are interpreted as appropriate and in properly structured.

Figure 4.1 CUSUM Test for TAR model-Thailand

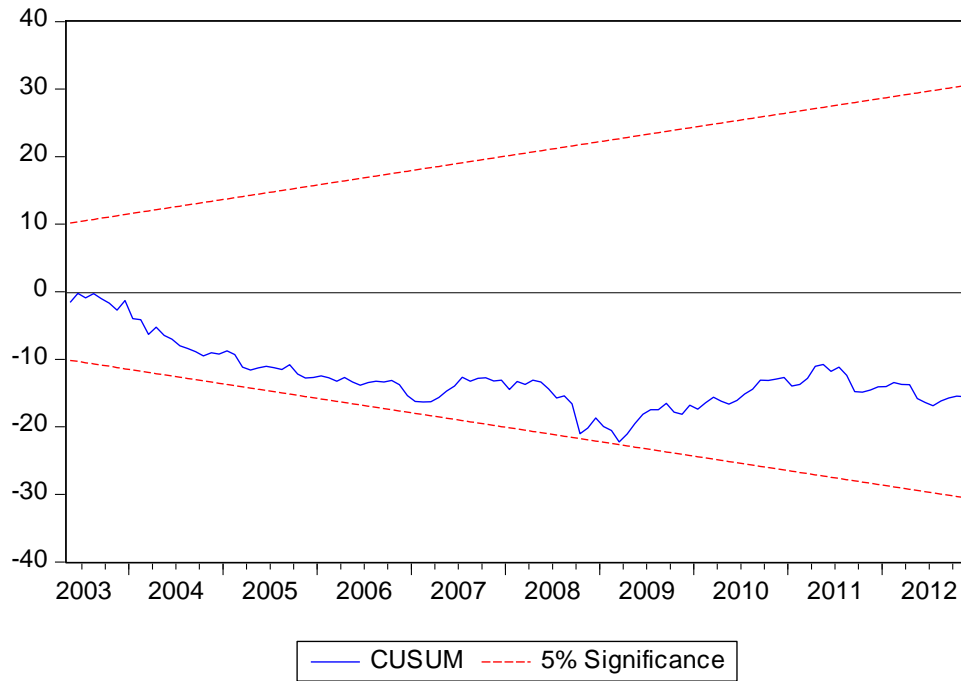


Figure 4.2 CUSUM Test for TAR model-Indonesia

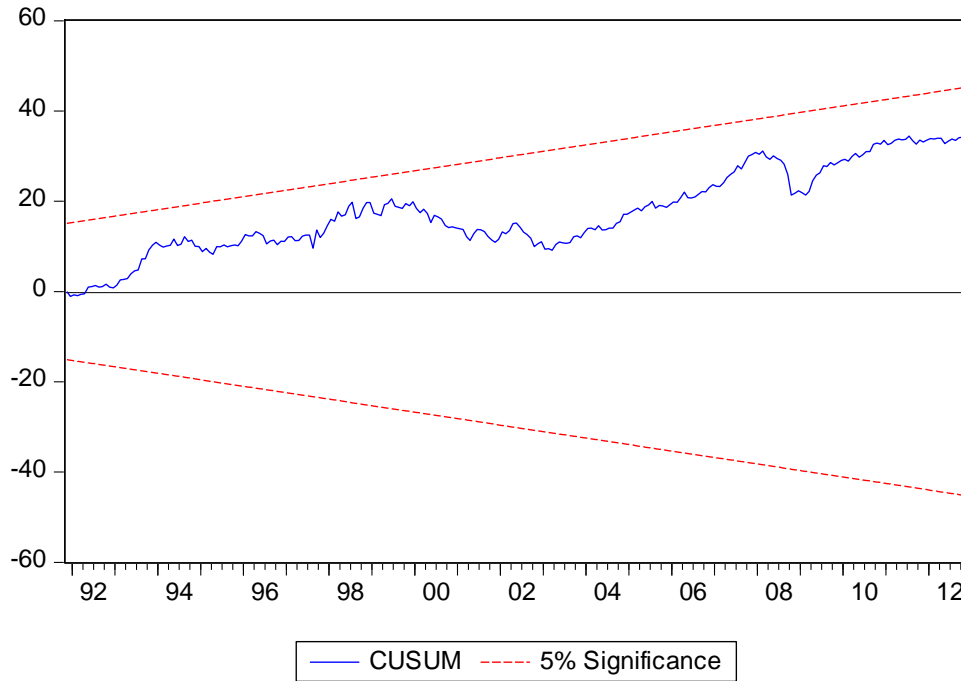


Figure 4.3 CUSUM Test for TAR model-Malaysia

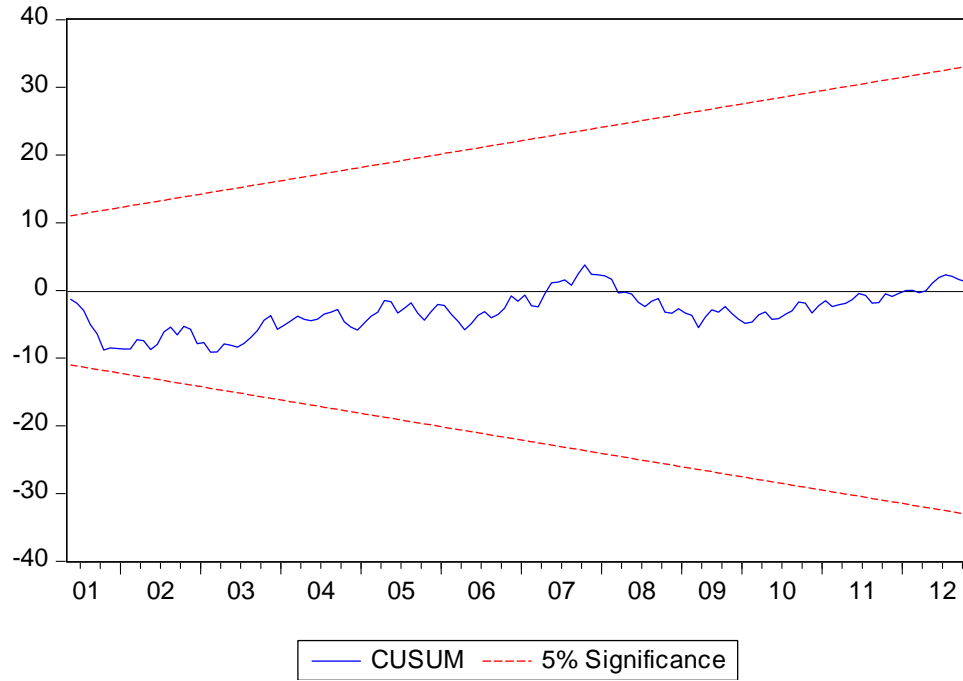


Figure 4.4 CUSUM Test for TAR model-Philippines

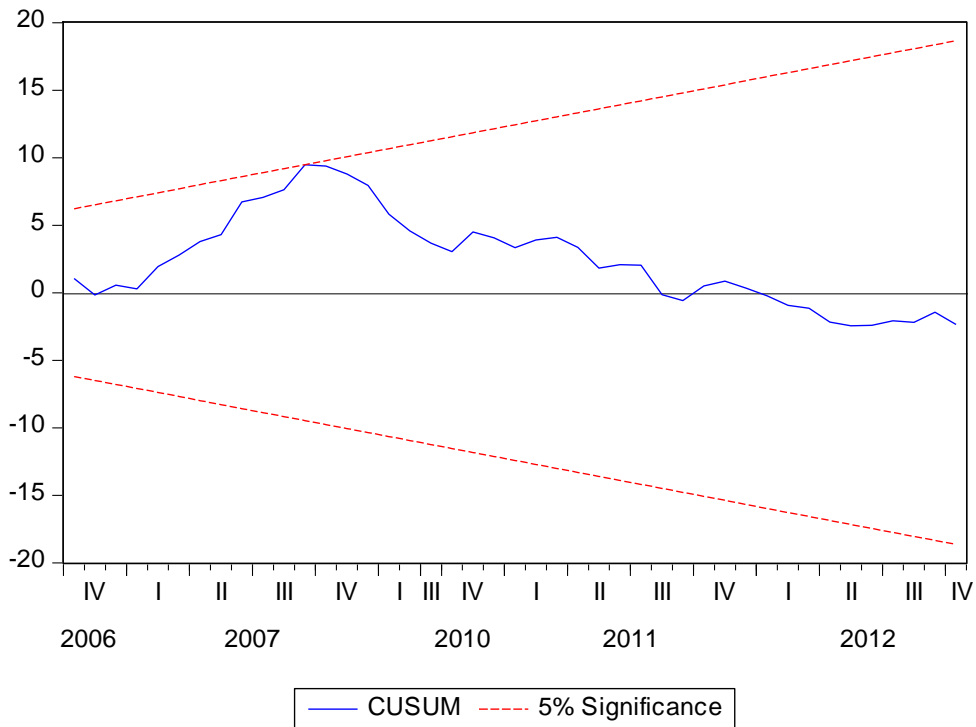


Figure 4.5 CUSUM Test for M-TAR model-Thailand

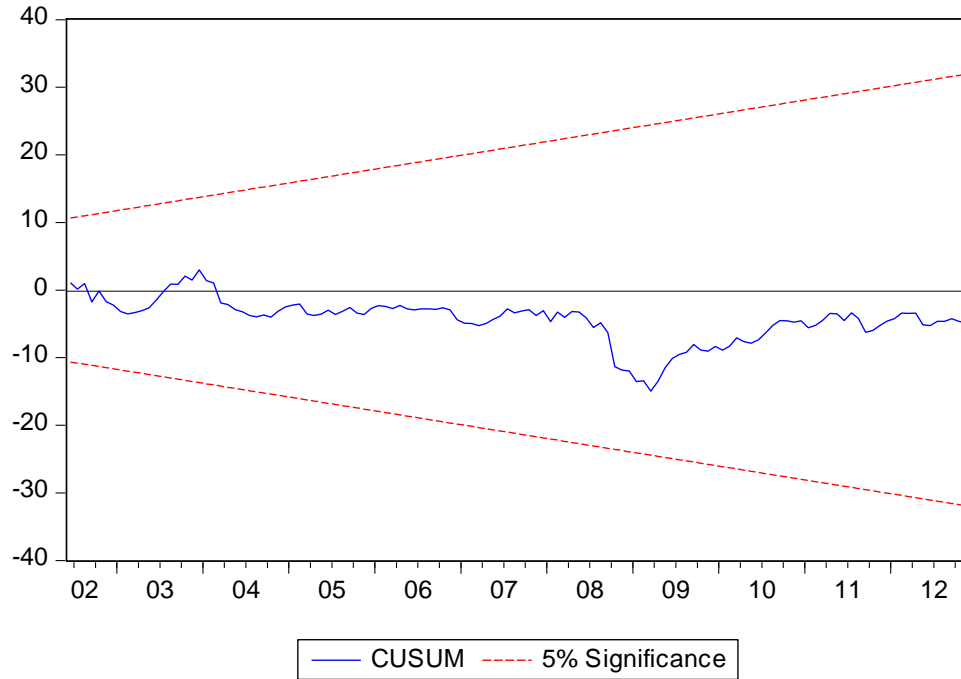


Figure 4.6 CUSUM Test for M-TAR model-Indonesia

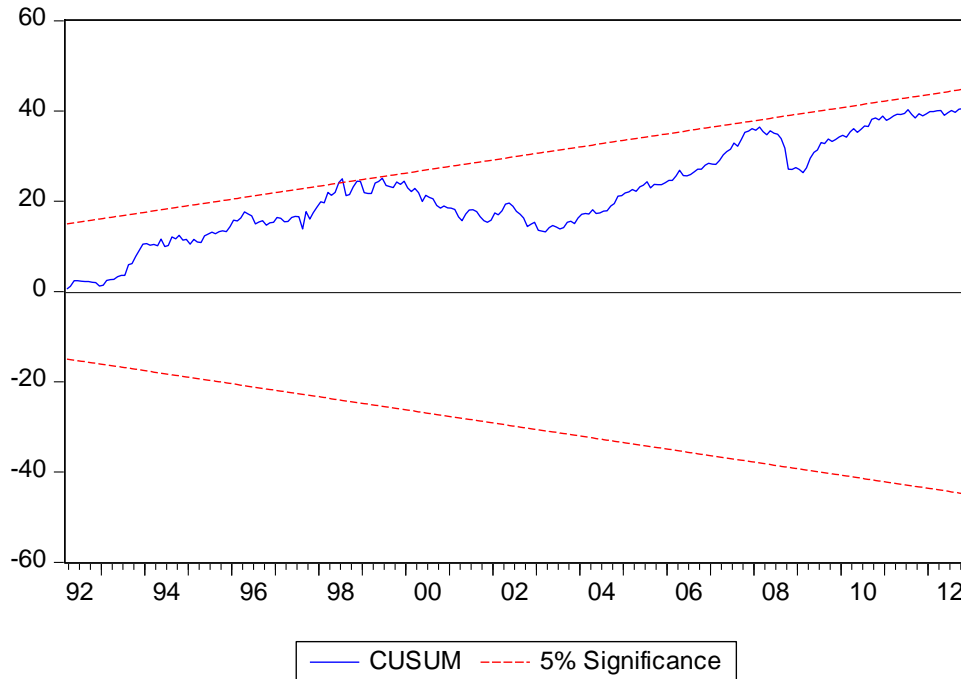


Figure 4.7 CUSUM Test for M-TAR model-Malaysia

