The Factors Affecting Stock Market Volatility and Contagion: Thailand and South-East Asia Evidence

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by

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Declaration

I, Paramin Khositkulporn, declare that the DBA thesis entitled "*The Factors Affecting Stock Market Volatility and Contagion: Thailand and South-East Asia Evidence*" is no more than 65,000 words in length including quotes and exclusive of tables, figures, appendices, bibliography, references and footnotes. This thesis contains no material that has been submitted previously, in whole or in part, for the award of any other academic degree or diploma. Except where otherwise indicated, this thesis is my own work.

Paramin Khositkulporn Date

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List of Abbreviations

ABX	Asset-backed security index
ADB	Asian Development Bank
ADF	Augmented Dickey-Fuller
AFTA	ASEAN free trade agreement
AIG	American International Group
AMC	Asset management company
APRA	Australian Prudential Regulatory Authority
APT	Arbitrage pricing theory
ARCH	Autoregressive Conditional Heteroscedasticity
ASEAN	Association of South-East Asian Nations
BOT	Bank of Thailand
BP	British Petroleum
BSI	Business sentiment index
CAPM	Capital asset-pricing model
CDO	Collateralised debt obligations
CDS	Credit default swaps
CEA	Chinese economic area
CEE	Central and Eastern European
DCC	Dynamic Conditional Correlation
DJIA	Dow Jones Industrial Average
ECM	Error correction model
EGARCH	Exponential Generalized Autoregressive Conditional Heteroscedasticity
EMU	Economic and Monetary Union
EU	European Union
FDI	Foreign direct investment
FINSIA	Financial Service Institute Australasia
GARCH	Generalised Autoregressive Conditional Heteroscedasticity
GCC	Gulf Cooperation Council
GDP	Gross domestic product
ICSS	Iterated Cumulative Sums of Squares
IGARCH	Integrated Generalised Autoregressive Conditional Heteroscedasticity

IKB	Industrie Kredit Bank
IMF	International Monetary Fund
JKSE	Jakarta Stock Exchange (Indonesia)
KLSE	Kula Lumpur Stock Exchange (Malaysia)
KPSS	Kwiatkowski, Phillips, Schmidt and Shin
LM	Lagrange multiplier
MA	Moving average
MBS	Mortgage-backed securities
MENA	Middle East and North Africa
MGARCH	Multivariate Generalised Autoregressive Conditional Heteroscedasticity
MNC	Multi-national corporations
MSCI	Morgan Stanley Capital International
NASDAQ	National Association of Securities Dealers Automatic Quotation
NPL	Non-performing loans
NYSE	New York Stock Exchange
OECD	Organisation for Economic Co-operation and Development
OLS	Ordinary least square
OPEC	Organisation of Petroleum Exporting Countries
PAD	People's Alliance for Democracy
PP	Phillips-Perron
PPP	People's Power Party
PRC	People's Republic of China
PSE	Philippine Stock Exchange (Philippine)
PTP	Pheu Thai Party
RBSI	Returns of business sentiment of Thailand index
RJKSE	Return of the Jakarta Stock Exchange
RKLSE	Return of the Kula Lumpur Stock Exchange
ROIL	Return of the crude oil price
RPSE	Return of the Philippines Stock Exchange
RSET	Return of the Stock Exchange of Thailand
RSGX	Return of the Stock Exchange of Singapore
RS&P 500	Return of the Standard & Poor's 500
S&P 500	Standard & Poor's 500

SET	Stock exchange of Thailand (Thailand)
SGX	Singapore Stock Exchange (Singapore)
SV	Stochastic volatility
TRT	Thai Rak Thai
UBS	Union Bank of Switzerland
UDD	United Front of Democracy Against Dictatorship
UIH	Uncertain information hypothesis
US	United States
VAR	Vector auto-regression

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Abstract

In recent years, the rapid growth in cross border international portfolio investments reflects the globalization of financial markets. The impetus for globalized financial markets initially comes from financial liberalization and high growth of capital such as superannuation funds, mutual funds, private funds and provident funds.

In South-East Asia, the investment portfolios have been growing continuously after the financial crisis in 1997 because of the revival of Asian financial markets presenting new challenges to practitioners, policy makers and researchers in the finance discipline. Also, there are significant shifts in economics and financial variables underlying emerging markets due to re-alignment of currency values, deregulation and globalisation. This revival can make South-East Asian financial markets more attractive and result in higher growth. As a result, South-East Asian financial markets have become attractive market for foreign investors. However, South-East Asian nations have to counter the adverse impacts of domestic and global economic factors which make their financial markets volatile.

The study of the factors affecting stock market has recognized the relationship between equity price, company performance, economic variables, financial liberalization, market integration, and incidents. However, these studies have not included some of the most significant recent change in the financial market, namely: oil price fluctuation, US subprime crisis, and the changing nature of political uncertainty. The literature on the contagion effects and the transmission of credit crisis has been limited to the developed financial markets in the western economies and those of the emerging markets in particular Thailand and South-East Asia financial markets have largely been left untouched. This is a serious limitation in the literature given the regional and international significance of these emerging markets.

The purpose of the research is to identify the dominant factors affecting stock market volatility in Thailand and measure the contagion effects of stock market volatility in Thailand on other South-East Asian stock markets.

The study adopted quantitative methods in testing the research hypotheses. The multiple regression and GARCH models have been employed to examine the factors affecting Thailand stock market volatility. The correlation coefficient and Granger causality tests were employed to hypothesis testing for contagion in South-East Asia.

The result from the factors affecting Thailand stock market volatility show that the S&P 500 had a major influence on Thailand's stock market, followed by the BSI and oil price. The

study results indicate that the movements of major stock markets and political uncertainty have direct effects on stock market volatility. The effect of movements of oil prices have an indirect effect on firm performance.

The result of the contagion tests on South-East Asian stock markets show that the movement of S&P 500 and oil price can cause contagion effects in the South-East Asia stock markets. These results conclude that stock market volatility and transmission can be caused by the movement of S&P 500 and oil price while the BSI can initially affect only Thailand's stock market volatility. The South-East Asian stock markets have a strong interrelationship in regards to market integration. However, the implementation of economic strategies and adaption of financial systems and regulation in each country can bring the stock market independent.

The outcomes of this study can contribute to helping the domestic and global investors to formulate strategies to minimize their risk. Also, policy administrators may bring the outcomes of this study to inform micro and macro level policy formulation. Moreover, the present study will contribute to filling the gap in knowledge concerning the new release of factors affecting stock market volatility, and regarding the contagion among stock market in the South-East Asia.

Chapter 1: Introduction

1.1 Research Background

In recent years, the rapid growth in cross-border international portfolio investments reflects the globalisation of financial markets. The impetus for globalised financial markets initially comes from financial liberalisation and the high growth of capital funds from developed countries, such as superannuation funds, mutual funds, private funds and provident funds.

Financial liberalisation should be viewed as financial implements that bring about an opportunity for diversification to international business, financial institutions and investors for finding potential returns and minimising their risk in the global financial market. There are four factors that might have caused this trend toward greater global integration. First, major capital markets became more liberalised through the reduction of governmental regulation, the elimination of fixed trading commissions and measures taken by the European Union to integrate their capital markets. Second, investors started to realise the advantages of international portfolio diversification. Third, Multi-National Corporations (MNC) realised the advantages of sourcing new capital internationally. Fourth, new communications and computer technology have facilitated fair and efficient securities trading through order rouging and execution, information dissemination and clearance and settlement (Eun & Resnick 2004). Moreover, Moosa (2003) states that international business firms are referred to the cross-border activity of importing and exporting; therefore, financial implications have become more significant and set up risk in finance and currency across borders. Additionally, the continuous liberalisation of investment and international trade and raid advances in transportation technologies and telecommunications play a key role in stimulating the world economy because of these factors bringing about greater integration for the world economy (Eun & Resnick 2004). Further, advances in computer and telecommunication technologies have contributed to the globalisation of investment by facilitating cross-border transactions (Abugri 2002). As a result, global liberalisation can bring about an interrelationship in financial markets.

The high growth of capital funds should be viewed as financial condition forcing corporate investors, financial institutions and individual investors to find a positive return in global financial markets. For example, investment in the emerging stock markets bring about

high positive returns and opportunities for cross-border investments. More and Monage (2007) reported that Australia's pool of superannuation assets continues to grow rapidly over approximately AUD1 trillion. This rapid growth has been ridden by large annual contributions about AUD77 billion in 2005 to 2006, and by the sustained high return achieved by Australia's superannuation funds. Also, Skully (2007) provided statistics from the Australian Prudential Regulatory Authority (APRA) showing how the first and second largest APRA asset categories are invested, with Australian shares at 32 per cent and international shares at 24.5 per cent in 2006.

The emerging stock market might be considered high risk, but with high potential returns. The total of world equity returns accumulated from January 1988 to December 2006 showed that high returns on major class of world equities from emerging markets was at 14.4 per cent, while the world equity return was 7.3 per cent and Australia's equity return was 11.9 per cent (Warren & Radcliffe 2008). However, the global economic recession has brought about negative returns for the world's equities market, but the returns are expected to improve, particularly for the emerging markets in Asia, which are more attractive and has higher growth potential than the world market in general (Oliver 2008). Hence, high potential returns have enhanced the attractiveness of the emerging markets and have created the best opportunity for cross-border investors for taking positive returns back from the economic recession.

With the rapid growth of capital markets, especially the South-East Asian market, investment portfolios have grown continuously following the financial crisis in 1997, mainly because of the revival of the Asia financial market presenting new challenges to practitioners, policy makers and researchers in the finance discipline (International Finance Corporation 2000). Also, during the aftermath of the 1997 Asian economic crisis, there were shifts in economics and in the financial market underlying emerging market investments due to re-aligned currency values and free trade (Murphy 2009). Additionally, Micklethwait (2009) reports that more than half of the global economic output has been generated from the world's emerging economies, especially in the Asian region.

For Thailand in particular, the statistics from the Stock Exchange of Thailand (SET) (2008) reported that a total market capitalisation of USD 209 billion, market turnover of USD 121.23 billion, market dividend yield of 3.31 per cent and market price to earnings (P/E ratio) of 12.63 per cent. Trading turnover held by local institutional investors at 14.24 per cent, foreign investors at 32.37 per cent, and local investors at 53.39 per cent. The growth index

performance is 20.20 per cent larger than that in the Singaporean, Malaysian and Philippine stock markets. Therefore, the SET is an important player in the financial market of the Association of South-East Asian Nations (ASEAN), South-East Asia and within Thailand. It has an important role in the domestic economy.

However, these countries have to encounter many factors, such as market volatility and contagion transmission. The outcome of volatility and contagion will affect market returns because of loss of investor confidence. A study of Ballie and De Gennaro (1990) states that the high level of volatility leads to reduced confidence of investors. Accurate forecasting of market volatility is vital for efficient financial decisions (Maddala & Rao 1996).

1.2 Definition of Volatility and Contagion

1.2.1 Volatility

Volatility is a statistical measure of the tendency of a security's price to change over time. Daly (1999) argues that volatility has become an important issue for many reasons. First, investors may find it difficult to agree that the explanation for these changes lies in information about fundamental economic factors when asset prices fluctuate sharply over a time differential as short as one, or less. This might lead to an erosion of confidence in the capital market and a reduced flow of capital into equity markets. Second, for individual companies, the volatility of the company is a significant factor in determining the probability of bankruptcy. The higher the volatility for a given capital structure, the higher the probability of default. Third, volatility is a significant factor in determining the bid-ask spread. The higher the volatility of the stock, the wider the spread between the bid and asked prices of the market marker. The volatility of the stock thus affects the liquidity of the market. Fourth, hedging techniques such as portfolio insurance are affected by the volatility level, with the prices of insurance increasing with volatility. Fifth, financial and economic theory introduces the notion that consumers are risk averse. Consequently, increased risk associated with a given economic activity should see a reduced level of participation in that activity, which will have adverse consequences for investment. Finally, over time, increased volatility may induce regulatory suppliers of agencies of capital to force organisations to allocate a larger percentage of available capital to cash-equivalent investments, to the potential detriment of efficient allocation (Daly 1999).

Volatility is calculated as the standard deviation from a certain continuously compounded return over a given period of time; for example, the variation of the price of a security from day to day or even month to month or year to year. If the price of a stock fluctuates widely, the volatility will be high, and, conversely, if the price variation is low, it has low volatility.

The study of stock market volatility has grown as a significant topic of interest in the finance literature because the stock markets around the world have become more integrated and volatile in general. Further, policy makers often use and rely on financial volatility estimation as an indicator of financial market and economy vulnerability. For example, Nasar (1992) asserts that the Federal Reserve in the United States explicitly took into account the stock, bond, currency and commodity volatility in order to establish its monetary policy.

Volatility is often viewed as a negative as if it represents uncertainty and risk. However, volatility can be favourable if the investor buys on the lows and sells on the peaks. In order to understand the statistical properties of volatility, Liu et al. (1999) state that volatility has important practical benefits to traders since it quantifies the risk and is the key to identifying situations in which stocks appear to be underpriced or overpriced. A study of Wyplosz (2001) has reported that the probability of the creation of a boom-bust cycle in an emerging market is high due to financial liberalisation and capital mobility. Due mainly to a lack of adequate financial policy frameworks to deal with advanced financial globalisation as, for example, in the Asian emerging market crisis, market disequilibrium and volatility have continued to be embedded in the functioning of the global financial market. However, volatility can be reduced by financial integration, which creates opportunities for borrowing from and lending to the global market, and enables the diversification of portfolios (Das 2004). Also, Ackert and Smith (1993) argue that volatility in stock prices is due to either a change in the discount rate or new information concerning future cash flows received by shareholders.

1.2.2 Contagion

The term contagion refers to the transmission of shocks across a country or other countries, regions and global correlation by direct or indirect contact. Bekaert, Harvey and Ng (2005) state that contagion is usually defined as a correlation between market excess that is implied by economic fundamentals. Understanding contagions is important for international portfolio diversification and diversifying risk because contagion is generally defined as the spread of market shock from the downside of globalisation. Thus, when contagion prevails, there is a transmittal of massive loss from one market to another market. Das (2004) reports that a crisis in one market can be transmitted to another market if the economy of each market is opened and is integrated with the global economy. In addition, the study of Forbes and Rigobon (2002) found some evidence of contagion from the Asian crisis to developed countries, based on conditional correlation analysis.

Contagion results from certain fundamental links that exist among the financial markets, as described below. Financial links exist when markets are connected with the international financial markets. Just as international institutions diversify their portfolio into many markets, if one market suffers a negative shock, the value of their assets will drop. In order to increase their reserves, international institutions should sell part of their asset holdings in another market that is still unaffected by the initial shock. This propagates the shock to other markets. One example of financial links is the subprime mortgage crisis. The cause of this crisis was generated by financial innovation that enabled international institutions and investors to invest in the United States (US) housing market, as securitisation and mortgage-backed securities (Karnad 2008). These innovations caused the housing market to bubble due to the high level of speculator, overbuilding, over borrowing and predatory lending (Dodd 2007). As housing prices declined, there was a dramatic rise in mortgage delinquencies and foreclosures in the United States. Consequently, this crisis eventually pushed the United States economy into a recession which spread around the world by destabilising other financial markets and further reducing consumption demand, product activity and purchasing power (Shin 2008).

Real links are usually associated with international trade and currency, when countries trade among themselves or compete in the same foreign markets. For example, if one country devalues its currency, it will deteriorate the other country's competitive advantage, the Asian financial crisis being an example of this phenomenon. The crisis started in Thailand with the financial collapse of the Thai currency caused by the Thai government's decision to float its

currency, cutting its peg to the USD after exhaustive efforts to support the burden of foreign debt that was, in part, real estate driven. As the crisis spread, some Asian countries, such as Indonesia and South Korea, devalued their currencies, stock and other asset prices and increased private debt (Hughes & MacDonald 2002).

1.3 Research Questions and Objectives of the Study

In order to fill the identified knowledge gap, the following research questions have been developed.

- Question 1: What are the determinants of the SET volatility?
- Question 2: What are the interrelationships between SET and other stock markets in the region?

The general aims of this study following the research questions are:

- To identify the dominant factors affecting Thailand's stock market volatility.
- To measure the contagion effects of Thailand's stock market volatility on other South-East Asian stock markets.
- To measure the contagion effects of other South-East Asian stock markets on Thailand's stock market.

The research questions will be answered by developing a multiple regression and generalised autoregressive conditional heteroskedastic (GARCH) model to test the factors affecting stock market volatility and a consolidation of knowledge within the contagion area by measuring the correlation coefficient and Granger causality model. The method is discussed in detail in Chapter 3 of the thesis.

1.4 Hypotheses

Drawing on the above discussion of the literature, the following hypotheses will be tested in this study:

a. World oil price fluctuation is an external factor. A change in oil prices can affect the production cost, thus affecting the company's performance and generating inflation in the

world economy. These effects bring about the Stock Exchange of Thailand index retunes (RSET) volatility. The relevant hypothesis is:

Hypothesis 1: World crude oil price returns (ROIL) have a significant effect on the RSET index.

b. The country risk is an internal factor based on political uncertainty and measured by the return of the Business Sentiment of Thailand (RBSI) index, which represents the confidence of the investor wishing to invest in Thailand. The relevant hypothesis is:

Hypothesis 2: The RBSI has a significant effect on the RSET index.

c. The movement of the return of the Standard & Poor's (S&P) 500 index resulting from the US subprime crisis has a significant effect on the RSET index volatility. The relevant hypothesis is:

Hypothesis 3: The movement of S&P 500 stock market index returns has a significant effect on the RSET index.

d. Contagion effect

The following hypotheses will test the relationship between the SET index and the other stock market returns in the region. The relevant hypotheses are:

Hypothesis 4: There is a relationship between the RSET index and the Singapore Stock Exchange index returns (RSGX).

Hypothesis 5: There is a relationship between the RSET index and the Kula Lumpur Stock Exchange index returns (RKLSE).

Hypothesis 6: There is a relationship between the RSET index and the Philippine Stock Exchange index returns (RPSE).

Hypothesis 7: There is a relationship between the RSET index and the Jakarta Stock Exchange index return (RJKSE).

1.5 Statement of Significance

This study extends the analysis of factors affecting stock market volatility through the analysis of multiple regression and GARCH structures, and also the contagion effect through the analysis of a correlation coefficient test and a Granger causality test within the South-East Asian stock market. The outcome of this study will be useful in informing investors and policy makers on their decisions relating to the SET in particular and other developing stock markets in general.

The significance of the proposed study is:

1. Understanding and accurate measurement of stock market volatility with the significance of the influential factors providing a useful tool to maximise benefit, because it is vital for investors to maintain confidence and forecast price movement. Domestic and foreign investors will be able to formulate strategies to minimise their risk by using portfolio diversification, risk management and hedging.
2. To offer benefits to Thai policy administrators, because the results of this project will inform micro and macro level policy formulation.
3. Identifying, measuring and understanding the factors of volatility will inform the countries of the region in the articulation of the policies to minimise the effect of contagion.

1.6 Contribution of the Research to Knowledge

The reported studies of Abugri (2002), Caner and Onder (2005), and Granger, Huang and Yang (2000) have identified that inflation rate, interest rate, exchange rate, dividend yield and money supply are the notable factors affecting market volatility. The recent events in the developed world has shown that bad financial policies and management, such as the subprime mortgage crisis of the US, rapidly rising oil prices and country risk, such as political uncertainty, significantly affect the financial markets in the developing world. A study of the SET (2008) states that country risk usually measured as uncertain political conditions, world oil prices fluctuation and US subprime mortgage crisis were the key factors affecting the Thai capital market in 2007. Further, other studies, such as those of Caner and Onder (2005) and

Aggarwal, Inclan and Leal (1999), have shown that when the stock markets have high volatility, it can lead to financial crisis.

The present study will fill the gap in the knowledge concerning how the volatility of Thailand's stock market has been affected by the new release of factors affecting the stock market after its recovery from financial crisis in 1997. This will be achieved by testing the effect of oil price fluctuation, the US subprime mortgage crisis and uncertain political conditions on Thailand's stock market.

Additionally, the present study will also contribute to filling the gap in knowledge regarding the contagion among stock markets in developing countries, in particular the South-East Asian financial markets. Contagion effects have been studied in relation to the currency crisis in Asia in 1997. It has been reported that the shock transmitted by the financial crisis has resulted in a higher level of volatility (Wilson & Zurbruegg 2004; Arestis, Caporale, Cipollini & Spagnolo 2005; Hughes & MacDonald 2002; Eun & Resnick 2004). Also, the transmission of the credit crisis in the US affected the global economy and financial market (Kato 2009; Shin 2008; Ostrup, Oxelheim & Wihlborg 2009; Longstaff 2010; Yilmaz 2009; Lee & Park 2009). However, no studies have tested the level of contagion and the spread of contagion from other events such as the US subprime mortgage crisis and political instabilities in Thailand to other stock markets in South-East Asia. The premise is that the intensity and length of these effects can vary between the developed and the developing world.

1.7 Research Methodology

The study uses time series data covering 1998 to 2007. The economic factors were collected from the Bank of Thailand, the International Monetary Funds (IMF), and the United Nations Research Department. All equity market indexes were obtained from the SET and Morgan Stanley Capital International (MSCI). The research was conducted in two stages: the first stage was the factors affecting stock market volatility and the second stage was contagion effect. Chapter 3 will describe the steps and methods performed in each stage in detail.

Regarding the factors effecting stock market volatility, this stage involves the multiple regression model contributing to the stock market, energy prices and economic data developed by Basher and Sadorsky (2006), Nandha and Faff (2008) and El-Sharif, Brown, Burton, Nixon and Russell (2005). The simplest multiple regression models are three-variable

regression, which are defined as the logarithm return for the SET index, oil prices, the S&P index and the BSI index.

The GARCH model was provided to measure the volatility in the financial market that was employed by the previous literature of Bollerslev (1986), Taylor (1986), Malik and Ewing (2009), Worthington and Higgs (2001), Hull (2006) and Bautista (2003). This study employed the GARCH model to examine the volatility dynamics of financial time series because it fits many data series and capture long lags in the shocks with only a few parameters (Hill, Griffiths & Lim 2011).

Regarding the contagion effect, this stage involves the correlation coefficient test. This test measures the relationship between two variables which are defined as the logarithm returns for Thailand and South-East Asia stock markets. There are many previous studies using this model to examine their results such as the studies of Forbes and Rigobon (2001) and (2002), Arestis, Caporale, Cipollini and Spagnolo (2005), Corsetti, Pericoli and Sbracia (2005), Wilson and Zurbruegg (2004), Dungey, Fry, Gonzalez-Hermosillo and Martin (2005), and Boschi (2007). The purpose of this study was to find how the SET index variable responded to other index variables. To test for contagion is a simple process, with the correlation coefficient for the high-volatility period compared with the correlation coefficient for lower volatility period. If the correlation coefficient for the high-volatility period is larger than lower volatility, it indicates contagion. If the correlation coefficient for the high-volatility period is less than lower volatility, it indicates non contagion.

The Granger causality test was a distinguished model to explain the contagion effect between two variables. The structure of Granger causality provides information about the ability of one variable or a group of variable to predict the other variables. This study extends the previous studies of Yang (2002), Hon, Strauss and Yong (2004), Nikkinen, Saleem and Martikainen (2010) and Egert and Kocenda (2007a). They employed the Granger causality approach to test the contagion between two stock markets. The outcome of this test is indicates whether Thailand’s stock market is significantly independent from or dependent on other stock markets.

1.8 Thesis Structure

This thesis is organised into five chapters. Chapter 1 introduced the topic under investigation and briefly discussed the methodology used. Chapter 2 presents the literature review on the factors affecting the volatility of the stock market and contagion, and critically reviews the studies conducted in the previous literature relating to the factors of volatility and their relationships with the financial market. Chapter 3 discusses the conceptual framework related to the factors that affect Thailand's stock market volatility and contagion among the region, followed by a discussion of the research questions, development of the hypotheses, data analysis and the methodology used. Chapter 4 presents the empirical results and discussion, and Chapter 5 presents a summary of the thesis, its conclusions, policy recommendations, study limitations and suggestions for extending the study.

Chapter 2: Literature Review

2.1 Introduction

The purpose of this chapter is to review the literature related to the factors affecting market volatility and contagion effects. This includes a discussion of the significance of the South-East Asian stock market, dominant factors affecting stock market volatility and the contagion effect of stock market volatility. This review is organised into six sections. The first section presents an overview of the stock markets in South-East Asia with reference to their respective economies. This is followed by a discussion of the factors affecting market volatility, which will identify internal and external factors in order to understand their contribution to volatility. The next section presents an overview of the volatility model used in this thesis. These are followed by an overview of the contagion model used to measure the contagion effect. The chapter concludes with a section discussing the problems and limitations of previous research and the current gaps in knowledge.

2.2 Stock Markets and Economic Performance in South-East Asia

The July 1997 crisis of the financial markets in Asia was primarily triggered by the collapse of the Thai currency. This in turn triggered a contagion effect throughout the South-East Asian region and in the global financial market in general (Fatemi 2006). Following the recovery from the crisis, the South-East Asian economies generally performed better incorporating others, with integration of market groups, infrastructure development and foreign direct investment.

ASEAN includes Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Vietnam. Bhattacharyay (2009) has reported that ASEAN is considered to be one of the world's fastest growing and significant economic regions, because the ASEAN free trade agreement (AFTA) has been ushered in to integrate the ASEAN economy into a single market.

Infrastructure development by foreign direct investment (FDI) and monetary and fiscal expansion play a significant role in supporting the South-East Asian economies. Ying (2008) states that ASEAN is a highly competitive region, as the blueprint envisions pass into the international economy. Also, he indicates that the cross-border infrastructure development,

such as transport, energy, telecommunications and public utilities, have had a significant effect on the economic advancement of the region. In addition, Ghosh and De (2005) argue that government spending on infrastructure has had a significantly positive effect on long-run economic growth. Nataraj (2007) supports the view that infrastructure developments have made a significant contribution to economic development and the enhancement of business and trade activity, because they reflects investor confidence, cost advantages and market competitiveness.

FDI has been identified as a significant factor that has boosted ASEAN economic growth rapidly. A study of Vijitnopparat (2008) argues that FDI is the factor that pushes economic growth and support towards other activities, such as human capital development. Doner (2012) states that the benefit of FDI is to support local economic, increase labour and technology development. Further, Zhang (2001) states that economic growth could result in further developments in the capital market, trade and human capital. In addition, the Asian Development Bank reported in 2010 that monetary and fiscal expansions by government among the emerging economies in South-East Asia are the key to fostering their macroeconomic stability and mitigating the negative effects of global financial crises. Consequently, it is now clearly concluded that market integration, FDI, infrastructure development, monetary and fiscal expansions have been the primary contributors to ASEAN economic growth since recovery from the Asian financial crisis.

Table 2.1: Index Performance of Major and South-East Asia Stock Markets 2008

	Singapore	Malaysia	Korea	Taiwan	Thailand	Philippines	Indonesia
Market Capitalisation/GDP	281	152	92	163	65	53	37

Source: GDP from Bloomberg and Market Capitalisation from World Federation of Exchange

Outlook for strong performance of the South-East Asian economy has led to accelerated capital inflows, as shown in Table 2.1. The proportion of market capitalisation to gross domestic product (GDP) has reached very high levels for the ASEAN countries (SET 2008).

The Asian Development Bank (2010) reports that the GDP growth in South-East Asia has declined from 6.5 per cent in 2007 to 4.3 per cent in 2008, then continued to decline to 1.2 per cent in 2009, and increased modestly to 5.1 per cent and 5.3 per cent in 2010 and 2011, while the GDP growth rate in Asian developed economies, such as Singapore, dropped dramatically from 8.2 per cent in 2007 to -2.0 per cent in 2009, and increased to 6.3 per cent in 2010. In developing countries in Asia, the GDP growth rate was 9.6 per cent in 2007, then

reduced to 5.2 per cent in 2009 and increased to 7.5 per cent in 2010 and 7.3 per cent in 2011 (see Table 2.2). A study of McCauley (2008) reports the proportion of equity holding by foreign investors, ending in 2003; Indonesian equity was USD 12,597 m or 6.0 per cent of the GDP, while the Malaysian equity was USD 14,544 m or 14.0 per cent of the GDP. In contrast, Philippines equity was USD 3,027 m or 3.8 per cent of the GDP, but Singaporean equity was USD 42,857 m or 46.90 per cent of the GDP. However, Thai equity was USD 21,291 m or 14.9 per cent of the GDP.

Table 2.2: Growth Rate of Asia's GDP Percentages Change

	2007	**2008**	**2009**	**2010**	**2011**
Singapore	8.2	1.4	-2	6.3	5
China	13	9.6	8.7	9.6	9.1
India	9.2	6.7	7.2	8.2	8.7
ASEAN-5					
Indonesia	6.3	6	4.5	5.5	6
Malaysia	6.2	4.6	-1.7	5.3	5
Philippines	7.1	3.8	0.9	3.8	4.6
Thailand	4.9	2.5	-2.3	4	4.5
Vietnam	8.5	6.2	5.3	6.5	6.8
Developing Asia	7.4	7.3	6.6	6.2	6.4

Source: Asian Development Outlook 2010

The economic growth in South-East Asia brings about financial services development. Based on Thailand's experience after recovery from the Asian financial crisis, Vijitnopparat (2008) reported that financial services like financial institutions and financial products in Thailand had improved after it released an active financial liberalisation policy. As a result, by the end of 2005 Thailand's equity market increased to 43 per cent. Based on the Malaysian experience, Ang and McKibbin (2007) confirm that economic growth can cause the financial services development. In Table 2.3, it can be seen that the ASEAN-5 has grown from 1.7 per cent in 2009 to 6.7 per cent in 2010, and slightly declined to 5.5 per cent and 5.7 per cent in 2011 and 2012. This growth was greater than other advanced economies. These changes were caused by the changes in investor expectations and risk appetite, which can rapidly inflate the financial asset prices across the region with both direct and indirect investment.

Table 2.3: Overview of the World Economic Outlook Projections (Percentage Change)

	2009	2010	2011	2012
			Projections	
World Output	-0.6	5.0	4.4	4.5
Advanced Economies	-3.4	3.0	2.5	2.5
Industrial Asia	-0.9	8.2	4.7	4.3
Emerging and Developing Economies	2.6	7.1	6.5	6.5
Developing Asia	7.0	9.3	8.4	8.4
China	9.2	10.3	9.6	9.5
India	5.7	9.7	8.4	8.0
ASEAN-5	1.7	6.7	5.5	5.7

Sources: International Monetary Fund and World Economic Outlook database

The Financial Services Institute of Australasia (2006) reports that the majority of South-East Asian stock market members are from Thailand, Malaysia, Indonesia, Singapore and the Philippines, which increased their performance after experiencing a decline during the financial crisis in 1997 with market capitalisation, share turnover velocity, P/E ratio and market yield, as shown in Table 2.4.

Table 2.4: South-East Asia Market Capitalisation, Share Turnover Velocity, P/E Ratio and Market Yield

	Thailand	Indonesia	Malaysia	Philippines	Singapore
Market capitalisation/billion USD	209	220	313	91	494
% of share turnover velocity	69	69	53	32	78
% of market yield	3.71	2.38	4.71	4.32	4.27
P/E ratio/times	16.6	16.9	13.7	12.1	9.2

Source: World Federation of Exchange as of 29 February 2008 and Bloomberg as of 31 March 2008

The South-East Asian stock market has become an attractive proposition to global investors in recent years due to their high rates of growth. Meanwhile, the performances of the developed stock markets have deteriorated. The index performances of the developed and the South-East Asian stock market are set out in Table 2.5.

Table 2.5: Index Performance of Major and South-East Asia Stock Markets 2008

	Dow Jones	S&P 500	NASDAQ	Japan	England	Australia	Singapore	Thailand	Malaysia	Indonesia	Philippines
% Growth	-1.6	-6.7	-5.6	-27.3	-8.3	-4.2	3	20.2	13.8	35.5	0.1

Source: Bloomberg as of 31 March 2008

From the above analysis, it could be concluded that, due mainly to rapid economic growth and improvement of financial services, the South-East Asian stock markets have become very attractive for global investment. Richards (2003) found that the buoyancy of the Asian equity markets in Thailand, Korea and Taiwan have significantly benefited through non-resident purchasing. The Asian Development Bank (2009) reported that the South-East Asian equity markets have improved their performance, and this has attracted foreign portfolio investment in the emerging East Asia due to improvements in their fundamentals, improvements in their economies and financial services.

However, these improvements and developments did not bring about improving of the stability of these markets. There is still high volatility because of the obstruction of oil price fluctuation, the global economic recession and internal affairs in each country. The Asian Development Bank (2009) has identified the following factors as the major contributors to their persistent market volatility: (a) prolonged recession and weaker than expected recovery in developed countries, (b) unintended consequences of economic stimulus or premature policy tightening, (c) falling inflations becoming deflation and (d) non-economic events with low probabilities, but potentially large effects. In addition, the statistics from the World Federation of Exchanges (2009) informs us that the volatility in the South-East Asian equity market has been high and growth rates have dropped sharply. In comparison, the total value of equity trading of Bursa Malaysia has declined by 37.2 per cent, the Indonesia Stock Exchange has dropped by 44.8 per cent, the PSE has dropped by 10.8 per cent, the Singapore Exchange was down by about 31.6 per cent and the SET has fallen by 29.4 per cent during January 2008 to June 2009.

2.3 Volatility Definition and Models

Volatility has been studied in many areas; for example, exchange rate volatility, oil price volatility and community price volatility. Volatility is frequently measured by stand deviation, which refers to the change of the value of financial asset on a daily, weekly or monthly basis. Volatility affecting the stock market is caused by several factors. Many studies have shown that domestic economic factors, such as the proxy of monetary, fiscal policies (exchange rate, interest rate and inflation) and economic indicators (industrial production, money supply, real activity and CPI) and internal factors, such as oil prices, the world index, the US Treasury bill

and the trade-weighted world exchange rate, have had a collective cumulative effect on returns volatility in the stock market.

In the numerous financial studies, measuring stock market volatility has been used as two of the volatility models in different approaches. The first is the stochastic volatility (SV) model and the second is autoregressive conditional heteroskedastic (ARCH) model. Poon and Granger (2003) indicate in forecasting volatility in financial markets that times series volatility forecasting models can be explained by standard deviations, the SV model and ARCH and GARCH models. Empirical findings from their study conclude that GARCH is a more parsimonious model than ARCH, and GARCH (1, 1) is the most popular model for examining financial time series.

Similarly, Hansen and Lunde (2005) find no evidence that a GARCH (1, 1) is outperformed by more sophisticated models in their analysis of the exchange rate. Also, a study of Taylor (2008) concluded that the great advantage of the ARCH model, compared with the SV model, is that there is only one random component per unit time and, thus, the availability of maximum likelihood estimation is easy to calculate as the product of conditional densities. As a result, the likelihood estimation can explain why ARCH models are more accepted than SV models in financial research literature.

In financial literature, a measure of volatility commonly used is provided by the class of ARCH models. Using daily data, Aggarwal, Inclan and Leal (1999) employed the methodology used in their study for detecting points of sudden changes in the variance of an observed time series based on the Iterated Cumulative Sums of Squares (ICSS) and the shifting in variance of an observed time series as the modified ARCH and GARCH model. The data cover the 10 year period from May 1985 to April 1995, and consist of daily closing values for S&P 500 (US), the Nikkei Average (Japan), FT100 (UK), DAX (Germany), Hang Seng (Hong Kong), the Singapore Straits Industrial (Singapore), Bolsa Indice General (Argentina), the BOVESPA Sao Paulo Stock Exchange Index (Brazil), the IGPA Index (Chile), the Bombay Sensitivity Index (India), the Seoul Composite Index (Korea), the Kuala Lumpur Composite Index (Malaysia), the IPC Index (Mexico), the Manola Composite Index (Philippines), the Taipei Weighted Price Index (Mexico) and the Bangkok SET index (Thailand). The outcome of their study was that the specific political, social, economic and local currency was the cause of large changes in volatility in emerging stock markets in 1985 to 1995. Also, Latin American stock markets exhibited higher levels of volatility than other

emerging stock markets during that period of data collection, because of the effect of the Mexican peso and hyperinflation in Latin America.

Hammoudeh and Li (2008) examined stock market sensitivity to worldwide regional and local events by using the GARCH model; the results show that volatility is very high, even compared with other emerging markets. Also, they found that in the Arab Gulf stock markets, as a consequence of international events, most of the volatility emergency changes. This suggests that the Gulf Cooperation Council (GCC) is more sensitive to international factors than local factors.

Asteriou and Price (2001) estimated the model of GARCH (1, 1) for GDP growth with political uncertainty proxies. The final result clearly shows that political instability has two identifiable effects. First, some measures affected the variance of GDP growth and, second, it directly affected itself. Christiansen (2007) found that a volatility spillover from the US and aggregate European bond markets affected individual European bond markets by using a GARCH volatility spillover model. The results showed that European volatility spillover effects were rather strong, while the effect of US volatility spillovers was weak. He suggests that European volatility spillover effects are strong because the bond markets of Economic and Monetary Union (EMU) countries became more integrated after the introduction of the Euro.

Worthington and Higgs (2001) examined the transmission of equity returns and volatility between the Asian developed stock market and the Asian emerging stock market by adopting a multivariate GARCH model to identify the source and magnitude of spillover. Their results indicate that domestic conditions were important in changing the level of volatility in the Asian emerging market, whereas Asian developed stock markets derive relatively more of their volatility persistence from outside the domestic market. Moreover, to scrutinise stock returns behaviour during financial crises for an emerging market from 1992 to 2009, using GARCH models, the results show that crises in general do not have a positive effect on stock returns for all parts, with the banking part being the most affected. The effect of the 2008 to 2009 crash is the most severe, with high volatilities and the largest drop (Al-Rjoub & Azzam 2012).

The financial crisis affects the relationship between output growth (real economy) and stock prices (stock markets), using bivariate GARCH (1, 1) model and monthly data for three industrialised nations and three Asian nations. The results show that the stock market volatility importantly and positively affects the output growth volatility. For the crisis

affecting East Asian nations, there were more important and stronger spillovers of volatility from the stock markets to growth in the post-crisis period compared with the pre-crisis period (Caporale & Spagnolo 2003). The study of Todorov (2012) investigated potential time-variability in the effect of US stock market returns on the returns of 21 frontier markets during the period between 1 December 2005 and 15 January 2010. The analysis shows that time-varying spillovers are statistically important for a majority of these markets in regards to the exposure of these markets to US economic shocks.

Malik and Ewing (2009) employed GARCH models to examine the mean and conditional variance between oil prices and five weekly major US stock market sector returns: financials, industrials, consumer services, health care and technology, from 1 January 1992 to 30 April 2008. The findings show that there was a different and significant transmission of shocks and volatility between variables. They concluded that oil prices, financials, industrials, consumer services and the health care and technology sector were directly affected by its own news and volatility, that the volatility of technology returns and industrials returns were indirectly affected by shocks and volatility in oil returns, that the volatility of consumer services and the health- care sectors were directly and indirectly affected by volatility in oil returns and that there was no evidence of direct or indirect effect of oil return volatility on the financial sector. Thus, the US financial sector is insulated from oil market shocks.

Asteriou and Hall (2011) state that recent developments in financial econometrics have led to the use of models and techniques, which can support the investor's attitude in the direction of both expected return and risk (uncertainty). At the higher volatility, the expected return may be greater compared with others, whereas lower volatility generates lower risk. Illustrations of ARCH/GARCH family of models are required as the models, which are capable of dealing with the volatility (variance) of the series. Demers and Vega (2008) employed an EGARCH model to measure the volatility of the stock market when receiving news, and found that negative shocks (bad news) had a larger effect on volatility than positive shocks (good news).

Worthington, Kay-Spratley and Higgs (2005) examined the transmission of spot electricity prices and price volatility among five Australian electricity markets; namely, New South Wales, Queensland, South Australia, the Snowy Mountains Hydroelectric Scheme and Victoria. The multivariate generalised autoregressive conditional heteroskedasticity (MGARCH) model was employed to identify the source and magnitude of the spillover from 1998 to 2001. The results indicate that only two of five markets displayed a significant mean

spillover. They concluded that a separate region spot market can prevent shocks or innovations, which exert an influence on price volatility more than full integration of the market.

Further, Ndako (2012) applied the GARCH family to discover market volatility in South Africa; the result shows that there is not the estimated break coinciding with the official liberalisation dates. Also, the analysis shows that after talking structural breaks into account, volatility decreased following financial liberalisation. Moreover, applying official liberalisation dates, the results indicate that on the stock markets, the effect of financial liberalisation is statistically important and not positive.

Worthington and Higgs (2004) investigated the transmission of equity return and volatility in three developed markets (Hong Kong, Japan and Singapore) and six emerging markets (Indonesia, Korea, Malaysia, the Philippines, Taiwan and Thailand). A MGARCH model was employed to identify the magnitude and source of the spillover. The results showed that the Thai stock market was influenced by the lagged return of the stock market in Hong Kong, Singapore, Indonesia, Korea and the Philippines, while the stock markets in Taiwan and Singapore were not influenced by the return of other stock markets in the samples. The results indicate that cross volatility spillovers are generally lower than own volatility spillovers for all market, especially for the emerging stock market.