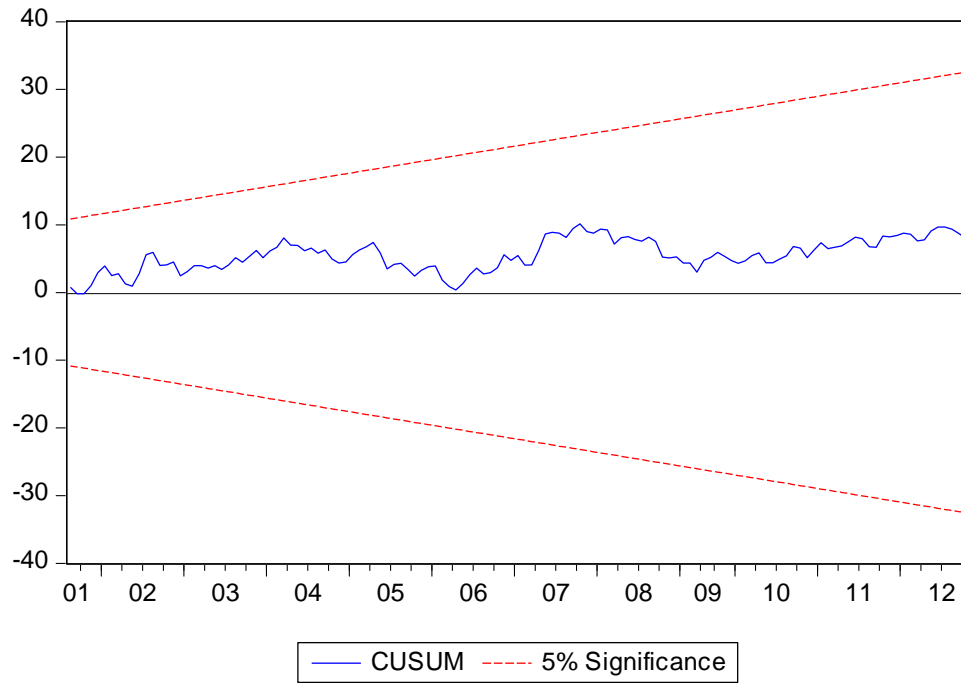
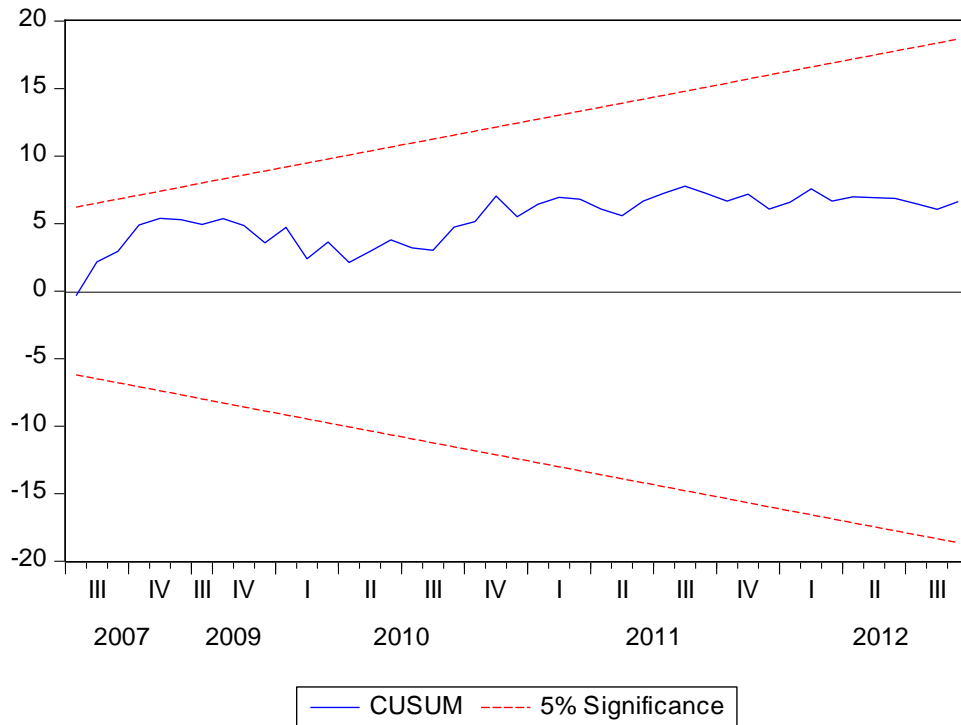


Figure 4.8 CUSUM Test for M-TAR model-Philippines



4.5.2 CUSUM of Square Test for TAR model and M-TAR model

The results of the CUSUM of square test for TAR and M-TAR model are shown as below from Figure 4.9 to 4.16. This test is basically used to assure that the result for CUSUM test is robust. As this test is similar with the aforementioned CUSUM test, the cumulative of variance must fall within the boundaries of 95% confidence interval so that significant result can be achieved. In brief, results shown in below signify that all the asymmetric ECM models tend to be appropriate and in structurally stable as it is significant at the 5% of significant level for Thailand (Figure 4.9), Malaysia (Figure 4.11) and Philippines (Figure 4.12) in TAR model. This result is also applicable on Thailand (Figure 4.13) and Malaysia (Figure 4.15). While for the countries such as Indonesia (Figure 4.10 and Figure 4.14) and Philippines (Figure 4.16) that are insignificant at 5% of significance level, the cumulative variance merely fall outside of the boundaries which actually still can be accepted since the asymmetric ECM models for both countries are significant at the significance level of 10%.

Figure 4.9 CUSUM of Square Test for TAR model-Thailand

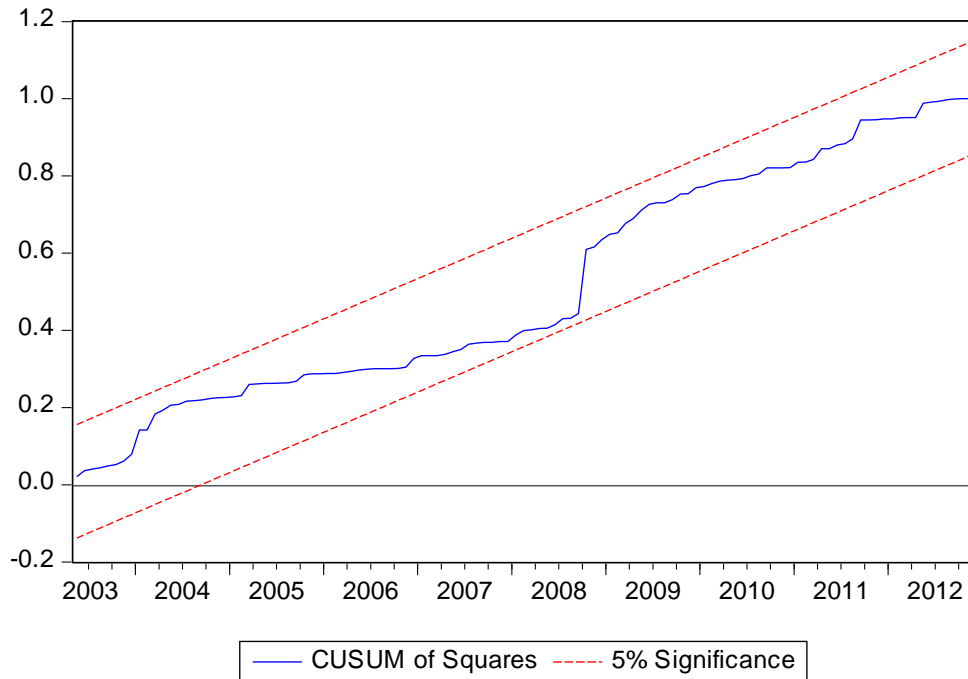


Figure 4.10 CUSUM of Square Test for TAR model-Indonesia

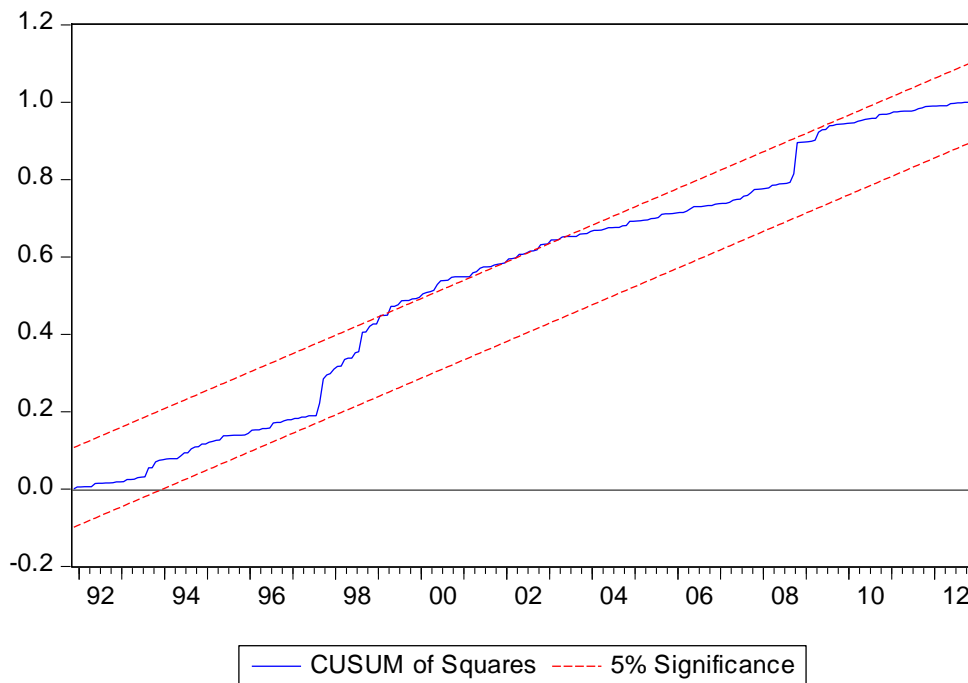


Figure 4.11 CUSUM of Square Test for TAR model-Malaysia

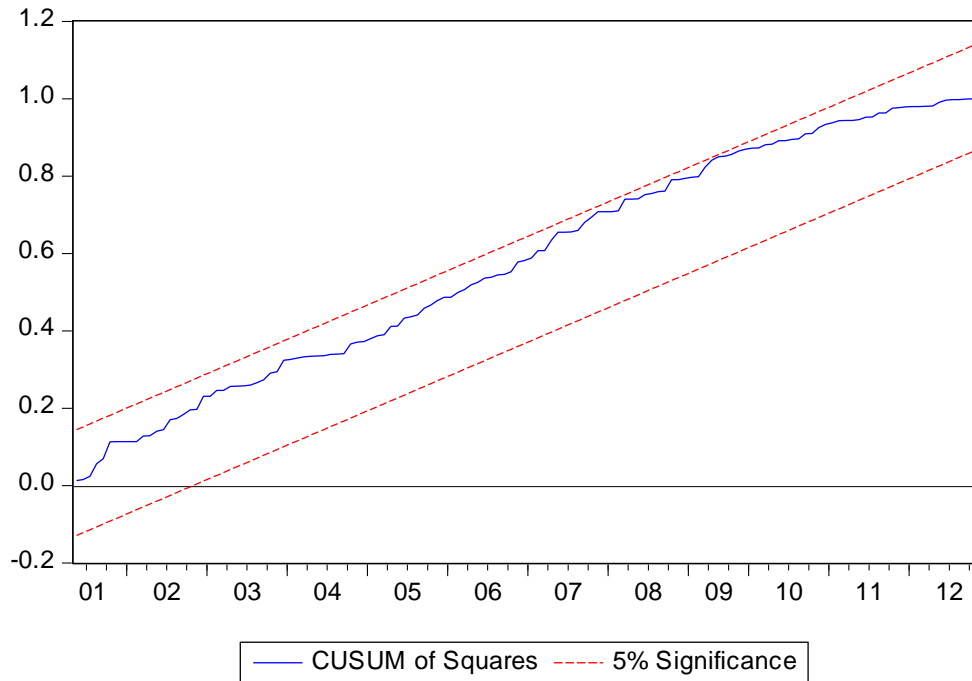


Figure 4.12 CUSUM of Square Test for TAR model-Philippines