Caner and Onder (2005) used monthly data from 17 emerging stock markets and two developed stock markets during the period of 1990 to 2000 to explore apparent sources of volatility. Dividend yield, exchange rate, real interest rate, inflation rate and the movement of the world market index were used as variables. In order to estimate the sources of volatility in stock return, the VAR model was employed as the methodology of their study to identify the sources. The VAR model has been separated into three models. The first model includes five variables: stock market return, yield on three month treasury bill, dividend yield, inflation rate and exchange rate. The second model includes all variables from the first model in addition to return on the world market index. The third model is the second model without the exchange rate. Their results show that dividend yield is the main factor in market return volatility in developed stock markets, such as the US, Hong Kong and Japan, while world markets insignificantly affect the volatility of emerging markets. The inflation rate is a significant factor on stock market volatility in Brazil, Chile and Malaysia. The exchange rate was a highly significant factor of volatility during the Asian financial crisis in Thailand, Korea and Indonesia.

2.4 Factors Affecting Stock Market Volatility

The existing literature has generally found that internal and external factors, such as dividend yield, exchange rate, inflation, interest rate, industrial production, the MSCI world index, financial liberalisation and market integration have had a collective cumulative effect on volatility in the stock market.

Caner and Onder (2005) have outlined the factors that explain the sources of volatility in stock return. Dividend yield, exchange rate, interest rate, inflation rate and the movement of the world market index have been identified as the more significant variables that affect market volatility. The study included data from 1990 to 2000 from the following 19 stock markets: US and Japan as developed stock markets, Hong Kong and Singapore as developed emerging stock markets and Argentina, Brazil, Chile, Mexico, the Czech Republic, Hungary, Poland, Russia, Turkey, Indonesia, Korea, Malaysia, the Philippines, Taiwan and Thailand as emerging stock markets. The results indicate that dividend yield is a significant source of stock return volatility with the highest volatility in all markets: the developed, the developed emerging and the emerging stock markets. Similar results were found by Kay and Putten (2007), who state that stock price volatility is related to company performance, which is shown as a dividend payoff. However, other factors, such as interest rate, exchange rate and inflation rate, are influenced by fiscal, monetary and trade policies that affect volatility in emerging stock markets.

Abugri (2002) studied the relationship between macroeconomic factors and the return and volatility characteristics of the stock market in the four Latin American stock markets of Brazil, Mexico, Argentina and Chile. He concluded that exchange rate, interest rate, industrial production and money supply in each country had a significant effect on explaining the relationship between stock return and stock market volatility. Further, Bilson, Brailsford and Hooper (2002) examined local macroeconomic variables and found that they have significant explanatory power over equity returns in the emerging markets.

Financial liberalisation and market integration significantly contribute to reducing stock market volatility. For example, the assembly of countries into an economic unit, as in the European Union (EU), can bring about stock market efficiency. Hardouvelis, Malliaropulos and Priestley (2006) have reported that the integration of the stock market following the launching of the single currency in January 1999 ameliorated the European equity market with improved transparency, standardised pricing in the financial market and reduced

investors information and transaction costs. Moreover, a single currency reduced risks in the overall exchange rate exposure of European equities. As a result of their study, the countries joining the Economic and Monetary Union (EMU) have achieved a degree of stock integration and expected return higher than the countries that are not members of the EU.

Blecker (2005) states that capital market liberalisation can be viewed as a more efficient temporal allocation of resources: international capital can be moved over time, resulting in investors, lenders and borrowers being able to increase their future appetite consumption by trading on the financial market. Cipriani and Kaminsky (2007) concluded that the volatility in international financial market can be described in part by the behaviour of financial fundamentals and macroeconomics, based on their finding, suggesting that international financial integration make financial markets more orderly.

In contrast, financial liberalisation and market integration can cause financial market volatility and bring about negative return. A study of Granger, Huang and Yang (2000) found that the negative effect on and market volatility in the stock exchange in 1997 in Thailand, South Korea and Indonesia was caused by an exchange rate collapse. Financial liberalisation that began in the late 1980s affected the currency policy in each stock market differently. This effect has been considered to be the cause of financial currency systems changing from a fixed to a floating system and continues to affect other financial markets.

In addition, a study by Morrissey and Udomkerdmongkol (2008) reported that the effect of local currency devaluation represents the negative measure of foreign investor confidence, which might restructure investment plans. Consequently, the currency of South Korea, Thailand and Indonesia lost half of its value against the US dollar, and this led to the stock market having high volatility and collapsing (Islam and Watanapachaikul 2005). Stiglitz (2002) states that rising capital account liberalisation has amplified the volatility of capital flows, causing a high degree of fluctuations of equity prices and exchange rates and posing serious impediments to domestic financial market stabilisation.

Moreover, emerging stock market volatility is sensitive to certain local and global events. The purpose of Aggarwal, Inclan and Leal's study (1999) was to identify the shifts in volatility and to investigate whether global or local events (social, political and economic) are the major cause of shifts in emerging market volatility. The outcome of their study indicates that the major change in volatility is seemingly related to the type of event, economy and the specific political and social situation in each country. When the values of these factors occur at a high level, this could result in a stock market crash, such as the Mexican peso crisis,

periods of hyperinflation in Latin America, the Marco-Aquino conflict in the Philippines and the stock market scandal in India.

Hence, it can be concluded that company performance, economic variables, financial liberalisation, market integration and economic events are the determining factors of stock market volatility. In the recent past, the oil price fluctuation, the US subprime crisis and political uncertain conditions have been identified as additional factors affecting equity market volatility.

2.4.1 Oil Prices

Oil is a vital source of energy, an essential transport fuel and an irreplaceable raw material in many industries. Further, it has become the world's most important international trading item. The surge in oil prices has affected microeconomic variables, such as production costs, investor decisions and industry growth and decline, and has also affected macroeconomic variables, such as inflation, levels of national incomes, aggregate spending and the balance of payments of different countries. The enormous sums involved affect levels of international debt, the functioning of the world's financial system and countries' rate of economic growth (Cleaver 2007).

There are three main causes affecting oil price fluctuation: oil demand, oil supply and speculation. A study of Brevik and Kind (2004) has asserted that the rise of energy prices is determined mainly by demand and supply and to lesser but significant extent by the movement of speculators.

Oil demand: Over the whole of 2008, the average prices for petroleum energy increased significantly, with an average USD 97.26 per barrel in 2008 and peaking above USD 114.0 per barrel in early July, rising for a seventh consecutive year, a first in the nearly 150 year history of the oil industry. This rise in oil prices resulted in a record level inflation in certain economies. Oil prices exhibited high volatility again due to the financial crisis in September 2008 triggering a sharp recession (BP Statistical Review of World Energy, June 2009).

The Asian Development Bank (2004) reported that over the previous two years, global oil demand grew more than expected due to a strengthening of the economic recovery in the US, as well as fast-growing economies in Asian countries, especially China and India. This global recovery and high-growth economy resulted in a rise in oil consumption and more than

doubled the average increase in annual demand between 2000 and 2002. Further, Claver (2007) states that total oil demand has increased sharply since the 1990s from 65.5 million barrels per day to 80.8 million barrels per day in 2004, due to high growth in consumption from China, India and the Organisation for Economic Co-operation and Development (OECD) countries. The BP Statistical Review of World Energy (June 2009) reported that China accounted for nearly three-quarters of global consumption growth in 2008. Oil prices exhibited low volatility for a few countries, such as Australia and New Zealand, because of their strong local currency.

In addition, the rising oil prices in terms of US dollars have been partially offset by an appreciation of the domestic currency. In contrast, low-income countries in Asia, such as Vietnam, Thailand and the Philippines, have been affected by high consumer price and inflation pressure, translating into effective monetary and fiscal policy against inflation (IMF 2008). Kilian, Rebucci and Spatafora (2007) studied the cumulative effects of demand and supply shocks in the global crude oil market and their data clearly show that global aggregate demand shocks have played a significant role in recent years.

Oil supply: Agreements and cartels such as the Organisation of Petroleum Exporting Countries (OPEC), which was established during the 1960s, have attempted to control energy supply and prices by manipulating stocks and productions. The diversity of stakeholders, such as oil companies, speculators and refineries, has brought additional dynamics into the market. Additionally, world events, such as wars, revolutions and embargoes, can generate a frequent effect on crude oil prices; for instance, the war between Iraq and Iran increased oil prices from USD 14 in 1978 to USD 35 per barrel in 1981, and after the Asian financial crisis, oil prices significantly dropped to USD 10 per barrel. Based on these observations, it can be concluded that the price of crude oil varies widely and erratically (Alvarez-Ramirez, Cisneros, Ibarra-Valdez and Soriano 2002). Moreover, Krichene (2006) indicates that rigid energy supply may generate high price volatilities and producers' market power. The relationship between oil price and interest rate has two sides during a supply shock; oil price increases bring about rises in interest rates, whereas oil price decreases result in interest rates falling during a demand shock.

Speculation: Oil price increase seems to be a result of basic economic forces, such as the high demand for oil appetites in China and India, the depreciation of the US dollar, the rapid

growth of world consumption, real supply limitations and the risk of supply disruption, especially in the Middle East (Eckaus 2008). However, Eckaus found that oil prices not only rely on demand and supply but also on speculation and hedging that result in irrational movements in oil prices. Oil stock can be distinguished by three categories: (1) stocks held by sovereign states for strategic and military purposes, (2) stocks held in refineries, for oil production and at distribution sites and for transportation vehicles and (3) stocks held for speculative reasons (Brevik & Kind 2004). Krichene (2006) states that when oil prices have high volatility, speculative demand will increase for futures contracts and will contributes to higher volatility and volatility clustering.

Federico, Daniel and Bingham (2001) have suggested that petroleum price volatility is an important economic variable affecting both consumers in terms of disposable income and governments in terms of fiscal revenues. These authors illustrate that financial hedging instruments, such as futures and options, can be used to counter this volatility. In terms of futures contracts, oil purchasers can lock in a future price and avoid having to bear risk due to short-term fluctuations in the spot market. With reference to call options, these options help investors buy options to purchase oil at a strike price; these options can guarantee a maximum price for investors. This also allows investors to receive full benefits if oil spot prices are below the exercise price.

2.4.2 Effect of Oil Price on the Economy

The history of oil price hikes has shocked the global economy many times; for example, in 1973, 1979, 1990, 2004 and 2007. Oil price hikes can have different effects on the economy. The direct effect of oil price hikes depends on oil import dependency, use efficiency and the structure of the GDP in each country. The indirect effect would depend on export demand and the world's consumption, which might be quarantined from oil price hikes (Asian Development Bank 2004).

The BP Statistical Review of World Energy (2009) reported that, since July 2008, oil prices rose to a peak above USD 114.0 per barrel, which is the highest in 150 years of oil industry. As a result, the global economy faced recession and equity market became very volatile. The IMF (2009) presented the idea that both oil price fluctuation and global recession effects on the region, which specialised in high and medium-technology manufacturing exports, particularly motor vehicles, electronic goods and capital machinery as commodity

exporters, rely on consumption outside the region mostly trading with advanced economic countries. The low demand of consumption has contributed to reducing the region's GDP, an increased unemployment rate and has led to a decline in the region's economic growth rate.

As reported in September 2004 by the Asian Development Bank, a rise in oil prices can affect macroeconomic performance, especially in Asian countries, through various channels. First, by transferring income from oil importer to oil exporter countries; in this process, net oil importer countries may suffer the loss of real national income. Second, oil price increases affect production costs and reduce the output of manufactured goods affecting the supply side and exerting an inflationary pressure on the economy. Nevertheless, higher oil prices directly affect consumer prices via the high prices of petroleum products, and an increase in input costs on the supply side translate into inflation. The higher consumer price levels and higher inflation are the causes of lower real income and further domestic demand, leading to rising unemployment.

Hunt, Isard and Laxton (2001) have analysed the macroeconomic factors affecting oil price shocks, with particular attention to the implications of inflation and economic activity. Their results show that an oil price movement has a clear negative correlation with economic activities through five relevant channels. First, transferring income from oil importing countries to oil exporting countries is a possible to decrease global demand. Second, input cost increases can reduce production levels. Third, producers and workers may prevent the decline of their profit margin and wages that put upward pressure on the prices of finished goods and services and unit labour costs. Fourth, the effect of higher oil prices can cause a potential increase in the headline price indexes, such as the consumer price index, and pass through into core inflation that may compel central banks to tighten monetary policy. Fifth, the credibility of the monetary policies may be eroded with inflation expectations and the inflation process if their policy reactions are inconsistent with announced policy objectives.

Additionally, Nordhaus (2002) indicates that inflation could be one result of a lengthened war due to rising oil prices. Abosedre and Baghestani (2004) demonstrate that lengthened sharp increases in oil prices lead to inflation and cause adverse economic performance, especially for oil importing countries. Another undesirable outcome of oil price volatility is increasing oil price causing instabilities in the equity market, money market and the foreign exchange market (Krichene 2008).

Thus, oil price volatility could impede the global economy and affect a variety of economic activities, such as cost plus inflation, reducing real income, high production costs

and commodity price (e.g. Nordhaus 2002; Abosedre & Baghestani 2004; Krichene 2008; Hunt, Isard & Laxton 2001).

2.4.3 Effect of Oil Price on Financial Market Volatility

Regarding the financial channel, there is substantial empirical evidence showing a negative relationship between oil price fluctuation and stock market volatility. Park and Ratti (2008) estimated the effect of oil price volatility and oil price shocks on the stock market in the United States and 13 European countries from 1986:1-2005:12. A multivariate vector auto-regression (VAR) model was employed to analyse the following variables: industrial production, interest rate, stock return and oil price. The document shows that rising oil prices have a negative and significant effect on real stock return, except some European countries that have a net exporter of oil represent a positive stock return when oil prices increase. With a similar result, Miller and Ratti (2009) analysed the long-run relationship between the major stock market and the world crude oil price by employing a co-integrated vector error correction model (ECM). Their finding shows that stock market indices have negatively responded with the oil price increasing.

A study of O'Neil, Penm and Terrell (2008) shows that oil price shocks have a significant negative effect on equity price, especially for developed stock markets. The same approach has been employed by Chen (2009), using time-varying transition-probability Markov switching models to examine whether higher oil prices push the stock market into bear territory. The empirical findings show that a fluctuation in oil price can cause the S&P 500 index volatility. Aloui and Jammazi (2008) examined the relationship between crude oil shocks and developed stock markets, such as in the United Kingdom, France and Japan, over the sample period January 1989 to December 2007. The findings illustrate that oil price increases had a significant role in determining both the probability of transition across regimes and the volatility of stock returns.

A study of Nandha and Faff (2008) employed monthly data from 35 industrial sectors from the globally diversified industry portfolios to examine how oil price changes affect equity prices. They found that only oil and mining industries have a positive effect on oil prices, whereas other industrial sectors, such as aerospace, autos and parts, banks, beverages, chemicals, construction, food and drug retailers, forestry, insurance companies, hotels and

telecommunications and transport, have a negative significant effect resulting from oil price volatility.

An international multi-factor Arbitrage Pricing Theory (APT) is used by Basher and Sadorsky (2006), involving both conditional risk factors and unconditional risk factors to examine the relationship between 21 emerging stock market returns and oil price risk. This study focused on the period form 31 December 1992 to 31 October 2003. The outcomes of this study indicate that oil price risk has a significant role in pricing emerging market stock returns. Other sources of unconditional risk, like total risk, kurtosis and skewness have a small effect on emerging market stock returns. Increasing oil price have a much bigger effect on stock returns than do decreasing oil prices. Guidi, Russell and Tarbert (2006) state that business conditions as oil price shocks effect on market return.

In contrast, some studies argue that the oil price movements have the same direction with the movement of stock markets. For example, Hammoudeh and Choi (2007) reveal that the spot oil market has an important role in explaining the behaviour of the Gulf Cooperation Council stock market. They conclude that all Gulf Cooperation Council stock market returns have the same direction with oil prices changing. In addition, Basher and Sadorsky (2006) have used a capital asset-pricing model (CAPM) to investigate the relationship between oil prices and emerging stock markets. They established 21 emerging stock markets, the MSCI, oil price and exchange rate returns as variables. They found that oil price increases have a positive effect on excess stock market returns for daily and monthly data, while for weekly data, oil price increases have negative and significant effects on emerging market returns. Their result had differences because some emerging countries, such as Russia, are oil producing countries, whereas other countries, such as India, Brazil, Korea, Taiwan and Thailand, consume energy products. Similar results are provided by Boyer and Filion (2007), who employed a multi-factor framework to analyse the common and fundamental factors in the equity returns of Canadian oil and gas companies. They discovered a positive association between energy equity returns and the appreciation of oil and gas prices.

The result from Sadorsky's (2001) study demonstrates that such risk factors as exchange rate, crude oil prices and interest rate have significantly affected the stock returns of Canadian oil gas companies. He indicates that oil price factor is positively correlated with oil and gas share price returns, while exchange and interest rate factors are negatively correlated with oil and gas share prices. Moreover, a study of El-Sharif, Brown, Burton, Nixon and Russell (2005) found that the relationship between the movements of crude oil prices and

equity values in the United Kingdom-listed oil and gas sector. The finding indicates that the relationship is often positive, highly significant and reflects the direct effect of crude oil price volatility on share values within the sector.

More recent empirical studies have suggested that, under imperfect competition, hedging instruments can be provided to combat against oil volatility and raise firm value. Hedging instruments, such as futures and options, can be used as flexible controllers of the cost of production and encourage future investment opportunities. For example, a study of Sadorsky (2001) suggests that instability regarding energy price volatility is a constant concern and hedging is one way to resolve this instability, because it will allow energy industries to be more flexible to manage their cash flow. Carter, Rogers and Simkins (2002) investigated the fuel hedging behaviour of the United States airlines increased firm value during 1994 to 2000. Their results show that fuel hedging has a positive effect on firm value for 12 to 16 per cent of firms in the airline industry.

Analogously, Kilian, Rebucci and Spatafora (2007) distinguish that international financial integration can relieve the effect of oil shock to allow risk sharing and oil importers to have the ability to diversify the risks associated by taking insurance as the oil future contract against oil price increases, whereas oil producers provide insurance as the oil spot contract against oil price falls through of hedging. Switzer and EI-Khoury (2006) state that during periods of extreme oil volatility as the case of Iraq war, crude oil future and oil spot contract was consistent with efficiency hedging against oil price volatility.

However, there is a body of literature arguing that other variables have a larger significant effect in explaining the determinants of stock market volatility than oil price volatility. For example, a study of Hayo and Kutan (2004) analysed the movements of oil price, the effect of news and the international financial market on Russian bond and stock market. Their findings show that the international financial market has a higher influence on the Russian financial market. The degree of influence depends upon the degree of financial liberalisation. Also, the movement of Russian stock market is sensitive to oil price volatility, suggesting that oil price volatility can significantly destabilise the Russian equity market.

Cong, Wei, Jiao and Fan (2008) used multivariate VAR to examine the interactive relationships between the Chinese stock market and oil price shocks. The results show that oil company stock prices are depressed by oil price shocks and speculations in the mining index and the petrochemical index might be increased by increases in oil volatility. They concluded that the real return of most Chinese stock market indices do not show a significant effect on

oil price shocks. Based on the Greek experience, Papapetron (2001) states that oil price movements play a significant role in explaining economic activity and employment growth rather than stock price.

A study of Chancharat, Valadkhani and Harvie (2007) examined the influence of international stock market and macroeconomic variables on the Thailand's stock market. Their findings concluded that the plummeting stock market was caused by the higher growth rates in oil price. Moreover, a study of Sehgal and Kapur (2012) found that oil price information, which investors could exploit in global markets, is not serious leakage. Further, the high-growth Asian emerging economies and the nature of oil prices shocks do delegate positive returns. Their findings concluded that oil price fluctuations do not seem to change investor optimism in Asian emerging market.

Apergis and Miller (2009) discovered that oil market structural shocks, such as oil supply shocks, global aggregate demand shocks and global oil demand shocks, have a significant role in explaining the movement in stock market returns for a sample of eight countries, ly, Australia, Canada, France, Germany, Italy, Japan, the United Kingdom and the US. Their finding shows that the stock market has no large responsibility for the magnitude of oil market shocks. It can be stated that other variables, such as exchange rate, interest rate and consumer spending, seemed to be significant in controlling the equity market in the samples.

A similar result has been offered by Al-Fayoumi (2009). This study investigates the relationship between stock market return in oil importing countries, namely Turkey, Tunisia and Jordan. He applies the local macroeconomic activities, the monthly returns of oil prices, interest rate, industrial production and stock market returns as variables. The results showed that the local macroeconomic activities were more significant rather than the fluctuation of oil price in explaining the change of stock market returns. Sadorsky (1999) investigated the relationship between oil prices, interest rate, industrial production, consumer price index and S&P 500 index by using a VAR model. He found that the change in interest rate could affect real stock return and industrial productions rather than oil price movements.

In summary, oil price fluctuation is a long-term external factor affecting stock market volatility. There are two groups relating to the stock market volatility affected by oil price fluctuation. First, importing oil countries, industries or firms consuming oil as input will suffer a significant effect because of the uncontrolled cost of production, which directly affects their profit, dividends and then the narrowing down of their equity prices. Second, oil volatility might create indirect channels to devalue equity by making interest rates higher and

by depressing consumer confidence. Consequently, volatility in the stock market can be correlated with the movement of oil prices via firm values and economic activities.

The following section presents the effects of uncertain political conditions on financial market and Thailand's stock market.

2.4.4 Uncertain Political Conditions

The stock market generally responds to new economic and political information. Fama, Fisher, Jensen and Roll (1969) and Fama (1970) have suggested that efficient stock market movements are normally a reaction to current news. Particularly, news about economic policies could be derived from onshore and offshore political events, such as political evolution, political dissolution, coup and sedition, which may influence stock market volatility and the economic architecture. Kim and Mei (2001) noted that political risks are based on political news and that there is a significant relationship between news and the Hong Kong stock market volatility. Emerging stock market returns and volatility are associated with event news, particularly political events (Kutan and Perez 2002). Hughes and MacDonald (2002) state that the key element of a country risk is political stability. Chan, Chui and Kwok (2001), using transaction data on 33 Hang Sang stocks in Hong Kong, indicated that political news has a significant effect on stock market activity rather than other economic news. They suggest that financial markets strongly respond when political events take place.

2.4.5 How Do Political Events Relate to the Stock Market?

Political stability is a key factor that controls the economy, reduces equity volatility and raises local and foreigner investor confidence. Frot and Santiso (2012) posit that investors do not prefer political uncertainty about value stability and future policies in the political environment. Moreover, a fall in equity flows normally characterises an election. This happens only where the incumbent is not re-elected, advising continuity is valued by investors. The choices of investors are affected by potentially radical swings in policy. A decrease in the democracy score represents lower equity flows, but democracy in itself does not affect equity flows that are consistent and equity funds are vigilant when potentially adverse changes in the political environment arise.

Brooks and Mosley (2008) state that in developing countries, political risk is higher due to lower transparency and less reliable economic data. Also, information asymmetry is more

pronounced than in developed economies: the cost of gathering information on the politics of developing nations is higher and drives the investor to believe signals rather than sound economic analysis. Desbordes and Vicard (2009), scrutinising FDI, suggest that interstate political relationships have a significant effect on the decision to invest abroad. Cherian and Perotti (2001) studied an option pricing model of capital investment decision under political risk. They state that the political instability of country is the factor affecting market volatility and FDI decisions.

Ismail and Suhardjo (2001) suggest that political events are known as one of the main factors that affect the stock market and a stable country tends to improve its economic performance and attract investors compared to an unstable country. Phylaktis and Ravazzolo (2005) have indicated that such factors as accounting standards, liquidity and political risk may affect international portfolio diversification decisions in emerging markets. Klein and Luu (2002) indicated that a country with more stable policies (commitment not to change the rules of the game ex-post) and high levels of economic freedom (protection of private property rights, an unhampered price system and respect for the rule of regulation) can bring a confidence to global investors.

Similarly, Beaulieu, Cosset and Essaddam (2005) reported that political risk is an important element in the determination of investment decision, currency, the probability of default of a country, the credit spread of sovereign borrowers and capital flight. Diamonte, Liew and Steven (1996) concluded that political risk is a more important determination of stock return in emerging than in developed markets. Political uncertainty, coups and corruption are the key elements of country risk, influencing economic policies and leading to market volatility (Hughes & MacDonald 2002). In addition, Brouwer (2003) states that the military dictatorship, political instability and cycles of major economic collapse are the cause of the financial unreliability in Latin America, but these causes cannot be widespread.

The effect of news on industry performance, economic and political changes are also major factors that can affect the volatility in developed stock markets, namely the DJIA, NASDAQ and S&P 500 (Goonatilake & Herath 2007). Political event studies have also suggested that local political events are important factors determining stock prices volatility and for making asset allocation decisions, particularly in developing and emerging countries, because political events generate the opportunity set to receive excess return and to generate an efficiency gains in the stock market and for portfolio diversification.

Bilson, Brailsford and Hooper (2002), investigating the relation between political risk and stock return, focusing on emerging markets and developed markets, argued that political risk significantly explains the return variation in emerging markets, while there is none in the developed market. This finding implies that there is a positive relationship between political risk and ex-post return in emerging markets. It is proposed that international investors diversify their portfolio from developed stock markets to developing stock markets and create an alternative risk measurement for portfolio management.

Perotti and Oijen (2001) expressed the idea that political stability has a strong effect on the stock market, while political change may bring about excess returns. According to Asri (1996), stock prices will show an abnormal return when the market conditions exhibit uncertain from a host country's governmental change. Pantzalis, Stangeland and Turtle (2000) using the uncertain information hypothesis (UIH) to study the reaction of stock market indices across 33 countries, with political election dates during the sample period of 1974 to 1995, and found that there were positive abnormal returns during the two weeks period previous to the elections.

Ma, Sun and Tang (2003) focused on examining the political events affecting foreign investment. The Tiananmen Square incident in China was chosen as an unexpected political event. Their study showed that this incident had a significant effect on the stock return of US firms with joint ventures in China. The result also indicates that this event only exercised an influence in the short term rather than the long term. This was because, first, foreign investors viewed this incident regional rather than national. Second, foreign investors had confidence in the Chinese government's commitment to its open-door economic policies and to reform programmes regarding China's long-term economic development and prospects. In addition, a study of He (1999) reported that the Sino-British negotiation and Tiananmen Square incident had a large effect on the Hang Sang index return. According to He, political events can result in change in the signs (positive and negative) of abnormal returns by responding positively with the good news and negatively with the bad news.

Chan and Wei (1996) investigated the effect of political news on stock market volatility in the Hang Sang index by selecting blue chip stocks, which were controlled by Hong Kong or British businessmen and red chip stocks, which were controlled by the People's Republic of China (PRC). The results indicate that news increased the stock volatility of both blue and red stocks while there was no effect on the returns on red chip stocks. They concluded that red chip stocks can be considered stocks that are safe from political shocks.

Amihud and Wohl (2004) correlated political news and stock prices by using the case of Saddam Hussein in their study. The results indicated that before the war there were lower stock prices with the increase of the cost of the war, while during the war there was a rise in the probability of Saddam Hussein falling from power, which may have been significantly and positively associated with stock prices, currency and lower oil prices. Their study concluded that the movement of stock prices responds to political events, such as news, which is observed by market participants and market expectation. Subsequently, stock prices will be affected according to the time when an event is announced. A study of Bialkowski, Gottschalk and Wisniewski (2008) examined the interplay between politics and financial markets by focusing on stock market volatility around national elections in 27 OECD countries. Their study found that the country-specific component of volatility can easily double during the week around an election day and then return to normal following the election.

In contrast, there is substantial empirical evidence showing that political uncertainty may generate volatility in the stock market and bring about negative returns.

Political news has a negative effect on the stock market; there are two observations to be made on how political events affect stock market movement. First, business cash flow is negatively affected; consequently, share prices are devalued. Second, investor attitudes may become more suspicious about the right function of the stock market, which leads to a loss of confidence in the market mechanism and in share prices. These observations may cause a multitude of other problems, which deteriorate corporate operation (Robbani & Anantharaman 2002). Wang and Lin (2009) argued that the relationship between the political uncertainty and stock market behaviour in Taiwanese democracy has negatively affected market return there and also has increased volatility.

According to Diamonte, Liew and Steven (1996), political risks, such as governmental changes, human rights abuses and social unrest, are the main factors that influence stock market returns, particularly in an emerging market more than in a developed market. Robbani and Anantharaman (2002) analysed the effect of political events on the four emerging stock markets of India, Indonesia, Pakistan and Sri Lanka, where political instability is common. The results indicate that political events are a function of information when stock markets receive information and when stock priced should be adjusted. The results also suggest that stock price reaction has some long-term effects.

Further, according to Wang and Lin (2009), political uncertainties take different forms, such as the transition of a ruling party, changes in fiscal and monetary policies and various political events. These uncertainties will be negative for market volatility and returns. Lobo (1999) used political information to test the developed stock market in the US. Their finding concludes that political information is an essential source of risk, volatility and uncertainty for the stock market. This summary reveals that political risk is a threat when political players change; it will have a negative effect on a firm's asset value, costs and revenues.

Nevertheless, another finding reveals that the political system does not affect all stock markets and generate volatility. For example, Ismail and Suhardjo (2001), using event methodology to study the effects of local political events on the Jakarta Stock Exchange (JKSE), illustrated that the stock market reactions respond differently to the political events because the stock market has different industry conditions. The results also indicate that abnormal returns before and after an event are not different. They suggest that a stable political condition tends to increase the country's economic performance, which attract investor rather than another country that was political unstable. Dopke and Pierdzioch (2006), estimating a VAR model, analysed Germany's political process and stock market return for the period 1977 to 2003. Their finding showed that no significant political system affected stock market in Germany. In terms of Chinese political events, Steeve (2001), using political dummy variables to investigate the reaction of Taiwan's and Japan's stock market from political conflict on 5 March 1996 when China announced live fire military exercises into the strait of Taiwan, found that there was little effect on either Taiwan's or Japan's stock market.

The key element of a country's risk is political stability. The effect of political uncertainty, coups and corruption are risks concerning cross-border investment because these risks can influence economic policies that lead to market volatility (Hughes & MacDonald 2002). A study of Bautista (2003) concluded that the Philippine stock market volatility was related to major political and economic events and to fluctuation in economic activity. His research found that high return volatility in the Philippine stock market was caused by a series of military coups, the Asian financial crisis, foreign exchange and capital account restrictions. Voronkova (2004) states that due to changes in economics, market environments among countries and political instability, the correlations across international stock markets cannot be constant over time.

Hence, political uncertainty has an important link to stock market volatility, because if there is political uncertainty, it may not be possible to implement stable policies. Unstable

policies can contract national economy, individual industries and confidence of participants in the stock market.

2.4.6 Thailand's Political Events

Thailand, being a democracy with a strong military influence, faces a high level of political uncertainty. Due to coup d'états by the military, dissolution, sedition by people and the sedition of the government by multi-parties are events that have brought about a slow economy and devaluated capital market as shown in Table 2.6.

Nimkhunthod (2007), evaluating 30 political events, such as dissolutions, elections, coup d'états and riots between 1975 and 2006, in order to investigate the effect of political events on the SET, found that election had positive effect on the stock market in the long term. In contrast, a temporary negative shock results from coup d'état, but this can boost the equity market over the long term. The results suggest that the market can have an over-reaction to bad news and an under-reaction to good news. Nimkhunthod suggests that the level of accessibility to information has been improved because the participants in the market have more sophistication. Regarding the aftermath of the 1997 financial crisis and economic recession, according to Tejapira (2002), Thai politics was mired in a triple impasse:

1) The Thai electorate political system by itself was incapable of coping with the financial crisis and salvaging the Thai capitalist economy in the age of globalisation; it needed the help of the IMF's credibility and directives in order to do so. At the same time, the economically dominant Thai capitalist class and the middle class on their own were also incapable of mounting a protest movement strong and effective enough to push for political reform or a change of national leadership; they needed the extraordinarily volatile and critical conditions of the economic crisis, plus the informal support of such extra parliamentary forces as the military, the IMF, people's organisations and the monarchy to achieve both.
2) Both the political system and the political leadership had a legitimacy deficit, whereas the revival of the Thai capitalist economy under the IMF programme required a high degree of political legitimacy, since its loan conditionality caused devastating socioeconomic dislocation. Therefore, the IMF loan rescue and economic restructuring programme needed a technocratic consensus-based mass political passivity as a *sine qua non* for its success; that is, people had to tamely believe that all economic

problems were technical by nature, that these were best solely entrusted to technocrats to decide on their behalf and that their interests and well-being would be best served and taken care of by letting the technocrats lead them by the nose in following the IMF's directives.

3) Thailand saw no alternative to the IMF line in solving its economic problems. Hence the utter meaninglessness and inconsequentiality of political reform, the new constitution, or the new general election in terms of economic policy from among many others to carry out a predetermined plan devised by the IMF. That was not much different from having a bunch of kids compete with one another to do an exercise consisting of questions posed by Teacher IMF. Some children might come up with better answers than others, but that was all they could do. Nothing went far beyond the framework already laid down.

In the general election on 6 January 2001, the Thai Rak Thai Party (TRT) secured power and Thaksin Shinawatra was elected prime minister. In order to release people from poverty, the Thaksin government reformed such social policies as 'populism' by reorganising the bureaucratically labyrinthine rules with government officers, launching and dispersing new welfare programmes, such as a universal low cost healthcare programme, suspended debt repayment and one district-one scholarship for lower class people. In addition to focusing on economic recovery, Thaksin's policies also boosted local business and restructured the financial sector—for example, creating one district-one products, launching new megaprojects for infrastructure development and setting up an asset management company (AMC) to remove bad debts from banks and financial institutions, thereby allowing the financial sector to recover more quickly and resume lending to local businesses.

Statistics compiled by the World Bank (2005) shows that the level of Thailand's poverty fell from 12.76 million in 2000 to 9.54 million in 2002 and then to 7.08 million in 2004. Also, the performance and health of the financial and corporate sector have improved significantly due to the number of non-performing loans (NPLs) declining to below 10 per cent, as well as mega-project investments raising the Thai GDP 7 per cent in 2005 to 10 per cent in 2007. Statistics compiled by SET (2009) show that by the end of 2008, the SET index decreased by 48 per cent from 858.10 at the end of 2007 to 449.96 at the end of 2008 due to the global financial crisis, the oil price crisis and internal political instability.

Islam and Chowdhury (2004) state that the cause of political instability was the military staying behind as a shadow of the civilian government in Thailand. Also, the conflict of interest between several groups such political parties, the government, the former government, the red shirt group, the yellow shirt group and the military were the cause of political and economic situation of the country uncertainty.

A recent paper issued by the IMF (2010), asserted that increased political uncertainty in Thailand is a factor that has shaken the nation's economy and financial markets. The power shifting between the red shirt group, yellow shirt group and other political camps many times during the past five years (2006 to 2010) has led to political protests and outbreaks of violence. As a result, the confidence of investors has fallen, consumption has slowed sharply and the SET has faced high volatility resulting in poor performance. After the government announced a state of emergency and cracked down on demonstrators, the stock market slumped from 812.63 in April 2010 to 721.29 in May 2010, and continues to decline (SET 2010).

There are no standard stock market reactions to any events. The studies of Diamonte, Liew and Steven 1996, Robbani and Anantharaman 2002, Wang and Lin 2009, Bilson, Brailsford and Hooper 2002, Chan, Chui and Kwok 2001, Bialkowski, Gottschalk & Wisniewski 2008 and Chan and Wei 1996 all confirm that political shock brings about stock market volatility. In contrast, political events can be hedged and priced by the market (see Kim & Mei 2001; Perotti & Oijen 2001; Ma, Sun & Tang 2003; Amihud & Wohl 2004; Asri 1996).

Table 2.6: Thailand's Recent Political Events

Political Officer	Political Problems	Key events
Chuan Leekpai Nov 1997–Feb 2001	House dissolutions	Corruption by health minister
Thaksin Shinawatra Feb 2001–Feb 2005	Completed full term in office by TRT	Re-election
Thaksin Shinawatra Feb 2005–Feb 2006	House dissolutions	Protests by the People's Alliance for Democracy (PAD) as yellow shirt 'the political crisis has begun'
Thaksin Shinawatra April 2006	Election committee unconfirmed the election	• Widely boycotted elections • Election commissioners found guilty of malfeasance by the court • Military coup by Commander Sonthi Boonyaratglin
Surayud Chulanont Oct 2006–Jan 2008	House dissolutions Temporary government approved by military	• TRT and members were banned for 5 years • People's Power Part (PPP) was set up for TRT politicians • The National United Front of Democracy Against Dictatorship (UDD) was established to against government
Samak Sundarvej July 2008–Sep 2008	• Disqualified by constitutional court • Misconduct for receiving payment for cooking TV shows after becoming prime minister	• Accused as a proxy of former prime minister Thaksin • Public street protest by the PAD • PAD protesters invade government • AntiPAD clash with the PAD, 1 dead and 43 injured • A state of emergency is declared in Bangkok
Somchai Wongsawat Sep 2008–Dec 2008	• Disqualified by constitutional court due to electoral fraud • PPP was dissolved and banned members of the party, including prime minister	• Pheu Thai Party (PTP) was established to take over members of PPP • PAD protesters occupied the Government House; the government decided to crackdown; 2 dead and over 300 injured • PAD demonstration enlarged to seize the international airport and parliament
Abhisit Vejjajiva Dec 2008–current		• Accused of receiving military support and was not elected by vote • Violence against Abhisit government began at ASEAN Summit in Pattaya • The redshirted UDD forced him to cancel summit plans; subsequent rioting around Bangkok • Prime Minister declared a state of emergency throughout Bangkok in April 2009, 2 protesters dead and over 120 injured • The protest enlarged and continued and in April 2010 it restored Thailand to democracy and new elections • Clashing between the red shirts and the military resulted in 18 dead and over 900 injured • The tensions of political continued to grow, the red shirt set up antigovernment protest camps in the main business area • May 2010, police and troops attempted to remove protest camps, 42 killed and over 250 injured, with destruction of business building and government hall in Bangkok and some provinces

2.4.7 US Subprime Mortgage Loans

The US subprime mortgage loan is an important event that changed the features of the global economy and financial market. The cause of the crisis was a combination of many factors, including house price bubbles, interest rates, easy credit conditions, over-leveraging, deregulation and complex financial instruments.

Karnad (2008) identified many factors that were responsible for the crisis. For example, excessive credit was the cause of the under-pricing of risk and increased debt burden. Lenders expected that house prices would always rise, which generated the price bubble. Moreover, financial mortgage innovation moving from a traditional mortgage lending model (credit segment) to distribution model (capital segment) broadened the crisis because of the transfer of subprime effects from asset to securitisation, which increased capital flows into the subprime market. Kritayanavaj (2008) states that other factors, such as higher unemployment and low introductory interest rates and higher interest rates thereafter, forced property prices downwards, ultimately leading to the bursting of the US real estate property bubble. He also argues that complex securitised products and derivatives, such as collateralised debt obligations (CDOs) and credit default swaps were the cause of the crisis, which needed to cross-border oversight and regulation.

According to Barth, Li, Phumiwasana and Yago (2008), the factors that caused individuals to foreclose were the financial circumstances that they found themselves in subsequent to obtaining mortgage loans. These factors included unemployment, marriage breakups, health problems and especially the downturn in house prices, where the market value dropped below the mortgage balance. A study by Dodd (2007) on the subprime market indicates that, along with private investors, nonfinancial institutions that invest their capital into hedge funds, private-equity firms and investment bank would buy the equity tranches of portfolios of US mortgage securitisations because they offered high yields. As a result, there were many foreign capital inflows into the US's mortgage market, which may possibly have generated asset speculation, over-leveraging by borrowers and under-pricing of risk by creditors.

The rapid rise in the securitisation of the subprime mortgages could have dropped interest spread and increased money supply and financial firms needing to increase lending in mortgage credit are also causes of rises in housing prices (Mian and Sufi 2009). In addition, Brunnermeier (2009) states that the Federal Reserve adopted a lax interest rate policy and

large capital inflows from abroad, with international investors purchasing mortgage securitisation, caused low interest rates in the mortgage market, which led to the housing price bubble and continued to cause turmoil in the financial market.

More empirical results documented by Demyanyk and Hemert (2009) found that loan quality as the performance of a loan in borrower characteristics (such as credit scoring, an ability to provide documentation and level of indebtedness), loan characteristics (such as an mortgage interest rates, loan amounts, amortisation and product type) and macroeconomic conditions (such as house price appreciation, level of neighbourhood income and changes in unemployment) deteriorated dramatically in the six years before the crisis, resulting in the subprime market collapse. Borio (2006) explained that speculation in commercial property may have been caused by financial institutions needing to increase their lending without pricing of risk because they needed to increase their future income.

2.4.8 Effect of Subprime Mortgages on the Global Economy and Financial Market

Subprime mortgages reached crisis proportions since the summer of 2007. The United States housing bubble has been in meltdown, resulting in the collapse of the banking system and financial institutions, the bailout of financial corporations by the government, declining home prices, increasing foreclosures and a tightening of credit standards by lenders. This crisis was retarding US economic growth, declining share prices, reducing investor confidence and resulting in downturns in the stock markets. As a result, with the US the major economic and financial power in the world, this may bring about a global economic recession and contagion into the global financial market.

Sakthivel, Bodkhe and Kamaiah (2012) examine the correlation and volatility transmission across international stock markets by using five major stock indices, namely, S&P 500 (US), BSE 30 sensex (India), FTSE 100 (UK), Nikkei 225 (Japan) and the Ordinary Share Price Index (Australia) from 30 January 1998 to 30 July 2011. Their findings suggest that the external news is concurrently received by Japanese and the United States stock markets and then transmitted to other European and Asian stock markets. They found evidence that major international stock markets are strongly correlated, and the S&P 500 index is a global factor affecting both developing and developed markets.

By October 2008, the IMF widely predicted aggregate losses of USD 1.4 trillion overall, USD 750 billion in US residential real estate lending and USD 650 billion from

repercussions of the crisis on other securities. As a result, many financial institutions involved in home construction and mortgage lending, like Lehman Brothers, Merrill Lynch, Washington Mutual, Fannie Mae and Freddie Mac, were directly forced to recapitalise; some financial institutions became bankrupt and some of were taken over by others and received bailouts from state government (Hellwig 2009). Shin (2008) argues that the subprime crisis eventually drove the US economy into a recession, which may have affected Asian economies in separate channels.

Recent study by Ostrup, Oxelheim and Wihlborg (2009) concluded that the subprime crisis led to the reduction of 30 per cent of real estate prices and a decline of half of the US stock market value, as well as an eruption of the US real economy. They argue that this crisis has spread to financial sectors worldwide and its contagion within the financial system is caused by the malfunction of regulatory and political institutions. Chomsisengphet and Pennington-Cross (2006) have posited that the subprime failure caused a reduction in the access to the financial market, foreclosure, loss of equity, house price appreciation and potentially a decline in the value of property in the whole housing market.

According to Park and Shin (2009a), when a global financial market becomes unstable, the global investors have to reappraise the risks of their investments and adjust their portfolios. In the case of the subprime crisis, the global investors decided to sell off their holding assets without discriminating between economic fundamentals and credit ratings. As a result, there was a large effect on the domestic financial market, causing unbearably large changes in exchange rates, equity prices and domestic asset prices.

Focusing on financial product innovation, global participants involved in financial product innovations, such as Collateralised Debt Obligations (CDOs), mortgage-backed securities (MBS) and credit default swaps (CDS), exerted the domino effect. For example, investment funds, financial corporations and corporate banks (such as Northen Rock, BNP Paribas, Swiss bank, Countrywide and Citigroup) purchasing a financial product like CDOs and MBS will lose from the US subprime default. To take another example, insurance corporations, such as the American International Group (AIG), which provides insurance products like CDS, were created to protect against CDOs and MBS defaults. These CDS have been downgraded from the losses in MBS. As a result, financial corporations and banks that insure their MBS with AIG were delinquent with payments due to the fact that AIG lacked liquidity. This led to lack of confidence on the part of the global investor; some investors withdrew their capital from investment funds, some sold off their shares to rebalance their

portfolios and some withdrew their deposit to secure their principle from the bank. These events may have generated a lack of liquidity in financial corporations. Corporation assets, such as local, international shares and community assets, should be sold off to support corporate liquidity and to provide against investor withdrawal. Consequently, there is a high potential to increase the volatility in the global financial market (Woo 2008).

According to the contagion study by Longstaff (2010), the Asset backed security (ABX) indexes consist of a portfolio of subprime home-equity CDOs that include the Bank of America, BNP Paribas, Deutsche Bank, Lehman Brothers, Morgan Stanley, Barclays Capital, Citigroup, Goldman Sachs, RBS Greenwich Capital, Union Bank of Switzerland (UBS), Bear Stearns, Credit Suisse, JP Morgan, Merrill Lynch and Wachovia, which have been adopted to examine the cross-market linkages between these indexes and other financial markets as contagion effects. The result of his study suggest strong evidence that, during the subprime crisis, the ABX index shock spread into the fixed-income, equity and volatility market via the correlated-information and liquidity channel. Additionally, Longstaff summarises that a subsequent negative return for the S&P 500 index return was caused by negative shocks in the ABX indexes, which originated from financial product innovations.

European financial firms, for example, Industrie Kredit Bank (IKB), LandesBank, the UBS and Northern Rock, collapsed and required a bailout from the European Central Bank to support their liquidity due to losses on MBS exposure in the US subprime market. Losses from subprime may have been a cause of insolvency fears in the Euro bank system. As a result, many depositors and shareholders began to withdraw their deposits and sold off their shares while reducing corporation liquidity and firm value (the share price of financial firms involved in the subprime declined 30 to 50 per cent in October 2008). In order to enhance investor confidence, the European Central Bank reacted to the difficulties in the financial crisis by using low interest rates, guaranteeing deposits, purchasing bad assets and providing bailout loans for liquidity (Ostrup, Oxelheim & Wihlborg 2009).

The fallout from the subprime crisis has negatively affected the financial market worldwide. However, some stock markets have been less affected. For example, a study of Edwards (2008) reports that major Australian financial corporations, financial system and economies did not receive significant damage from the financial crisis contagion, because the strengths of the regulatory arrangements were helpful in minimising the effect of the global financial crisis. Also household debt, low incomes and poor credit records were less than in United Kingdom and US households. The Australian banking system was closer to a

traditional balance sheet banking model rather than the combined commercial and investment banking model, which caused the major losses in the subprime crisis. The proportion of investment in financial product innovation was less than in other financial products; further, the durability of export products, such as metals, minerals and energy, has seen rapid growth and this sustained economic stabilisation. However, the crisis has exerted influence through exchange rates and interest rates, which lowered import businesses and consumer confidence and caused a slowdown in the demand for housing and consumption and a turndown in the equity market (Edwards 2008).

A study of Das (2012) states that Asian economies can insulate from the global financial crisis of 2007 to 2009 and were the first to recover from crisis. Das also explains that Asian financial markets were only affected to a moderate degree by the subprime crisis for many reasons. First, global investors, such as large pension funds and mutual funds, believed that Asian economies had strong long-term growth prospects and looked for investment in the Asian economies as a relatively safer proposition. Second, the proportion of investment in the US subprime and derivative products from the Asian financial institutes was limited. Third, after the Asian financial crisis, the Asian financial markets had more experience with financial crisis than the advanced financial market. They set up financial implementations and prudential regulations to minimise their financial risk. Fourth, the Asian banks looked for investment opportunities by lending on domestic consumers as a major profitable proposition. They did not look for higher yields in alternative investments. As a result, the Asian banks were not pressured by the subprime crisis.

Further, the financial stock from S&P 500 was transmitted to the Asian-Pacific equity markets. This has been combined by some efforts at policy coordination and intensification of trading within the Asia-Pacific region itself and developed trading technology (Burdekin & Siklos 2012). The ongoing international financial crisis only reinforces the significance of understanding the links between the US and equity markets, particularly the Asia-Pacific markets of Taiwan, Malaysia, Indonesia, Thailand, Philippines and Shanghai. The analysis of Burdekin and Siklos (2012) confirm that financial stocks were transmitted regionally and from the US to the Asia-Pacific region over 1995 to 2010. Crises spreading beyond a single country may even shift the pole of effect to a different region or country and are typically found to have lasting effects on the degree of financial market integration.

Batten and Szilagyi (2011) also studied the effect of the global financial crisis on emerging financial markets during 2007 to 2009. They concluded that after the Asian financial crisis of 1997 to 1998, the emerging financial markets reformed their banking system, strengthening regulations and limiting credit risk to prevent the crisis. As a result, there was a non-constant change in the level of bank assets and non-evidence of banks failed in Asian-Pacific countries from the subprime crisis.

In conclusion, the subprime home-equity loans meltdown was a major source of credit segment losses, which led to global recession and resulted in restraining the global economy. This crisis was spread from the US credit segment to other financial segments, resulting in financial illiquidity, investor lack of confidence and causing financial market volatility worldwide.

2.4.9 Effect of Subprime Mortgages on the Thailand Economy and Financial Market

In Thailand, this crisis has affected the real economy and financial market via three channels: the financial sector, the capital market and the international trading market. The Thai financial sector, such as financial corporations and financial system, has not suffered seriously from the subprime crisis because it received more experience after encountering financial crisis in 1997. Regulation, the proportion of investment between inbound and outbound and standard pricing of risks by creditors are the key structures for financial protection and bring good financial health to the Thai financial sector. A global financial turmoil study by Lee and Park (2009) showed the US subprime generated turmoil in the credit market and its potential contagion affected the global financial system. There was limited suffering of spillover effects in Asia's emerging financial systems because of enhanced transparency and governance, a deepening and broadening of financial systems as local currency bond markets, improvement in risk management, a strengthening of regulations and supervision fostering regional financial stability. As a result, the Asian banks and financial sector were not directly affected by the subprime crisis.

In order to mitigate the maturity and currency mismatches between liabilities and assets that led to the global liquidity crisis and pervaded the banking industries in advanced countries, East Asia's emerging economies reformed a number of micro-prudential regulations on the bank's asset-liability management, which has allowed the exchange rate system to move more flexibly. This regulation has helped the emerging economies have a

competitive advantage in international financial intermediation because, in emerging economies, the mismatching of maturity does not provoke a financial crisis; in advanced countries, where currencies can be swapped for reserve currencies, such as the US dollar, with unlimited or are internationalisation of exchange and hold as foreign exchange reserves (Park 2009).

The Thai banking industry has successfully implemented safeguards against external shocks and housing price bubbles. Kritayanavaj (2008) states that there were no oversupply in available housing units and housing prices have not increased significantly. This was because, first, prudent mortgage lending practices, including income, employment and National Credit Bureau verifications, were presented as credit implemental verifications that were provided to mortgage loan borrowers. Second, because of the experience of the 1997 financial crisis, the banking industry and housing developers became more cautious, closely monitored and conducted extensive housing market and market research by disseminating housing market data, investment and development knowledge based on supply and demand statistics. Also, a study of Walter (2010) argued that the implementation of the Basel II framework in the banking system helped the banks upgrade their risk management systems. Consequently, speculative buying was not a part of the overall housing market and the banks had more ability to manage their financial risk.

Regarding the capital market, the Thai equity market has declined sharply and has exhibited high volatility because of three factors, including a spillover effect, fundamental and investor sentiment. Inevitably, these factors were caused by the global economic recession from the subprime crisis. According to the cross-country stock market spillovers study by Diebold and Yilmaz (2008), financial integration can bring about equity returns and volatility spillover across the country. For example, as a result of the US equity market spillover during the subprime crisis, there were a sharp decline and high volatility in the stock market, which could have reached the Asian stock market in such places as Hong Kong, Japan, Australia, Singapore, Indonesia, Korea, Malaysia, the Philippines, Taiwan and Thailand.

In addition, Yilmaz (2009a) states that subprime crisis can be seen as having a contagion effect in major East Asian equity markets, such as Hong Kong, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Taiwan, Australia and Thailand. This finding shows that the movement of major Asian equity markets has followed the US market. Yilmaz concludes that the result of increased market integration makes equity markets more interdependent, which increases return volatility.

Kato (2009) states that the lingering global economic crisis has emanated from the bursting of the US property bubble, which has had huge implications for Asian economies. Kato indicates that demand in the advanced economies and US consumers remain important to Asian export countries, and this crisis caused advanced economies' and US consumers' growth to be below their potential, which implies an increase in unemployment and a sharp decline in consumer demand. As a result, the number of Asian exports has dropped by 30 per cent. In the fourth quarter of 2008, the Asian GDP plummeted by 15 per cent, with expected large losses as capital flowed and retains earning in equity market. The US subprime mortgage crisis became a key concern in reducing investor confidence. As a result of the crisis, the SET index fell 133 points or 15 per cent in 2007 (SET 2008).

Yilmaz (2009b) states that the spillovers across countries are based on the correlation of macroeconomic aggregates: output, consumption and investment. The subprime mortgage crisis has been developed as global recession and passed through to other advanced and emerging economies. Trading partners will suffer spillover shocks from consumer reduction in one country to the output of industrial production in other countries. An emphasised in May 2009 by the IMF, the spillover from the US subprime became a recent global recession, which affected the Asian economy harshly in the trading and equity market. As the turbulence of the recession gave the global stock market low performance and high volatility, global institutional investors, global funds and hedge funds who suffered from subprime securitisation were forced to sell off their stock holding due to the high pressure of investors holding redemptions. The international trading market, due to the US market, is the major export market of Thailand and US economic recession and the US subprime crisis will inevitably lead to low demand on the part of the US consumer, which may negatively affect the Thai export market and spillover into Thailand's real economy and other countries. Consequently, the fundamental value of corporations that trade in the US market as a major market will decline and indirectly reduce their share price as retained earnings in stock market.

Park (2007) adopts the Oxford Economics Global Model to analyse the economic integration between the US and Asian countries. The evidence shows that the Asian region has become synchronised with the US in trade integration. He indicates that the US is the largest importer and economy, and if their economy slows down, the countries trading on the US market will receive direct and indirect suffering via low demand of goods and services and currency changing. According to Gerjarusak (2008), the onshore and offshore Thai baht

market trend continues to be volatile. He expects that volatility will amplify significantly as offshore traders join the party. For Tharachai (2008), the Thai domestic economy will be adversely affected by the subprime crisis, especially in the export sector. Ultimately, it will be affected through reduced consumer income, savings, purchasing decisions and consumer sentiment and confidence.

Hence, this crisis is seen to have a spillover effect that has affected Thailand's economy and has led to stock market volatility. However, Thailand's stock market is affected only in the short term, because both financial and trade integration between Asian countries have been significantly enhanced. To sum up, factors such as oil price fluctuation, uncertain political conditions and the US subprime mortgage crisis have brought about economic recession, high production and operating costs, dampening of investor confidence and a generation negative economic conditions, such as inflation and interest rates, which will possibly directly and indirectly affect firms' value and create volatility in the Thailand capital market.

2.5 Contagion in Financial Markets: Definitions and Measurement

Contagion has been defined as the transmission of shocks between two countries group of countries or markets or sectors. Dornbush, Park and Claessens (2000) posit that contagion could be defined as receiving a significant increase of shock across countries. Yang (2002) defines contagion as the shift of cross-country correlation from a tranquil period to a crisis period. To Forbes and Rigobon (2002), a contagion effect could be defined as an increase of common movements of financial asset markets at a particular time, such as an increase in correlation during a period of crisis. A similar definition is that the contagious transmission channel is represented by local shocks from the asset market in one country to another markets or countries (Dungey, Fry, Gonzalez-Hermosillo & Martin 2005).

Paas and Kuusk (2012) state that, in the recent decades, financial contagion has become an increasingly popular research topic. The concept of 'financial contagion' and the transmission channels of financial crisis are examined in a large amount of economic literature and empirical evidence of this phenomenon is scrutinised. The study of Pass and Kuusk (2012) found that the contagion hypothesis are clear in dominance, while taking into account differences in testing methodologies and definitions based on the qualitative analysis

of previous studied about financial contagion did not give clear results as to which evidence should dominate or dominates.

Khallouli and Sandretto (2010) present a range of definitions as follows:

1) Contagion is the transmission of a crisis from one country to another (or from one market to another).
2) Contagion is the propagation of shocks in excess of fundamentals, which is faster than the regular transmission through the usual commercial or financial channels and mechanisms between countries or markets.
3) Contagion is the spread of shock as a result of panic movements and herding behaviour of investors.
4) Contagion is the transmission of shocks through any channel, which causes markets to co-vary.
5) Contagion is a high frequency process of transmission of shocks that occurs with a higher probability during crisis period rather than tranquil periods.

The World Bank Group (2009) gives three different definitions of financial contagion as follows:

1) Contagion is the general cross-country spillover effects or the cross-country transmission of shocks. This definition excludes fundamental linkages as a channel of contagion.
2) Contagion is excess co-movement—a correlation that remains even after controlling for common and fundamentals shocks. Also, contagion means only those transmissions of crises that cannot be classified with observed changes in macroeconomic fundamentals.
3) Contagion implies a shift and excludes a constant high degree of co-movement crisis period.

For Hughes and MacDonald (2002), the contagion effect is generated by a financial crisis in one country spreading into the financial system of other countries; for example, the Asian financial crisis, which emerged in Thailand and spread to Indonesia, Korea and Hong Kong. Another example is the Mexican financial crisis, which emerged in Mexico and spread to other Latin American countries. They concluded that inadequate preparation for financial

liberalisation, such as the lending boom in foreign currencies and increasing bank liabilities, with currency mismatches and economic policy mistakes—for example, maintaining fixed exchange rate, high interest rate and budget surplus—are the causes of the devaluation of local currency and turn into the financial crisis.

Regarding the currency crisis, a study of Eun and Resnick (2004) indicated that the cause of financial turmoil in Mexico and Thailand was the governments' decision to liberalise their financial markets by allowing cross-border capital flows with inconsistent economic policies in the exchange rate regime and an undeveloped domestic financial system, for example, financial regulation and supervision. As a result, the Mexican peso and the Thai baht have been devalued and continue to have a contagion effect on the regions. The effect of local currency devaluation may lead to local stock market collapse, because foreign investors may cut their losses by selling their stock and moving to another currency. In any case, the subprime crisis was not confined to the US housing market. As a result of securitisation, the crisis was transmitted to other financial markets, including the developed and emerging market (Kato 2009; Yilmaz 2009a; Ostrup, Oxelheim & Wihlborg 2009).Currently, developed, developing and emerging countries have integrated their financial markets into an international market by allowing international capital movement and financial liberalisation. Financial integration can increase vulnerability to foreign influences, particularly in international capital movements, which can possibly generate the risk of contagion and volatility (Stiglitz 2002; Morrissey & Udomkerdmongkol 2008). However, some experts state that international capital movements and financial liberalisation produces beneficial effects on growth, currency, financial cost and employment (Blecker 2005).

Dungey, Fry and Martin (2003) studied a theoretical framework for testing and estimating contagious linkages between Asian equity markets, such as Hong Kong, Korea, Indonesia, Thailand, Malaysia and Australia, and the Australian equity over the period 1997 to 2001. The main empirical results showed that there was very small evidence of contagion from the East Asian equity markets in delegating to the total volatility in the Australian equity market over the period. Moreover, Karunanayake, Valadkhani and O'Brien (2010) examined the interplay between volatility and stock market returns, focusing on the Asian and worldwide financial crises of 1997 to 1998 and 2008 to 2009 for Singapore, Australia, the US and the United Kingdom. They applied a MGARCH model and used weekly information (January 1992 to June 2009). Based on the results gained from the mean return equations, they could not find any important effects on returns arising from the Asian crisis and more

present international financial crises across these four markets. In contrast, both crises importantly increased the stock return volatilities across all of the four markets. Further, the US stock market is the most crucial market, affecting the volatilities of smaller economies like Australia. Also, the 2008 financial crisis has contributed to the increased stock return volatilities across all these four markets. The positive return spillovers effects run from both the United Kingdom and the US (the bigger markets) to Singapore and Australia (the smaller markets).

The 2007 US financial crisis, starting in the subprime market, has turned into the most severe international economic crisis (Neaime 2012). In general, the crisis has put pressure on the emerging market and the Middle East and North Africa (MENA) region and the EU in particular, contributing to fast decreases in their stock markets. These stock markets have experienced significant economic and financial slowdowns on different levels because of accelerated liberalisation and financial and economic integration at the regional and international levels (Neaime 2012).

A study of the influence of international stock market and macroeconomic variables on the stock market in Thailand in both the pre- and post-1997 crisis periods (Chancharat, Valadkhani & Harvic 2007). This evidence is not strange due to the fact that Singapore is a main nation financial hub with extensive investment throughout the nation, a price leader with its dominance in the Asian market and also the main producer of data. Further, global investors often overreact to news from the market of Singapore and place less weight on data from other Asian markets. Therefore, innovations in Singapore could be applied as an indicator to predict the performance of Thai stock market. Also, in the pre-1997 period, apart from Singapore, changes in stock returns in Malaysia and Indonesia were the most important determinants of the returns in Thailand, whereas post-1997, Korea and the Philippines replaced these. This shift in significance in the post-1997 period is a result of capital controls imposed in Malaysia during 1998, and the economic turbulence in Indonesia. The effect of macroeconomic variables on the dependent variable was not important, with the only exception being changes in oil price. A rise in oil prices had no positive effect on stock returns prior to 1997, and became insignificant after 1997.

Bae, Karolyi and Stulz (2003) argue that in Latin America, contagion was more serious when compared with in Asia. Collins and Gavron (2005) conducted 44 studies of contagion in 42 nations and results showed that the Argentinean and Brazilian crises generated most of the

contagion events. This suggests that more incidences of contagion were not recorded within the trade blocs of the crisis nations, which are opposed to nations outside those trade blocks.

Sola, Spagnolo and Spagnolo (2002) have examined the effects of contagion on emerging market currency crises and found evidence of contagion from the South Korean crisis to Thailand. Results indicate that worldwide stock markets, especially in Europe, responded closely to US stock market shocks in the three to six months after the US September 11 crisis than before (Hon, Strauss & Yong 2006). Alper and Yilmaz (2004) undertook an empirical analysis of real stock return volatility contagion from emerging markets and found the evidence of volatility contagion from the financial centres, particularly from the Asian crisis to the Istanbul Stock Exchange.

Also, Fernandez-Izquierdo and Lafuente (2004) analysed the dynamic linkages between national stock market volatility during the Asian crisis in 12 relevant stock exchanges at a global level: Chile, Germany, Argentina, Hong Kong, Italy, Japan, Mexico, the United Kingdom, South Korea, Spain and the US. Their results show that the contagion from the Asian crisis cannot effect developed stock markets.

Chan, Treepongkaruna, Brooks and Gray (2011) explored asset market linkages between financial assets (US stock and treasury bonds), commodities (oil and gold) and real estate assets (US Case-Shiller index). Their findings confirm that the crisis regime is characterised by higher volatility and deeply negative stock returns, along with the result of contagion between stocks to other assets; however, there is no-contagion effect between stocks and treasury bonds. This suggests that at the crisis period, investors have to minimise their risks by holding a component of treasury bonds.

Lim, Brooks and Kim (2008), scrutinised the effects of the 1997 financial crisis on the efficiency of eight Asian stock markets on a nation-by-nation basis. The results showed that the crisis adversely affected the efficiency of most Asian stock markets, with Hong Kong the hardest hit, followed by Malaysia, Singapore, the Philippines, Thailand and Korea. However, in the post-crisis period, in terms of developed market efficiency, most of these markets recovered.

Besides, Yang, Kolari and Min (2003) analysed both the short-run dynamics and long-run relationship among Japanese, the US and ten Asian stock markets, with particular attention to the 1997 to 1998 Asian financial crisis. The results indicated that the long-run co-integration relationships among these markets were strengthened during the crisis and that, after the crisis, these markets have been more integrated. Also, Tan and Tse (2002) have

examined the linkages among Japan, US and seven Asian stock markets comprising Singapore, Thailand, Malaysia and the Philippines. By applying the information at the end of 1996 and redefining the information in mid-1998 to generate a post-crisis and pre-crisis comparison, they have found that markets are more created after the crisis than before, and that Asian markets are more heavily affected by the US, although that the effect of Japan is increasing. The most noteworthy effect among the ASEAN-5 is that Malaysia is less affected by Japan and the US after the crisis affected its currency and capital controls; Malaysia is apparently an outlier, while Malaysia and Singapore still affect each other, which is strongly attributed to structural symmetry, geographic proximity and economic linkages.

In order to measure the contagion effect, the analysis of market correlation coefficients, the Granger causality test, the GARCH model and VAR model are adopted by empirical literature. Previous studies in financial crisis found that interdependence and contagion transmission in equity markets can be measured by correlation analysis. A study of Chuang, Lu and Tswei (2007) used the correlation matrix to examine the interdependence of equity volatilities in six Asian stock markets, including those in Japan, Hong Kong, Singapore, South Korea, Taiwan and Thailand. Their findings confirmed that the equity in the six Asian stock markets were highly interdependent.

Forbes and Rigobon (2002) and Rigobon (2002; 2003) show that in the presence of heteroskedacity of asset price movements, an increase in correlation could be a continuation of strong transmission mechanisms existing also in tranquil times. During a crisis, normally volatility increases. Among markets, if there is a historically high cross-correlation, then an extensive and rapid change in one market will lead to important changes in the other markets. They also argue that these changes should not be counted as evidence of contagion. Forbes and Rigobon's (2002) tests for contagion focused on cross-market correlation coefficient and a definition of contagion traditionally applied: an important increase in cross-market linkages after a shock to one country. The results show that in cross-market correlation coefficients during the 1997 East Asian crisis, 1994 Mexican peso devaluation and 1987 US stock market crash, in Australia, Canada, France, Germany, Hong Kong, Japan, Netherlands, Switzerland and the UK there is virtually no evidence of an important increase.

Hon, Strauss and Yong (2004) used cross-country correlation of assets and the Granger causality to test contagion in financial markets after September 11; the information set includes Australia, Belgium, Canada, Denmark, Finland, France, Germany, Hong Kong, Indonesia, Italy, Japan, Korea, Malaysia, Mexico, New Zealand, Philippines, Portugal,

Singapore, Spain, Sweden, Switzerland, Taiwan, Thailand, United Kingdom and US stock markets. This finding shows that Asian and European stock markets respond to the US stock market and that the transmission of stock was one way. Also, cross-country interdependence can increase significantly at the time of crisis.

Egert and Kocenda (2007b) analysed comovements among three stock markets in Eastern and central Europe from 2 June 2003 until 9 February 2005 for stock indices at the stock markets in Budapest (BUX), Prague (PX-50), Warsaw (WIG-20), London (FTSE-10, UKX), Frankfurt (DAX-30) and Paris (CAC-40). In order to find a causal relationship among the stock markets, they employed the Granger causality test; the results conclude that there is not only stock returns in London, Paris and Frankfurt, but Granger cause stock returns in the three CEE market, whereas the CEE-3 also effect each other and stock returns in Paris, London and Frankfurt. Their findings showed that there were signs of short-term contagion effects in terms of stock returns and stock price volatility.

Further, Nikkinen, Saleem and Martikainen (2011) examined the linkage between the fastest growing economics of the world and the US equity market, the BRIC (Brazil, India, Russian and China) equity markets and the transmission of the US subprime crisis of 2007 to 2009 to BRIC countries. The results found evidence that volatility crisis periods exhibit highly significant return spillovers from the US market to all the BRIC equity and industrial sectors. In addition, to analyse the long-term relationship among the markets, they applied the Granger causality test and confirmed that all markets were interdependent.

Boschi (2007) studied the evidence of financial contagion from the Argentinean crisis of 2001 to 2002 to a set of nations including Brazil, Mexico, Russia, Turkey, Uruguay and Venezuela by using correlation coefficients test. The analysis shows that the evidence of contagion is not found because some countries, such as Russia, Mexico and Turkey, experienced a severe financial crisis at the same time as Argentina. Other Latin countries, characterised by sounder fundamentals, seemed to have an immunity to the Argentinean crisis.

Dungey, Fry and Martin (2005) studied an empirical modelling of contagion. They suggest that a range of different methodologies is applied to make it difficult to assess the evidence for and against contagion and especially its importance in transmitting crises between nations. However, they indicate that correlation analysis framework can be used to test contagion by comparing asset returns in across-crisis and crisis periods. Corsetti, Pericoli and Sbracia (2005) applied correlation analysis to find out the transmission of shocks from the

Hong Kong stock market crisis in October 1997. This finding from a sample of 16 nations shows evidence of contagion from the Hong Kong stock market to the stock markets in the Philippines and Singapore among the emerging markets and Italy, France and the United Kingdom among the industrial nations.

Sun and He (2012) used correlation analysis to measure the contagion severity of stock markets in US, Russia, Australia, China, Brazil, India, Hong Kong and Japan during the 2007 to 2009 stock market crisis periods for simulated analysis. The results show that the global financial crisis caused by the American subprime mortgages brought about the massive decline of stock markets worldwide, and Japan was the highest affected by contagion. However, littlest contagion severity is seen in India's stock market.

The correlation coefficients model is commonly used in calculating the contagion effect. Wilson and Zurbruegg (2004) tested the correlation coefficients between the Thai securitised real estate market and the Hong Kong, Singapore, Malaysia and Australia property stock markets during 1994 and 1998. Their analysis showed that there were some contagious effects spreading from Thailand to other developed stock markets, such as Hong Kong and Singapore, during the crisis in 1997. However, before the stock market crisis, there was very little evidence to show that the plunge of the Thai securitised real estate market had any contagious, adverse effect on other countries.

Bekaert, Harvey and Ng (2005) state that the contagion is usually defined as an excess correlation between markets, which is implied by economic fundamentals. They used the CAPM and GARCH model to measure the correlation between a three-regional equity portfolio return (Europe, South-East Asia and Latin America) and US equity market returns from January 1980 to December 1998. Their findings conclude that higher correlation has been detected during the Asian crisis. They suggest that the model of excess correlation could be more desirable within the context of an asset-pricing model than the GARCH model.

Yang (2002) examined the contagion from the East Asian stock market crisis using the correlation test and Granger causality test for short-term interrelationship and co-integration test and VAR for long-term interrelationship. The findings concluded that during a period of financial crisis, market participants tended to move together across a range of countries.

Arestis, Caporale, Cipollini and Spagnolo (2005) tested the financial contagion between 1990 and 1998 by using weekly stock returns for four developed countries, Japan, Germany,

the United Kingdom and France, and four of the largest economies in the East Asian region, Thailand, Indonesia, Korea and Malaysia, and adopted correlation studies and the GARCH analysis. Their results showed that there were small contagions from emerging countries to developed countries. They suggest that prudential supervision, regulation and risk diversification are some measures that could have reduced the effect of contagion.

Many studies have tested the contagion effect when the market exhibited volatility transmitted to other markets using the MGARCH, dynamic conditional correlation and VAR models. Evidence of contagion was reported during the periods of the subprime crisis; Khallouli and Sandretto (2010), for example, used a Markov switching EGARCH model to examine the contagion of the subprime crisis in the MENA stock markets. Their results highlight a significant increase in the likelihood of crisis occurrence characterised by low return and high volatility, following the US stock market plunge and the US volatility rise. Some MENA countries have been spared the devastating effects of financial turmoil and contagion because some of these countries exhibit a difference in the process of economy, financial liberalisation, international capital investment, capital control and trade relations.

Baur and Fry (2009) tested multivariate contagion and interdependence during the Asian crisis of 1997 to 1998 by employing the GARCH model. Their findings show that most of the countries in the sample (China, Hong Kong, India, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand) were directly involved in the Asian financial crisis. This result confirms that there is a common volatility arising during the Asian financial crisis, which reflects interdependencies more than contagion. However, the contagion effect was both negative and positive in relation to the asset market, but reversed quickly. They concluded that none of the factors of isolation of financial markets, fundamentals or level of financial development insulates the stock return of a country from the effect of contagion.

Wang and Thi (2006) employed a Dynamic Conditional Correlation (DCC)-bivariate GARCH model to scrutinise the contagion effect existing during the Asian financial crisis on the Thailand and Chinese economic area (CEA), including China, Hong Kong and Taiwan. Their findings show that the crisis had a significant shock on the stock market and that the stock return volatility was detected and higher in the post-crisis than during the pre-crisis. The conditional correlation coefficient increased significantly during the post-crisis period, which provided evidence of contagion. Egert and Kocenda (2007a) employed the DCC-Bivariate GARCH model to test the correlation between three emerging Central and Eastern European markets (CEE) and three developed markets (Germany, France and the United Kingdom)

from 2 June 2003 to 24 January 2006. Their results showed a strong correlation between the German, French and UK stock markets for a common daily window adjusted for the observed U-shaped pattern. By contrast, there was little systematic positive correlation detected between the French index and the three CEE stock markets.

Pisedtasalasai and Gunasekarage (2007) used VAR and Causality tests to examine the relationship among stock return, return volatility and trading volume from emerging market in South-East Asia. The findings showed that there was strong evidence of asymmetry in the relationship between the stock return and trading volume. Longstaff (2010) employed a VAR model to test the contagion effect in financial markets between the pricing of subprime asset-backed CDOs and S&P 500 financial firms; the finding showed that prior to the subprime crisis, there was little useful information between CDOs and financial firms. However, after the crisis started, there was a high prediction regarding the return of CDOs and other financial firms. Also, Nagayasu (2001) analysed the Asian financial crisis with time series techniques, applying a VAR model to test for causal relationships. His findings showed that the transmission of Thailand's currency crisis affected some sectoral indices, including banking and financial sectors, in the Philippine stock market via the foreign exchange rate channel. It can be observed that contagion is supposed to work during crisis periods, and when the market has volatility, contagion is possibly operated.

Yu, Fung and Tam (2010) state that financial integration has strong implications for financial stability. Financial integration among groups of economies can improve their capacity to take on the financial shocks and foster development, whereas the intensification of financial linkages in the financial world can increase capital movement. This movement may increase the risk of cross-border financial contagion. Their findings confirm that the process of the stock market integration in Asia has improved from 2007 to 2008. Nevertheless, the process is not complete, and the degree of integration between developed and emerging equity markets is different.

2.6 Problems and Limitations of Previous Research and Gaps in the Studies

2.6.1 Volatility

This study introduces the determinative factors of the volatile stock market in the short and long term. According to previous research, for example in Caner and Onder (2005), Abugri (2002), Wang and Lin (2009) and Cipriani and Kaminsky (2007), exchange rate, inflation, interest rate, dividend yield, industrial production and money supply affect stock market volatility. However, the effect of oil price fluctuations, the subprime crisis and political uncertainty should be acknowledged as factors in stock market volatility for the following reasons.

First, previous research factors, such as exchange rate, inflation, interest rate, dividend yield, industrial production and money supply, varied by fiscal and monetary policies that were influenced by government. If the political situation is uncertain, it will affect financial policies and then turn volatile in the stock market. Bautista (2003) indicates that the major change in the Philippine stock market was a result of a series of military coups, the Asian financial crisis and capital account restrictions. Nimkhunthod (2007) evaluated 30 political events in Thailand and their effect on the SET. He concluded that the negative shock in the stock market was given by a coup d'état, house dissolution and a state of emergency. The statistics compiled by the SET 2010 are highly volatile and underperforming. After the government announced the state of emergency and the crackdown on demonstrators, the stock market slumped from 812.63 in April 2010 to 721.29 in May 2010 and continues to decline.

Second, the studies of Miller and Ratti (2009), Chen (2009), Aloui and Jammazi (2008) and Park and Ratti (2008) show that rising oil prices have a significant role in determining both the probability of transmission across regimes and the volatility in stock market, while some studies argue that oil prices can affect the stock market on both sides. For instance, the work of Nandha and Faff (2008) concluded that only equity in the oil and mining industrial sectors experience a positive effect when oil prices increase, while 33 other industrial sectors experience a negative effect. Papapetron (2001) states that the movement of oil prices play a significant role in explaining economic activity, rather than the movement of stock market returns. Similarly, a study of Al-Fayoumi (2009) indicates that the local macroeconomic

activity was more significant than the movement of oil prices in explaining the volatility in the stock market.

Third, the global financial crisis caused by the US subprime meltdown brought about investor sentiment. As a result of the crisis, by the end of 2008, the SET index decreased 48 per cent from 858.10 at the end of 2007 to 449.96 at the end of 2008 due to the global financial crisis, the oil price crisis and internal political instability (SET 2009). Burdekin and Siklos (2012) report that the S&P 500 index is a major factor affecting stock market in the Asian-Pacific.

Therefore, there have not been other studies of the factors affecting stock market volatility relative to oil prices, the US subprime crisis and the BSI index in the context of Thailand's stock market. Also, the volatility of Thailand's stock market has not been examined so far. As a result, this study will fill this gap by exploring the factors that bring about the volatility of Thailand's stock market and by examining the volatility.

2.6.2 Contagion

Since 1997, the issue of the contagion effect in Thailand has been known as the currency contagion, which began with the Thai currency system changing and affected other internal sectors, such as banking the equity market, and reduced the national economy. The changing of the currency system from fixed to floating caused financial problems and this became a crisis that was transmitted to other financial markets in the region and globally.

Previous literature has attempted to test whether there was a contagion across countries related to the currency crisis, from developing markets to other markets (Eun & Resnick 2004; Hughes & MacDonald 2002; Arestis, Caporale & Spagnolo 2005). The contagion between market sectors across countries via currency crises has been tested (Wilson & Zurbruegg 2004). Testing has also been undertaken for contagion across countries, which related to credit crisis and developed market to other markets (Longstaff 2010; Yilmaz 2009a). Consequently, contagion from one market to another market has been investigated in a similar theoretical framework. However, the contagion of the proposed factors affecting stock market volatility in Thailand has not been examined so far, and there has been little research on Thailand's stock market relative to other stock markets in the region. As a result, this paper will fill a gap by observing the transmission from the new release of the factors affecting stock market volatility in Thailand to other equity markets in the same region. This

has not been carried out in other studies that tested for a possible contagion in the Thai context. This paper will examine if oil price fluctuation presented a contagion effect from the energy market to the financial market, if the subprime crisis presented a contagion effect from the credit market to the developed and developing financial market and if political instability presented a contagion effect from the unstable domestic condition to the financial market within the same region.

2.7 Summary

Stock market volatility can be caused by both internal and external factors, which in turn can aggravate the fragilities of the domestic financial market and financial systems. Also, one financial market fluctuation can affect another market. This paper focuses on whether the volatility in Thailand's stock market is influenced by the sampled factors or not, and whether the Thailand stock market is decoupled from other stock markets in the region or not. These questions are answerable by identifying the linkages between the Thai stock market returns and the sample examined factors. Testing the contagion effect in equity markets includes Thailand's stock market returns and other stock market returns in the region.

Chapter 3: Conceptual Framework and Methodology

3.1 Introduction

The second chapter reviewed the literature related to the factors affecting Thailand stock market volatility and the study of the contagion effect in financial markets. The aim of this chapter is to achieve the objectives of the research and describe the methodologies used in this research. Based on the findings from the previous studies, a theoretical model will be developed in order to identify the dominant factors affecting Thailand's stock market volatility and to measure the contagion effects of Thailand's stock market volatility on other South-East Asian stock markets, as well as to measure the contagion effects of other South-East Asian stock markets on Thailand's stock market.

This chapter is organised into two parts. The first part of Chapter 3 provides the conceptual framework, which is organised as follows. Section 3.2 presents and discusses the theoretical framework. Section 3.3 summarise the conceptual framework, and Section 3.4 discusses the development of the research question, and tested hypotheses. Section 3.5 presents the overall research methodology of the study, including research philosophy, research approach, research design techniques and quantitative approach. Section 3.6 details sample selection data sources and data collection. The statistical methods employed to test the study hypotheses for the factors affecting stock market volatility in Thailand and contagion among regions are explained in Section 3.7 and 3.8. A summary of the conclusions is presented in Section 3.9

3.2 Theoretical Framework

A theoretical framework was specifically developed to focus on the relationships among the factors related to stock market volatility and the relationships within the stock market in the region that are related to contagion effects. Veal (2005) indicates that a theoretical framework should be applied to the conceptual framework when the research is quantitative in nature, and that the framework indicates how the research analyses the concepts involved in the study via the relationship between concepts. Hussey (1997) believes that a positivistic research study can be underpinned by a theoretical framework as a collection of theories and models from the literature. Hence, developing a conceptual framework helps the researcher to

articulate hypotheses and to meaningfully analyse the interrelationship among the identification variables relevant to the topic.

The theoretical framework presented in the chapter is designed to meet the aims of the study, which are as follows:

1) to identify the dominant factors affecting Thailand's stock market volatility
2) to measure the contagion effects of Thailand's stock market volatility on other South-East Asian stock markets
3) to measure the contagion effects of other South-East Asian stock markets on Thailand's stock market.

3.2.1 Development of the Theoretical Framework for Stock Market Volatility

Previous studies on the factors affecting stock market volatility have long recognised the relationship between equity price, dividend payoff, company performance, economic variables, financial liberalisation and market integration. Caner and Onder (2005), for example, have stated that stock price volatility is related to company performance, which is presented as dividend yield. Kay and Putten (2007) extended the knowledge by arguing that dividend payoff is a significant source of stock market volatility. Abugri (2002) and Bilson, Brailsford and Hooper (2001) state that economic variables in each country are used as the proxy of fiscal and monetary policies, which relate to stock market volatility. Moreover, the study of Hardouvelis, Malliaropulos and Priestly (2006), Blecker (2005) and Stiglitz (2002) found that financial liberalisation and market integration bring about market efficiency, improved transparency, standardised prices and reduced transaction costs. In addition, market integration can make the market more orderly, whereas in the case of the Asian financial crisis, concluding with financial liberalisation and market integration was the cause of volatility in the stock market (Cipriani and Kaminsky 2007).