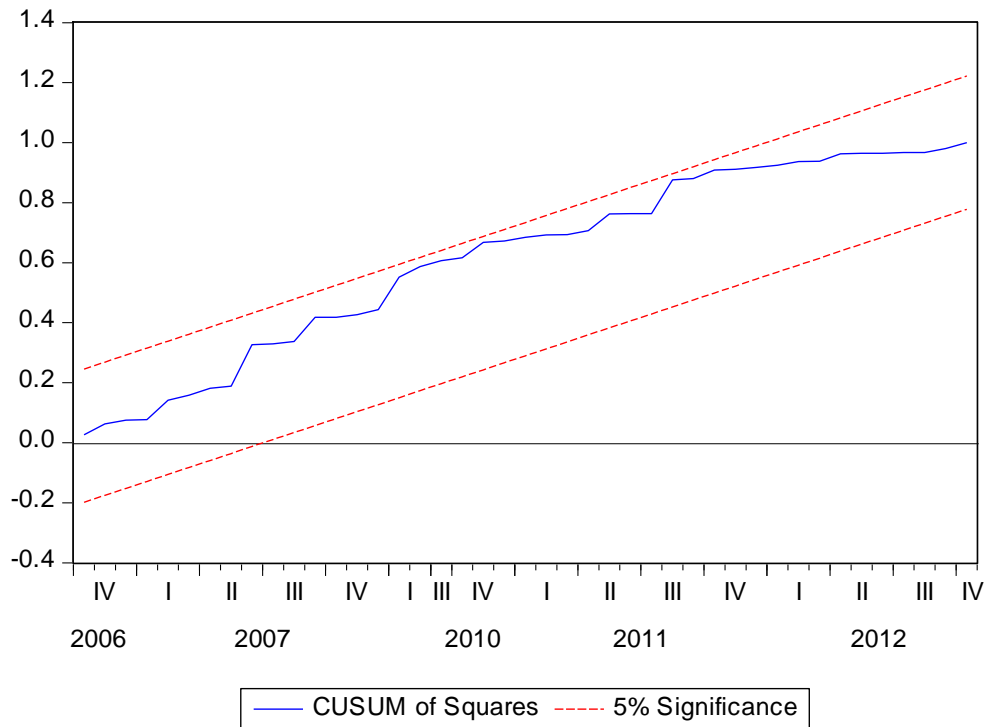


Figure 4.13 CUSUM of Square Test for M-TAR model-Thailand

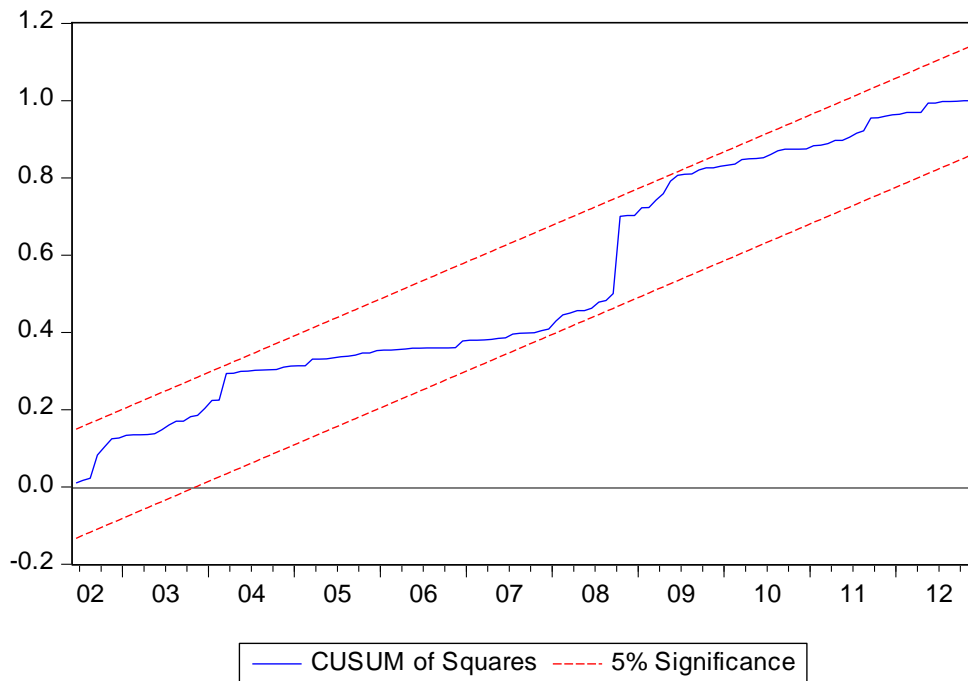


Figure 4.14 CUSUM of Square Test for M-TAR model-Indonesia

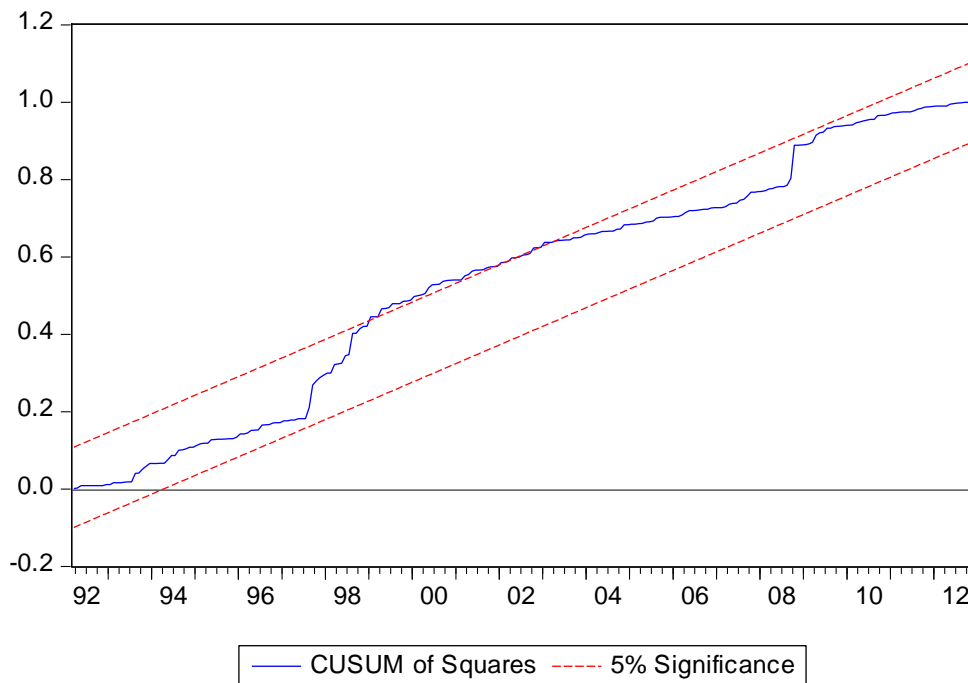


Figure 4.15 CUSUM of Square Test for M-TAR model-Malaysia

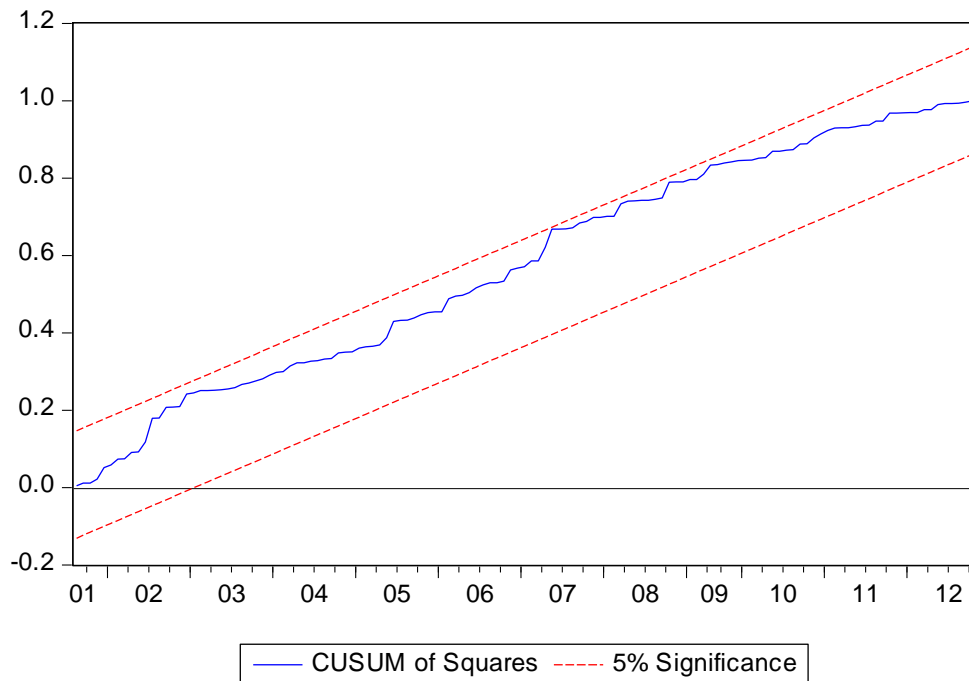
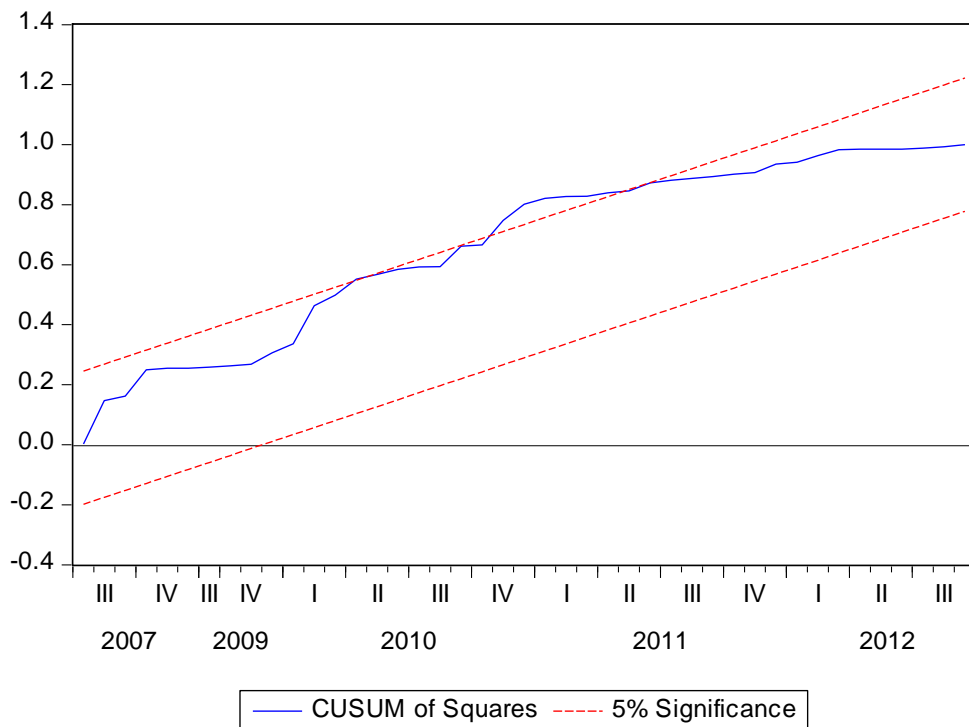