The above factors can lead to stock market volatility. However, the findings of Papapetron (2001), Sadorsky (2001), Chen (2009), Brouwer (2003), Wang and Lin (2009), Diebold and Yilmaz (2008) and Longstaff (2010) argue that oil price fluctuation, the US subprime mortgage crisis and politically uncertainty can strongly influence stock market volatility. Consequently, the present study will fill the gap in knowledge of the factors affecting stock market volatility in Thailand, as presented in Section 2.6.1, by adding the

variables of oil price fluctuation, US subprime mortgage crisis and uncertain political conditions as factors affecting stock market volatility.

3.2.2 Development of the Theoretical Framework on the Contagion Effect

Contagion effects have been studied in relation to situations when stock markets have been highly volatile as a result of a strong correlation and integration of market, currency crises and credit default crises. According to the literature on contagion, the contagion effect can occur in other markets if they have a correlation or are integrated with each other (Egert & Kocenda 2007b; Khallouli & Sandretto 2010). The transmission from one financial market to another financial market takes many shapes. For example, in regards to the contagion effect from the currency crisis to the stock market, Hughes and MacDonald (2002) and Eun and Resnick (2004) reported that the currency devaluation in Thailand, South Korea and Indonesia generated volatility and negative effects on the stock market in the region. Moreover, the findings of Baur and Fry (2009) indicate that there was high volatility in the stock market during the Asian financial crisis. They suggest that the contagion has a negative effect at first and then reverses.

In the case of a contagion effect from credit default crises on the stock market, Longstaff (2010) found that the financial market between the pricing of subprime asset-backed CDOs and S&P 500 financial firms had a high predictive power after the crisis started. However, some studies have argued that the contagion effect in the financial market cannot be transmitted from an emerging market to a developed market.

For example, the study of Arestis, Caporale and Spagnolo (2005) reported on financial contagion during the Asian financial crisis and the findings showed that there were small contagions from emerging stock markets, such as Thailand, Indonesia, Korea and Malaysia, to developed stock markets, such as Japan, Germany, France and the United Kingdom. The present study also addresses the gap (see Section 2.6.2) in our knowledge regarding the contagion among stock markets in developing countries, in particular Thailand and the South-East Asian financial markets.

3.3 Conceptual Framework

The literature review presented in the previous chapter examined various theoretical concepts as part of developing a clear understanding of the factors affecting stock market volatility, as well as the contagion effect between Thailand's stock market and other stock markets in the region. The present study extends the findings of Caner and Onder (2005) on factors of volatility in stock market, the findings of Basher and Sadorsky (2006) and Nandha and Faff (2008) on oil prices and the equity market, the findings of Bautista (2003) and Nimkhunthod (2007) on politics and stock prices and the findings of Longstaff (2010) on subprime and the S&P 500 volatility. Also, it extends the findings of Wilson and Zurbuegg (2004), who studied the financial contagion caused by the currency crisis, and the findings of Nikkinen, Saleem and Martikainen (2010), who studied the financial contagion caused by the subprime crisis.

Figure 3.1 presents a simplified version of the study framework, which is then followed by a detailed exposition.

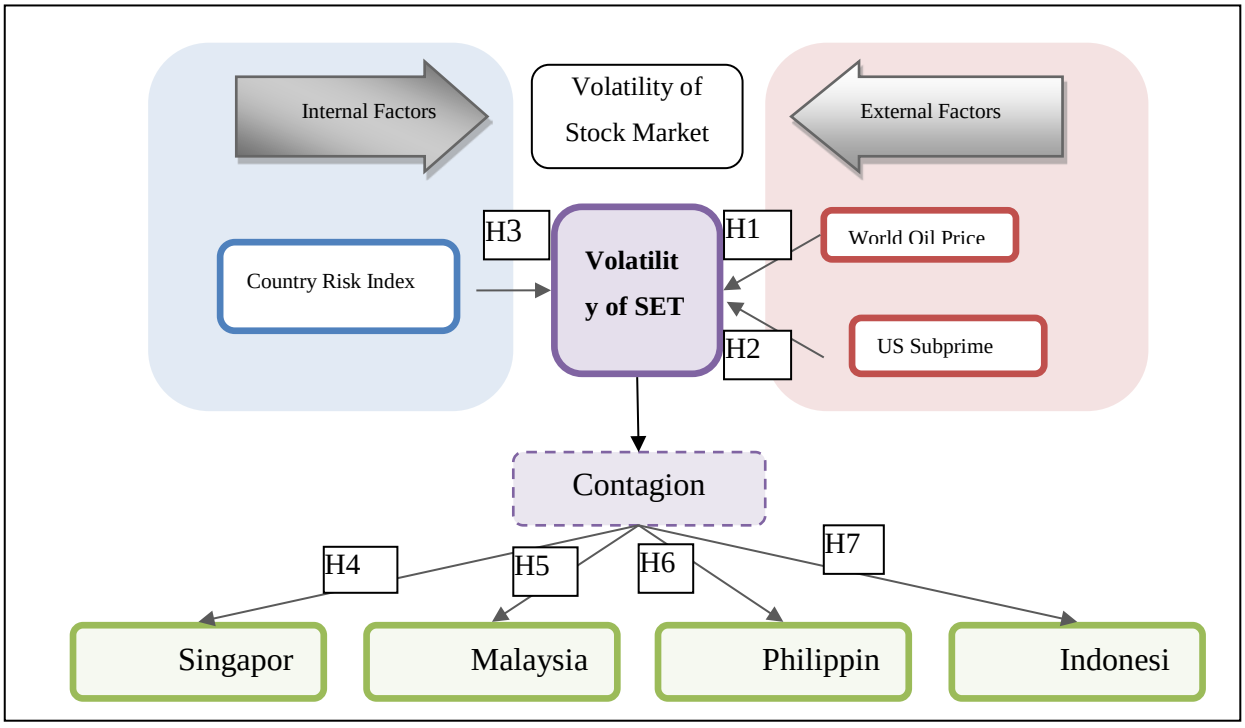

Figure 3.1: Conceptual framework.

3.4 Research Questions and Tested Hypotheses

As discussed in the previous chapter, there are many theories employed to explain the factors affecting stock market volatility and contagion in the financial market. The following are the two main questions studying the research:

1) What are the determinants of the SET volatility?
2) What are the interrelationships between SET and other stock markets in the region?

A clear understanding and accurate measurement of market volatility and contagion would be beneficial to portfolio managers, global funds and other investors to minimise their risks, and policy makers could use this information to articulate effective policies to minimise the effect of volatility and contagion. The above research questions will be answered with the aid of the hypotheses developed in the following discussion.

Previous research on the factors affecting stock market volatility confirms that dividend yield, interest rate, exchange rate, industrial production, inflation, firm performance and the movement of the world market index have been the key factors used to analyse stock market volatility. However, some studies have found that oil prices, political risks and the subprime crisis were the key factors that influenced stock market volatility in the recent past.

This thesis posits that the external effects, such as oil price fluctuation and the subprime crisis, and internal effects, such as political uncertainty, were the dominant factors affecting Thailand's stock market volatility. In fact, it is the first time that a study on factors affecting stock market volatility has been undertaken by combining three different variables. Following are the relevant hypotheses for research question 1.

Hypothesis 1: The world oil price returns (ROIL) has a significant effect on SET returns (RSET). Oil price fluctuation brings about SET index volatility.

Hypothesis 2: The business sentiment of Thailand index returns (RBSI) has a significant effect on the RSET.

Hypothesis 3: The S&P 500 returns (RSP500) caused by the US subprime mortgage crisis affects the volatility of the RSET.

A previous study on contagion in Thailand suggests that it was strongly related to the currency crisis, which spilled over into other financial markets worldwide (Granger, Huang

and Yang 2000). The contagion effect from credit default generated by the subprime crisis resulted in the collapse of the US financial system and corporations. The effect of this crisis was transmitted to local stock markets and created a recession, which then became a global financial contagion. The contagion affecting these variables initiating in developing countries have not been studied. Following are the hypotheses related to research question 2:

Hypothesis 4: There is a strong positive relationship between the SET index returns (RSET) and the Singapore Stock Exchange index returns (RSGX).

Hypothesis 5: There is a strong positive relationship between the SET index returns (RSET) and the Kula Lumpur Stock Exchange index returns (RKLSE).

Hypothesis 6: There is a strong positive relationship between the SET index returns (RSET) and the Philippines Stock Exchange index returns (RPSE).

Hypothesis 7: There is a strong positive relationship between the SET index returns (RSET) and the Jakarta Stock Exchange index returns (RJKSE).

3.4.1 Contribution of the Theoretical Framework

The theoretical framework articulated for the research makes two significant contributions. First, the study attempts to incorporate recent identified factors into an empirical model on stock market volatility. These variables are important for the stock market in developing countries in order to establish a benchmark for posterior comparisons with the financial markets in the region in general, and for Thailand in particular. Second, the study will build awareness among policy makers and global investors on the potential of contagion, which is positive for current SET index challenges and the future insecurities.

The next section of the chapter will discuss the methodology analysed and give a detailed exposition of the empirical methods employed to address the research hypotheses.

3.5 Research Methodology

There are two main types of research philosophy that have influenced the research procedure up to the present: positivist and interpretive. Since both of the two different types of philosophy have played a vital role in business and management research, researchers that understand the nature of the research philosophy will be able to implement an appropriate

approach to their research (Creswell 2003; Cavana, Delahaye & Sekaran 2001). In addition, an appropriate research philosophy is considered to be compatible with the way in which the researcher thinks about how to develop knowledge (Saunders, Lewis and& Thornhill 2002).

Positivist research is conducted within the rules and conventions of science. Saunders, Lewis and Thornhill (2002) have stated that positivist research employs deductive reasoning through the guidance of a specific theory towards achieving concrete empirically verifiable results of the investigation. The positivist holds the perspective that social research should adopt the scientific method and that it consists of rigorous testing of hypotheses by means of the data that take the forms of quantitative measurement (Atkinson & Hammersley 1994). The positivist belief that there are facts that represent an objective reality can be expressed numerically. Thus, the researcher that conducts quantitative research relies heavily on number, measurement, experiment, numerical relationship and description (Johnson & Christensen 2004).

Interpretative research is viewed as an empirical strategy for the answering of questions about how people make sense of their lives, their experiences and the structures of their world (Creswell 2003). It is based on logic, reasoning and systematic examination of evidence. Zikmund (2000) states that interpretative research should be capable of replication by the same or different researches with similar results achieved.

Up to the present, it has been difficult to determine which research paradigm has an advantage over the others since generally these research paradigms have been separately or mutually conducted in many businesses (Saunders, Lewis & Thornhill 2002). Moreover, there are limitations for all research philosophies that the researcher should consider before applying each paradigm to the study.

The author conducted this research based upon the ‘positivist philosophy’ as an appropriate research method for answering the research problems, because this research concerns the collection of numeric data with the objectives of testing research hypotheses through statistical analysis.

3.5.1 Research Approach

In general, research in the social and behavioural sciences can be categorised into three groups as follows. First is quantitative research, which originally subscribed to the concept of the positivist philosophy, which relies on the collection of quantitative data. It focuses on the

deductive component of the scientific method, since the focus is on hypothesis testing and theory testing. Quantitative research is also said to be confirmatory because the researcher tests or attempts to confirm a set of hypotheses (Johnson & Christensen 2004; James 2005; Collis & Hussey 2009). Quantitative methods include the techniques associated with the gathering, analysis, interpretation and presentation of numeral information (Johnson & Turner 2003).

Second, a qualitative approach is an interpretative approach that emphasises qualitative measures rather than quantification in the collection and analysis of data (Bell & Bryman 2003; 2007). It is an unstructured, primarily exploratory design based on small samples, intended to provide insight and understanding. Qualitative research is often used when the researcher has little knowledge about a certain topic or when an inductive approach is considered more appropriate in finding solutions (Johnstone 2004).

The third is a mixture of methods, often referred to as triangulation. This type of research involves the mixing of quantitative and qualitative research methods, approaches or paradigm characteristics where the researcher uses the qualitative study for one phase and uses the quantitative study for another phase of the research (Kemper, Stringfield & Teddie 2003).

This research employed the quantitative method. The research purpose and questions are designed for a quantitative research study based upon the positivist philosophy and uses the deductive approach in finding solutions for the research problems. Also, this study mostly depends on numeric data, which were employed in testing the research hypotheses, and the benchmarking process, which depended on secondary data from the Bank of Thailand, the SET, Datastream, IMF and World Bank, which provide practical learning through comparing indicators and outcomes. These processes are particularly useful for developing countries in terms of generating their economic knowledge compared with their neighbours, the region and the world (World Bank Institute 2002).

Lastly, this research is focused on an examination of the relationships between the sample variables affecting stock market volatility, and scrutinises the correlation of each country in order to determine the contagion effects in the region. The following is a description and a discussion of the methods used in the study.

3.6 Methods

3.6.1 Sample Identification

The S&P 500 index is one of the most widely used benchmarks for US equity market performance. It is from the New York Stock Exchange (NYSE), which consists of 500 large capital common stock companies trading on either the NYSE or NASDAQ. The S&P 500 is a free-float capitalisation-weighted index, selected and maintained by S&P. The S&P 500 index variable was selected for this study because it is widely used to analyse the reflection between the US stock market and other stock markets.

The asymmetric effect of oil price increases and the decline of the aggregate economy were generally contractions and expansions of the availability of resource shifting production, inflationary effects shifting aggregate demand and distortion of business mechanisms, this fluctuation has been prominent as the cause of stock market volatility. As a result, the oil price variable was selected because oil has been traded in each economy and has had a direct effect on the stock market. The data used in this research were monthly averages of three crude oil spot prices, West Texas Intermediate, Dated Brent and the Dubai Fateh, and converted to USD per barrel.

The BSI was developed by the Bank of Thailand (BOT). The BSI diffusion index is divided into two main parts. The first part is the information used to compute the index and is composed of six components; namely, production, total order books (which replaces the people's purchasing power and export in the original version), investment, production cost, performance and employment. Each component is applied with equal weight and is then composed into a single monthly index. The second part is information that reflects business confidence. This information is comprised of inventories, financial conditions, financial market outlook, selling price, export, production capacity, expected inflation and limits of business. The representative firms (sample) were acquired from databases of the SET and the Ministry of Industry. The samples consisted of approximately 800 large and medium business firms, which had registered capital of at least 200 million Thai baht. The interpretations of the index are as follows:

- index=50 indicates that business sentiment remain stable
- index > 50 indicates that business sentiment has improved
- index < 50 indicates that business sentiment has worsened.

The BSI variable was selected because this index reflects the overall domestic economy. Additionally, the BSI has a significant trend of major components of the GDP, which consist of consumption, investment and export. For instance, if business improves, this could be commonly consistent with the boosted domestic demand, which reflects the consumer's purchasing power sector or should be reciprocal with external demand, which reflects the export sector and other positive factors concerning production costs. Finally, the BSI also has an effect of investment activities and the resulting effect on employment.

The contagion effect of this study included five monthly indexes: the SET, the SGX, the JKSE, the PSE and the KLSE. To compute regional indices, the national indices were converted to USD.

The SET index was collected by the Stock Exchange of Thailand. The index was computed daily based on constituent stocks representing energy, banking, finance, mining, property and industry, among others. As of December 2007, the SET index comprises about 523 registered companies with a combined market capitalisation of USD 197 billion. It began to be traded on a daily basis in 1991. The data used in this research were the monthly SET index quotes for the period from February 1999 to October 2010.

The SGX Straits Time index was calculated by the Singapore Stock Exchange. As of January 2010, the SGX Straits Time index was computed daily, based on 774 securities trading with a combined market capitalisation of USD 650 billion. As a result, this has become the major stock trading market in South-East Asia. The data used in this research were the monthly SGX Straits Time index quotes for the period from February 1999 to October 2010.

The JKSE composite index was calculated by the Indonesia Stock Exchange, which was a merger between the JKSE and Surabaya Stock Exchange. As of June 2010, the Indonesia Stock Exchange had 341 listed companies with a total market capitalisation of USD 269.9 billion. The data used in this research were the monthly Jakarta stock exchange index (JKSE) quotes for the period from February 1999 to October 2010.

The PSE index was established by the Philippines Stock Exchange in December 1927. It is one of the longest operating stock exchanges in South-East Asia. As of December 2009, the PSE had 248 listed companies with a combined market capitalisation of USD 130.0 billion. The data used in this research were the monthly PSE composite index quotes for the period from February 1999 to October 2010.

The KLSE composite index was calculated by the Malaysia Stock Exchange. This stock market was established in 1964. In April 2004, it was renamed the Bursa Malaysia Berhad. As of December 2009, the Bursa Malaysia Berhad had 844 listed companies with a combined market capitalisation of USD 299.0 billion. The data used in this research were the monthly KLSE composite index quotes for the period from February 1999 to October 2010.

3.6.2 Data Sources and Data Collection

The data required for the analysis process were obtained from secondary sources. The author collected monthly time series data covering February 1999 to October 2010. The economic factors were collected from the BOT, the IMF and the Datastream website. All equity market indexes were obtained from the SET, Datastream and the World Federation of Exchange website, which provide a range of equity indexes across countries. The empirical model was fitted to the following these periods.

1) February 1999 to October 2010 (full period) was the entire period of this study, which allows the comparison of dependent relationships in a period of relative financial stability (low volatility) that results in Thailand's political certainty, while oil price has a minor change and low fluctuation in S&P 500 index. Financial instability (high volatility) results in Thailand's political uncertainty, oil price fluctuation and high volatility in S&P 500 index due to subprime mortgage crisis.
2) From February 1999 to October 2006 (low-volatility period), Thailand had a stable political situation. The SET had normal conditions from less fluctuation of oil price and S&P 500 index.
3) The selection of November 2006 to October 2010 (high-volatility period) was highly volatile due to three major factors. First, political events, such as parliament dissolution, a boycotted election, a coup d'état in 2006, civil disobedience and political turmoil in 2007, can cause political uncertainty in Thailand. These uncertainties can lead to a political crisis, such as after the government announced the state of emergencies in 2009 and 2010 and military, police and government had crackdowns in 2009 and 2010. Second, oil price fluctuated dramatically due to speculation, high demand from oil importing countries and a supply decrease by OPEC. Third, the volatility of the S&P 500 had changed dramatically due to the subprime crisis. As a result, Thailand's stock market had abnormal conditions.

Analysis is the application of reasoning to understand and interpret the data that have been collected for the research project (Zikmund 2000). According to Pallant (2005), there are three basic objectives for data analysis:

- to check the preliminary ideas of frequency, central tendency and dispersion
- to test the integrity of the data in term of reliability and validity
- to test whether the hypotheses were substantiated or research questions were are answered.

To be able to achieve the answers for the research hypotheses, the computer program EViews was employed to analyse the compiled data in order to obtain the research results (Griffiths, Hill & Lim 2012).

3.7 Hypothesis Testing for Factors Affecting SET Volatility

In order to answer research question 1, which incorporated the hypotheses 1, 2 and 3, empirical models were drawn from econometrics, which have been employed to examine the factors affecting Thailand stock market volatility. Two econometric models were used in this study. The first is the multiple regression model, which was employed to test the effect of the factors affecting the stock market, following the study of Basher and Sadorsky (2006), Nandha and Faff (2008) and Al-Sharif, Brown, Burton, Nixon and Russell (2005) The second is the GARCH model. This model was widely applied to examine the volatility in financial markets; see, for example, the previous literature of Malik and Ewing (2009), Worthington and Higgs (2004), Hull (2006) and Bautista (2003). The following section provides the details of these two models as applied in the present research.

3.7.1 Multiple Regression Model

To facilitate the empirical analysis, a multi-factor regression model contributing to the stock market, energy prices and economic data was developed by Faff and Brailsford (1999), Sadorsky (2001) and Basher and Sadorsky (2006). The simplest multiple regression model was three-variable regression, with one dependent variable and two explanatory variables. The model used in previous studies was the two-factor version:

$$R_{it}=\alpha + \beta_o R_{ot} + \beta_m R_{mt} + \varepsilon_t$$

Where: α is the constant term, R_{it} is the return on day *t* on the oil and gas sector index, R_{ot} is the daily return on crude oil prices on day *t*, R_{mt} is the daily market portfolio excess return on day *t*, β_o and β_m are the regression coefficients and ε is a random error term. The present study applies the multi-factor model, which employs the ordinary least square (OLS) method to estimate the equation:

$$R_{set}= \alpha + \beta_{oil} R_{oil} + \beta_{s\&p} R_{s\&p} + \beta_{bsi} R_{bsi} + \varepsilon_t$$

Where: α is the constant term, R_{set} is measured as a SET index, R_{oil} is measured as a spot crude oil price per barrel in USD, $R_{s\&p}$ is a S&P 500 index and the BSI index used throughout the study is measured by the BOT. These variables' returns were calculated by the log differences of monthly closing price or indexes, such as $R_{c,t}=In(P_{c,t})- In(P_{c,t-1})$ for each variables (*c*) on month (*t*). The parameters β_{oil} $\beta_{s\&p}$ and β_{bsi} are crude oil price, the stock market index and BSI, respectively, and ε_t is a random error term. R_{set}, R_{oil}, $R_{s\&p}$ and R_{bsi} are defined as the logarithm return for SET index, oil price, S&P index and the BSI index respectively.

3.7.2 GARCH Model

The GARCH model was established by Bollerslev (1987) and Taylor (1986), who extended the ARCH model by allowing the past conditional variance to be a linear function of *p* lagged conditional variances in addition to *q* past squared errors. Asteriou (2006) states that the simplest form of the GARCH (p, q) model is the GARCH (1,1) model, which changes p=0 and reduces the model to ARCH (q). The variance equation has the form:

$$Ln(R)_t=a + \beta' Ln(R)_{t-1} + u_t \qquad (3.0)$$

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2 \qquad (3.1)$$

The GARCH model is easy to estimate and specifically performs very well because it has only three unknown parameters: ω,α and β.

The (1,1) in the GARCH (1,1) model refers to the presence of a first-order autoregressive GARCH term (the first term in parentheses) and a first-order moving average ARCH term (the second term in parentheses). The GARCH model is often interpreted in a financial context, where an agent or trader predicts this period's variance by forming a weighted average of long-term average (the constant), the forecasted variance from the GARCH term and information about volatility observed in the ARCH term. If the asset return was unexpected by large in either the upward or the downward direction, then the trader will increase the estimate of the variance for the next period. This model is also consistent with the volatility clustering often seen in financial return data, where large changes in returns are likely to be followed by further large changes.

In addition, the intention of higher order GARCH models, denoted GARCH (*p*,*q*), can be estimated by choosing either *p* or *q* larger than 1, where *p* is the order of the moving average GARCH terms and *q* is the order of the autoregressive ARCH terms. The GARCH (*p*,*q*) model can be represented as follows:

$$\sigma_t^2 = \omega + \sum_{j=1}^{q} \beta_j \, \sigma_{t-j}^2 + \sum_{i=1}^{p} \alpha_i \, \varepsilon_{t-i}^2 \qquad (3.2)$$

Where:

- ω,α and β are parameters
- the lag of the squared residual from the mean equation of the ARCH term is σ_{t-j}^2 The ARCH parameters correspondent is β_j
- the lag of the squared residual from the mean equation of the GARCH term is ε_{t-i}^2
- the GARCH parameters correspondent is α_i.

For a GARCH (1,1) process, the variance can be calculated as ω/1- α – β, which require α + β < 1. Otherwise, if α + β > 1 the study requires an integrated generalised autoregressive conditional heteroskedastic (IGARCH) model (Hill, Griffiths & Lim 2011). A study of Hamilton (1994) notes that the conditional of ω,α and β > 0 are sufficient but not necessary to ensure nonnegative of σ^2. For a GARCH (1,2) process, for example, the σ_t^2 coefficients are positive, provided that ω > 0, β > 0 and $\alpha_0+\alpha_1 > 0$. Hamilton concludes that α_1 could be negative as long as α_1 is less than α_0. The following is a description of the variance calculation.

$$\sigma_t^2 = \frac{\omega}{1-\beta-\alpha} \qquad (3.3)$$

In the above equation the mean is written as a function of exogenous variables with an error term. Since σ_t^2 is the one-period ahead forecast variance based on past information, it is called the conditional variance. This variance can be calculated to describe uncertainty by the square root of the variance, and is called the standard deviation (Brailsford, Heaney & Bilson 2004).

This model specification usually performs very well and provides a more flexible framework to capture various dynamic structures of conditional variance. This is because the GARCH model incorporates the time-varying conditional variance and the covariance process. Knight and Satchell (1998) state that the GARCH model allows the distributions of both the conditional variance and the observed variable (unconditionally) to be computed numerically. Consequently, the conditional variance of the time series relies on the squared residuals of the process, which is the square of the lagged innovation.

There are limitations in the ARCH model as developed by Engle (1982) and presented by Pagan (1996) and Pagan and Schwert (1990). Their studies confirmed that the GARCH model has performed well in comparison with other methods regarding volatility in the stock market. Also, the surveys of Bollerslev, Engle and Nelson (1994) confirmed that the GARCH and ARCH models were widely used in various branches of econometrics, especially in financial time series analysis, and they are flexible enough to incorporate variations in model specification and requirements. An empirical study of Poon and Granger (2003) indicated in forecasting volatility in financial markets that GARCH is a more parsimonious model than ARCH, and GARCH (1, 1) is the most popular model for examining financial time series.

Similarly, a study of Hansen and Lunde (2005) examined whether sophisticated volatility models provide a better description of financial time series compared to parsimonious models. They addressed this question by comparing 330 ARCH-type models to estimate the one-day-ahead conditional variance. The main finding for the exchange rate data concluded that the GARCH (1,1) is one of the best performing models. Following the above discussion, the present study employs the multi-factor regression and the GARCH (1, 1) model to examine the volatility dynamics of the financial time series.

3.7.3 Breusch-Pagan LM Test

Prior to estimating the GARCH model, the analyst should determine whether all data are heteroskedastic (non-constant) or homoskedastic (constant) by conducting the Breusch-Pagan Lagrange multiplier (LM) test. Breusch and Pagan (1979) developed a LM test for heteroskedasticity expressed as:

$$LM=obs*R\text{-}squared$$

The LM test statistic is distributed under a chi-square distribution with degrees of freedom equal to the number of slope coefficients included in the auxiliary regression. If the LM statistic is higher than the critical chi-square statistic, the null hypothesis of homoskedasticity can be rejected (Hill, Griffiths & Lim 2011; Asteriou 2006).

3.8 Hypothesis Testing for Contagion in South-East Asia

In order to test hypotheses 4, 5, 6 and 7 developed earlier in the chapter, empirical models were drawn from econometrics that have been employed to examine contagion in the stock market. The two econometric methods used in this study to test the presence of contagion effects are correlation coefficient and the Granger causality tests. Correlation coefficient is deemed appropriate to test the contagion because the contagion is defined as a significant increase in the degree of co-movement between stock return in different countries and previous studies have used this method to examine their finding. Some examples are Forbes and Rigobon (2001) and (2002), Arestis, Caporale, Cipollini and Spagnolo (2005), Corsetti, Pericoli and Sbracia (2005), Wilson and Zurbruegg (2004), Dungey, Fry, Gonzalez-Hermosillo and Martin (2005) and Boschi (2007).

The Granger causality test is a well-established model to test the contagion effects between two variables. This test was a type of VAR model, which is very effective in testing the presence of the contagion effect between two stock markets. For example, the previous studies of Yang (2002), Hon, Strauss and Yong (2004), Nikkinen, Saleem, Martikainen (2010) and Egert and Kocenda (2007) have employed Granger causality to test the contagion between two stock markets. The Granger causality is outlined in the following section.

3.8.1 Stationary and Non-Stationary Time Series

A stationary time series is one that exhibits near constant mean, variance and autocorrelation. A requirement of time series econometric methods is that the data set for estimating the parameters should be stationary. Stationary data is suitable for econometric modelling (Maddala 2001; Maddala & Wu 1999; Gujarati 1978). In addition, Philips (1986) states that the inferential statistics, such as thet-statistics and *F*- tests, may provide misleading results if non-stationary time series data are used in the regression analysis. The formal method used in testing the stationary of a series is the unit root test (Dickey, Bell & Miller 1986; Dickey & Fuller 1979). Some macroeconomic variables seem non-stationary; the step in the co-integration study is necessary to check for the stationary of the variables and determine the order of integration. All variables have to integrate in the same order. The order of integration of a series must refer to the number of time series, which must be differenced in order to make it stationary (Brooks 2002).

This study tested for unit roots in the natural logarithms of the sample variables for the Thailand stock market. The type of unit root has been specified to Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), Kwiat-kowski, Phillips, Schmidt and Shin (KPSS) and Ng and Perron (NP). However, this test may choose two of the four tests, ADF and PP methods, to test for a unit root in the level and first series. The present study has chosen the ADF and PP tests due to their strength and suitability for the study data. These two methods are described below:

$$\Delta y_{t} = \alpha y_{t-1} + \sum_{j=1}^{p} \beta \Delta y_{t-1} + \varepsilon_{t}$$

Where: $\Delta y_t = y_t - y_{t-1}$. The factor $\sum_{j=1}^{p} \beta \Delta y_{t-1}$ represents the lagged terms with the length of the lag structure '*p*' number of lagged difference terms. The distribution theory supporting the ADF test was based on the assumption that the error terms were statistically independent and have a constant variance. Dickey and Fuller (1981) established that the ADF test is asymptotically valid in the presence of a moving average (MA) component, provided that adequate lagged difference terms were included in the test regression. Consequently, when using the ADF tests, the researcher has to ensure that the error terms are uncorrelated and have a constant variance.

The PP test was developed by Phillips (1987) and Phillips and Perron (1988). They propose an alternative (nonparametric statistical methods) method to handle the serial correlation in the error terms without adding lagged difference terms. The PP test was based

on the null hypothesis that a unit root exists in the autoregressive representation of the time series. The test regression for the PP analysis is the AR (1) process:

$$\Delta y_{t-1} = \alpha_o + \beta y_{t-1} + \varepsilon_t$$

Where: the process of y_{t-1} is the explanatory variable, α_o is the constant term and β is the autoregressive (AR) coefficient. If $\beta \geq 1$, Δy_{t-1} is a non-stationary series and the variance of Δy_{t-1} increases with time and approaches infinity. If $\beta < 1$, Δy_{t-1} is a stationary series. If $\beta=1$, the series contains a unit root and is non-stationary. Hence, the hypothesis of stationarity can be tested by comparing β against 1, where $H_o : \beta=1$ and $H_1 : \beta < 1$.

The PP test is a modification of the ADF t-statistics, taking into account the less restrictive nature of the error process. Brooks (2002) indicate that a unit root test investigates whether a time serious variables are non-stationary by using an autoregressive model. The ADF test and the PP test are the most famous of the unit root tests, which are used to examine the stationary of time series. Brooks also reports that if the test statistics are higher than the critical values, the variable is none stationary. MacKinnon (1991) states that the asymptotic distribution of the PP t-statistics is the same as the ADF t-statistics, because the critical values are still applicable. Therefore, both the PP and the ADF test can be performed with the inclusion of a constant and a linear trend, or only a constant term (Boschi 2007; Egert & Kocenda 2007).

3.8.2 Correlation Coefficient Test

Correlation is a common measure of the relationship between two variables. It is often used in financial analysis to investigate the nature of the relationship between different variables, such as stock indices between two markets. The correlation coefficient is also an alternative convenient measure of the contagion effects. For example, Calvo and Reinhart (1996) and Yang (2002) scrutinised the contagion effects by analysing the cross-country correlations among emerging stock markets. They suggest that correlation coefficients indicate the short-term co-movement in the stock market. Levine, Stephan, Krehbiel and Berenson (2002) suggest that the correlation coefficient measures the relative strength of a linear relationship between variables. Additionally, Koop (2006) demonstrated the properties of correlation as positive values of r indicate a positive correlation between X and Y; if r has large positive

values, it indicates a strong positive correlation, and also if *r* equals to 1, it indicates a perfect positive correlation. If the correlation shows negative values, it indicates a negative correlation, and if *r* equals to -1, it indicates a perfect negative correlation. The correlation coefficient can be expressed as follows:

$$r = \frac{cov(\mathrm{X}, \mathrm{Y})}{Sx\ Sy}$$

Where: *cov*(x,y) is the covariance between x and y and S_x and S_y are their respective standard derivations.

Correlation coefficients have been used in the past studies to test for the existence of contagion (Forbes & Rigobon 2001, 2002; Wilson & Zurbruegg 2004; Boschi 2007). They concluded that the correlation between two variables is significantly higher in turmoil periods than in tranquil periods, and thus contagion exists. To calculate cross-market correlations, the present study adopted their model as follows:

$$R_t = c + \text{ø}(L)R_t + \eta_t$$
$$R_t = (\gamma_t^{SET}, \gamma_t^i)$$

Where: R_t represents the vector of return in the same two equity markets, γ_t^{SET} is the SET index, while γ_t^i is other indexes in the region, where indexes are calculated as the logarithm, ø(L) is the vector of lags and η_t is a vector of reduced-form disturbances.

To calculate the standard correlation coefficient, the variances of the VAR residuals for SET, SGX, PSE, JKSE and KLSE (σ_{set} and σ_i, respectively), along with the covariance ($\sigma_{i,set}$), were used as follows:

$$\rho_c = \sigma_{i,set} / \sigma_{set}\ \sigma_i$$

If the correlation between $\gamma_t^{SET}\ and\ \gamma_t^i$ does not change, ρ_c will rise whenever the variance for γ_t^{SET} rises. This implies that the ρ_c will increase and overestimate the correlation between the markets under the assumptions discussed above. To overcome this bias within the time series, they propose to correct the standard correlation coefficient by employing the formula:

$$\rho_u = \frac{\rho_c}{\sqrt{1+\delta\,(1-\rho c^{\,2})}}$$

Where: ρ_c is the conditional correlation coefficient, ρ_u is the unconditional correlation coefficient, l is the non-crisis period, h is a highly volatile crisis period and δ is the relative increase in the variance of γ_t^{SET}, which can be defined as:

$$\delta = \sigma_{set}^{h} / \sigma_{set}^{l} - 1$$

To test for contagion is a simple process, with the correlation coefficient between two asset returns for ρ^h during the crisis period (high-volatility period) compared with the correlation coefficient for ρ^l during non-crisis period (lower volatility period). The result of comparing is to determine whether they are significantly different from each other. The null hypothesis indicates non contagion as:

$$H_0 : \rho^h \leq \rho^l$$

And against the alternative hypothesis indicates contagion as:

$$H_1 : \rho^h > \rho^l$$

3.8.3 Granger Causality Test

The general VAR model has many types of structures. The three main types of structure are (1) Granger causality, (2) impulse response function and (3) forecast error variance decompositions. Causality in econometrics is different from the concept in everyday use. The structure of Granger causality provides information about the ability of one variable or a group of variables to predict the other variables. Suppose two variables, x_t and y_t, have an effect on each other with distributed lags, this relationship between these variables can be measured by Granger (1969). He was the first to develop a relatively simple test that defined causality as follows: a variable y_t is said by Granger to cause x_t, if x_t can be predicted with greater accuracy by using the past value of the y_t variable rather than not using such past values, with all other terms remaining unchanged.

The Granger causality test consists of running regressions from one stock return on its lagged values to other stock returns. If the lagged values of one stock return do not yield a statistically significant relationship, then it could be concluded that the stock return does not

cause other stocks (Asteriou & Hall 2011). This study employs the unit root test for checking the stationary. The test for the case of two stationary variables y_t and x_t can be written as:

$$y_t = a_1 + \beta_i x_{t-i} + \gamma_j y_{t-1} + e_{1t} \quad (4.1)$$

$$x_t = a_2 + \theta_i x_{t-i} + \delta_j y_{t-1} + e_{2t} \quad (4.2)$$

Where: a_1 and a_2 are constant coefficients and e_{1t} and e_{2t} are random disturbance terms. This model can be answered in different cases:

Case 1: the lagged *x* terms in (4.1) may be statistically different from zero as a group, and the lagged *y* terms in (4.2) are not statistically different from zero. In this case, change in x_t causes changes in y_t.

Case 2: the lagged *y* terms in (4.2) may be statistically different from zero as a group, and the lagged *x* terms in (4.1) are not statistically different from zero. In this case, changes in y_t causes changes in x_t.

Case 3: both sets of lagged *x* and *y* terms are statistically different from zero in (4.1) and (4.2). In this case, changes in x_t and y_t have bi-directional causality.

Case 4: neither sets of lagged *x* and *y* terms are statistically different from zero in (4.1) and (4.2). In this case, changes in x_t is independent of y_t.

The Granger causality test involves the following procedure. First, estimate the VAR model given by equations (4.1) and (4.2). Then check the significance of the coefficients and apply variable deletion tests, first in the lagged *x* terms for Equation (4.1) and then in the lagged *y* terms in Equation (4.2). For the result of the variable deletion tests, the study may arrive at a conclusion about the direction of causality based upon the four cases presented in the Granger test above.

3.9 Summary

This research is a quantitative study that aims to identify the dominant factors affecting Thailand's stock market volatility and to measure the contagion effects of Thailand's stock market volatility on other South-East Asian stock markets, as well as to measure the

contagion effects of other South-East Asian stock markets on Thailand's stock market. The data required for the analysis process were mostly obtained from secondary sources, mostly from the databases of financial and research institutions. This chapter has discussed the sample identification, estimation procedures and hypothesis testing methodology used in this thesis.

Testing of the hypotheses was divided into two main categories. The first category tested the factors affecting stock volatility (see hypotheses 1, 2 and 3). A multi-factor regression model and a GARCH model will be developed to test the hypotheses. The second category tested the contagion effect on the stock market index in the region (see hypotheses 4, 5, 6 and 7). Two econometrics models, correlation coefficient and Granger causality tests, will be employed to test the hypotheses of contagion. The results of these tests are reported in Chapter 4.

Chapter 4: Research Results and Discussion

4.1 Introduction

This chapter presents a discussion of the results of the factors affecting stock market volatility and contagion. The factors affecting stock market volatility are presented in Section 4.2; this section reports the descriptive statistics of the factors affecting Thailand's stock market. Following this, sections 4.3 and 4.4 describe the results of the test of factors affecting stock market volatility, which relate to the multiple regression and GARCH models. Section 4.5 presents hypotheses 1, 2 and 3 and discusses the findings from sections 4.3 and 4.4 on hypotheses 1, 2 and 3 to answer research question 1. The contagion transmission results are in Section 4.6, which presents the descriptive statistics of Thailand's and South-East Asia's stock markets. Following this, sections 4.7 and 4.8 discuss the outcome of tests that relate to the correlation coefficient and Granger causality models. The next section presents hypotheses 4, 5, 6 and 7 to answer research question 2. This is followed by a discussion of research question 2. A summary of the conclusion is presented in Section 4.10.

4.2 Summary Statistics of Variables

The descriptive statistics of the SET index for the period of February 1999 to October 2010 are presented in Table 4.1. The statistics included the average monthly returns, median, maximums, minimums, standard deviations, skewness, kurtosis, Jacque-Bera statistic, p-value and correlation with returns on the SET index.

First, the highest monthly return was 0.266153 per cent and the lowest was –0.359188 per cent. Second, regarding volatility as measured by standard deviation, ROIL had a higher standard deviation than other returns. Third, all of the variables had negative skewness as recorded from -1.054351 to -0.20565. Further, the kurtosis were from 4.732614 to 6.007368. This indicated that there were higher peaks around the mean compared to normal distribution, which led to thick tails on both sides (leptokurtic distribution). Fourth, the Jarque-Bera statistics were all positive and statistically significant. The corresponding p-values were less than 0.0001 and all t-statistics were closer to zero. Finally, the correlation matrix of the RSET were positively correlated with the RBSI, ROIL and the RSP500. The RSET was strongly

correlated with RSP500 at +0.522001, but weakly correlated with the RBSI at +0.277982 and ROIL at +0.168667.

Table 4.1: Descriptive Statistics—Monthly Returns of Variables on Stock Index of Thailand, February 1999 to October 2010

	RSET	RBSI	ROIL	RSP500
Mean	0.007574	0.000705	0.014489	-0.000325
Median	0.011038	0.001942	0.027422	0.007014
Maximum	0.266153	0.146835	0.201448	0.198243
Minimum	-0.359188	-0.191339	-0.311841	-0.185636
Std Dev	0.082208	0.043292	0.091003	0.049896
Skewness	-0.684177	-0.500595	-1.054351	-0.20565
Kurtosis	5.989407	6.007368	4.732614	5.017133
Jarque-Bera	63.05221	58.60544	43.45	24.72161
P-value	0	0	0	0.000004
T-statistic	0.00779	0.00137	0.01345	0.00055
Correlation with SET index	1	0.277982	0.168667	0.522001
Observations	140	140	140	140

Note: variables include The Stock Exchange of Thailand (RSET), The business sentiment of Thailand index returns (RBSI), The oil price returns (ROIL) and The S&P 500 returns (RSP500).

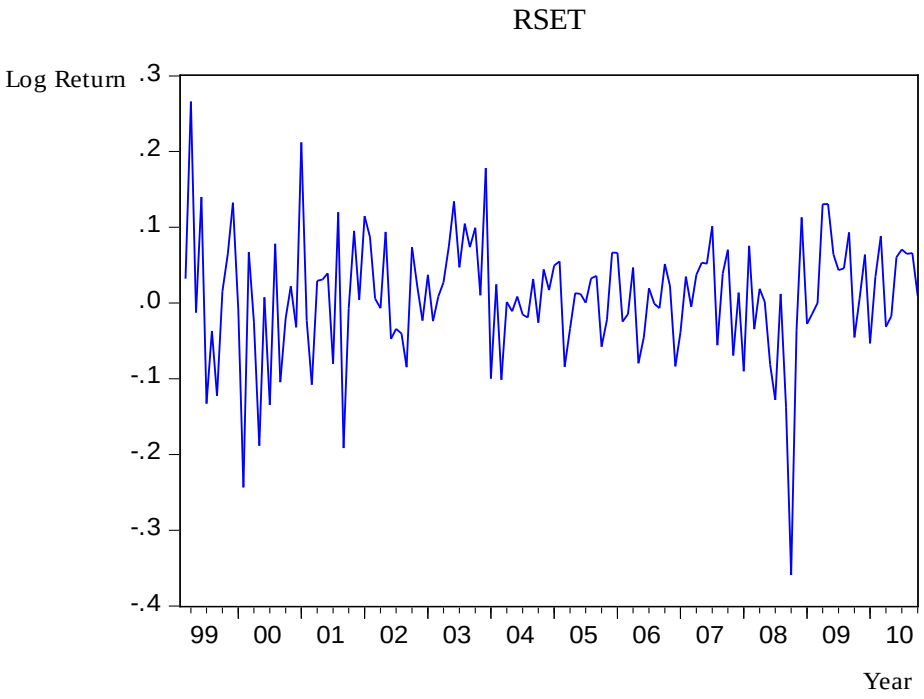

Figure 4.1a: Time series of RSET.

Figure 4.1a plots the time series of monthly returns for RSET. The mean return appeared to be close to zero. Volatility in the return showed clear evidence of time-varying volatility on certain periods (volatility clustering). In particular, the RSET alternated between periods of low and high volatility. The volatility clustering of the stock return series fluctuated, which showed that small shocks tended to follow small shocks and big shocks tended to be followed by big shocks. In this case, the high-volatility periods included Thailand's political crisis of 2006 to 2010, the subprime crisis of 2007 to 2009 and the oil price increase of 2007 to 2009. Comparing these periods, the mid-2007s was the highest volatility period coinciding with the subprime crisis. However, the effect of oil price fluctuation and political uncertainty seemed to be less significant than S&P 500 on Thailand's stock market. Also, the monthly return plot shows that there were more negative returns than positive returns and inconstant, confirmed in the histogram of returns where the negative skewness is clear in Figure 4.1b.

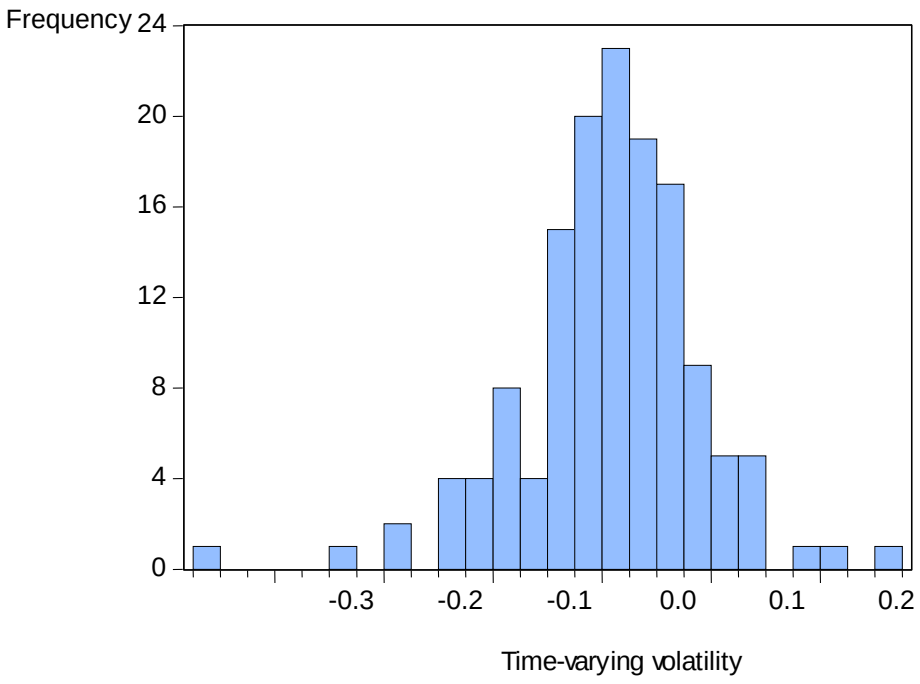

Figure 4.1b: Histogram of RSET.

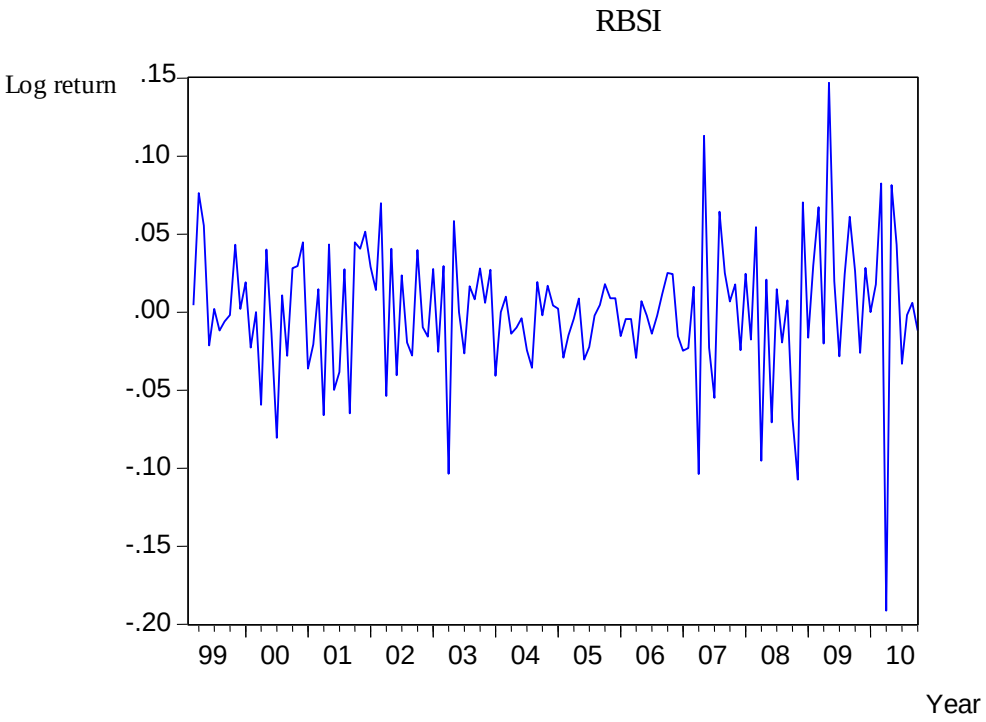

Figure 4.2a Time series of RBSI.

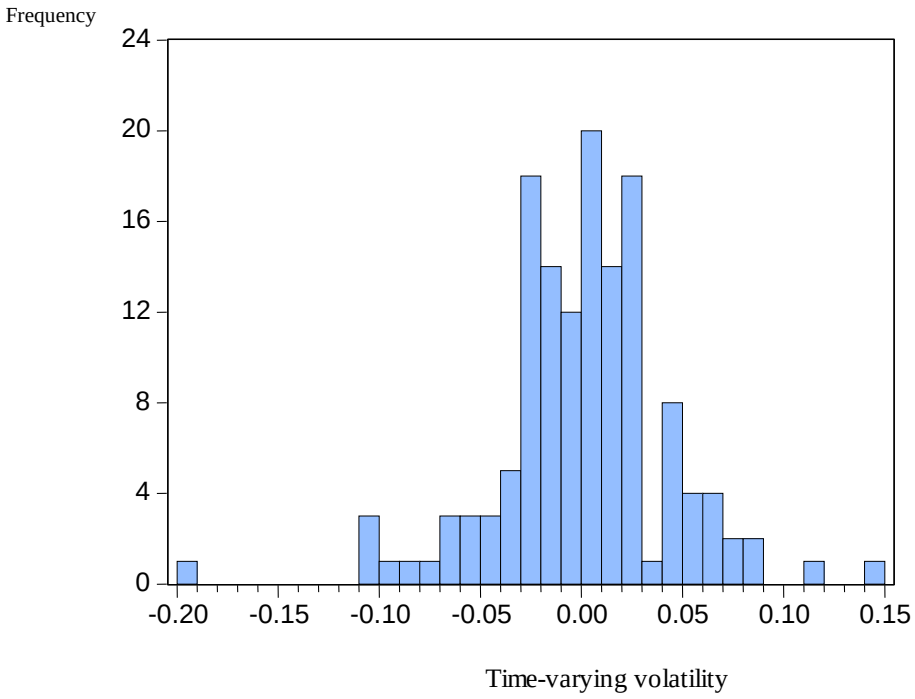

Figure 4.2b Histogram of RBSI.

Figure 4.2a shows the plots of the monthly returns of RBSI. The volatility of the RBSI showed a series plunge from the end of 2006 to the end of 2010 due to parliament dissolution, a boycotted election, a coup d'état in 2006, civil disobedience and political turmoil in 2007, state of emergencies in 2009 and 2010 and military, police and government crackdowns in 2009 and 2010. Also, the histogram returns confirmed that the RBSI were inconstant and showed the negative returns were larger than positive returns (see Figure 4.2b).

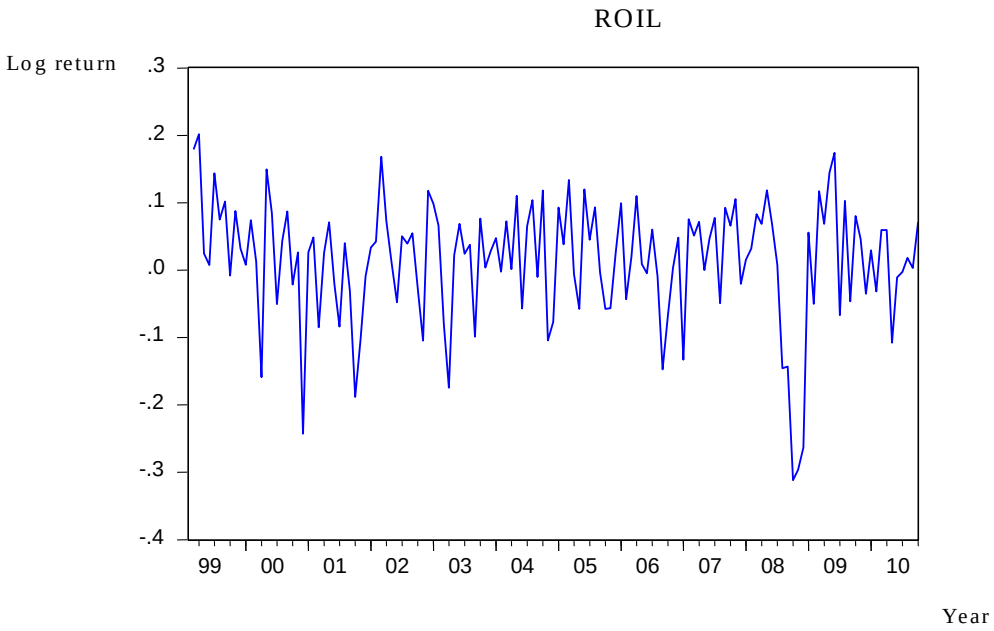

Figure 4.3a Time series of ROIL.

Figure 4.3a presents the plots monthly series of the ROIL. The ROIL were moderate in 2007 and fluctuated dramatically during 2008 due to speculation, high demand from oil importing countries and a supply decrease by OPEC. The ROIL shows that the negative returns were larger than positive returns and inconstant, confirmed by the histogram of returns (see Figure 4.3b).

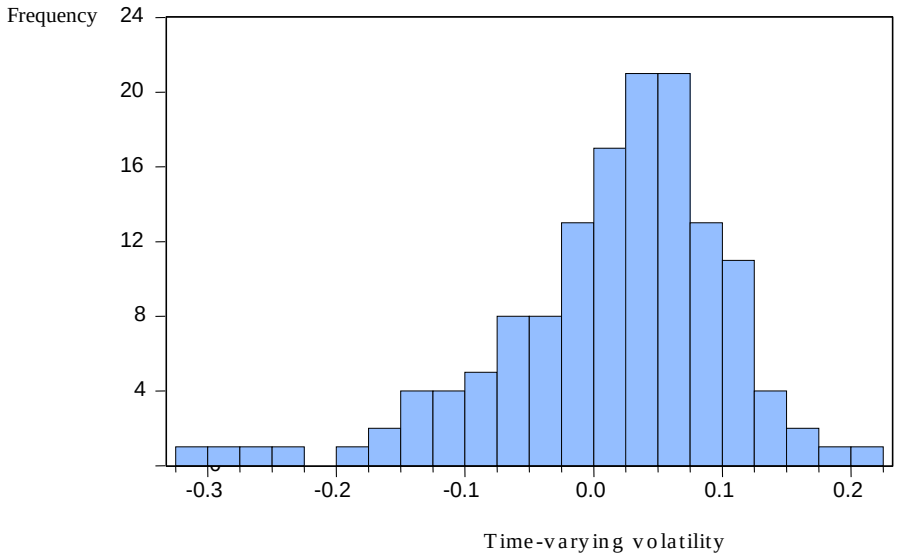

Figure 4.3b Histogram of ROIL.

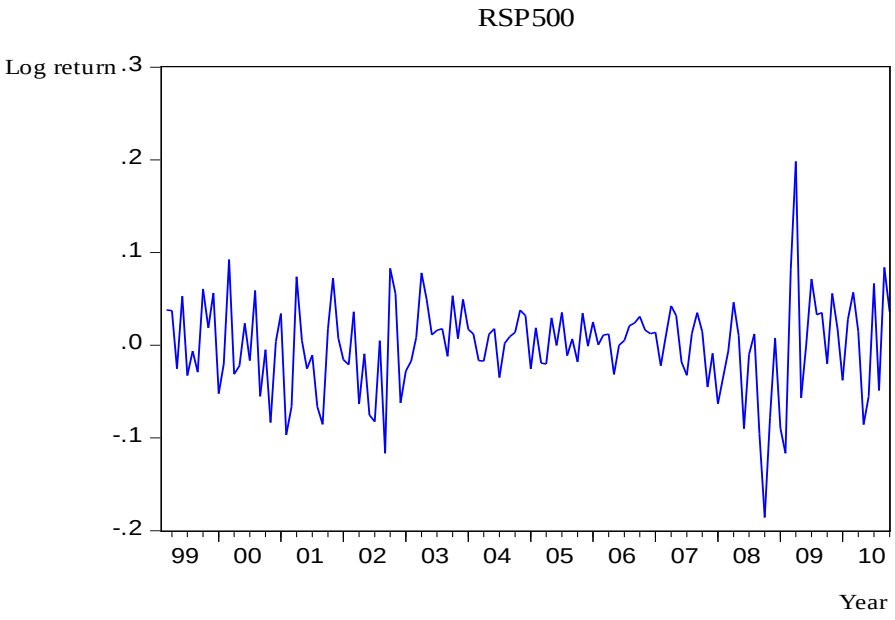

Figure 4.4a Time Series of S&P 500 Stock Index Returns (RSP500)

Figures 4.4a and 4.4b provides the plots for the RSP500 monthly series and the histogram of returns. The return series showed a slight decrease during mid-2007 and a series plunge during 2008 to 2009 coinciding with the subprime crisis. The plot shows that there was a precedence of negative returns compared to positive returns and is inconstant.

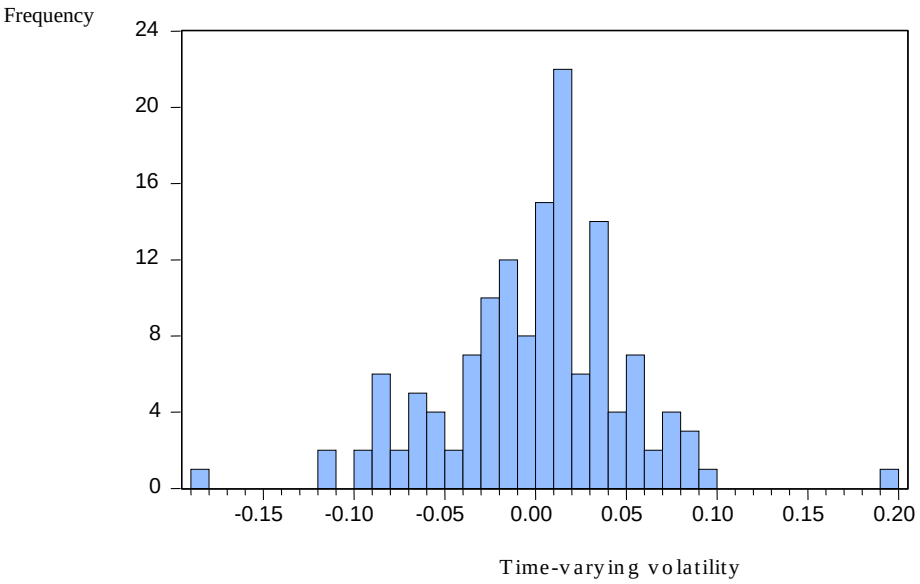

Figure 4.4b Histogram of RSP500.4.3 Multiple Regression Model

The multiple regression models are employed to test the factors affecting Thailand stock market volatility, which are divided into three periods. First, the full period (February 1999 to October 2010), which includes the period of relative financial stability (low volatility) as a result of Thailand's political certainty, minor changes in oil price and low fluctuation in S&P 500 index, and financial instability (high volatility) as a result of Thailand's political uncertainty, oil price fluctuation and the subprime mortgage crisis affecting the S&P500 index. Second, the low-volatility period (February 1999 to October 2006) estimations, which includes a stable political situation in Thailand and the SET having less effects from normal conditions concerning oil price and the S&P 500 index.

Third, the high-volatility period (October 2006 to October 2010) estimations included three major factors affecting Thailand stock market volatility. There are many political crises, such as parliament dissolution, a boycotted election, a coup d'état in 2006, civil disobedience and political turmoil in 2007, state of emergency and military, police and government crackdowns in 2009 and 2010. Oil price had fluctuated dramatically and there was transmission of the subprime crisis.

Table 4.2a: Regression Results on Monthly Return, 1999:02 to 2010:10 (n=140)

Variable	Coefficient	Std Error	T-statistic	Prob
C	0.006289	0.005790	1.086033	0.2794
ROIL	0.085731	0.063633	1.347269	0.1801
RBSI	0.436710	0.133434	3.272846	0.0013
RSP500	0.813623	0.115902	7.019947	0.0000
R-squared	0.337713	Mean dependent var		0.007574
Adjusted R-squared	0.323104	SD dependent var		0.082208
SE of regression	0.067636	Akaike info criterion		-2.521203
Sum squared resid	0.622146	Schwarz criterion		-2.437156
Log likelihood	180.4842	Hannan-Quinn criter		-2.487049
F-statistic	23.11634	Durbin-Watson stat		2.205635
Prob (F-statistic)	<0.000001			

The results presented in Table 4.2a, the relationship between the RSET and some variables (BSI of Thailand returns and S&P 500 stock index returns) were statistically significant at a lower level of $p = 0.0013$ and < 0.0001 with positive coefficients of 0.436713 and 0.813623 for the BSI and S&P 500 index returns respectively. In contrast, the ROIL coefficient was 0.085731 but was not significant. This finding concluded that the highest contribution of factor affecting RSET was the RSP500 and the RBSI. However, fluctuation in oil prices was not a significant factor affecting Thailand's stock market.

Table 4.2b: Regression Results of the Low-Volatility Period, 1999:02 to 2006:10 (n=92)

Variable	Coefficient	Std Error	T-statistic	Prob
C	0.005697	0.007412	0.768560	0.4442
ROIL	0.081851	0.088907	0.920636	0.3598
RBSI	0.606097	0.226034	2.681437	0.0088
RSP500	0.921279	0.178226	5.169165	0.0000
R-squared	0.308537	Mean dependent var		0.008163
Adjusted R-squared	0.284965	SD dependent var		0.081892
SE of regression	0.069248	Akaike info criterion		-2.459743
Sum squared resid	0.421984	Schwarz criterion		-2.350100
Log likelihood	117.1482	Hannan-Quinn criter		-2.415490
F-statistic	13.08883	Durbin-Watson stat		2.226044
Prob (F-statistic)	<0.000001			

Note that Table 4.2b was estimated from February 1999 to October 2006 (low-volatility period). This period comprised a stable political situation in Thailand and the SET had normal conditions. The results showed that the estimated coefficients on the RBSI and RSP500 were positives at 0.606097 and 0.921279, respectively, with approximately half of the models estimated and statistically significant at a lower level of $p = 0.0088$ and < 0.0001. By contrast, the estimated coefficient for ROIL was positive at 0.081851, but did not have a statistically significant effect. This finding concluded that RSP500 and the RBSI have a significant effect on the Thailand stock market.

Table 4.2c: Regression Results of the High-Volatility Period, 2006:11 to 2010:10 (n=47)

Variable	Coefficient	Std Error	T-statistic	Prob
C	0.007001	0.009755	0.717745	0.4768
ROIL	0.130294	0.099059	1.315320	0.1954
RBSI	0.320728	0.165720	1.935355	0.0595
RSP500	0.685271	0.164350	4.169585	0.0001
R-squared	0.422464	Mean dependent var		0.006100
Adjusted R-squared	0.382171	SD dependent var		0.084538
SE of regression	0.066449	Akaike info criterion		-2.503503
Sum squared resid	0.189864	Schwarz criterion		-2.346043
Log likelihood	62.83232	Hannan-Quinn criter		-2.444250
F-statistic	10.48475	Durbin-Watson stat		2.094074
Prob (F-statistic)	0.000027			

The high-volatility period estimated from November 2006 to October 2010 related to three factors affecting Thailand's stock market: first, the S&P 500 stock index had a serious plunge during 2008 to 2009 due to the subprime crisis. Second, the oil price had fluctuated dramatically during 2008 due to speculation, high demand from oil importing countries and a supply decrease by OPEC, and third, political uncertainty ran from the end of 2006 to the end of 2010 with many political disorders, such as parliament dissolution, a boycotted election, a coup d'état in 2006, civil disobedience and political turmoil in 2007, state of emergency in 2008 and 2010 and military, police and government crackdowns in 2008 and 2010. The results from the high-volatility period (see Table 4.2c) showed that only the estimated coefficient on the RSP500 had a positive relationship with the RSET at 0.685271, and was

statistically significant at a lower level of p=0.0001. Conversely, the estimated coefficient for ROIL and RBSI were positive at 0.130294 and 0.320728, respectively, but did not have a statistically significant effect.

The fit of the three models were measured by the adjusted R-squared (R^2). The adjusted R-squared (R^2) value of three models were 0.3231, 0.2849 and 0.3821, respectively (see tables 4.2a, 4.2b and 4.2c), which indicates that, given the nature of data used, the estimated model fitted the data reasonably well. Asteriou and Hall (2011) state that the adjusted R^2 is an appropriate statistic instead of R,^{2} because it is adjusted for the degrees of freedom. The highest adjusted R^2 is 1 and lowest adjusted R^2 can be negative. However, a negative adjusted R^2 indicates that the model is inadequate in describing the data-generating process. Further, Studenmund (2001) states that the adjusted R^2 can be used to compare the fits of equations with the same dependent variable and different numbers of independent variables. Because of this, most research automatically uses the adjusted R^2 instead of R^2 when evaluating the fit of their estimated regression equations. The values of the Durbin-Watson statistic were closer to two, indicating that these representations were likely to be free of serial correlation. He also states that the Durbin-Watson statistic can help detect an impure serial correlation. He computed that the Durbin-Watson statistic should have a range from 0 to 4. All of the coefficients were positive, indicating direct effects, but only RSP500 and RBSI were statistically significant. There was no evidence of ROIL having a significant effect on the SET. Therefore, while the results confirm some of the earlier findings, it does not confirm the effect of oil price on the SET.

Table 4.2d: Summary of Regression Results of the Full Data Set and Two Sub-samples

	Coefficient		
Variable	Full	Low Volatility	High Volatility
ROIL	0.085731	0.081851	0.130294
RBSI	0.43671 ***	0.606097 ***	0.320728 **
RSP500	0.813623 ***	0.921279 ***	0.685271***
Adjusted R-squared	0.323104	0.284965	0.382171

***, **, * significant at the 1%, 5%, and 10% levels, respectively

Table 4.2d presents a comparison of the estimates of the full data set and the two sub-samples. All three models are statistically significant and the three parameter estimates were all positive. RSP500 was significant in the three models and RBSI was significant in the full data set and low-volatility models. ROIL was not significant in all models. This comparison

shows that while all of the variables have positive effects, only two (RBSI and RSP500) are significant and the level of significant varies among the models

The next step of the analysis is to conduct the Breusch-Pagan LM test. This test is to determine whether all data are heteroskedastic (non-constant). The result of this test will guide the researcher on the choice between ARCH and GARCH models.

Table 4.3: Breusch-Pagan LM Test Auxiliary Regression

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	2.488483	Prob F (3,136)	0.0631
LM stat (Obs*R-squared)	7.285118	Prob chi-square (3)	0.0633
Scaled explained SS	11.05053	Prob chi-square (3)	0.0115

According to Asteriou (2006), the LM test statistic is distributed under a chi-square distribution with degrees of freedom equal to the number of slope coefficients included in the auxiliary regression. The LM statistic is 7.285118 and has a probability of chi-square at 0.633. This clearly suggests that the null hypothesis of homoskedasticity is rejected and it follows that the appropriate model is the GARCH model.

4.4 GARCH Model

The ARCH family of models are appropriate to examine when variance of the disturbance terms are non-constant over time (heteroskedasticity). Asteriou (2006) states that the financial econometric requires the use of models and techniques that are able to respond the demand of investors' expected returns and also towards risk (or uncertainty). This fact requires models that are capable of dealing with the volatility of the series (Asteriou 2006). In order to estimate the GARCH (p, q) model, this study applied the EView program to estimate equations and change the values in the boxes of the ARCH and the GARCH alternative specification by choosing the number of the p lags (1, 2 … p) for the order of the ARCH and the number of q lags (1, 2 … q) for the GARCH. To explain an appropriate model, this study compares the model from both the ARCH and the GARCH alternative specification. If the Schwarz criterion is less, it can indicate the best model for the GARCH (p, q).

Table 4.4: GARCH (1, 1) of SET, Period 1999M02 2010M10 (n=140)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.006711	0.005783	1.160438	0.2459
ROIL	0.096983	0.057603	1.683653	0.0922
RBSI	0.387994	0.123521	3.141105	0.0017
RSP500	0.754141	0.117808	6.401452	0.0000
Variance Equation				
C	0.000148	8.70E-05	1.703194	0.0885
RESID(-1)^2	0.009138	0.027428	0.333154	0.7390
GARCH(-1)	0.942166	0.038623	24.39400	0.0000
R-squared	0.335556	Mean dependent var		0.007574
Adjusted R-squared	0.320900	SD dependent var		0.082208
SE of regression	0.067746	Akaike info criterion		-2.573806
Sum squared resid	0.624172	Schwarz criterion		-2.426724
Log likelihood	187.1664	Hannan-Quinn criter		-2.514037
F-statistic	11.44709	Durbin-Watson stat		2.191294
Prob (F-statistic)	<0.000001			

The values in the boxes of the ARCH and GARCH were specified to 1 and 1 in order to estimate the GARCH (1, 1) model, the results shown in Table 4.4. The estimated coefficients of all variables were positive and statistically significant at a low level of p-value. However, the coefficients of the variance equation from the ARCH and GARCH lagged terms were positive at 0.009138 and 0.942166, respectively. The Schwarz criterion has a low level of -2.426724.

Changing the values in the boxes by typing 2 for the ARCH and 1 for GARCH led to the results shown in Table 4.5. The estimated coefficients of all variables were positive and statistically significant at a low level of p-value. However, the coefficients of the variance equation from the ARCH lagged terms have some negative values of -0.089328 and 0.179728, respectively, and the GARCH lagged term has 0.777630. The Schwarz criterion has a level of -2.399699. As a result, the GARCH (2, 1) was not an appropriate model.

Table 4.5: GARCH (2, 1) of RSET, Period 1999:03 to 2010:10 (n=140)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.007968	0.005102	1.561691	0.1184
ROIL	0.139074	0.055005	2.528376	0.0115
RBSI	0.393942	0.124663	3.160065	0.0016
RSP500	0.679527	0.112523	6.039011	0.0000
Variance Equation				
C	0.000510	0.000280	1.819681	0.0688
RESID(-1)^2	-0.089328	0.028341	-3.151888	0.0016
RESID(-2)^2	0.179728	0.080839	2.223293	0.0262
GARCH(-1)	0.777630	0.107938	7.204416	0.0000
R-squared	0.327163	Mean dependent var		0.007574
Adjusted R-squared	0.312321	SD dependent var		0.082208
SE of regression	0.068172	Akaike info criterion		-2.567793
Sum squared resid	0.632056	Schwarz criterion		-2.399699
Log likelihood	187.7455	Hannan-Quinn criter		-2.499485
F-statistic	9.447021	Durbin-Watson stat		2.199539
Prob (F-statistic)	<0.000001			

Similarly, the result of GARCH (2, 2) in Table 4.6 showed that the estimated coefficients of all variables were positive and statistically significant at a low level of p-value, but the coefficients of the variance equation from the ARCH lagged terms have some negatives of -0.084452 and 0.188746, respectively, and the GARCH lagged terms have 0.555577 and 0.181979. The Schwarz criterion has -2.358520. This result concluded that the GARCH (2, 2) was not an appropriate model.

The results of GARCH (3, 1) in Table 4.7 showed that the estimated coefficients of all variables were positive and significant, but the coefficients of the variance equation from the ARCH lagged terms have some negatives of -0.071913, 0.201410 and 0.045417, respectively, and the GARCH lagged term has 0.494385. The Schwarz criterion has a level of -2.355844. This result concluded that the GARCH (3, 1) was an inappropriate model.

Table 4.6: GARCH (2, 2) of RSET, Period 1999:03 to 2010:10 (n=140)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.007612	0.004547	1.674251	0.0941
ROIL	0.140890	0.051763	2.721844	0.0065
RBSI	0.397445	0.124329	3.196708	0.0014
RSP500	0.682902	0.064592	10.57256	0.0000
Variance Equation				
C	0.000594	0.000487	1.219756	0.2226
RESID(-1)^2	-0.084452	0.045450	-1.858104	0.0632
RESID(-2)^2	0.188746	0.138554	1.362262	0.1731
GARCH(-1)	0.555577	0.429388	1.293883	0.1957
GARCH(-2)	0.181979	0.285850	0.636625	0.5244
R-squared	0.327581	Mean dependent var		0.007574
Adjusted R-squared	0.312748	SD dependent var		0.082208
SE of regression	0.068151	Akaike info criterion		-2.547626
Sum squared resid	0.631664	Schwarz criterion		-2.358520
Log likelihood	187.3338	Hannan-Quinn criter		-2.470779
F-statistic	8.281859	Durbin-Watson stat		2.201572
Prob (F-statistic)	0.000000			

The values in the boxes of the ARCH and GARCH were specified to 2 and 3 in order to estimate the GARCH (2, 3) model. The results shown in Table 4.8 conclude that all estimated variables coefficients were positive and significant, but some coefficients of the variance equation from the ARCH and GARCH lagged terms have some negatives of -0.016670 and 0.168428 for ARCH, and 1.072392, -1.090018 and 0.802025 for GARCH. Also, the Schwarz criterion has a level of -2.403112, so this model was not appropriate.

The GARCH model is estimated in stages, where stage 1 involves the determination of the order of ARCH and GARCH. Table 4.4 through Table 4.8 presents the various GARCH models estimated. The best form of the model is determined by the estimated value of Schwarz criterion; the one with the smallest value is the best model. Table 4.9 provides a summary of the Schwarz criterion of the model estimated. Comparing all of models from the ARCH and GARCH alternative specifications, the GARCH (1, 1) demonstrated the best performance with the smallest value of Schwarz criterion at -2.42

Table 4.7: GARCH (3, 1) of RSET, Period 1999:03 to 2010:10 (n=140)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.006804	0.005702	1.193350	0.2327
ROIL	0.135736	0.063118	2.150509	0.0315
RBSI	0.388085	0.129167	3.004520	0.0027
RSP500	0.663453	0.108165	6.133731	0.0000
Variance Equation				
C	0.001408	0.001126	1.249821	0.2114
RESID(-1)^2	-0.071913	0.027732	-2.593158	0.0095
RESID(-2)^2	0.201410	0.154681	1.302101	0.1929
RESID(-3)^2	0.045417	0.105889	0.428912	0.6680
GARCH(-1)	0.494385	0.315332	1.567822	0.1169
R-squared	0.326413	Mean dependent var		0.007574
Adjusted R-squared	0.311555	SD dependent var		0.082208
SE of regression	0.068210	Akaike info criterion		-2.544950
Sum squared resid	0.632761	Schwarz criterion		-2.355844
Log likelihood	187.1465	Hannan-Quinn criter		-2.468103
F-statistic	8.238024	Durbin-Watson stat		2.200049
Prob (F-statistic)	<0.000001			

Table 4.8: GARCH (2, 3) of RSET, Period 1999:03 to 2010:10 (n=140)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.007859	0.004760	1.651069	0.0987
ROIL	0.129294	0.049958	2.588050	0.0097
RBSI	0.365612	0.125148	2.921433	0.0035
RSP500	0.667242	0.138502	4.817579	0.0000
Variance Equation				
C	0.000200	0.000184	1.086493	0.2773
RESID(-1)^2	-0.016670	0.056417	-0.295469	0.7676
RESID(-2)^2	0.168428	0.062185	2.708484	0.0068
GARCH(-1)	1.072392	0.041696	25.71916	0.0000
GARCH(-2)	-1.090018	0.065192	-16.72024	0.0000
GARCH(-3)	0.802025	0.052203	15.36361	0.0000
R-squared	0.326090	Mean dependent var		0.007574
Adjusted R-squared	0.311224	SD dependent var		0.082208
SE of regression	0.068227	Akaike info criterion		-2.613229
Sum squared resid	0.633064	Schwarz criterion		-2.403112
Log likelihood	192.9260	Hannan-Quinn criter		-2.527844
F-statistic	7.311925	Durbin-Watson stat		2.188602
Prob (F-statistic)	<0.000001			

Table 4.9: Schwarz Criterion of GARCH, Period 1999:03 to 2010:10 (n=140)

GARCH (p, q)	Schwarz criterion
GARCH (1, 1)	**-2.42**
GARCH (2, 1)	-2.39
GARCH (2, 2)	-2.35
GARCH (2, 3)	-2.40

The GARCH (1, 1) model also requires the positive variance coefficients $\alpha + \beta < 1$ as discussed in Chapter 3, whereas other models have given some negative signs in the ARCH and GARCH lagged terms. Based on the result of stage 1, further analysis will be limited to estimates of the GARCH (1, 1) model.

The results for the GARCH (1,1) model show in Table 4.4, based on the specification that used the variance series to capture risk, as given by equations 3.0 and 3.1 discussed in Chapter 3, gives the final estimate of the GARCH (1,1) equation as:

$$Ln(RSET)=0.006711+0.096983Ln(ROIL)+0.387994Ln(RBSI)+0.754141Ln(RSP500)$$
$$(1.160438) \quad (1.683653) \qquad (3.141105) \qquad (6.401452)$$

and the variance equation as:

$$\sigma_t^2=0.000148 + 0.009138\varepsilon_{t-1}^2 + 0.942166\sigma_{t-1}^2$$
$$(0.000148) \; (0.333154) \quad (24.39400)$$

The numbers in parentheses are the z-statistics.

From the estimates of the variance equation of the GARCH model, we can estimate the volatility of the dependent variable (RSET) by applying Equation 3.3 discussed in Chapter 3. The corresponding values are ω=0.000148, α=0.009138 and β=0.942166, with $\alpha + \beta < 1$. The volatility of RSET (σ) is:

$$\sigma_t^2 = \frac{0.000148}{1 - (0.942166 + \; 0.009138)}$$
$$\sigma_t^2 = 0.0030393$$
$$\sigma = 0.055129$$

The volatility of the SET is 0.055. All estimation variables during this period were statistically significant at the 1 per cent level on the RSP500 and the RBSI and at the 10 per cent level on ROIL. In order of magnitude, the estimated coefficients for RBSI, ROIL and RSP500 gave a positive sign. This result suggests that the variables were generally volatile for the RSET at 5.5 per cent per month. The study observed that the RBSI and the RSP500 exhibited significant effects on the variation in the RSET, with contributions of 0.387 per cent and 0.754 per cent of return volatility, respectively, while ROIL explained a little of the stock market returns in Thailand with a contribution of about 0.096 per cent of the returns volatility.

The following sections present and discuss the estimation of the GARCH model for the low-volatility sub-samples.

Table 4.10a: GARCH (1, 1) of RSET, Period 1999:03 to 2006:10 (n=92)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.003009	0.000954	3.152996	0.0016
ROIL	0.158857	0.073260	2.168409	0.0301
RBSI	0.513518	0.213091	2.409848	0.0160
RSP500	0.864965	0.188852	4.580123	0.0000
Variance Equation				
C	-4.04E-05	6.41E-05	-0.629285	0.5292
RESID(-1)^2	-0.064609	0.053727	-1.202536	0.2292
GARCH(-1)	1.063987	0.064180	16.57812	0.0000
R-squared	0.299474	Mean dependent var		0.008163
Adjusted R-squared	0.275593	SD dependent var		0.081892
SE of regression	0.069700	Akaike info criterion		-2.712346
Sum squared resid	0.427515	Schwarz criterion		-2.520471
Log likelihood	131.7679	Hannan-Quinn criter		-2.634904
F-statistic	6.269991	Durbin-Watson stat		2.203541
Prob (F-statistic)	0.000016			

The values in the boxes of the ARCH and GARCH were specified to 1 and 1 in order to estimate the GARCH (1, 1) model. The results shown in Table 4.10a conclude that all estimated variables coefficients were positive and significant. However, the estimates of the variance equation of the GARCH model cannot estimate the volatility of the dependent variable (RSET). Because of the corresponding value of $\omega < 0$ (see discussion in Chapter 3). As a result, this study will re-estimate the GARCH model. The best form of the GARCH specification model is determined by comparing all of models with the value of Schwarz

criterion and the corresponding value of $\alpha + \beta$ and ω (see Appendix C). The GARCH (2, 1) demonstrated the best performance with the result of a smaller value of Schwarz criterion and the corresponding value of $\alpha + \beta < 1$ and $\omega > 0$ discussed in Chapter 3.

Table 4.10b GARCH (2, 1) of RSET, Period 1999:03 to 2006:10 (n=92)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.006788	0.006684	1.015577	0.3098
ROIL	0.151560	0.088843	1.705927	0.0880
RBSI	0.614076	0.181066	3.391450	0.0007
RSP500	0.698101	0.101116	6.903949	0.0000
Variance Equation				
C	0.000309	0.000258	1.196953	0.2313
RESID(-1)^2	-0.088822	0.060774	-1.461513	0.1439
RESID(-2)^2	0.198584	0.100864	1.968829	0.0490
GARCH(-1)	0.789350	0.109067	7.237317	0.0000
R-squared	0.287715	Mean dependent var		0.008163
Adjusted R-	0.263432	SD dependent var		0.081892
SE of regression	0.070283	Akaike info criterion		-2.550436
Sum squared resid	0.434692	Schwarz criterion		-2.331150
Log likelihood	125.3201	Hannan-Quinn criter		-2.461931
F-statistic	5.078004	Durbin-Watson stat		2.252207
Prob (F-statistic)	0.000071			

Table 4.10b showed the GARCH (2, 1) with the sample period 1999:02 to 2006:10. This period related to Thailand, which had a stable political condition while the SET had normal conditions (low volatility). The estimated coefficients of all variables were positive and statistically significant at a low level of p-value. Also, the coefficients of the variance equation from the ARCH lagged terms have -0.088822 and 0.198584, respectively, and the GARCH lagged term has 0.789350. According to equations 3.0 and 3.1 discussed in Chapter 3, the final estimated of GARCH (2, 1) equation is:

$$Ln(RSET)=0.006788+0.151560Ln(ROIL)+0.614076Ln(RBSI)+0.698101Ln(RSP500)$$
$$(1.015577) \quad (1.705927) \quad (3.391450) \quad (6.903949)$$

and the variance equation is:

$$\sigma_t^2=0.000309 - 0.088822\varepsilon_t^2 + 0.198584\varepsilon_{t-1}^2 + 0.789350\sigma_{t-1}^2$$
$$(1.196953) \; (-1.461513) \quad (1.968829) \quad (7.237317)$$

The numbers in parentheses are the z-statistics.