Figure 4.16 CUSUM of Square Test for M-TAR model-Philippines



4.6 Discussion of major findings

In accordance with the empirical results from the Asymmetric Error Correction Model as in Table 4.7, it implies that the macroeconomic variables such as interest rate, money supply, inflation rate, exchange rate, and oil price will bring asymmetric effect towards the stock market in Thailand, Indonesia, Malaysia and Philippines as the speed of adjustment on the stock price will be different. The statistical methods of Threshold Autoregressive (TAR) Model and Momentum-Threshold Autoregressive (M-TAR) model have proved that the result has been achieved for the four countries. It conveys the result in rejecting the null hypothesis for F-joint and F-equal at 5% significance level in which there is a long run and asymmetric relationship between the macroeconomic variables and stock return.

As referring to Table 4.7, z_{plus} or z_{minus} indicates the speed of adjustment of the stock price to the positive or negative shock on the macroeconomic variables. Either z_{plus} or z_{minus} shows significant and has negative coefficient from the observation in Asymmetric Error Correction Model for Indonesia, Malaysia and Philippines but Thailand obtain positive coefficient for z_{minus} . Therefore, it indicates that positive coefficient for TAR model is insignificant but it is proved to be significant in M-TAR model. In the results of M-TAR model, it observes the momentum speed of adjustment of the stock price towards the positive or negative announcement. From the empirical result of Asymmetric error correction model, it captures that either m_{plus} or m_{minus} is significant and has negative coefficient for the four countries. Referring to the TAR model, stock prices of Thailand and Malaysia will have greater sensitivity towards the negative shock whereas stock prices of Indonesia will respond immediately when positive announcement arises.

While for M-TAR model, stock prices of Thailand are more responsive towards the positive shock. This result is in line with one of the BBC News (2013) as the stock return in Thailand has been raised about 7.5% starting from New Year. Thailand stock market is improving due to the increase in the issue of initial public offerings

(IPO) and cross-border takeovers by Thailand organization. Moreover, the securities trading between Malaysia, Singapore and Thailand have led the Stock Exchange of Thailand to become a hub. For these reasons, investors are interested in investing in Thailand and thus, welcoming a positive effects towards the market from the outbreak of the news.

In addition, stock prices of Indonesia are proved to be more responsive to positive shock in TAR and M-TAR model. According to the BBC News (2012), the increase in the stock prices of Jakarta Composite index was due to upgrading of credit rating of debt in Indonesia. The credit rating is relatively low for 14 years when Asian financial crisis happens. However, it has now been improved to the investment grade which is beneficial to the stock market, bond market and foreign direct investment. Thus, investors are more willing to make investment in its stock market which will in turn drive up the stock price. This is shown in Appendix (Figure 4.1).

Nevertheless, stock prices of Malaysia are more responsive towards negative shock which can be seen in TAR and M-TAR model. This result can be proved by the Appendix (Figure 4.2). From the cha, there is a sharp decrease in the stock price during year 1997-1999 due to the negative announcement. According to Stanford (1999), in 24 July 1998, Moody's had cut Malaysia's foreign currency debt rating to 'Baa2' from 'A2' and 'Baa1' to 'Baa3' for deposits in response to the Asian crisis, which is the bad news to Malaysia and caused the investors to lost confidence on Malaysia stock market, thus declining stock sales and stock price as well.

Philippines are found to be sensitive towards positive and negative announcement for both models and yet, negative announcement tend to have more influential on the stock price. This can be evidenced by the Appendix (Figure 4.3), it is clearly showed that the stock price moves at higher speed when there is negative announcement in the market as it has steeper slope.

Furthermore, the variables that are adopted in this study have gone through two unit root tests which are ADF test and KPSS test. All variables for the four countries illustrated that each of them is integrated at first order or has a unit root. In other words, they are non-stationary at the level form at 1%, 5% or 10% significance level. Therefore, it has achieved the optimal result before conducting other statistical tests. The final results are then undergoing with the diagnostic checking tests by using CUSUM test and CUSUM of Squares test. Thus, the results obtained tend to be more precise since these tests are useful in checking the models' accurateness. In short, the asymmetric effect on the relationship between macroeconomic variables and stock prices in the four countries has been captured.

In this study, the relationship between macroeconomic variables and stock prices is favorably proved to be asymmetric. However, the statistical method that is being adopted varies with previous researchers. The most frequent model that is applied by previous researchers is Error Correction Model (ECM) in which they studied from a symmetric perspective. However, Asymmetric ECM model is used in this study and it is actually derived from the ECM model. For instance, Asmy et al. (2009) and Pal and Mittal (2011) applied ECM model in determining the causal relationship between macroeconomic variables and stock price in Malaysia and Indian stock market respectively. The research of Kyereboah-Coleman and Agyire-Tettey (2008) is similar to Asmy et al. (2009) and Pal and Mittal (2011) just that it is examining on the Karachi Stock Exchange.