From the estimates of the variance equation of the GARCH model, we can estimate the volatility of the dependent variable (RSET) by applying Equation 3.3, discussed in Chapter 3. The corresponding values are ω=0.000309, α_0=-0.088822, α_1=0.198584 and β=0.789350, with $\alpha + \beta < 1$. The volatility of RSET (σ) is:

$$\sigma_t^2 = \frac{0.000309}{1 - (0.789350 - 0.088822 + 0.198584}$$

$$\sigma_t^2 = 0.0030062$$
$$\sigma = 0.055335$$

The volatility of the SET was 0.055335. The variance decomposition revealed that all variables were positively significant at the 1 per cent level on the RSP500 and the RBSI, and at 10 per cent level on the ROIL. The RSP500 had a great influence at a 0.698101 coefficient term. The RBSI presented at a 0.614076 coefficient term and the ROIL had the least effect variable at a 0.151560 coefficient term. This result implies that the RSP500 is more important in explaining the changes in RSET.

The following section is the estimation of the GARCH model on the high volatility sub-samples. The study compares all of GARCH models from the ARCH and GARCH alternative specifications to find the best-fit GARCH model (see Appendix D). The GARCH (1, 2) demonstrated the best performance with the result in smallest value of Schwarz criterion at -2.177357 and the corresponding value of $\alpha + \beta < 1$ and $\omega > 0$, discussed in Chapter 3.

Table 4.11 GARCH (1, 2) of RSET, Period 2006:11 to 2010:10 (n=47)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.010584	0.009518	1.111931	0.2662
ROIL	0.198182	0.095705	2.070762	0.0384
RBSI	0.342132	0.085855	3.984976	0.0001
RSP500	0.513233	0.200416	2.560835	0.0104
Variance Equation				
C	0.001182	0.000318	3.715410	0.0002
RESID(-1)^2	0.015908	0.043794	0.363252	0.7164
GARCH(-1)	1.762586	0.134811	13.07447	0.0000
GARCH(-2)	-1.083954	0.080020	-13.54598	0.0000
R-squared	0.402582	Mean dependent var		0.006100
Adjusted R-squared	0.360902	SD dependent var		0.084538
SE of regression	0.067583	Akaike info criterion		-2.492276
Sum squared resid	0.196401	Schwarz criterion		-2.177357
Log likelihood	66.56848	Hannan-Quinn criter		-2.373770
F-statistic	4.139485	Durbin-Watson stat		2.119589
Prob (F-statistic)	0.001474			

Table 4.11 showed the sample of the high-volatility period from 2006M11 to 2010M10. At a high-volatility period, the Thailand stock market encountered many factors affecting volatility, which includes (1) the S&P 500 stock index had a serious plunge during 2008 to 2009 because of subprime crisis, (2) the oil price fluctuated dramatically during 2008 due to speculation, high demand from oil importing countries and a supply decrease by OPEC and (3) the BSI of Thailand had a serious plunge from the end of 2006 to the end of 2010, due to parliament dissolution, a boycotted election, a coup d'état in 2006, civil disobedience and political turmoil in 2007, state of emergency in 2008 and 2010 and military, police and government crackdowns in 2008 and 2010.

The estimated coefficients of all variables were positive and statistically significant at a low level of p-value. In addition, the coefficients of the variance equation from the ARCH lagged term has 0.015908 and the GARCH lagged terms have 1.762586 and -1.083954, respectively. According to equations 3.0 and 3.1 discussed in Chapter 3, the final estimate of the GARCH (1, 2) equation is:

$$Ln(RSET)=0.010584+0.198182Ln(ROIL)+0.342132Ln(RBSI)+0.513233Ln(RSP500)$$
$$(1.111931) \quad (2.070762) \quad (3.984976) \quad (2.560835)$$

and the variance equation is:

$$\sigma_t^2 = 0.001182 + 0.015908\varepsilon_{t-1}^2 + 1.762586\sigma_t^2 - 1.083954\sigma_{t-1}^2$$
$$(3.715410) \quad (0.363252) \qquad (13.07447) \qquad (-13.54598)$$

The numbers in parentheses are the z-statistics.

From the estimates of the variance equation of the GARCH model, we can estimate the volatility of the dependent variable (RSET) by applying Equation 3.3, discussed in Chapter 3. The corresponding values are ω=0.001182, α=0.015908 and β_0=1.762586 and β_1=-1.083954, with $\alpha + \beta < 1$. The volatility of RSET (σ) is:

$$\sigma_t^2 = \frac{0.001182}{1 - (1.762586 - 1.083954 + 0.015908}$$
$$\sigma_t^2 = 0.00387$$
$$\sigma = 0.06221$$

The volatility of the SET is 0.062. All estimation of variable coefficients are statistically positive significant. The RSP500 and the RBSI presented a low level of p-value at 1 per cent. Also, the ROIL showed a level of p-value at the 5 per cent. The study observed that the ROIL, RBSI and the RSP500 exhibited significant effects on the variation in the SET (RSET), with a contribution of 0.198 per cent, 0.342 per cent and 0.513 per cent of return volatility, respectively. This result suggests that all variables were generally volatile for the RSET, and the RSP500 was an important variable involved in the stock market volatility.

The following sections present and discuss the estimation of the GARCH models on the full data set and the sub-sample of the data. The results of the GARCH test for volatility are summarised in Table 4.12.

For comparison, the results for the full data set at low and high volatility reveal statistically significant evidence of positives in three parameter estimations, indicating a direct effect on Thailand's stock market volatility. RSP500 and RBSI were significant at the 1 per cent level in the three models, while ROIL was significant at the 10 per cent level in the full data set and low-volatility models and the 5 per cent level in the high-volatility model. This comparison shows that while all of the variables have positive effects, three variables (RBSI, RSP500 and ROIL) are significant and the level of significance varies among the models. The results from this study observed that RSP500 had a significant effect on the variation in

Thailand's stock market returns. As well, RBSI had contributed more than the ROIL in terms of the full data set and two sub-samples. The significant estimated coefficient on the time-varying variance (σ) indicates that volatility itself exerted a positive effect on the stock market of Thailand returns in all data periods.

Table 4.12: Summary of GARCH Results of the Full Dataset and Two Sub-samples

	Coefficient		
Variable	Full	Low Volatility	High Volatility
ROIL	0.096933 *	0.15156 *	0.198182 **
RBSI	0.387994 ***	0.614076 ***	0.342132 ***
RSP500	0.754141 ***	0.698101 ***	0.513233 ***
	Variance		
C	0.000148	0.000309	0.001182
RESID (-1)^2	0.009138	-0.088822	0.015908
RESID (-2)^2	-	0.198584	-
GARCH (-1)	0.942166	0.78935	1.762586
GARCH (-2)	-	-	-1.083954
σ	0.055	0.055	0.062
Adjusted R-squared	0.320900	0.263432	0.360902

***, **, * significant at the 1%, 5%, and 10% levels, respectively

4.5 Hypothesis Testing and Discussion of Research Question 1

The first research question for the study is: What are the determinants of the SET volatility? In order to answer this, the methodology discussed in Chapter 3, the multiple regression and the GARCH models were selected to analyse via three hypotheses; the conclusions are discussed below.

Hypothesis 1: World ROIL have a significant effect on RSET.

The results of the multiple regression and the GARCH models showed that oil prices had a positive coefficient in all periods and was statistically significant for the various GARCH models. However, there was statistical insignificance for the multiple regression model. Table 4.10a showed the p-value of the ROIL in the multiple regression was statistically insignificant, indicating that the variable cannot explain the factor affecting stock market in Thailand. However, the GARCH models presented the p-value of the ROIL are significant at the 5 per cent and 10 per cent levels. The coefficient of the ROIL was positive at

0.096983, 0.15156 and 0.19818 for the various GARCH models, respectively. The results of both models imply that the ROIL had a lesser effect on Thailand's stock market.

Table 4.13a: ROIL with Regression and GARCH Models

Model	Full period	Low-volatility period	High-volatility period
	1999M02-2010M10	1999M02-2006M10	2006M11-2010M10
Regression	0.085731	0.081851	0.130294
	0.1801	0.3598	0.1954
GARCH	0.096983	0.15156	0.19818
	0.0922 *	0.0880 *	0.0384 **

** significant at the 5 per cent level; * significant at the 10 per cent level

Hypothesis 2: The BSI has a significant effect on the SET index. The political uncertainty can change the BSI, which can affect the RSET by investor.

Regarding the results for multiple regression, Table 4.13b showed the p-value of the RBSI was 0.0013, 0.0088 and 0.0595, which indicate that the variable was statistically significant at 1 per cent and 5 per cent level. The results for the GARCH models showed that the p-value of the RBSI was 0.0017, 0.0007 and 0.0001, indicating that the variable was statistically significant at a 1 per cent level. The coefficient of the RBSI presented a positive at 0.43671, 0.606097 and 0.320728 for the multiple regressions and 0.387994, 0.614076 and 0.342132 for the GARCH models, respectively. The results of both models reveal that the RBSI were a cause of stock market volatility in Thailand.

Table 4.13b: RBSI with Regression and GARCH Models

Model	Full period	Low-volatility period	High-volatility period
	1999M02-2010M10	1999M02-2006M10	2006M11-2010M10
Regression	0.43671	0.606097	0.320728
	0.0013 ***	0.0088 ***	0.0595 **
GARCH	0.387994	0.614076	0.342132
	0.0017 ***	0.0007 ***	0.0001 ***

*** significant at the 1 per cent level; ** significant at the 5 per cent level

Hypothesis 3: The RSP500 caused by the subprime mortgage crisis affects the volatility of the RSET.

The multiple regression and the various GARCH models were applied to test Hypothesis 3. The results of both tests disclosed that the RSP500 had a strongly positive coefficient and was statistically significant in all periods for the multiple regression and the GARCH models. Table 4.13c showed the p-value of the RSP500 was significant at the 1 per cent level in all sample periods, indicating that the RSP500 was a statistically significant factor affecting the stock market in Thailand. The coefficient of the RSP500 was strongly positive at 0.813623, 0.921279 and 0.685271 for the multiple regression, respectively, and 0.754141, 0.698101 and 0.513233 for the various GARCH models, respectively. The results of both models imply that the RSP500 had a major effect on Thailand's stock market.

Table 4.13c: RSP500 with Regression and GARCH Models

Model	Full period	Low-volatility period	High-volatility period
	1999M02-2010M10	1999M02-2006M10	2006M11-2010M10
Regression	0.813623 0.0000 ***	0.921279 0.0000 ***	0.685271 0.0001 ***
GARCH	0.754141 0.0000 ***	0.698101 0.0000 ***	0.513233 0.0104 ***

*** significant at the 1 per cent level

The following section presents and discusses the results of hypothesis tests for research question 1. The findings from Hypothesis 1 confirmed that ROIL can have a positive effect on the stock market, but this factor does not explain a significant effect on the stock market volatility in Thailand. The following are the reasons to support this finding.

First, the findings confirm that ROIL can cause SET volatility, but were less effective than other variables given in this study. Our results were mainly in agreement with the previous studies of Chancharat, Valadkhani and Harvie (2007), who state that that the cause of Thailand's stock market returns plummeting is the higher growth rates in oil prices, Thai macroeconomic variables and major international stock markets. They conclude that the Singapore stock market movement was more significant than the Thai macroeconomic variables and oil price fluctuation in explaining the volatility of monthly stock market returns in Thailand. Also, the study of Sehgal and Kapur (2012) concluded that the movement of oil prices does not influence investors investing in the high growth Asian emerging economies.

Additionally, the finding of Apergis and Miller (2009); and Al-Fayoumi (2009) show that the stock market has no large responsibility for the magnitude of oil price fluctuations compared to local macroeconomic activities.

Second, the oil price fluctuations may affect economic activities more than the stock price returns. The stock market will suffer a negative effect from oil price fluctuation through two relevant channels. With a direct channel, the oil price volatility may directly affect the oil consuming firms with uncontrolled costs of production, which may reduce their profit, dividend and then their equity price. With an indirect channel, the oil price volatility may create indirect channels to affect the stock market via inflation and economic activity by causing economic downturn, decreasing consumption and stock market depreciation. To support this, the study of Hunt, Isard and Laxton (2001) reveals that the oil price movement has affected economic activities by changing global demand and commodity prices and inflation. These changes may impede the equity market growth. Papapetron (2001) reported that oil prices have a significant effect on increasing the cost of industrial production, changing the movement of economic activity and the employment rate, more than the stock price return. Cong, Wei, Jiao and Fan (2008) reported that oil price volatility cannot show a significant effect on the real return of most indices; its only effect is on mining and petrochemical return indices in Chinese stock markets. Abosedre and Baghestani (2004) and Krichene (2008) state that the effect of oil price volatility may raise commodity prices and inflation and cause adverse economic performance and then equity price movement.

Third, the findings from this study show that the coefficient of ROIL was less than other variables given on the full data set and two sub-periods. This may result in hedging instruments that can reduce the volatility in their equity. Thailand is a country that imports petroleum and many industries in the stock market purchase petroleum to produce their products. The change of oil price can affect their performance and turn into volatility in their equity. However, hedging instruments can be applied against oil price volatility, where oil consumers will be more flexible in controlling their cash flow and then stock prices will be less volatile. This reason was supported by the previous studies of Federico, Daniel and Bingham (2001), who state that oil consumers can avoid suffering risk from short-term fluctuations in the spot market by using options and future contracts. Sadorsky (2001) concluded that the instability of energy prices can be resolved by hedging. Analogously, Kilian, Rebucci and Spatafora (2007) have suggested that international financial firms, oil

importers and oil producers use hedging instruments, such as oil future contracts and spot contracts, to diversify their risk of oil price volatility.

The findings from Hypothesis 2 indicated that the BSI of Thailand returns can cause volatility in Thailand's stock market. This finding was in agreement with the previous study of Nimkhunthod (2007) and the SET (2010). They concluded that Thailand financial markets are sensitive to change in the political environment. National elections, parliamentary dissolution, military coups d'état, a state of emergency and crackdowns on demonstrators led to large volatility in the stock price index. Based on the Philippine stock market, Bautista (2003) states that the series of military coups were the major cause of enlarging stock market volatility. However, this study observed that the statistical coefficient of the BSI of Thailand returns during the full data set and two sub-periods have been positive. This finding implies that Thailand's financial markets have more experience with political uncertainty. To support this finding, Nimkhunthod (2007) states that stock market in Thailand had a temporary negative effect after the military coups d'état, but this can boost the market in the long term. In the case of riots, the stock market strongly reacted to the latest riot compared to previous riots. Nimkunthod's results indicate that the level of accessibility to news regarding the stock market has improved and market participants have more experience in identifying political events. Ma, Sun and Tang (2003) reported that the Tiananmen Square incident in China had a significant effect in the short term rather than the long term on the stock return of US joint ventures firms, because investors had confidence in the Chinese government's commitment to opening the economic door.

The findings from Hypothesis 3 confirmed that the S&P 500 returns had a significant effect on Thailand's stock market volatility. This finding was in agreement with the previous studies of Burdekin and Siklos (2012), Yilmaz (2009a), Kato (2009), Diebold and Yilmaz (2008) and Tharachai (2008). They concluded that the subprime crisis can be presented as having a contagion effect from the US stock market to other Asian equity markets, such as Indonesia, Korea, Malaysia, the Philippines, Singapore and Thailand. They suggest that the movement of major Asian equity markets have followed the movement of the US stock market. Also, market integration was the cause of the US and Asian stock markets being more interdependent.

Notably, this study found that the S&P 500 returns presented strong statistical coefficients in the full data set and two sub-periods, indicating that the movement of S&P 500 is a major change in Thailand's stock market. This finding seems to suggest that Thailand

financial market and the participants gained more sophistication after receiving experience from the Asian financial crisis in 1997. To support this finding, Batten and Szilagyi (2011) state that emerging countries have reformed their financial systems and have implemented economic strategies to avert volatility transmission across countries after suffering from the 1997 to 1998 Asian financial crisis. The financial crisis transmission from the S&P 500 returns affected the Asian financial markets but did not affect major businesses. As a result, the Asian financial market recovered quite well because no major businesses failed from the subprime crisis compared with the Asian financial crisis in 1997. Das (2012) concluded that after the Asian financial crisis, Asian financial markets have had more experience with financial crisis than the other advanced financial market. They establish financial implementations and issue prudential regulations to minimise their financial risk. As a result, the major businesses receive a few pressures from the subprime crisis. Walter (2010) reported that Thailand and Asian financial sectors did not receive a direct effect from the subprime crisis because they implemented the Basel II framework to bear their risk. Lee and Park (2009) and Kitayanavaj (2008) state that no major businesses in Asia, such as banks and financial firms, failed from the subprime crisis because they were prudent with credit loans and used credit verification against speculative buyers and housing price bubbles.

Therefore, the outcome of hypotheses 1, 2 and 3 can answer research question 1. Hypotheses 1, 2 and 3 confirmed that the RSP500 was a major international financial market with extensive investment throughout the Thailand financial market. A movement of their index influences the movement of SET, and their information is reacted to by investors regularly. Thus, the volatility of S&P 500 could be used as an indicator to predict the performance of the SET. The RBSI was a second factor affecting Thailand's stock market volatility and ROIL was a third significant factor explaining the determinants of Thailand's stock market volatility.

The following part displays the results for the test of the existence of financial contagion transmission which include displays results for the test of the existence of financial contagion e the descriptive statistics and discuss the outcome of test relating to the Correlation Coefficient and Granger Causality models.

4.6 Summary Statistics of Monthly Stock Market Returns from South-East Asia

The descriptive statistics for the stock index return series for the period of February 1999 to October 2010 are presented for the monthly returns (see Table 4.14). The statistics included the average monthly returns, median, maximums, minimums, standard deviations, skewness, kurtosis, Jacque-Bera statistic, p-value and observations.

Table 4.14: Descriptive Statistics of Stock Market Returns: February 1999 to October 2010

	RSET	RSGX	RPSE	RKLSE	RJKSE
Mean	0.007574	0.005715	0.005654	0.007295	0.015834
Median	0.011038	0.01406	0.00413	0.011035	0.024369
Maximum	0.266153	0.216961	0.245735	0.294421	0.229616
Minimum	-0.35919	-0.27364	-0.2015	-0.16514	-0.3772
Std Dev	0.082208	0.066428	0.077486	0.05801	0.080129
Skewness	-0.68418	-0.712	-0.13714	0.50921	-0.80527
Kurtosis	5.989407	6.207812	3.650071	6.744473	6.145076
Jarque-Bera	63.05221	71.85403	2.90395	87.83984	72.83117
Probability	0	0	0.234107	0	0
Sum	1.060387	0.800113	0.791616	1.021296	2.216811
Sum Sq. Dev.	0.93939	0.613356	0.83456	0.467765	0.892464
Observations	140	140	140	140	140

Note: the variables include the SET returns (RSET), the SGX returns (RSGX), the PSE returns (RPSE), the KLSE returns (RKLSE) and, the JKSE returns (RJKSE).

First, the RJKSE had the highest average monthly returns (0.015834), while the RSET had the lowest average monthly returns (0.007574). Second, the volatility of returns as measured by the standard deviation in the South-East Asian stock indexes moved from 5 to 8 per cent. The RSET and the RJKSE had the highest standard deviation, while the RKLSE had the lowest standard deviation. The study indicates that the risk of stock market is illustrated by the large standard deviation. As a result, the RSET and the RJKSE exhibited higher risk than other markets in the region. Third, many of the stock returns exhibited negative skewness, except for the RKLSE. This indicated that the sample distributions were approximately symmetric. Additionally, the kurtosis or degree of excess in all stock returns was larger than 3, indicating that stock market returns are leptokurtic and have flatter tails and a higher peak than a normal distribution. Fourth, the calculated Jarque-Bera statistics and

corresponding p-values were applied to test the null hypotheses, where the monthly distributions of returns were normally distributed. Most of the Jarque-Bera statistics and corresponding p-values rejected the normality assumption at any conventional level of significance for the RSET, the RJKSE, the RKLSE and the RSGX, with the exception of the monthly stock return in the RPSE.

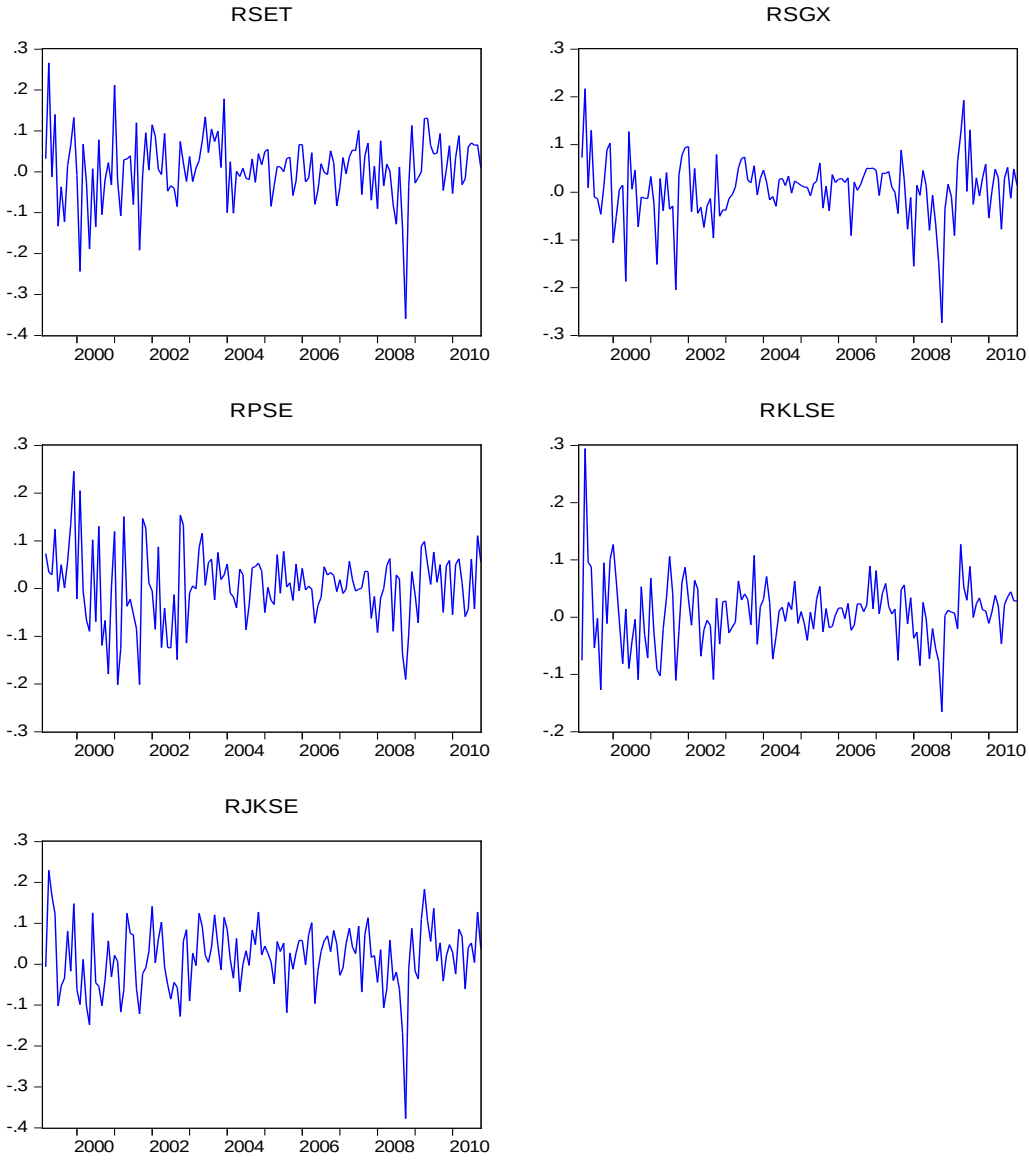

Figure 4.5: Plots of monthly stock market returns from South-East Asia.

Figure 4.5 presents graphs for all of the equity market returns. The plots clearly reveal the phenomenon of time-varying volatility in the South-East Asian stock markets. The volatility of these markets was quite stable before the financial crisis. However, the volatility

of the markets increased dramatically with the transmission of the subprime crisis. RSET, RSGX and RJKSE dropped sharply in the period of crisis.

The following section analyses contagion between market returns by applying the correlation analysis and Granger causality. In the next step of the analysis, the unit root test is conducted. This test is to determine whether all data are stationary. If the stock index return series are non-stationary, the study should model their data with an ECM. Conversely, if the stock index return series are stationary, the study should conduct a VAR analysis (Hill, Griffiths and Lim 2011). In order to make robust conclusions about the time series properties of the data, this study uses the unit root tests of the ADF and the PP. These were introduced by Dickey-Fuller (1979) and Phillips and Perron (1988), respectively. The result of this test will guide the researcher on the choice between the ECM or VAR model.

The unit root tests of all index returns at levels are reported in Table 4.15. The statistics reported for both the ADF and the PP tests suggest that all stock index returns follow a stationary process; all of the t-statistics are significant at the 1 per cent critical value and both the ADF and the PP tests statistics consistently rejected the null hypothesis of the unit root in all markets analysed. The results show that all variables are stationary in the level form.

Table 4.15: Unit Root Test Results for Monthly Series

$$\Delta \boldsymbol{y_t} = \boldsymbol{\alpha y_{t-1}} + \sum_{\boldsymbol{j=1}}^{\boldsymbol{p}} \boldsymbol{\beta \Delta y_{t-1}} + \boldsymbol{\varepsilon_t}$$

where : Δy_t denotes the index for i at time t; $\Delta y_t = y_t - y_{t-1}$, β are coefficients to be estimated; α is the constant; p is the number of lagged terms

Variable	**ADF Test Statistics**		**PP Test Statistics**	
	Levels	**Prob**	**Levels**	**Prob**
ROIL	-8.994783	<0.0001	-8.994783	<0.0001
RBSI	-16.07699	<0.0001	-15.85945	<0.0001
RSP500	-10.54560	<0.0001	-10.55281	<0.0001
RSET	-11.33659	<0.0001	-11.39327	<0.0001
RSGX	-10.05186	<0.0001	-10.12380	<0.0001
RPSE	-10.86004	<0.0001	-10.87460	<0.0001
RKLSE	-10.38160	<0.0001	-10.38160	<0.0001
RJKSE	-9.060143	<0.0001	-9.08182	<0.0001
1 % critical value	-3.477835		-3.47784	
5 % critical value	-2.882279		-2.88228	
10 % critical value	-2.577908		-2.57791	

4.7 Correlation Coefficient Test

The estimation of correlation coefficients among stock returns is the most common method used in estimating contagion effects. Contagion can occur as a significant increase in cross-market linkages resulting from a crisis in one country (or group of countries) to other countries (Forbes & Rigobon 2002). As in Wilson and Zurbruegg (2004), measuring contagion effects is a simple process where the correlation coefficient for the high-volatility period (crisis period) is compared with the correlation coefficient for the low-volatility period (normal period). If the correlation coefficient for the low-volatility period is measured higher than the correlation coefficient for the high-volatility period, this indicates interdependence between stock markets. If the correlation coefficient for the low-volatility period is measured lower than the correlation coefficient for the high-volatility period, this indicates contagion among the markets.

This section uses monthly stock returns to examine the correlation between five stock market returns in South-East Asia compared with the ROIL, the RBSI and the RSP500. The correlation coefficients were used to measure the extent of the association between the stock market returns (Dungey, Fry, Gonzalez-Hermosillo & Martin 2005). In order to test the contagion effect, this framework is applied to the basis study of the correlation models of Forbes and Rigobon (2002), Yang (2002), Chuang, Lu and Tswei (2007) and Wilson and Zurbuegg (2004), which compared the relationships among the ROIL, the RBSI, the RSP500 and the South-East Asia stock markets at the full data set and two sub-periods (low and high-volatility periods) and discussed whether there were any contagion effects in the region.

Table 4.16a: Correlation Coefficients Test of Five Stock Markets and ROIL

Host	Recipient	Full data set		Low volatility		High volatility		Contagion
		Correlation	T-statistic	Correlation	T-statistic	Correlation	T-statistic	
ROIL	RSET	0.168667 **	2.010185	0.03169	0.30082	0.37489 ***	2.7127	Y
	RSGX	0.238858 ***	2.889589	0.06435	0.61173	0.45333 ***	3.41175	Y
	RPSE	0.087429	1.031007	-0.06583	-0.62589	0.41486 ***	3.05859	Y
	RKLSE	0.210172 ***	2.525371	0.15061	1.4453	0.34897 ***	2.49796	Y
	RJKSE	0.216664 ***	2.60715	0.00988	0.09369	0.49048 ***	3.77553	Y

*** significant at the 1 per cent level; ** significant at the 5 per cent level

The test for the correlation coefficients between the monthly stock returns in five South-East Asian countries and the ROIL during the full data set period covering all data from 1999:03 to 2010:10, the low-volatility period covering all of the data from 1999:03 to 2006:10 and the high-volatility period covering all of data from 2006:11 to 2010:10 are reported in Table 4.16a. This table displays results for the test of the existence of financial contagion from the ROIL. A South-East Asia stock market correlation exhibits a sharp increase in the correlation coefficients from the full data set period and the low-volatility period to the high volatility. These results confirm that the set of stock market returns seem to have suffered contagion from the ROIL. A p-value of 1 per cent significance level shows that the RJKSE, the RKLSE and the RSGX display the highest level of contagion. In contrast, a p-value of 5 per cent significance level in the RSET provides some evidence of contagion transmission, and a high level of p-value in the RPSE can result in a lesser effect of contagion.

Table 4.16b: Correlation Coefficients Test of Five Stock Markets and RBSI

Host	Recipient	Full data set		Low volatility		High volatility		Contagion
		Correlation	T-statistic	Correlation	T-statistic	Correlation	T-statistic	
RBSI	RSET	0.277982 ***	3.399541	0.313839 ***	3.135766	0.263679 **	1.833707	N
	RSGX	0.185078 **	2.212395	0.204377 **	1.9807	0.172412	1.174155	N
	RPSE	0.150898 *	1.793187	0.169665 *	1.633262	0.160283	1.089296	N
	RKLSE	0.172447 **	2.056601	0.331153 ***	3.32945	-0.01764	-0.11837	N
	RJKSE	0.114171	1.350031	0.10226	0.975233	0.124353	0.840714	N

*** significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level

In the case of the political crisis in Thailand, it could cause the high volatility in Thailand's stock market. This study ran correlation coefficients tests to determine whether there is a contagion from the RBSI to Thailand's stock market and other stock markets in South-East Asia. This study compares the correlation coefficients during the full data set period covering all data from 1999:03 to 2010:10, the low-volatility period covering all of the data from 1999:03 to 2006:10 and the high- volatility period covering all of data from 2006:11 to 2010:10. The high-volatility period encompasses several significant events that include Thailand's political uncertainties (2009:04 to 2010:09), such as the state of emergency and military crackdown in April 2009 and May 2010. The results in Table 4.16b reports that the correlation coefficients of five stock markets have decreased from the high-volatility period and insignificant with high p-value; these results suggest that stock market in the data set have not suffered the contagion from the RBSI. In fact, the RSET has the market closest to

the effect of the RBSI and displays the lowest p-value level. Also, the positive correlation with lower p-value level (less than 10 per cent significant level) shows the relationship between the RKLSE, the RSGX and the RPSE with RBSI at the full data set and low-volatility period. These results explain that RBSI refer to market condition in Thailand, if the market has a certain condition or market has low volatility, the investors will prefer to invest rather than uncertain condition.

Table 4.16c: Correlation Coefficients Test of Five Stock Markets and RSP500

Host	Recipient	Full data set		Low volatility		High volatility		Contagion
		Correlation	T-statistic	Correlation	T-statistic	Correlation	T-statistic	
RSP500	RSET	0.522001 ***	7.189346	0.49106 ***	5.34781	0.58299 ***	4.81339	Y
	RSGX	0.659601 ***	10.30919	0.6182 ***	7.46134	0.70795 ***	6.72418	Y
	RPSE	0.792628 ***	15.27175	0.82237 ***	13.711	0.87736 ***	12.2659	Y
	RKLSE	0.405067 ***	5.204464	0.29889 ***	2.97134	0.62728 ***	5.40308	Y
	RJKSE	0.506364 ***	6.89817	0.34989 ***	3.5326	0.68633 ***	6.33043	Y

*** significant at the 1 per cent level

The test of the correlation coefficients between the monthly stock returns in five South-East Asian countries and the RSP500 during the full data set and two sub-periods are reported in Table 4.16c. This table displays a sharp increase in the correlation coefficients for the RSET. The RPSE, the RKLSE, the RSGX and the RJKSE results confirm that South-East Asia stock markets have suffered contagion transmission from the subprime crisis. A p-value of 1 per cent significant level shows that five stock markets exhibit evidence of contagion. The RPSE displays the highest level of contagion, followed by the RSGX, the RJKSE and the RKLSE. The RSET can display a lesser effect of contagion from the subprime crisis. The following section presents and discusses the estimation of the Granger causality model.

4.8 Granger Causality Test

This section uses monthly stock returns to examine the causality effects between two markets. This study applies the Granger causality model of Nikkinen, Saleem and Martikainen (2010), Yang (2002) and Egert and Kocenda (2007a), which consisted of running regressions of one stock return on its lagged values and on other stock returns. The results can be seen in the different cases as follows.

Case 1: the lagged *x* terms may be statistically different from zero as a group and the lagged *y* terms are not statistically different from zero. In this case, x_t causes y_t.

Case 2: the lagged *y* terms may be statistically different from zero as a group and the lagged *x* terms are not statistically different from zero. In this case y_t causes x_t.

Case 3: both sets of lagged *x* and *y* terms are statistically different from zero. In this case, x_t and y_t have bi-directional causality.

Case 4: neither sets of lagged *x* and *y* terms are statistically different from zero. In this case, x_t is independent of y_t.

Table 4.17a: Granger Causality Test, Full Sample Period (n=138)

Null Hypothesis	Obs	F-Statistic	Prob	Result
RSGX does not Granger cause RSET	138	4.01376	0.0203 **	SGX cause SET
RSET does not Granger cause RSGX		0.86418	0.4238	
RPSE does not Granger cause RSET	138	3.33587	0.0386 **	PSE cause SET
RSET does not Granger cause RPSE		1.54185	0.2178	
RKLSE does not Granger cause RSET	138	0.49494	0.6107	SET cause KLSE
RSET does not Granger cause RKLSE		6.51221	0.002 ***	
RJKSE does not Granger cause RSET	138	4.62488	0.0114 **	JKSE cause SET
RSET does not Granger cause RJKSE		1.06721	0.3469	
RPSE does not Granger cause RSGX	138	1.05782	0.3501	Independent
RSGX does not Granger cause RPSE		2.17618	0.1175	
RKLSE does not Granger cause RSGX	138	0.25087	0.7785	SGX cause KLSE
RSGX does not Granger cause RKLSE		7.0268	0.0013 ***	
RJKSE does not Granger cause RSGX	138	0.85304	0.4284	SGX cause JKSE
RSGX does not Granger cause RJKSE		2.89696	0.0587 **	
RKLSE does not Granger cause RPSE	138	0.04474	0.9563	PSE cause KLSE
RPSE does not Granger cause RKLSE		5.82342	0.0038 ***	
RJKSE does not Granger cause RPSE	138	1.78721	0.1714	PSE cause JKSE
RPSE does not Granger cause RJKSE		2.91346	0.0578 **	
RJKSE does not Granger cause RKLSE	138	7.00867	0.0013 ***	JKSE cause KLSE
RKLSE does not Granger cause RJKSE		1.17865	0.3109	

*** significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level

The result of Granger causality analyses are reported in Table 4.17a (full sample period). A p-value of 1 per cent significant level, both the RSGX and the RPSE, explains the key factor that caused stock markets in Thailand, Indonesia and Malaysia. The RKLSE is most likely to be influenced by other stock markets. The RSGX is independent to the RPSE. The RSET is influenced by the RJKSE, the RSGX and the RPSE.

Table 4.17b: Granger Causality Test, Low-Volatility Sample Period (n=90)

Null Hypothesis	Obs	F-Statistic	Prob	Result
RSGX does not Granger cause RSET	90	2.12525	0.1257	Independent
RSET does not Granger cause RSGX		1.53682	0.221	
RPSE does not Granger cause RSET	90	2.17881	0.1195	Independent
RSET does not Granger cause RPSE		2.48858	0.0891	
RKLSE does not Granger cause RSET	90	0.06682	0.9354	SET cause KLSE
RSET does not Granger cause RKLSE		8.51519	0.0004 ***	
RJKSE does not Granger cause RSET	90	2.78085	0.0676	Independent
RSET does not Granger cause RJKSE		1.46411	0.2371	
RPSE does not Granger cause RSGX	90	1.28656	0.2815	SGX cause PSE
RSGX does not Granger cause RPSE		3.41174	0.0376 **	
RKLSE does not Granger cause RSGX	90	0.40831	0.6661	SGX cause KLSE
RSGX does not Granger cause RKLSE		5.89862	0.004 ***	
RJKSE does not Granger cause RSGX	90	0.60786	0.5469	Independent
RSGX does not Granger cause RJKSE		1.68972	0.1907	
RKLSE does not Granger cause RPSE	90	0.23539	0.7908	PSE cause KLSE
RPSE does not Granger cause RKLSE		6.59225	0.0022 ***	
RJKSE does not Granger cause RPSE	90	2.70251	0.0728	Independent
RPSE does not Granger cause RJKSE		2.7183	0.0717	
RJKSE does not Granger cause RKLSE	90	7.70975	0.0008 ***	JKSE cause KLSE
RKLSE does not Granger cause RJKSE		0.5564	0.5753	

*** significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level

The results of the Granger causality analyses are reported in Table 4.15b (low-volatility period). These findings seem to address the idea that a p-value of 1 per cent significance level confirms that the RKLSE is highly influenced by all South-East Asia stock market returns. The RPSE, the RSET and the RJKSE are independent from each other, which results in a higher level of p-value. The RSGX displays the cause in the RPSE and the RKLSE. The RJKSE displays the highest level of influence to the RKLSE, which results in the lowest p-value level (0.0008).

The results of the Granger causality analyses are reported in Table 4.17c (high-volatility period). The RSET, the RJKSE, the RKLSE, the RSGX and the RPSE are independent from each other. The following section is the hypothesis testing and discussion on research question 2.

Table 4.17c: Granger Causality Test, High-Volatility Sample Period (n=45)

Null Hypothesis	Obs	F-Statistic	Prob	Result
RSGX does not Granger cause RSET	45	2.18355	0.1259	Independent
RSET does not Granger cause RSGX		0.19755	0.8215	
RPSE does not Granger cause RSET	45	1.54396	0.226	Independent
RSET does not Granger cause RPSE		1.39946	0.2585	
RKLSE does not Granger cause RSET	45	1.97756	0.1517	Independent
RSET does not Granger cause RKLSE		0.05578	0.9458	
RJKSE does not Granger cause RSET	45	1.44818	0.2471	Independent
RSET does not Granger cause RJKSE		0.02202	0.9782	
RPSE does not Granger cause RSGX	45	1.67905	0.1994	Independent
RSGX does not Granger cause RPSE		3.21425	0.0508	
RKLSE does not Granger cause RSGX	45	0.05916	0.9426	Independent
RSGX does not Granger cause RKLSE		0.85946	0.4311	
RJKSE does not Granger cause RSGX	45	0.17674	0.8386	Independent
RSGX does not Granger cause RJKSE		0.91987	0.4068	
RKLSE does not Granger cause RPSE	45	1.4171	0.2543	Independent
RPSE does not Granger cause RKLSE		1.55574	0.2235	
RJKSE does not Granger cause RPSE	45	1.30938	0.2813	Independent
RPSE does not Granger cause RJKSE		0.23371	0.7927	
RJKSE does not Granger cause RKLSE	45	0.05664	0.945	Independent
RKLSE does not Granger cause RJKSE		1.53824	0.2272	

4.9 Hypothesis Testing and Discussion on Research Question 2

The second research question for the study is: What are the interrelationships between the SET and other stock markets in the region? In order to answer this, the methodology discussed in Chapter 3 was the correlation coefficient test and the Granger causality test. These tests were employed to analyse, via four hypotheses, and the conclusions are discussed below.

Hypothesis 4: There is a strong positive interrelationship between the SET and SGX. The result of the correlation coefficients statistics can explain the contagion transmission from the ROIL, the RBSI and the RSP500 to the RSET and the RSGX.

Table 4.18a: Summary of Correlation Results of the Full Dataset and Two Sub-samples

Host	Recipient	Full data set		Low Volatility		High Volatility		Contagion
		Correlation	T-statistic	Correlation	T-statistic	Correlation	T-statistic	
ROIL	RSET	0.168667 **	2.010185	0.03169	0.30082	0.37489 ***	2.7127	Y
	RSGX	0.238858 ***	2.889589	0.06435	0.61173	0.45333 ***	3.41175	Y
RBSI	RSET	0.277982 ***	3.399541	0.313839 ***	3.135766	0.263679 **	1.833707	N
	RSGX	0.185078 **	2.212395	0.204377 **	1.9807	0.172412	1.174155	N
RSP500	RSET	0.522001 ***	7.189346	0.49106 ***	5.34781	0.58299 ***	4.81339	Y
	RSGX	0.659601 ***	10.30919	0.6182 ***	7.46134	0.70795 ***	6.72418	Y

*** significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level

The results in Table 4.18a demonstrate that the correlation of the RSET and the RSGX increase during high-volatility periods. These findings indicate that there is evidence of contagion transmission of the subprime crisis via the RSP500 and oil price fluctuation via the ROIL to the stock market returns in Thailand and Singapore. In the case of political crisis in Thailand, the correlation of the RSGX and the RSET decreased, indicating that there is no evidence of contagion transmission from the RBSI to the RSET and the RSGX.