Furthermore, Vector Error Correction Model (VECM) has been employed in the research of Frimpong (2009) and Sohail and Hussain (2009). This model is to study the relationship between macroeconomic variables and stock prices in Ghana and Pakistan stock market separately. Maysami et al. (2004) has also applied VECM model in their research which is done in Singapore. In contrast to Pal and Mittal (2011) in examining the Indian capital market, it can be observed that Panda (2008) employed different model which is VECM model. Olowe (2007), Ratanapakorn and

Sharma (2007), and Mukherjee and Naka (1995) also supported for the use of VECM model to conduct their research in investigating the relationship between those variables. In addition, VAR model was introduced by Mashayekh et al. (2011), Yahyazadehfar and Babaie (2012), Abugri (2006) and Verma and Ozuna (2005) with the objective of examining the relationship between macroeconomic variables and stock prices. Several researchers were found to be adopting simple or multiple regression model in carrying out research. Simple regression model was applied by Rehman et al. (2011) and Hussain and Khan (2011) whereas multiple regression model was used by Mohammad et al. (2009) and Kandir (2008).

Nonetheless, Johansen-juselius cointegration test was intended to be used in order to capture the long run equilibrium relationship between macroeconomic variables and stock prices. This has been carried out by Humpe and Macmillan (2009) and Yahyazadehfar and Babaie (2012). Puah and Jayaraman (2007), Asmy, Rojilina, Hassama and Fouad (2009) and Gan et al. (2006) had also conducted similar test as Yahyazadehfar and Babaie (2012) in Iran capital market and then they further move on to conduct the Granger-causality test with the aim to investigate the short-run causal relationships or the direction of influence between the dependent variable and independent variable. Abdullah and Hayworth (2013) also applied Granger-causality test in their research. Thus, it has come to a conclusion that all these methodologies that have been used by previous researchers are symmetric model which is contradicted with the intention of this study.

The actual impact on the stock price is actually mirrored from the major findings of this study which is asymmetric. It is similar to the real stock market of the world as investors will not react symmetrically when positive or negative shock occurs. Investors are not solely respond to the negative shock but also respond immediately once positive shock takes place. As an overview, the stock market is not said to be completely symmetric. This is contradicting to the studies of previous researchers that assumed macroeconomic variables will have symmetric effect towards the stock

prices by using inappropriate empirical method in conducting their research. Consequently, the results from the previous researcher might not be accurate.

4.7 Conclusion

The diagnostic checking tests which are CUSUM and CUSUM of Squares Test have successfully proved that the individual asymmetric error correction model for each of the country is appropriate and well structured. Hence, the macroeconomic variables have contributed asymmetric impact towards the stock prices for the four countries in this study.

Chapter 5: Conclusion

In conclusion, the ASEAN-4 countries' stock return is asymmetrically influenced by both positive shock and negative shock in macroeconomic variables, such as interest rate, exchange rate, inflation rate, oil price and money supply, in short run and long run integration. This is proven by the result obtained as shown in Table 4.5 and Table 4.6. However, the speed of adjustment of stock price to long run equilibrium during positive news and negative news are different across the countries, which represented by the result of z_{plus} and z_{minus} as presented in Table 4.7.

5.1 Policy Implications

As the result suggested by both TAR and M-TAR model shows that there is an asymmetric effect between all five of the macroeconomic variables, namely money supply, interest rate, inflation rate, real exchange rate and crude oil prices, investors should attain more information regarding the stock market that they are interested in investing before engaging into a transaction. This is because they should be aware that the stock market response to negative announcement faster than positive announcement. Besides, negative announcements causes the stock prices to decrease almost instantaneously but it requires more time to raise back to its original position. Thus, investors should be aware of the information speculating around the market to minimize the risk while investing in a particular market. They should buy and sell their stocks in hand according to the news released by the related party to maximize their profit.

Furthermore, the management of various organizations and the government of the countries of study should be well aware that the market response to good and bad news announcement asymmetrically. This understanding helps them to formulate

better management strategy as they know the release of negative announcements will bring greater effect than positive announcements. They should also be well aware that the stock prices increase in slower pace but decrease in faster pace when they are forecasting their earnings as according to the outlook of the stock market. With proper formulation of strategy, organizations can take advantages over their competitors as they are aware that the market response asymmetrically to positive and negative news announcements. In addition, government can have a sound and efficient financial system regardless of the news released by incorporating this understanding into their strategy too.

Lastly, many of the researches done in the past have employed symmetric methodologies when they are determining the impact of macroeconomic variables towards stock market. With the result shown by TAR and M-TAR model, researchers should consider using them as the methodologies in their research to have a more accurate and reliable result. This is because these two models help reflecting the asymmetric response in stock market from the changes in macroeconomic variables.

5.2 Limitation and Recommendation for Further Study

As according to “Southeast Asia Following the Economy Train” (2013), Vietnam is one of the country that has the potential to surpass Four Asian Tigers along with the countries of study, namely, Indonesia, Malaysia, Thailand and Philippines. However, this study is unable to further investigate the asymmetric impact of macroeconomic variables towards the Ho Chi Minh Stock Index due to limitation of data. Thus, future researchers are recommended to include Vietnam into their researches to determine if Ho Chi Minh Stock Index response asymmetrically towards changes in macroeconomic variables. It will help the society in better understanding the emerging market that might lead the economy of Southeast Asia in the future.

Moreover, this study has only focused on the four countries as mentioned above. Even though the four countries were proven to be under asymmetric impact, the same result may not be able to apply on other countries as different countries have different policies and cultures. Thus, future researchers are recommended to expand their studies to other countries, in order to increase the literature evidence of asymmetric impact towards stock markets.

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FTSE Bursa Malaysia KLCI (^KLSE) - Historical price. (2008, March 10). Retrieved January 2013, from Yahoo Finance:
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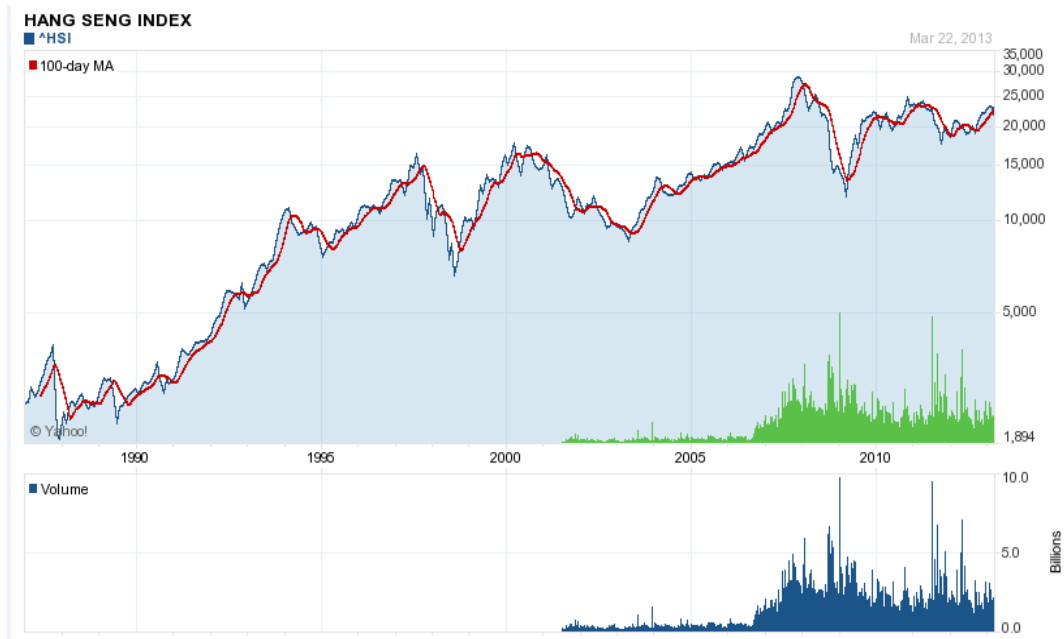
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APPENDICES**Figure 1.1 - Japan stock market (NIKKEI 225)**