Table 4.18b: Summary of Granger Causality Results of the Full Dataset and Two Sub-samples

Period	Null Hypothesis	Obs	F-Stat	Prob	Result
Full data set	RSGX does not Granger cause RSET	138	4.01376	0.0203 **	SGX cause SET
	RSET does not Granger cause RSGX		0.86418	0.4238	
Low volatility	RSGX does not Granger cause RSET	90	2.12525	0.1257	Independent
	RSET does not Granger cause RSGX		1.53682	0.221	
High volatility	RSGX does not Granger cause RSET	45	2.18355	0.1259	Independent
	RSET does not Granger cause RSGX		0.19755	0.8215	

*** significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level

The results of the Granger causality test can explain the interrelationship between the RSET and the RSGX, shown in Table 4.18b. The results report the null hypothesis, the f-statistic and the probability limit value at 5 per cent significance level for the pairs of variables. In the case of the full period, the null hypothesis can reject (prob < 0.05) for RSGX

does not Granger cause RSET; it could be concluded that the RSGX causes the RSET. In the cases of low- and high-volatility periods, the null hypothesis cannot be rejected (prob > 0.05) for RSGX does not Granger cause RSET, and RSET does not Granger cause RSGX; it could be concluded that the RSGX and the RSET are independent from each other.

These findings conclude that there is a strong positive interrelationship between the SET and SGX, and both stock markets are interdependent at full data set periods. The movement of the RSP500 and the ROIL can be the contagion transmission to the stock market returns in Thailand and Singapore.

Hypothesis 5: There is a strong positive interrelationship between the SET and KLSE. The results of correlation coefficients statistics can explain the contagion transmission from the ROIL, the RBSI and the RSP500 to the RSET and the RKLSE.

Table 4.19a: Summary of Correlation Results of the Full Dataset and Two Sub-sample

Host	Recipient	Full data set		Low Volatility		High Volatility		Contagion
		Correlation	T-statistic	Correlation	T-statistic	Correlation	T-statistic	
ROIL	RSET	0.168667 **	2.010185	0.03169	0.30082	0.37489 ***	2.7127	Y
	RKLSE	0.210172 ***	2.525371	0.15061	1.4453	0.34897 ***	2.49796	Y
RBSI	RSET	0.277982 ***	3.399541	0.313839 ***	3.135766	0.263679 **	1.833707	N
	RKLSE	0.172447 **	2.056601	0.331153 ***	3.32945	-0.01764	-0.11837	N
RSP500	RSET	0.522001 ***	7.189346	0.49106 ***	5.34781	0.58299 ***	4.81339	Y
	RKLSE	0.405067 ***	5.204464	0.29889 ***	2.97134	0.62728 ***	5.40308	Y

*** significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level

The results in Table 4.19a show that the correlation of the RSET and the RKLSE amplifies during the high-volatility period. These findings indicate that the RSET and the RKLSE exhibit evidence of contagion transmission from the subprime crisis and oil price fluctuation. In the case of the political crisis in Thailand, the results show the correlation of the RKLSE and the RSET have decreased during political crisis, indicating that there is no evidence of contagion transmission from the RBSI to the RSET and the RKLSE.

The results of the Granger causality test can explain the interrelationship between the RSET and the RKLSE, shown in Table 4.19b. The results report the null hypothesis, the f-statistic and the probability limit value at 5 per cent significance level for the pairs of variables. In the case of the full period and low-volatility period, the null hypothesis can reject (prob < 0.01) for RSET does not Granger cause RKLSE; it could be concluded that the

RKLSE is caused by the RSET. In the case of high-volatility periods, the null hypothesis cannot be rejected (prob > 0.05) for RKLSE does not Granger cause RSET, and RSET does not Granger cause RKLSE; it could be concluded that the RKLSE and the RSET are independent from each other.

Table 4.19b: Summary of Granger Causality Results of the Full Dataset and Two Sub-samples

Period	Null Hypothesis	Obs	F-Statistic	Prob	Result
Full data set	RKLSE does not Granger cause RSET	138	0.49494	0.6107	SET cause KLSE
	RSET does not Granger cause RKLSE		6.51221	0.002 ***	
Low volatility	RKLSE does not Granger cause RSET	90	0.06682	0.9354	SET cause KLSE
	RSET does not Granger cause RKLSE		8.51519	0.0004 ***	
High volatility	RKLSE does not Granger cause RSET	45	1.97756	0.1517	Independent
	RSET does not Granger cause RKLSE		0.05578	0.9458	

*** significant at the 1 per cent level

These findings conclude that the movement of the RSP500 and the ROIL can cause contagion transmission to the stock market returns in Thailand and Malaysia. The political crisis in Thailand cannot bring the contagion to both stock markets. The study found a strong positive interrelationship at the full data set and low-volatility period, suggesting that both markets are interdependent but independent at high-volatility periods.

Hypothesis 6: There is a strong positive interrelationship between the SET and PSE. The result of correlation coefficient statistics can explain the contagion transmission from the ROIL, the RBSI and the RSP500 to the RSET and the RPSE.

Table 4.20a: Summary of Correlation Results of the Full Dataset and Two Sub-samples

Host	Recipient	Full data set		Low Volatility		High Volatility		Contagion
		Correlation	T-statistic	Correlation	T-statistic	Correlation	T-statistic	
ROIL	RSET	0.168667 **	2.010185	0.03169	0.30082	0.37489 ***	2.7127	Y
	RPSE	0.087429	1.031007	-0.06583	-0.62589	0.41486 ***	3.05859	Y
RBSI	RSET	0.277982 ***	3.399541	0.313839 ***	3.135766	0.263679 **	1.833707	N
	RPSE	0.150898 *	1.793187	0.169665 *	1.633262	0.160283	1.089296	N
RSP500	RSET	0.522001 ***	7.189346	0.49106 ***	5.34781	0.58299 ***	4.81339	Y
	RPSE	0.792628 ***	15.27175	0.82237 ***	13.711	0.87736 ***	12.2659	Y

***significant at the 1 per cent level; **significant at the 5 per cent level; *significant at the 10 per cent level

The results in Table 4.20a demonstrate that the correlation of the RSET and the RPSE increase during high-volatility period. These findings indicate that there is evidence of contagion transmission of the subprime crisis via the RSP500 and oil price fluctuation via the ROIL to the stock market returns in Thailand and the Philippines. In the case of the political crisis in Thailand, the correlation of the RPSE and the RSET have decreased during the political crisis, indicating that there is no evidence of contagion transmission from the RBSI to the stock exchange in Thailand and the Philippines.

The Granger causality test is shown in Table 4.20b. The results report the null hypothesis, the f-statistic and the probability limit value at 5 per cent significant level for all possible pairs of variables. In the case of the full period, the null hypothesis can reject (prob < 0.05) for RPSE does not Granger cause RSET; it could be concluded that the RPSE causes the RSET. In the case of low- and high-volatility periods, the null hypothesis cannot be rejected (prob > 0.05) for RPSE does not Granger cause RSET, and RSET does not Granger cause RPSE; it could be concluded that the RPSE and the RSET are independent from each other.

Table 4.20b: Summary of Granger Causality Results of the Full Dataset and Two Sub-samples

Period	Null Hypothesis	Obs	F-Stat	Prob	Result
Full data set	RPSE does not Granger cause RSET	138	3.33587	0.0386**	PSE cause SET
	RSET does not Granger cause RPSE		1.54185	0.2178	
Low volatility	RPSE does not Granger cause RSET	90	2.17881	0.1195	Independent
	RSET does not Granger cause RPSE		2.48858	0.0891	
High volatility	RPSE does not Granger cause RSET	45	1.54396	0.226	Independent
	RSET does not Granger cause RPSE		1.39946	0.2585	

** significant at the 5 per cent level

These findings conclude that there is a strong positive interrelationship between the SET and PSE. At full data set periods, the movement of PSE can influence the Thailand stock market. The stock market returns in Thailand and the Philippines have received a contagion transmission from the movement of the RSP500 and the ROIL.

Hypothesis 7: There is a significant positive interrelationship between the SET and JKSE.

The result of correlation coefficient statistics can explain the contagion transmission from the ROIL, the RBSI and the RSP500 to the RSET and the RJKSE. The results in Table 4.21a demonstrate that the correlation of the RSET and the RJKSE have increased during high-volatility periods. These findings indicate that the RSET and the RJKSE exhibit evidence of contagion from the S&P500 returns and the ROIL. In the case of the political crisis in Thailand, the correlation of the RJKSE and the RSET have decreased during political crisis, confirming that there is no evidence of contagion transmission from the RBSI to the RSET to the RJKSE.

Table 4.21a: Summary of Correlation Results of the Full Dataset and Two Sub-samples

Host	Recipient	Full data set		Low Volatility		High Volatility		Contagion
		Correlation	T-statistic	Correlation	T-statistic	Correlation	T-statistic	
ROIL	RSET	0.168667 **	2.010185	0.03169	0.30082	0.37489 ***	2.7127	Y
	RJKSE	0.216664 ***	2.60715	0.00988	0.09369	0.49048 ***	3.77553	Y
RBSI	RSET	0.277982 ***	3.399541	0.313839 ***	3.135766	0.263679 **	1.833707	N
	RJKSE	0.114171	1.350031	0.10226	0.975233	0.124353	0.840714	-
RSP500	RSET	0.522001 ***	7.189346	0.49106 ***	5.34781	0.58299 ***	4.81339	Y
	RJKSE	0.506364 ***	6.89817	0.34989 ***	3.5326	0.68633 ***	6.33043	Y

*** significant at the 1 per cent level; ** significant at the 5 per cent level; * significant at the 10 per cent level

The Granger causality test is shown in Table 4.21b. The results report the null hypothesis, the f-statistic and the probability limit value at 5 per cent significant level for all possible pairs of variables. In the case of the full period, the null hypothesis can reject (prob < 0.05) for RJKSE does not Granger cause RSET; it could be concluded that the RJKSE causes the RSET. In the case of low- and high-volatility periods, the null hypothesis cannot be rejected (prob > 0.05) for RJKSE does not Granger cause RSET, and RSET does not Granger cause RJKSE; it could be concluded that the RJKSE and the RSET are independent from each other.

Table 4.21b: Summary of Granger Causality Results of the Full Dataset and Two sub-samples

Period	Null Hypothesis	Obs	F-Stat	Prob	Result
Full data set	RJKSE does not Granger cause RSET	138	4.62488	0.0114**	JKSE cause SET
	RSET does not Granger cause RJKSE		1.06721	0.3469	
Low volatility	RJKSE does not Granger cause RSET	90	2.78085	0.0676	Independent
	RSET does not Granger cause RJKSE		1.46411	0.2371	
High volatility	RJKSE does not Granger cause RSET	45	1.44818	0.2471	Independent

	RSET does not Granger cause RJKSE		0.02202	0.9782	

** significant at the 5 per cent level

These finding conclude that there is a strong positive interrelationship between the SET and PSE. At full data set periods, the movement of JKSE can affect Thailand's stock market. The movement of the RSP500 and the ROIL can cause the contagion transmission to both SET and PSE stock market returns.

The following section discusses research question 2. The findings from hypotheses 4, 5, 6 and 7 show that the movement of oil prices and the S&P 500 index on South-East Asian stock markets have a strong positive interrelationship. The study shows that the volatility of South-East Asian stock market returns increased during the crisis period and moved in a similar direction with the oil price and S&P 500 index. This result indicates that the South-East Asian stock market was sensitive to the oil price fluctuation and the S&P 500 returns.

Comparing the correlation coefficients of the movement of oil prices and the S&P 500 index with the stock market returns in South-East Asia, it can clearly be observed that there was strong evidence of contagion transmission across countries. The results in Figure 4.6 indicate that the correlation coefficients of the RPSE have the highest change with the RSP500, followed by the RSGX, the RJKSE, the RKLSE and RSET. From these results, it can be implied that the contagion transmission from the subprime crisis had the highest effect on the RPSE, followed by the RSGX, and the RSET received less of an effect from this crisis.

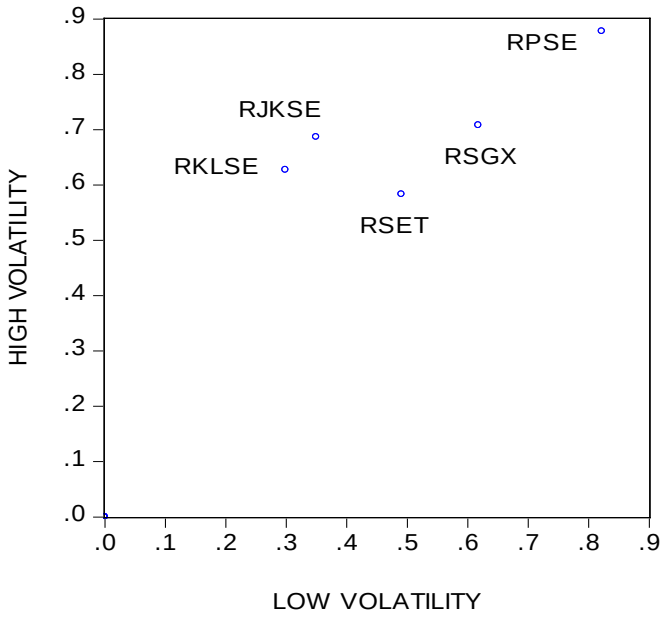

Figure 4.6: Contagion Test for S&P 500 and Stock Markets in the Region

Likewise, the results of the correlation coefficient statistics establish clear evidence of contagion from the subprime crisis effect on South-East Asian stock markets at different levels. This finding was similar to the study of Burdekin and Siklos (2012); their study confirms that the financial shock from the US has transmitted regionally to the Asian-Pacific stock markets. This transmission has a significant shift due to the proportion of trading and finance of each country. Karunanayake, Valadkhani and O'Brien (2010) reported that volatility in major financial markets can spillover to minor financial markets. Sakthivel, Bodkhe and Kamaiah (2012) indicate that the S&P 500 index is a global factor affecting both developing and developed markets. They found evidence that news received by the S&P 500 index can transmit to other European and Asian stock markets. Bae, Karolyi and Stulz (2003) state that the contagion in the Asian crisis was less significant than the contagion in the Latin American crisis, but both crises did not spillover to major financial markets. A study of Yu, Fung and Tam (2010) state that financial integration among groups of economies can improve their capacity, which absorbs the risk of cross-border financial contagion. Their findings found the evidence of achievement in the regional financial integration in the Asian equity market.

However, the SET was less affected by the subprime crisis transmission because Thailand's financial market and its participants had more knowledge after experiencing the Asian financial crisis in 1997. This can be supported by Batten and Szilagyi (2011), who state that emerging countries reformed their financial system and implemented economic strategies to prevent the contagion transmission across countries after suffering from the Asian financial crisis in 1997 to 1998. The financial industry in Thailand has successfully implemented safeguards against financial crisis by enhancing transparency and governance, standard pricing of risk and issuing the Basel II to manage bank risk (Walter 2010; Kritayanavaj 2008; Lee & Park 2009).

Moreover, the results in Figure 4.7 show that the correlation coefficients of the RJKSE have changed most with the ROIL, followed by the RSGX, the RPSE, the RSET and the RKLSE. From these results it can be implied that the contagion transmission from oil prices has most affected the RJKSE, and the RKLSE received less of an effect from this fluctuation .

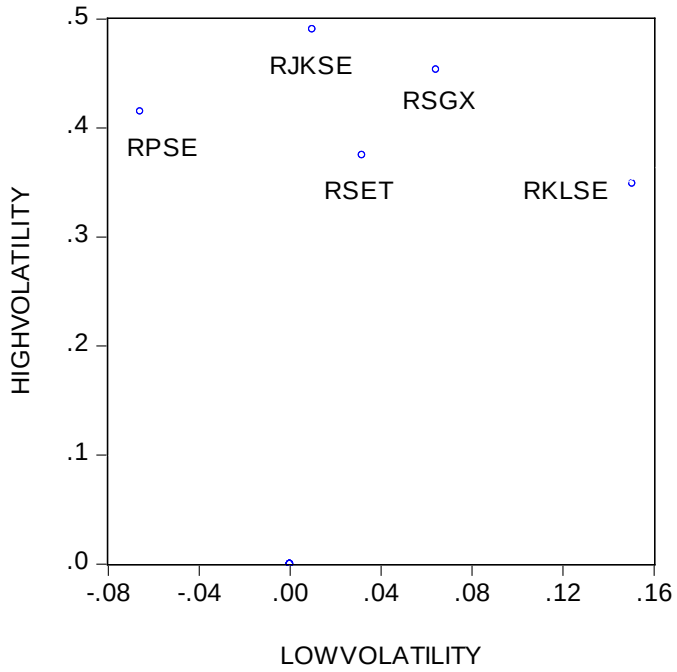

Figure 4.7: Contagion Test for Oil Prices and Stock Markets in the Region

The results of the correlation coefficient statistics establish evidence of transmission from the oil price movement on South-East Asian stock markets. This finding is supported by previous studies of Aloui and Jammazi (2008), who illustrate that oil price increases had a significant role in determining both the probability of transition across regimes and the stock market volatility. Chen (2009) states that the fluctuation of oil prices can transmit to make the S&P 500 volatile and push the stock market into bear territory. The outcomes of Basher and Sadorsky (2006) indicate that oil prices have a significant role in pricing emerging market stock returns, and increases in oil prices have a bigger effect on emerging stock returns rather than oil price decreases.

Surprisingly, there is no evidence of contagion from political crisis in Thailand to other stock market in the region. The results in Figure 4.8 display that the correlation coefficients of all stock market in South-East Asia have decreased during high-volatility period. Only the RSET was sensitive with the movement of the RBSI. Some political event studies suggest that local political events are important factors influencing the stock market volatility in the short term rather than the long term (Ma, Sun & Tang 2003; Bialkowski, Gottschalk & Wisniewski 2008). The study of Thailand's political events by Nimkhunthod (2007) suggest that political bad news, such as a coup d'état, can cause the stock market to slump by investor overreaction

in the short term. After information improves, it can boost the stock market over the long term.

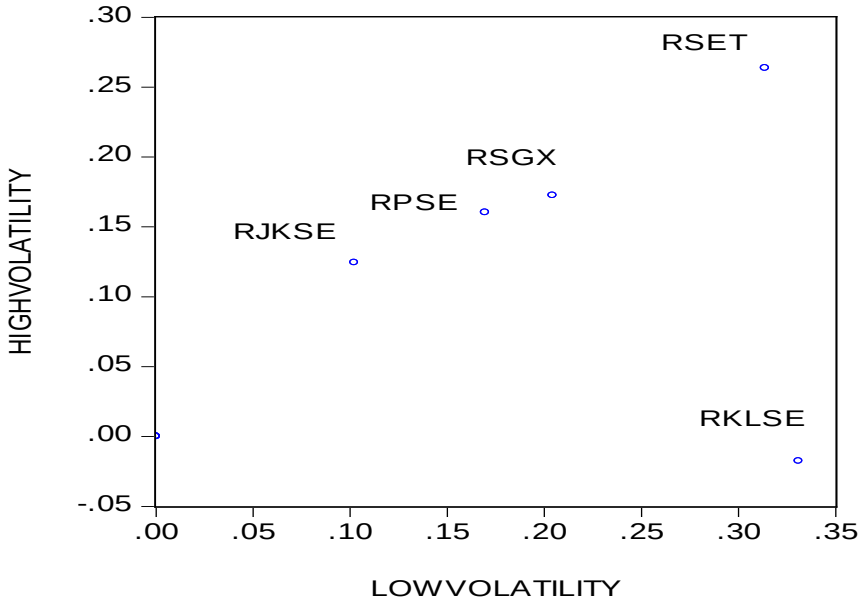

Figure 4.8: Contagion Test for BSI and Stock Markets in the Region

The result of Granger causality also confirms that there is evidence of stock market interdependence and independence during the period of this study. At the high-volatility period, all data are independent. This result can be explained by Batten and Szilagyi (2011), Dos (2011) and Lee and Park (2009). Their studies conclude that emerging stock markets have adapted their financial systems and implemented economic strategies to prevent volatility transmission across countries. At the full data set and low-volatility period, Singapore's stock exchange displays major evidence of market interdependence to the stock market in Malaysia, the Philippines, Indonesia and Thailand. This study's finding was similar to that of Chancharat, Valadkhani and Harvie (2007), who indicated that Singapore is a major regional financial hub in South-East Asia. Thus, Singapore could be used as a price leader with its dominance in the South-East Asia financial market.

Consequently, the outcomes of hypotheses 4, 5, 6 and 7 can answer research question 2. These hypotheses confirmed that the positive interrelationship between SET, the RSGX and the RJKSE, the RPSE, RSET and the RKLSE are interdependent. Five stock market returns in South-East Asia are sensitive to the S&P 500 returns and oil prices; this finding confirmed that the crises from major financial markets and oil price volatility have the ability to transmit

their uncertainties across countries. Further, the contagion transmission in the South-East Asian stock market cannot be explained by the political crisis in Thailand.

4.10 Summary

This chapter presented a discussion of the results from the quantitative components of the research regarding the factors affecting stock market volatility and contagion, and also compared these results with those of previous studies. In order to answer research question 1, hypothesis testing (hypotheses 1, 2 and 3) was discussed. The results explain that the RSP500 is the major influence on the volatility of the SET. Also, the RBSI and ROIL are the causes of volatility in the SET. Hypothesis testing (hypotheses 4, 5, 6 and 7) shows S&P 500 returns and oil prices were the major causes of contagion affecting South-East Asia stock markets. The RBSI could be factor of volatility, but did not show evidence of contagion in the stock markets. The South-East Asia stock markets have a strong positive interrelationship as interdependent at the low volatility and full data set period.

In the next chapter, the conclusions and limitations of the study will be discussed. Additionally, recommendations for future study will be presented.

Chapter 5: Conclusion and Limitations

5.1 Introduction

This chapter is in three sections. The first section presents a synopsis of the findings from the study of the factors affecting stock market volatility and contagion, involving evidence from Thailand and South-East Asia and focusing on the conclusions and summary of the research. The second section is briefly the potential significant of the finding can be used to formulate policies to against the volatility and contagion. The Third section discusses major limitations that contributed to the research process and gives recommendations for future study.

5.2 Conclusion on the Factors Affecting Stock Market Volatility

This study introduces the determinative factors affecting stock market volatility. As stated in the literature review, the major stock market, exchange rate, inflation, interest rate, dividend yield, industrial production, money supply, fiscal and monetary policies and company performance contributed as factors affecting stock market volatility. However, stock market volatility can be caused by other factors. For example, SET (2010) report that Thailand's stock market is highly volatile and underperformed when the government announced the state of emergency and the crackdown on demonstrators. Oil price volatility can cause volatility in the stock market (Papapetron 2001; Chen 2009; Park & Ratti 2008). The global financial crisis caused by the US subprime meltdown also caused high volatility in the S&P 500 index, which transmitted to other stock market worldwide (SET 2009). Thailand's stock market volatility has not been explored according to these factors or analysed so far. Consequently, this study filled this gap by employing the sample factors of oil price volatility, political uncertainty and the S&P 500 index to examine the volatility on SET. The results of this study can inform investors on portfolio diversification.

This study applied two econometric models to examine this: the multiple regression model and the GARCH model. Data were collected from February 1999 to October 2010 and converted into monthly index prices. All data were separated into three sub-periods. February 1999 to October 2010 (full period) was the entire period of this study, February 1999 to October 2006 (low-volatility period) was the normal condition in Thailand's stock market, November 2006 to October 2010 (high-volatility period) was the period where the stock

market was hit by oil price fluctuation, the movement of the S&P 500 index was varied by the subprime crisis and the BSI index was changed by the political crisis in Thailand.

The multiple regression model was chosen to test the effect of the factors affecting the stock market, because multiple regression was used to examine the relationship between economic factors in the study of Basher and Sadorsky (2006), Nandha and Faff (2008) and Hl-Sharif, Brown, Burton, Nixon and Russell (2005). The GARCH model was the well-known model used to examine volatility in the financial market; for example, see the previous literature of Malik and Ewing (2009), Worthington and Higgs (2004), Hull (2006) and Bautista (2010). The estimate of the LM test can determine whether all data are heteroskedastic or homoskedastic. In the case of finding heteroskedasticity, the study can continue to estimate using the GARCH model.

Table 5.1: Summary a contagion results relating to the Multiple Regression and GARCH models.

Hypothesis	Method	Direction of effect		
		Full data set	Low volatility	High volatility
H 1 Oil	multiple regression GARCH	positive positive *	positive positive *	positive positive **
H 2 BSI	multiple regression GARCH	positive *** positive ***	positive *** positive ***	positive ** positive ***
H 3 S&P 500	multiple regression GARCH	positive *** positive ***	positive *** positive ***	positive *** positive ***

* significant at 10 per cent level, ** significant at 5 per cent level, *** significant at 1 per cent level

The results of the summary statistics using both methods showed that the RSET was positively correlated to the RBSI, ROIL and the RSP500. The RSP500 was strongly positively correlated, the RBSI was positively correlated and the ROIL was less correlated with the RSET. These finding concluded that that the RSP500 was the highest factor affecting the stock market volatility of Thailand, while the factor of the RBSI had greater effects than oil prices on Thailand's stock market volatility. These results were similar to the previous studies of Kilian, Rebucci and Spatafora (2007), Papapetron (2001), Chancharat, Valadkhani and Harvie (2007), Krichence (2008) and Hunt, Isard and Laxton (2001).

The study found that the ROIL can cause volatility in Thailand's stock market for two reasons. First, oil consuming countries or firms cannot control the cost of production, which may affect a change in dividend, firm performance and share price (Kilian, Rebucci & Spatafora 2007; Papapetron 2001; Chancharat, Valadkhani & Harvie 2007). Second, oil price

volatility may create indirect channels to affect the stock market via inflation and economic activity (Krichence 2008; Hunt, Isard & Laxton 2001). Thailand and industries in the stock market need to purchase petroleum to produce their products, and so the volatility of oil prices can affect the volatility of Thailand's stock market. However, oil price volatility can be prevented by hedging instruments, such as options and future contracts. The result of hedging will help oil consumers have more control over their production costs (Federico, Daniel & Bingham 2001). Carter, Rogers & Simkins (2002) has suggested that US airline firms have been able to increase their firm value because fuel hedging can protect their cash flow.

This study also found that RBSI can cause volatility in Thailand's stock market for two reasons. First, Thailand financial markets are sensitive to change in the political environment. Second, political events such as National elections, parliamentary dissolution, military coups d'état, a state of emergency and crackdowns on demonstrators led to large volatility in the stock price index (Bautista 2003; Nimkhunthod 2007; SET 2010).

The RSP500 was positively statistically significant to explain the factors affecting stock market in Thailand. The study found that the RSP500 had a major effect on Thailand's stock market for two reasons. First, high volatility in the developed stock market may have had a spillover effect into the Asian financial markets via market integration and financial liberalisation (Diebold & Yilmaz 2008; SET 2008; Yilmaz 2009a). Second, the volatility in the S&P 500 index caused by the subprime crisis had a different effect on the Asian financial crisis. However, Thailand received the effect less than other stock market in the region because the Thailand financial market was more sophisticated after experiencing the Asian financial crisis in 1997 (Batten & Szilagyi 2011). Therefore, the RSP500 had a major significant effect on Thailand's stock market, followed by the RBSI. ROIL was less significant in explaining the determinants of Thailand's stock market volatility.

5.3 Conclusion on the Contagion Effect

Contagion effects have been studied in relation to situations when markets have been highly volatile as a result of financial crises, which evidence from currency crisis to other financial markets (Egert & Kocenda 2007b; Khallouli & Sandretto 2010; Hughes & MacDonald 2002). For example, the currency devaluation in Thailand, South Korea and Indonesia generated volatility and negative effects on the stock market in the region (Eun & Resnick 2004). In any case of a contagion effect, the contagion across countries related to

credit crisis in the developed market affects other financial markets (Longstaff 2010; Yilmaz 2009a). However, there has been some research on contagion in Thailand's stock market relative to other stock markets in the region. This paper filled a gap by observing the transmission from the sample variables to the Thai equity market and other equity markets in the same region in the context of the subprime crisis, oil prices and political crisis.

This study applied two econometric models: the correlation coefficient and Granger causality tests. The data were collected from the SET, the SGX and the JKSE, the PSE and the KLSE during February 1999 to October 2010, which were converted into monthly index price returns. All data were separated into three sub-periods. February 1999 to October 2010 (full period) was the entire period of this study, February 1999 to October 2006 (low-volatility period) was the normal condition in Thailand's stock market, November 2006 to October 2010 (high-volatility period) was the period where the stock market was hit by oil price fluctuation, the movement of the S&P 500 index was varied by the subprime crisis and the BSI index was changed by the political crisis in Thailand. The correlation coefficient was chosen to test the contagion because the contagion was defined as a significant increase in the degree of co-movement between stock returns in different countries. Previous studies used this model, such as the studies of Forbes and Rigobon (2001) and (2002) and Wilson and Zurbruegg (2004).

The Granger causality test was used to test the contagion effect between two variables. This test was a type of VAR model, which was an important model to examine the contagion effect between two stock markets (Yang 2002; Hon, Strauss & Yong 2004; Nikkinen, Saleem & Martikainen 2010).

The result of the correlation coefficient shows that the movement of S&P 500 and oil prices can generate the contagion transmission to the RSET, the RSGX, the RJKSE, the RPSE and the RKLSE. This finding of S&P 500 spillover can be explained by the study of Bae, Karolyi and Stulz (2003), Burdekin and Siklos (2012) and Karunanayake, Valadkhani and O'Brien (2010). They conclude that the movement of major stock markets, namely, S&P 500, can transmit to other stock markets worldwide while the volatility in minor stock markets cannot affect major stock markets. The finding of oil price spillover can be seen in the studies of Aloui and Jammazi (2008), Chen (2009) and Basher and Sadorsky (2006). They report that oil price volatility has a significant transmission on emerging stock market volatility.

Table 5.2: Summary a contagion results relating to the Correlation Coefficient and Granger Causality models.

	Correlation			Granger causality
	Oil	BSI	S&P500	
H4: SET and SGX				
Full data set	positive **	positive ***	positive ***	SGX cause SET
Low volatility	positive	positive ***	positive ***	Independent
High volatility	positive ***	positive **	positive ***	Independent
H5: SET and KLSE				
Full data set	positive ***	positive **	positive ***	SET cause KLSE
Low volatility	Positive	positive ***	positive ***	SET cause KLSE
High volatility	positive ***	Negative	positive ***	Independent
H6: SET and PSE				
Full data set	positive	positive *	positive ***	PSE cause SET
Low volatility	Negative	positive *	positive ***	Independent
High volatility	positive ***	positive	positive ***	Independent
H7: SET and JKSE				
Full data set	positive ***	positive	positive ***	JKSE cause SET
Low volatility	positive	positive	positive ***	Independent
High volatility	positive ***	positive	positive ***	Independent

* significant at 10 per cent level, ** significant at 5 per cent level, *** significant at 1 per cent level

In contrast, the movement of the BSI does not show contagion transmission on the stock market in Thailand and South-East Asia. This finding can be supported by the study of Nimkhumthod (2007), Ma, Sun and Tang (2003) and Bialkowski, Gottschalk and Wisniewski (2008). They conclude that only the stock market in the original unstable political country will receive a short-term effect from investor overreaction. After the information has been improved, the stock market will return to normal.

The results of the Granger causality test can explain the strong interrelationship of the RSET, the RSGX, the RJKSE, the RPSE and the RKLSE, which display an interdependence at the full data set. Only the SET can cause to KLSE at low-volatility periods and all stock markets are independent at high-volatility periods. This finding can be supported by the studies of Das (2012), Lee and Park (2009) and Batten and Szilagyi (2011). Their findings show that the implementation of economic strategies and adaption of financial systems and

regulation in each Asian country can prevent financial transmission across countries. As a result, high-volatility periods show each stock market being independent.

In conclusion, variable factors, such as the RSP500, the RBSI and ROIL, can influence the volatility of the SET. The evidence of contagion transmission to the stock market in Thailand and South-East Asia are caused by the RSP500 and ROIL. As the results of the RBSI of Thailand shows, politics in each country can make volatile their own stock market but does not show a contagion transmission. The RSET, the RSGX, the RJKSE, the RPSE and the RKLSE have a positive interrelationship in regards to market integration. Thailand and South-East Asia have their own financial barrier to defend the crisis transmission across countries.

5.4 Suggestion of the finding

The result from the factors affecting Thailand stock market volatility show that the S&P 500 had a major influence on Thailand's stock market, followed by the BSI and oil price. The study results indicate that the movements of major stock markets and political uncertainty have direct effects on stock market volatility. The effect of movements of oil prices has an indirect effect on firm performance. In brief, the empirical results of the contagion tests on South-East Asian stock markets show that the movement of S&P 500 and oil price can cause contagion effects in the South-East Asia stock markets. These results conclude that stock market volatility and transmission can be caused by the movement of S&P 500 and oil price while the BSI can initially affect only Thailand's stock market volatility. The South-East Asian stock markets have a strong interrelationship in regards to market integration. However, the implementation of economic strategies and adaption of financial systems and regulation in each country can bring the stock market independent.

Since, the stock markets are affected by global events such as political turmoil, major stock market uncertainty, oil price movement, economic downturns and natural disasters. It is clear that volatility and contagion in equity markets will continue to be an important consideration for the policy administrators, domestic and global investors. However, these persons have to take advantage of volatility and contagion rather than be afraid of it. For example,

1) Using dollar-cost average purchases an asset on a monthly or quarterly basis, regardless of market values. It will be a solid strategy when adding funds to a volatile stock market.
2) Releasing mutual funds, the policy administrators should launch mutual funds such as retirement mutual fund, long-term equity fund and pension fund investing with the lowest betas from SET. This technique will keep the equities that have fallen in value during high volatility and hold it when the market become normally. As a result, mutual funds will enhance stability of equities in SET.
3) Launching the implementation of the Basel II framework, it will improve solidity of banking system to against speculative buying and the bank system had more ability to manage their financial risk.
4) Financial market openness leads to increase in capital inflows via FDI, portfolio, and other investments. It is associated the stock market more stable. However, the policy administrators should enhance a strengthening of regulations, closely monitor, conducted extensive stock market and market research in order to preventing stock price bubbles.
5) Using derivative, derivative obligations have become an important element that has helped protect portfolios against loss. These instruments allow an investor to obtain protection from a third party against the risk of corporate default.

The examples above will bring the capital market become stable. Whenever the market becomes more stable, the financial volatility and contagion may turn into less frequent and milder.

5.5 Limitations

This thesis has certain limitations as outlined below. The major limitation was the use of monthly data as a proxy of the economic activities and stock market variables. The evaluation of the stock index and oil prices in the monthly data as varying every day. Therefore, this may contribute to the insignificant results for the explanation of the stock index and oil prices. It would be interesting to apply daily statistics rather than monthly statistics for better results.

Another limitation is that the firms and industries in the stock market have different structures. For example, bank firms have a structure based on the movement of the interest rates. The structure of oil industries vary based on daily oil prices. Thus, several different

variables may have a potential importance in explaining the returns of different firms. In order to achieve a more accurate result, it would be suggested to test firms and industries rather than the whole market.

5.5 Recommendations for Future Research

The notion of factor volatility and contagion in South-East Asia would benefit from further research of several aspects of the knowledge in stock market. In particular, future research should be conducted in relation to the following suggestions:

- This thesis tested the factors affecting stock market volatility in the SET. There is a room for future research, which could narrow the field to firms and industries in a stock market, because each firm and industry respond differently to volatility; for example, banking firms have different volatility responses to transportation firms.
- The original method used in examining stock market volatility is the GARCH structure. A further area of research is to extend the GARCH structure using other variables.
- The result of this thesis is to test the contagion between stock and others assets during the sample periods. However, there is a room for future research focusing on the contagion spillover from other assets. This will provide diversification benefits to investment portfolios that minimise and hedging their risks during crisis period.
- This thesis tested contagion within a region. However, there is a room for future research focusing on contagion spillover to firms or industries, because the effect of contagion may bring different results to different firms and industries.
- Future research could reapply this study into other financial areas. For example, community trade, such as gold price volatility and agricultural crop price volatility, can be tested by applying this volatility method.

References

Abosedra, S & Baghestani, H 2004, 'On the predictive accuracy of crude oil futures prices', *Energy Policy*, vol. 32, no. 12, pp. 1389–1393.

Abugri, BA 2002, 'Stock return volatility in emerging market: the relative effects of country and global factors', PhD thesis, University of Texas-Pan American.

Ackert, LF & Smith, BF 1993, 'Stock price volatility, ordinary dividends, and other cash flows to shareholders', *The Journal of Finance*, vol. 48, no. 4, pp. 1147–1160.

Aggarwal, R, Inclan, C & Leal, R 1999, 'Volatility in emerging stock markets', *Journal of Financial and Quantitative Analysis*, vol. 34, no. 1, pp. 33–55.

Al-Fayoumi, NA 2009, 'Oil price and stock market returns in oil importing countries: the case of Turkey, Tunisia and Jordan', *European Journal of Economics,* vol. 16, pp. 86–101.

Aloui, C & Jammazi, R 2009, 'The effects of crude oil shocks on stock market shifts behaviour: a regime switching approach', *Energy Economics,* vol. 31, pp. 789–799.

Alper, CE & Yilmaz, K 2004, 'Volatility and contagion: evidence from the Istanbul Stock Exchange', *Economic Systems*, vol. 28, pp. 353–367.

Al-Rjoub, SAM & Azzam, H 2012, 'Financial crises, stock returns and volatility in an emerging stock market: the case of Jordan', *Journal of Economic Studies,* vol. 39, no. 2, pp. 178–211.

Alvarez-Ramirez, J, Cisneros, M, Ibarra-Valdez, C & Soriano, A 2002, 'Multifractal Hurst analysis of crude oil prices', *Elsevier,* vol. 313, pp. 651–670.

Amihud, Y & Wohl, A 2004, 'Political news and stock prices: the case of Saddam Hussein contracts', *Journal of Banking & Finance*, vol. 28, pp. 1185–1200.

Ang, JB & McKibbin, WJ 2007, 'Financial liberalisation, financial sector development and growth: evidence from Malaysia', *Journal of Development Economics*.

Apergis, N & Miller, SM 2009, 'Do structural oil-market shocks affect stock prices?', *Energy Economics*, vol. 31, pp. 569–575.

Arestic, P, Mariacaporale, G, Cipollini, A & Spagnolo, N 2005, 'Testing for financial contagion between developed and emerging markets during the 1997 East Asian Crisis', *International Journal of Finance and Economics*, vol. 10, pp. 359–367.

Asian Development Bank 2009, 'Asian economic monitor', July 2009, Manila.

Asian Development Bank 2004, 'Asian development outlook' 2004 update, September, Manila.

Asian Development Bank 2010, 'Asian development outlook 2010, July 2011, Manila.

Asri, M 1996, '"US multinationals", stock price reaction to host country's governmental change: the case of Prime Minister Takeshita's resignation', *Kelola*, vol. 5, no. 11, pp. 126–137.

Asteriou, D & Price, S 2001, 'Political uncertainty and economic growth: UK time series evidence', *Scottish Journal of Political Economy*, vol. 48, no. 4, pp. 383–389.

Asteriou, D 2006, *Applied econometrics a modern approach using EViews and microfit*, Palgrave Macmillan, China.

Asteriou, D & Hall, SG 2011, *Applied Econometrics*, 2nd edn, Palgrave Macmillan, China.

Atkinson, P & Hammersley, M 1994, 'Ethnography and participant observation', *Handbook of Qualitative Research*, Sage Publications, London, pp. 248–61.

Bae, KG, Karolyi & Stulz, R 2003, 'A new approach to measuring financial contagion', *The Review of Financial Studies*, vol. 16, pp. 717–763.

Ballie, RT & DeBennaro, RP 1990, 'Stock returns and volatility', *Journal of Financial and Quantitative Analysis*, vol. 25, pp. 203–215.

Barth, JR, Li, T, Phumiwasana, T & Yago, G 2008, 'A short history of the sub-prime mortgage market meltdown', *GH Bank Housing Journal*, vol. 2, no. 2, pp. 2–8.

Basher, SA & Sadorsky, P 2006, 'Oil price risk and emerging stock market', *Global Finance Journal*, vol. 17, pp. 224–251.

Bautista, CC 2003, 'Stock market volatility in the Philippines', *Applied Economics Letters*, vol. 10, pp. 315–318.

Baur, DG & Fry, RA 2009, 'Multivariate contagion and interdependence', paper presented at *The Econometric Society World Congress*.