Source: Yahoo Finance. (2013). *Nikkei225*. Retrieved Mar 19, 2013, from <http://finance.yahoo.com/q/ta?s=%5EN225&t=my&l=on&z=l&q=l&p=m50%2Cv&a=&c=>

Figure 1.2 - Hong Kong stock market (Hang Seng Index)



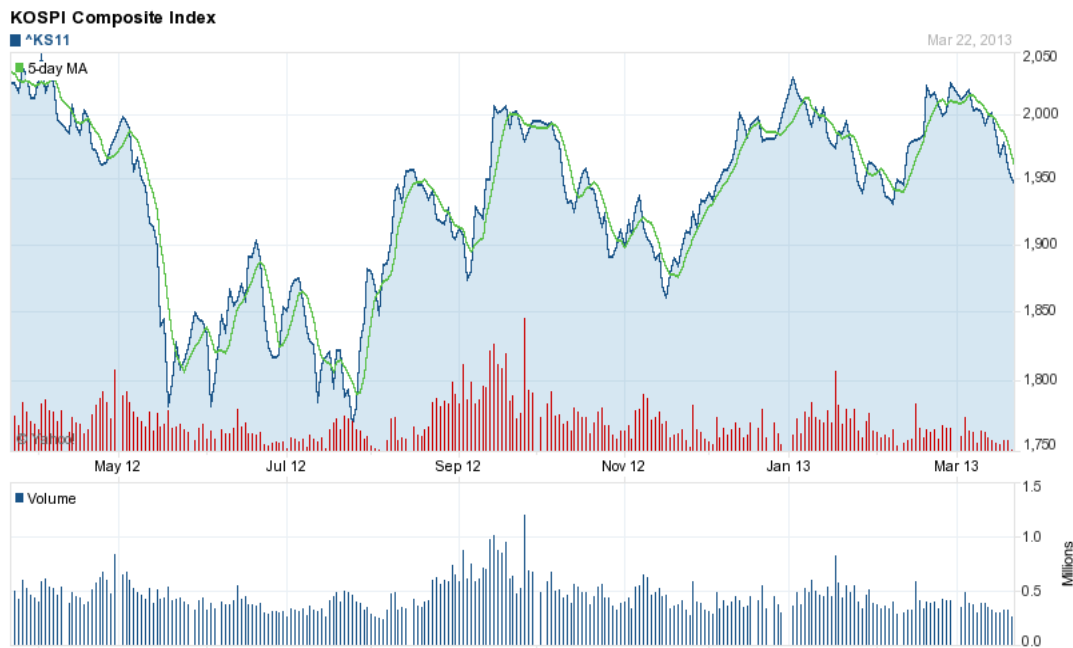
Source: Yahoo Finance. (2013). *Hang Seng Index*. Retrieved Mar 19, 2013, from <http://finance.yahoo.com/q/ta?s=%5EHSI&t=my&l=on&z=l&q=l&p=v%2Cm100&a=&c=>

Figure 1.3 - Shanghai stock market (SSE Composite Index)



Source: Yahoo Finance. (2013). *SSE Composite Index*. Retrieved Mar 19, 2013, from <http://finance.yahoo.com/q/ta?s=000001.SS&t=2y&l=on&z=l&q=l&p=m20%2Cv&a=&c=>

Figure 1.4 - South Korea stock market (KOSPI Composite Index)



Source: Yahoo Finance. (2013). *KOSPI Composite Index*. Retrieved Mar 19, 2013, from <http://finance.yahoo.com/q/ta?s=%5EKS11&t=1y&l=on&z=1&q=l&p=m5%2Cv&a=&c=>

Figure 1.5 - Singapore stock market (Straits Times Index)



Source: Yahoo Finance. (2013). *Straits Times Index*. Retrieved Mar 19, 2013, from <http://finance.yahoo.com/echarts?s=%5ESTI+Interactive#symbol=%5Esti;range=my;compare=;indicator=volume;charttype=area;crosshair=on;ohlcvvalues=0;logscale=off;source=undefined;>

Figure 4.1 – Indonesia stock market (JKSE)



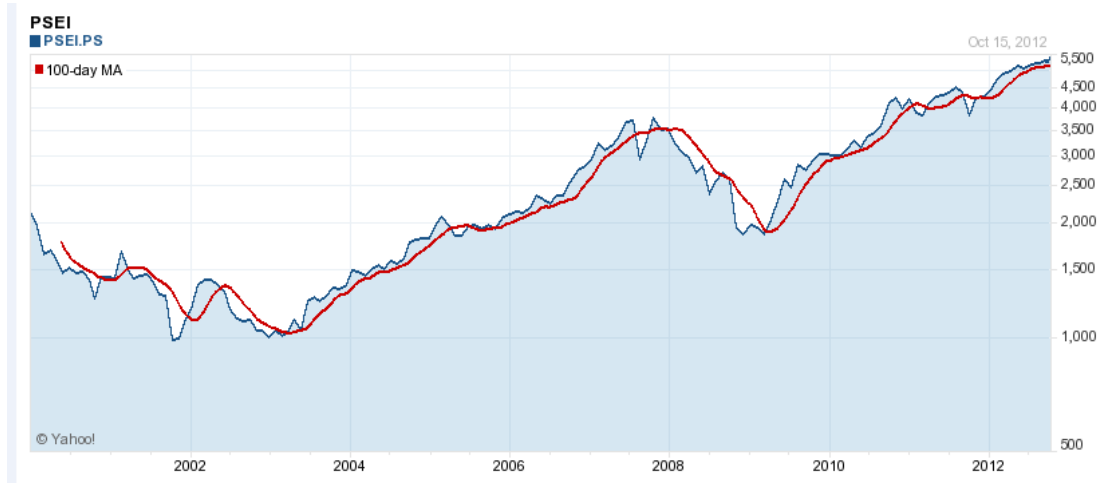
Source: Yahoo Finance. (2013). *Jakarta Composite index*. Retrieved March 22, 2012, from <http://finance.yahoo.com/q/ta?s=%5EJKSE&t=2y&l=on&z=1&q=1&p=v%2Cm5&a=&c=>

Figure 4.2 – Malaysia stock market (KLCI)



Source: Yahoo Finance (2013) *FTSE Bursa Malaysia KLCI*. Retrieved March 20, 2013, from <http://finance.yahoo.com/q/ta?s=%5EKLSE+Basic+Tech.+Analysis&t=my>

Figure 4.3 – Philippines stock market (PSEI)



Source: Yahoo Finance. (2012). PSEI (Philippines). Retrieved March 20, 2013, from <http://finance.yahoo.com/q/ta?s=PSEI.PS+Basic+Tech.+Analysis&t=my>