Batten, JA & Szilagyi, PG 2011, 'The effect of the global financial crisis on emerging financial markets: an introduction', *Contemporary Studies in Economic and Financial Analysis*, vol. 93, pp. 3–16.

Beaulieu, MC, Cosset, JC & Essaddam, N 2005, 'The effect of political risk on the volatility of stock returns: the case of Canada', *Journal of International Business Studies*, vol. 36, no. 6, pp. 701–718.

Bekaert, G, Harvey, CR & Ng, A 2005, 'Market integration and contagion', *Journal of Business*, vol. 25, no. 78, pp. 39–69.

Bell, E & Bryman, A 2003, *Business research methods*, Oxford University Press, Oxford.

Bell, E & Bryman, A 2007, *Business research method*, 2nd edn, Oxford University Press, Oxford.

Bhattacharyay 2009, 'Infrastructure development for ASEAN economic integration', ADBI working paper, no. 138, Asian Development Bank Institute, Tokyo.

Bialkowski, J, Gottschalk, K & Wisniewski, TP 2008, 'Stock market volatility around national elections', *Journal of Banking & Finance*, vol. 32, pp. 1941–1953.

Bilson, CM, Brialsford, TJ & Hooper, VC 2002, 'The explanatory power of political risk in emerging markets', *International Review of Financial Analysis*, vol. 11, no. 1, pp. 1–27.

Blecker, RA 2005, *Financial globalisation, exchange rates, and international trade*, Political Economy Research Institute.

Bollerslev, TP 1987, 'Generalized autoregressive conditional heteroscedasticity', *Journal of Economics*, vol. 31, pp. 307–327.

Bollerslev, T R F Engle & Nelson DB 1994, 'ARCH models', Northwestern University working paper, prepared for *The Handbook of Economics*, vol. 4.

Borio, C 2006, 'Monetary and financial stability. Here to stay?', *Journal of Banking & Finance*, vol. 30, no. 12, pp. 3407–3414.

Boschi, M 2007, 'International financial contagion: evidence from the Argentine crisis of 2001–2002', *Applied Financial Economics*, vol. 15, no. 3, pp. 153–163.

Boyer, MM & Filion, D 2007, 'Common and fundamental factors in stock returns of Canadian oil and gas companies', *Energy Economics*, vol. 29, no. 3, pp. 428–453.

Brailsford, T & Fall, R 1999, 'Oil price risk and the Australian stock market', *Journal of Energy Finance & Development*, vol. 4, pp. 69–87.

Brailsford, T, Heaney, R & Bilson, C 2004, *Investments concepts and applications*, 2nd edn, Thomson, Australia.

Breusch, T & Pagan A 1979, 'A simple test for heteroskedasticity and random coefficient variation', *Econometrica*, vol. 47, pp. 1278–94.

Brevik, F & Kind, A 2004, 'What is going on in the oil market?', *Financial Markets and Portfolio Management*, vol. 18, no. 4, pp. 442–457.

Brooks, C 2002, *Introductory econometrics for finance*, Cambridge University Press, London.

Brooks, S & Mosley, L 2008, 'Risk, uncertainty and autonomy: financial market constraints in developing nations', Mimeo.

Brouwer, GD 2003, 'Financial markets, institutions, and integration in East Asia', *Asian Economic Paper*, vol. 2, no. 1, pp. 53–80.

British Petroleum 2009, 'Statistical Review of World Energy', viewed 20 August 2012, <http://www.bp.com/statisticalreview2009>.

Brunnermeier, MK 2009, 'Deciphering the liquidity and credit crunch 2007–2008', *Journal of Economic Perspectives*, vol. 23, no. 1, pp. 77–100.

Burdekin, RCK & Siklos, PL 2012, 'Enter the dragon: interactions between Chinese, US and Asia-Pacific equity markets 1995–2010', *Pacific-Basin Finance Journal*, vol. 20, pp. 521–541.

Calvo, S & Reinhart, C 1996, 'Capital flows to Latin America: is there evidence of contagion effects', World Bank Policy Research Working Paper, no. 1619, New York.

Caner, S & Onder, Z 2005, 'Sources of volatility in stock return in emerging market', *Applied Economics*, vol. 37, pp. 929–942.

Caporale, G & Spagnolo, N 2003, 'Asset prices and output growth volatility: the effects of financial crises', *Economic Letters*, vol. 79, pp. 69–74.

Carter, DA, Rogers, DA & Simkins, BJ 2002, 'Does fuel hedging make economic sense? The case of the US airline industry', *Social Science Research Network*, pp. 1–48.

Cavana, RY, Delahaye, BL & Sekaran, U 2001, *Applied business research: qualitative and quantitative methods*, John Wiley & Sons, Sydney.

Chan, KF, Treepongkaruna, S, Brooks, R & Gray, S 2011, 'Asset market linkages: evidence from financial, commodity and real estate assets', *Journal of Banking and Finance*, vol. 35, pp. 1415–1426.

Chan, Y, Chui, ACW & Kwok, CCY 2001, 'The effect of salient political and economic news on the trading activity', *Pacific-Basin Finance Journal*, vol. 9, no. 3, pp. 195–217.

Chan, Y & Wei, KJ 1996, 'Political risk and stock price volatility: the case of Hong Kong', *Pacific-Basin Finance Journal*, vol. 4, pp. 259–275.

Chancharat, S, Valadkhami, A & Harvie, C 2007, 'The influence of international stock markets and macroeconomic variables on the Thai stock market', *Applied Econometrics and International Development*, vol. 7, no. 1, pp. 221–238.

Chen, SS 2009, 'Do higher oil prices push the stock market into territory?', *Energy Economics*, vol. 32, pp. 490–495.

Cherian, JA & Perotti, E 2001, 'Option pricing and foreign investment under political risk', *Journal of International Economics*, vol. 55, pp. 359–377.

Chomsisengphet, S & Pennington-Cross, A 2006, 'The evolution of the subprime mortgage market', *Federal Reserve Bank of St. Louis Review*, vol. 88, no. 1, pp. 31–56.

Christiansen, C 2007, 'Volatility-Spillover effects in European bond market', *European Financial Management*, vol. 13, no. 5, pp. 923-948.

Chuang, I, Lu, J & Tswei, K 2007, 'Interdependence of international equity variances: evidence from East and Asian markets', *Emerging Markets Review*, vol. 8, pp. 311–327.

Cipriani, M & Kaminsky, GL 2007, 'Volatility in international financial market issuance: the role of the financial centre', *Open Economic Review*, vol. 18, no. 2, pp. 157–176.

Cleaver, T 2007, *Understanding the world economy*, 3nd edn, Routledge, the USA and Cananda.

Collins, D & Gavron, S 2005, 'Measuring equity market contagion in multiple financial events', *Applied Financial Economics*, vol. 15, pp. 531–538.

Collis, J & Hussey, R 2009, *Business research: a practical guide for undergraduate and postgraduate students*, 3rd edn, Palgrave Macmillan, Basingstoke.

Cong, RG, Wei, YM, Jiao, JL & Fan, Y 2008, 'Relationships between oil price shocks and stock market: an empirical analysis from China', *Energy Policy*, vol. 36, pp. 3544–3553.

Corsetti, G, Pericoli, M & Sbracia, M 2005, 'Some contagion, some interdependence: more pitfalls in tests of financial contagion', *Journal of International Money and Finance*, vol. 25, pp. 1177–1199.

Creswell, J 2003, *Research design: quantitative and mixed methods approach*, 2nd edn, Sage Publications, London.

Daly, K 1999, *Financial volatility and real economic activity*, Ashgate Publishing Ltd, England.

Das, DK 2004, *Financial globalisation and the emerging market economics*, Routledge, London.

Das, DK 2012, 'How did the Asian economy cope with the global financial crisis and recession? A revaluation and review', *Asia Pacific Business Review*, vol. 18, no. 1, pp. 7–25.

Demers, E & Vega, C 2008, 'Soft information in earning announcements: news or noise?', working paper, INSEAD.

Demyanyk, Y & Hemert, OV 2009, 'Understanding the subprime mortgage crisis', viewed 30 January 2012, <http://rfs.oxfordjournals.org/cgi/content/full/hhp033v1>.

Desbordes, R & Vicard, V 2009, 'Foreign direct investment and bilateral investment treaties: an international political perspective', *Journal of Comparative Economic*, vol. 37, no. 3, pp. 372–386.

Diamonte, RL, Liew, JM & Steven, RL 1996, 'Political risk in emerging and developed markets', *Financial Analysis Journal*, pp. 71–76.

Dickey, DA, Bell, WR & Miller, RB 1986, 'Unit roots in time series models: tests and implications', *American Statistician*, vol. 40, pp. 12–26.

Dickey, DA & Fuller, WA 1979, 'Distribution of the estimator for autogressive time series with a unit root', *Journal of the American Statistical Association*, vol. 74, no. 366, pp. 427–31.

Dickey, DA & Fuller, WA 1981, 'Likelihood ratio statistics for autoregressive time series with a unit root', *Econometrics*, vol. 49, no. 4, pp. 1057–72.

Diebold, FX & Yilmaz, k 2008, 'Measuring financial asset return and volatility spillovers with application to global equity markets', NBER working paper, no. 13811.

Dodd, R 2007, 'Subprime: tentacles of a crisis', *Finance and Development*, vol. 44, no. 4, pp. 15–19.

Doner, R 2012, 'Success as trap? Crisis response and challenges to economic upgrading in export-oriented South-East Asia', JICA-RI working paper, no. 45.

Dopke, J & Pierdzioch, C 2006, 'Politics and the stock market: evidence from Germany', *European Journal of Political Economy*, vol. 22, pp. 925–943.

Dornbush, R, Park, YC & Claessens, S 2000, 'Contagion: understanding how it spreads', *The World Bank Observer*, vol. 15, pp.177–97.

Dungey, M, Fry, R, Gonzalez-Hermosillo, B & Martin, V 2005, 'Empirical modelling of contagion: a review of methodologies', *Quantitative Finance*, vol. 5, no. 1, pp. 9–24.

Dungey, M, Fry, R & Martin, VL 2003, 'Equity transmission mechanisms from Asia to Australia: interdependence of contagion?', *Australian Journal of Management*, vol. 28, no. 2, pp. 157–182.

Eckaus, RS 2008, 'The oil price really is a speculative bubble', A Joint Center of the Development of Economics, MIT Energy Initiative, and Sloan School of Management, 13 June.

Edward, J. 2008, Australia's experience in the sub-prime crisis, paper presented at *Flinder University*, Adelaide.

El-Sharif, I, Brown, D, Burton, B, Nixon, B & Russell, A 2005, 'Evidence on the nature and extent on the nature and extent of the relationship between oil prices and equity values in the UK', *Energy Economics*, vol. 27, pp. 819–830.

Egert, B & Kocenda, E 2007a, 'Time-varying comovements in developed and emerging European stock markets: evidence from intraday data', William Davidson Institute working paper, no. 861.

Egert, B & Kocenda, E 2007b, 'Interdependence between Eastern and Western European stock markets: evidence from intraday data', *Economic Systems*, vol. 31, pp. 183–203.

Engle, RF 1982, 'Autoregressive conditional heteroskedasticity with estimates of the variance of UK inflation', *Econometrics*, vol. 50, pp. 987–1008.

Eun, CS & Resnick, BG 2004, *International financial management*, 3th edn, McGraw Hill, New York.

Faff, RW & Brailsford, TJ 1999, 'Oil price risk and the Australia Stock Market', *Journal of Energy Finance and Development*, vol. 4, pp. 69-87.

Fama, E 1970, 'Efficient capital markets: a review of theory and empirical work', *Journal of Finance*, vol. 25, pp. 383–417.

Fama, E, Fisher, L, Jensen, M & Roll, R 1969, 'The adjustment of stock prices to new information', *International Economic Review*, vol. 10, pp. 1–21.

Fatemi, K 2006, *Globalisation and East Asia opportunities and challenges*, International Business Press, New York.

Federico, G, Daniel, JA & Bingham, B 2001, 'Domestic petroleum price smoothing in developing and transition countries', IMF working paper, WP/01/75.

Fernandez-Izquierdo, A & Lafuente, JA 2004, 'International transmission of stock exchange volatility: empirical evidence from the Asian crisis', *Global Finance Journal*, vol. 15, pp. 125–137.

Financial Service Institute of Australasia (FINSIA) 2006, 'The share market: role and operations', Financial Service Institute Australasia (FINSIA), Melbourne.

Forbes, K & Rigobon, R 2001, 'Contagion in Latin America: definition, measurement, and policy implications', paper presented at MIT-Sloan School of Management and NBER, January 17.

Forbes, KJ & Rigobon, R 2002, 'No contagion, only interdependence: measuring stock market comovements', *The Journal of Finance*, vol. 17, no. 5, pp. 2223–2261.

Frot, E & Santiso, J 2012, 'Political uncertainty and portfolio managers in emerging economies', *Review of International Political Economy*, vol. 2, no. 55, pp. 1–26.

Gerjarusak, S 2008, 'US sub-prime crisis-value of baht and home mortgage interest rates', *GH Bank Housing Journal*, vol. 2, no. 2, pp. 20–23.

Ghosh, B & De, P 2005, 'Investigating the linkage between infrastructure and regional development in India: era of planning to globalisation', *Journal of Asia Economic*, vol. 15, no. 16, pp. 1023–1050.

Goonatilake, R & Herath, S 2007, 'The volatility of the stock market and news', *International Research Journal of Finance and Economics*, vol. 11, pp. 55–65.

Granger, CWJ 1969, 'Investigating causal relations by econometric models cross spectual methods', *Econometrica*, vol. 35, pp. 424–438.

Granger, WJC, Huang, BN & Yang, CW 2000, 'A biveriate causality between stock prices and exchange rate: evidence from Asia Flu', *The Quarterly Review of Economics and Finance*, vol. 40, pp. 337–354.

Griffiths, WE, Hill, R & Lim, GC 2012, *Using EViews for principles of econometrics*, 4th edn, John Wiley & Sons, USA.

Gujarati, D 1978, *Basic econometrics*, McGraw Hill, New York.

Guidi, M, Russell, A & Tarbert, H 2006, 'The effect of OPEC policy decisions on oil and stock prices', *OPEC Review*, vol. 30, no. 1, pp. 1–18.

Hammoudeh, S & Choi, K 2007, 'Characteristics of permanent and transitory returns in oil-sensitive emerging stock market: the case of GCC countries', *Journal of International Financial Market Institutions & Money*, vol. 17, pp. 231–245.

Hammoudeh, S & Li, H 2008, 'Sudden changes in volatility in emerging markets: the case of Gulf Arab stock markets', *International Review of Financial Analysis*, vol. 17, no. 1, pp. 47–63.

Hansen, P & Lunde, A 2005, 'A forecast comparison of volatility models: does anything beat a GARCH (1,1)?', *Journal of Applied Econometrics*, vol. 20, pp. 873–889.

Hardouvelis, GA, Malliaropulos, D & Priestley, R 2006, 'EMU and European stock market integration', *Journal of Business*, vol. 79, no. 1, pp. 365–392.

Hayo, B & Kutan, A 2004, 'The effect of news, oil prices, and global market developments on Russian financial markets', working paper, no. 656, University of Michigan, Ann Arbor.

He, H 1999, 'Political risk and stock returns: the case of Hong Kong', Thesis, The University of Hawaii.

Hellwig, MF 2009, 'Systemic risk in the financial sector: an analysis of the subprime-mortgage financial crisis', *De Economist*, vol. 157, pp. 129–207.

Hill, RC, Griffiths, W & Lim, GC 2011, *Principle of Econometrics*, 4th edn, Wiley, USA.

Hon, MT, Strauss, J & Yong, S 2004, 'Contagion in financial markets after September 11: myth or reality?', *The Journal of Financial Research*, vol. 27, no. 1, pp. 95–114.

Hughes, JE & MacDonald, SB 2002, *International banking: text and cases*, Pearson Education, United States.

Hull, J 2006, *Options, futures and other derivatives*, 6th edn, Pearson Prentice Hall, New Jersey.

Hunt, B, Isard, P & Laxton, D 2001, *The macroeconomic effects of higher oil prices*, IMF working paper, WP/01/14.

Hussey, J & Hussey, R 1997, *Business research*, Palgrave Macmillan, London.

International Finance Corporation (IFC) 2000, Emerging Stock Market Factbook 2000.

International Finance Corporation, Washington DC.

International Monetary Fund 2010, *International Monetary Fund Factsheet*, July, pp. 1–3.

International Monetary Fund 2009, 'Crisis and recovery', *World Economic Outlook*, April, Washington DC.

International Monetary Fund 2009, 'Asia and Pacific, global crisis: the Asian context', *Regional Economic Outlook*, May, Washington DC.

International Monetary Fund 2008, 'Global financial stability report', Washington DC.

International Monetary Fund 2008, 'Asia and Pacific', *Regional Economic Outlook*, April, Washington DC.

Ismail, I & Suhardjo, H 2001, 'The effect of domestic political events on an emerging stock market: the case of Indonesia', proceedings of the *Asia Pacific Management Conference*, University of Malaya, pp. 235–262.

Islam, I & Chowdhury, A 2004, *The political economy of East Asia post-crisis debates*, Oxford, South Melbourne.

Islam, SMN & Watanapalachaikul, S 2005, *Empirical finance modelling and analysis of emerging financial and stock markets*, Physica-Verlag A Springer Company, Germany.

James, VA 2005, *Business research methods: a managerial approach*, 2nd edn, Pearson Education, Australia.

Johnstone, P 2004, 'Mixed methods, mixed methodology, health services research in practice', *Qualitative Health Research*, vol. 14, no. 2, pp. 259–271.

Johnson, RB & Christensen, LB 2004, *Educational research: quantitative, qualitative, and mixed approaches*, Allyn and Bacon, Boston.

Johnson, RB & Turner LA 2003, 'Data collection strategies in mixed methods research', *Handbook of mixed methods in social and behavioural research*, pp. 297–319.

Karnad, RS 2008, 'Housing finance: too much finance, not enough housing?', *GH Bank Housing Journal*, vol. 2, no. 4–5, pp. 17–21.

Karunnanyake, I, Valadkhani, A & O'Brien, M 2010, 'An empirical analysis of international stock market volatility transmission', University of Wollongong economics working paper, series 2010, Wollongong.

Kato, T 2009, 'Global economic crisis-effects on East Asia', *GH Bank Housing Journal*, vol. 3, no. 9, pp. 42–50.

Kay, IT & Putten, SV 2007, *Myths and realities of executive pay*, Cambridge University Press, New York.

Kemper, E, Stringfield, S & Teddlie, C 2003, 'Mixed methods sampling in social science research', *Handbook of mixed methods in social & behavioral research*, pp. 273–296.

Khallouli, W & Sandretto, R 2010, 'Testing for "contagion" of the subprime crisis on the Middle East and North African stock markets: a Markov switching EGARCH approach', working paper 1022.

Kim, HY & Mei, J 2001, 'What makes the stock market jump? An analysis of political risk on Hong Kong stock returns', *Journal of International Money and Finance*, vol. 20, pp. 1003–1016.

Kilian, L, Rebucci, A & Spatafora, N 2007, 'Oil shocks and external balances', IMF working paper, WP/07/110.

Klein, PG & Luu, H 2002, 'Politics and productivity', Contracting and Organisations Research Institute working paper, WP/02/02.

Knight, J & Satchell, S 1998, *Forecasting volatility in the financial markets*, Butterworth-Heinemann, Woburn.

Koop, G 2006, *Analysis of financial data*, John Wiley & Sons, England.

Krichene, N 2008, 'Crude oil prices: trends and forecast', IMF working paper, WP/08/133.

Krichene, N 2006, 'World crude oil markets: monetary policy and the recent oil shock', IMF working paper, WP/06/62.

Kritayanavaj, B 2008, 'Global Financial Crisis 2008: a view from Thailand', *GH Bank Housing Journal*, vol. 2, no. 4–5, pp. 36–43.

Kutan, AM & Perez, SM 2002, 'Does organized crime affect stock market development? Evidence from Colombia', the Emerging Markets Group, working paper, 4/02, Cass Business School, London.

Lee, CS & Park, CY 2009, 'Beyond the crisis: financial regulatory reforms in emerging Asia', working paper, no. 34, Asian Development Bank, Manila.

Lee, JW & Park, CY 2009, 'Asian economic papers', *MIT Press Journals*, vol. 8, no. 1, pp. 9–40.

Lee, JW & Park, CY 2009, 'Global financial turmoil: effect and challenges for Asia's financial systems', *MIT Press Journals*, vol. 8, no. 1, pp. 9–40.

Levine, DM, Stephan, DF, Krehbiel, TC & Berenson, ML 2002, *Statistics for managers using Microsoft Excel*, 5th edn, Prentice Hall.

Lim, KP, Brooks, RD & Kim, JH 2008, 'Financial crisis and stock market efficiency: empirical evidence from Asian countries', *International Review of Financial Analysis*, vol. 17, pp. 571–591.

Liu, Y, Gopikrishnan, P, Cizeau, P, Meyer, M, Chung-Kang Peng & Stanley HE 1999, 'Statistical properties of the volatility of price fluctuations', *The American Physical Society*, vol. 60, no. 2, pp. 1390–1400.

Longstaff, FA 2010, 'The subprime credit crisis and contagion in financial markets', *Journal of Financial Economics*, vol. 97, no. 3, pp. 436–450.

Lobo, B 1999, 'Jump risk in the US. Stock market: evidence using political information', *Review of Financial Economics*, vol. 8, pp. 149–163.

Ma, Y, Sun, H & Tang, AP 2003, 'The stock return effect of political risk event on foreign joint ventures: evidence from the Tiananmen Square incident', *Global Finance Journal*, vol. 14, pp. 49 – 64.

MacKinnon, JG 1991, 'Critical Values for Cointegration Tests', in Engle, R.F. and Granger, C.W.J (eds.), *Long-run Economic Relationships*, Oxford University Press, Oxford.

Maddala GS 2001, *Introduction to econometrics*, John Wiley & Sons, London.

Maddala, GS & Rao, CR 1996, *Handbook of statistics 14, statistical methods in finance*, Elsevier Science BV, Netherlands.

Maddala, GS & Wu, S 1999, 'A comparative study of unit root tests with panel data and a new simple test', *Oxford Bulletin of Economics and Statistics*, vol. 61, pp. 631–52.

Malik, F & Ewing, BT 2009, 'Volatility transmission between oil prices and equity sector returns', *International Review of Financial Analysis*, vol. 18, pp. 95–100.

McCauley, RN 2008, 'Managing recent hot money inflows in Asia', ADBI institute discussion paper, no. 99, Asian Development Bank Institute, Tokyo.

Mian, A & Sufi, A 2009, 'The consequences of mortgage credit expansion: evidence from the U.S. mortgage default crisis', *The Quarterly Journal of Economics*, pp. 1449–1496.

Micklethwait, J 2009, 'Will the global financial crisis halt the rise of emerging economies?', *The Economist*, January.

Miller, JI & Ratti, RA 2009, 'Crude oil and stock markets: stability, instability, and bubbles', *Energy Economics*, vol. 31, pp. 559–568.

Moosa, IA 2003, *International Finance an analytical approach*, McGraw Hill, Australia.

More, A & Monage, S 2007, 'Superannuation funds and alternative asset investment: issues for policy makers', *The FINSIA Journal of Applied Finance (JASSA)*, vol. 3, pp. 15–20.

Morrissey, O & Udomkerdmongkol, M 2008, 'Foreign direct investment and exchange rates: a case study of US FDI in emerging market countries', paper presented at the BOT in June 2008, Bangkok.

Murphy, T 2009, 'Wealth Management', *inFinance*, June, pp. 35–36.

Nagayasu, J 2001, 'Currency crisis and contagion: evidence from exchange rates and sectoral stock indices of the Philippines and Thailand', *Journal of Asian Economics*, vol. 12, pp. 529–546.

Nandha, M & Faff, R 2008, 'Dose oil move equity prices? A global view', *Energy Economics*, vol. 30, pp. 987–997.

Nasar, S 1992, 'For fed, a new set of tea leaves', *New York Times*.

Nataraj, G 2007, 'Infrastructure challenges in South Asia: the role of public-private partnerships', ADB institute discussion paper, no. 80, Asian Development Bank Institute, Tokyo.

Ndako, UB 2012, 'Financial liberalisation, structural breaks and stock market volatility: evidence from South Africa', *Applied Financial Economics*, vol. 23, no. 19, pp. 1259–1273.

Neaime, S 2012, 'The global financial crisis, financial linkages and correlations in returns and volatilities in emerging MENA stock markets', *Emerging Markets Review*, vol. 13, pp. 268–282.

Nikkinen, J, Saleem, K & Martikainen, M 2011, 'Transmission of the subprime crisis: evidence from industrial and financial sector of BRIC countries', University of Vaasa Department of Accounting and Finance.

Nikkinen, J, Saleem, K & Martikainen, M 2010, 'Volatility spillovers from the US subprime crisis to BRIC countries', University of Vaasa Department of Accounting and Finance.

Nimkhunthod, W 2007, 'An effect of political events on the stock exchange of Thailand', thesis, Thammasat University.

Nordhaus, WD 2002, 'The economic consequences of a war with Iraq', working paper, Yale University Department of Economics and the NBER.

Oliver, S 2008, 'Supernormal investment returns run their course', *inFinance*, August, pp. 12–25.

O'Neil, TJ, Penm, J & Terrell, RD 2008, 'The role of higher oil prices: a case of major developed countries', *Research in Finance*, vol. 24, pp. 287–299.

Ostrup, F, Oxelheim, L & Wihlborg, C 2009, 'Origins and resolution of financial crisis: lessons from the current and Northern European crisis', *Asian Economic Paper*, vol. 8, no. 3, pp. 178–220.

Paas, T & Kuusk, A 2012, 'Contagion of financial crises: what does the empirical evidence show?', *Baltic Journal of Management*, vol. 7, no. 1, pp. 25–48.

Pagan, A 1996, 'The econometrics of financial markets', *Journal of Empirical Finance*, vol. 3, pp. 15–102.

Pagan, AR & Schwet GW 1990, 'Alternative models for conditional stock volatility', *Journal of Econometrics*, vol. 45, pp. 267–290.

Pallant, J 2005, *SPSS survival manual: a step by step guide to data analysis using SPSS*, 2nd edn, Allen and Unwin, Sydney.

Pantzalis, C, Stangeland, DA & Turtle HJ 2000, 'Political elections and the resolution of uncertainty: the international evidence', *Journal of Banking and Finance*, vol. 24, pp. 1575–1604.

Papapetron, E 2001, 'Oil price shocks, stock market, economic activity and employment in Greece', *Energy Economics*, vol. 23, pp. 511–532.

Park, YC 2009, 'Reform of the global regulatory system: perspectives of East Asia's emerging economies', paper presented at the World Bank, 22–24 July, Seoul, Korea.

Park, YC 2007, 'Whither financial and monetary integration in East Asia', *Asian Economic Papers*, vol. 6, no. 3, pp. 95–128.

Park, YC & Shin, K 2009a, 'Economic integration and changes in business cycles in East Asia', *Asian economic papers*, vol. 8, no. 1, pp. 107–140.

Park, YC & Shin, K 2009b, 'Internationalisation of currency in East Asia: implications for regional monetary and financial cooperation', paper presented at the BOK-BIS Seminar on currency internationalisation: Lessons from the global financial crisis and prospects for the future in Asia and the Pacific, Seoul, Korea.

Park, JW & Ratti, RA 2008, 'Oil price shocks and stock markets in the US and 13 European countries', *Energy Economics*, vol. 30, pp. 2578–2608

Perotti, EC & Oijen, PV 2001, 'Privatisation, political risk and stock market development in emerging economics', *Journal of International Money and Finance*, vol. 20, no. 1, pp. 43–69.

Phillips, PCB 1986, 'Understanding spurious regression', *Journal of Economics*, vol. 33, pp. 311–40.

Phillips, PCB 1987, 'Time series regressions with a unit root', *Econometrica*, vol. 55, pp. 277–301.

Phillips, PCB & Perron, P 1988, 'Testing for a unit root in time series regressions', *Biometrika*, vol. 65, pp. 335–46.

Phylaktis, K & Ravazzolo, F 2005, 'Stock market linkages in emerging markets: implications for international portfolio diversification', *Journal of International Financial Market Institutions & Money*, vol. 15, pp. 91–106.

Pisedtasalasai, A & Gunasekarage, A 2007, 'Causal and dynamic relationship among stock returns, return volatility and trading volume: evidence from emerging markets in South-East Asia', *Asia-Pacific Financial Markets*, vol. 14, pp. 277–297.

Poon, S & Granger, CWJ 2003, 'Forecasting volatility in financial market: a review', *Journal of Economic Literature*, vol. 41, pp. 478–539.

Robbani, MG & Anantharaman, S 2002, 'An econometric analysis of stock market reaction to political events in emerging markets', *Second Annual ABIT Conference*, Pennsylvania.

Richards, A 2003, 'Big fish in small ponds: the trading behaviour and price effect of foreign investors in Asian emerging equity', research discussion paper, Economic Analysis Department Reserve Bank of Australia.

Rigobon, R 2002, 'International financial contagion: theory and evidence in evolution', the Research Foundation of AIMR, Charlottesville.

Rigobon, R 2003, 'The curse of non-investment grade countries', *Journal of Development Economics*, vol. 69, pp. 423–449.

Sadorsky, P 1999, 'Oil price shocks and stock market activity', *Energy Economics*, vol. 21, pp. 449–469.

Sadorsky, P 2001, 'Risk factors in stock returns of Canadian oil and gas companies', *Energy Economics*, vol. 23, pp. 17–28.

Sakthivel, P, Bodkhe, N & Kamaiah, B 2012, 'Correlation and volatility transmission across international stock market: a Bivariate GARCH analysis', *International Journal of Economics and Finance*, vol. 4, no. 3, pp. 253–264.

Saunders, M, Lewis P & Thornhill, A 2002, *Research methods for business students*, 2nd edn, Pearson Education, London.

Sehgal, S & Kapur, R 2012, 'Relationship between oil price shocks and stock market performance: evidence for select global equity markets', *The Journal of Business Perspective*, vol. 16, no. 2, pp. 81–92.

Shin, HS 2008, 'Risk and liquidity in a system context', *Journal of Financial Intermediation*, vol. 17, no. 3, pp. 315–329.

Skully, M 2007, 'Alternative investments: definition, importance and risks', *The FINSIA Journal of Applied finance (JASSA)*, vol. 3, pp. 35–39.

Sola, M, Spagnolo, F & Spagnolo, N 2002, 'A test for volatility spillovers', *Economics Letters*, vol. 76, no.1, pp. 77–84.

Steeve, GM 2001, 'Political shocks and abnormal returns during the Taiwan crises, Masters thesis, University of Colorado.

Stiglitz, JE 2002, 'Capital market liberalisation and exchange rate regimes: risk without reward', *The Annals of the American Academy of Political and Social Science*, vol. 579, pp. 219–248.

Studenmund, AH 2001, *Using Econometrics: A Practical Guide.* Reading, Mass Addison-Wesley Longman Inc.

Switzer, LN & EI-Khoury, M 2006, *Extreme volatility, speculative efficiency, and the hedging effectiveness of the oil futures markets*, Finance Department at Concordia University.

Sun, Y & He, JM 2012, 'Modeling contagious severity of the stock markets', paper presented at the School of Economic and Management South-East University, Nanjing.

Tan, KB & Tse, YK 2002, 'The integration of the east and south-East Asian equity markets', International Centre for the Study of East Asian Development, working paper, no. 2002–11, viewed 11 January 2011, <http://www.icsead>.

Taylor, SJ 2008, *Modelling financial time series*, 2nd edn, World Scientific Publishing Co. Pte. Ltd., Singapore.

Taylor, SJ 1986, *Modelling financial time series*, John Wiley & Sons, New York.

Tejapira, K 2002, 'Post-crisis economic impasse and political recovery in Thailand: the resurgence of economic nationalism', *Critical Asian Studies*, vol. 34, no. 3, pp. 323–356.

Tharachi, T 2008, 'Global Financial Crisis 2008: Thai real estate market effect', *GH Bank Housing Journal*, vol. 2, no. 4–5, pp. 22–31.

The Stock Exchange of Thailand 2008, *Face book 2007*, viewed 6 June 2008, <http://www.set.or.th/>.

The Stock Exchange of Thailand 2009, *Face book 2008*, viewed 26 May 2010, <http://www.set.or.th/>.

The Stock Exchange of Thailand 2008, *Market overview 2008*, viewed 7 June 2009, <http://www.set.or.th/>.

The Stock Exchange of Thailand 2008, *Thai securities market's presence in Asia and Thai securities market's presence in the world*, viewed 27 April 2008, <http://www.set.or.th/>.

The Stock Exchange of Thailand 2010, *Market data 2008 and 2009*, viewed 26 May 2010, <http://www.set.or.th/>.

Todorov, GK 2012, 'A study of stock market linkages between the US and frontier markets', thesis, Florida International University.

Veal, AJ 2005, *Business research methods: a managerial approach*, 2nd edn, Pearson Education Australia.

Vijitnopparat, P 2008, 'Financial development-growth nexus: evidence from Thailand', paper presented at *The 2nd National Conference on E-saan Business and Economy 2008*, Khon Kaen University.

Voronkova, S 2004, 'Equity market integration in Central European emerging markets: a cointegration analysis with shifting', *International Review of Financial Analysis*.

Wang, K & Thi, TN 2006, 'Does contagion effect exist between stock markets of Thailand and Chinese economic area (CEA) during the "Asian Flu?"', *Asian Journal of Management and Humanity Science*, vol. 1, no. 1, pp. 16–36.

Wang, Y & Lin, C 2009, *The political uncertainty and stock market behaviour in emerging democracy: the case of Taiwan*, Department of Finance, Yuanpei University, Hsinchu, Taiwan.

Walter, S 2010, 'Basel II and revisions to the capital requirements directives', 3 May, Bank for International Settlements, Basel.

Warren, G & Radcliffe, D 2008, 'Emerging market equities: an Australian perspective', *The FINSIA Journal of Applied finance (JASSA)*, vol. 1, pp. 15–20.

Wilson, P & Zurbruegg, R 2004, 'Contagion or interdependence? Evidence from comovements in Asian-Pacific securitised real estate markets during the 1997 crisis', *Journal of Property Investment & Finance*, vol. 22, no. 5, pp. 401–413.

Woo, KI 2008, 'Credit default swaps almost bring down global financial system', *GH Bank Housing Journal*, vol. 2, no. 4–5, pp. 10–16.

World Bank 2002, 'World development indicators 2002', the World Bank, Washington DC.

World Bank 2004, 'World development indicators 2004', viewed 19 August 2010, <http://devdata.worldbank.org/dataonline/>.

World Bank 2009, 'World development indicators', viewed 31 December 2011, <http://www.worldbank.org>.

World Federation of Exchanges 2009, *Focus: the monthly newsletter of regulated exchanges, with key market figures*, viewed 1 August 2009, <http://www.worldexchanges.org>.

Worthington, A & Higgs, H 2001, 'A multivariate GARCH analysis of equity returns and volatility in Asia equity markets', discussion paper, no. 89, Queensland University of Technology, February, Brisbane.

Worthington, A & Higgs, H 2004, 'Transmission of equity returns and volatility in Asian developed and emerging markets: a multivariate GARCH analysis', *International Journal of Finance and Economics*, vol. 9, no. 1, pp. 71–80.

Worthington, A, Higgs, H & Kay-Spratly, A 2005, 'Transmission of prices volatility in Australia electricity spot market: a multivariate GARCH analysis', *Energy Economics*, vol. 27, no. 2, pp. 337-350.

Wyplosz, C 2001, 'How risky is financial liberation in the developing countries?', discussion paper, no. 2724, Centre for Economic Policy Research, London.

Yang, T 2002, 'Crisis, contagion, and East Asia stock markets', *Economic and Finance*, vol. 1, pp. 5–33.

Yang, J, Kolari, JW & Min, I 2003, 'Stock market integration and financial crises: the case of Asia', *Applied Financial Economics*, vol. 13, pp. 477–486.

Yilmaz, K 2009a, 'International business cycle spillovers', Tusiad-Koc University Economic Research Forum working paper, WP/09/03.

Yilmaz, K 2009b 'Return and volatility spillovers among the East Asian equity markets', *Journal of Asian Economics*, vol. 21, pp. 304–413.

Yu, I, Fung, K & Tam, C 2010 'Assessing financial market integration in Asia-equity markets', *Journal of Banking & Finance*, vol. 34, pp. 2874–2885.

Ying, GC 2008, 'ASEAN infrastructure financing mechanism: concepts and progress', paper presented at *ASEAN Infrastructure Financing Mechanism Conference*, Malaysia.

Zhang, KH 2001, 'Does foreign direct investment promote economic growth? Evidence from East Asia and Latin America', *Contemporary Economic Policy*, vol. 19, pp. 175–185.

Zikmund, WG 2000, *Business research methods*, 6th edn, Harcourt Collage Publisher, Fort Worth.

Appendices

Appendix A: The Sample Variables Returns

obs	RSET	ROIL	RSP500	RBSI
1999M02	NA	NA	NA	NA
1999M03	0.031953	0.179216	0.038061	0.004405
1999M04	0.266153	0.201448	0.037242	0.076147
1999M05	-0.012597	0.024491	-0.025287	0.055460
1999M06	0.140011	0.007417	0.053008	-0.021422
1999M07	-0.132959	0.143716	-0.032571	0.001967
1999M08	-0.036879	0.074984	-0.006274	-0.011858
1999M09	-0.122550	0.101543	-0.028967	-0.005982
1999M10	0.015439	-0.008079	0.060662	-0.002002
1999M11	0.065012	0.087537	0.018882	0.043144
1999M12	0.132488	0.032097	0.056233	0.001918
2000M01	-0.009067	0.007965	-0.052245	0.018976
2000M02	-0.243600	0.074136	-0.020313	-0.022815
2000M03	0.067153	0.012445	0.092324	0.000000
2000M04	-0.025092	-0.158952	-0.031280	-0.059423
2000M05	-0.188622	0.149449	-0.022159	0.040005
2000M06	0.007396	0.084131	0.023652	-0.013821
2000M07	-0.134615	-0.050547	-0.016476	-0.080706
2000M08	0.078217	0.043432	0.058928	0.010718
2000M09	-0.104484	0.086898	-0.054966	-0.028110
2000M10	-0.019850	-0.021425	-0.004962	0.028110
2000M11	0.022120	0.026090	-0.083456	0.029414
2000M12	-0.031916	-0.242884	0.004045	0.044542
2001M01	0.212034	0.026158	0.034050	-0.036294
2001M02	-0.023011	0.048515	-0.096831	-0.020748
2001M03	-0.107892	-0.085011	-0.066359	0.014568
2001M04	0.029332	0.025258	0.074007	-0.066193
2001M05	0.031111	0.071069	0.005077	0.043203
2001M06	0.039267	-0.021277	-0.025354	-0.049848
2001M07	-0.080205	-0.083881	-0.010798	-0.038510
2001M08	0.119778	0.039918	-0.066256	0.027337
2001M09	-0.191669	-0.030687	-0.085257	-0.064988
2001M10	-0.007064	-0.188493	0.017937	0.044556
2001M11	0.095380	-0.103593	0.072484	0.040455
2001M12	0.004056	-0.009137	0.007545	0.051514
2002M01	0.114820	0.033451	-0.015696	0.028868
2002M02	0.087028	0.042429	-0.020985	0.014127
2002M03	0.005739	0.168208	0.036080	0.069661
2002M04	-0.006789	0.072989	-0.063385	-0.053756
2002M05	0.093836	0.010172	-0.009123	0.040585
2002M06	-0.047333	-0.047837	-0.075214	-0.040585
2002M07	-0.034194	0.050170	-0.082300	0.023393

2002M08	-0.040321	0.039221	0.004870	-0.019456
2002M09	-0.084819	0.054500	-0.116561	-0.027890
2002M10	0.073850	-0.026879	0.082914	0.039609
2002M11	0.021272	-0.104836	0.055501	-0.009756
2002M12	-0.023345	0.117828	-0.062229	-0.015811
2003M01	0.037252	0.098272	-0.027797	0.027507
2003M02	-0.023766	0.066324	-0.017150	-0.025517
2003M03	0.008900	-0.079739	0.008323	0.029385
2003M04	0.027275	-0.174840	0.077927	-0.103646
2003M05	0.075030	0.022115	0.049646	0.058229
2003M06	0.134206	0.068583	0.011259	0.000000
2003M07	0.047137	0.024072	0.016094	-0.026614
2003M08	0.105007	0.037416	0.017715	0.016461
2003M09	0.073949	-0.099091	-0.012016	0.008130
2003M10	0.099340	0.076258	0.053504	0.027946
2003M11	0.010238	0.003785	0.007103	0.005888
2003M12	0.178333	0.028104	0.049519	0.027029
2004M01	-0.099671	0.047279	0.017129	-0.040822
2004M02	0.024591	-0.002551	0.012135	0.000000
2004M03	-0.101289	0.072350	-0.016494	0.009872
2004M04	0.001312	0.001187	-0.016933	-0.013848
2004M05	-0.011015	0.110007	0.012011	-0.010010
2004M06	0.008682	-0.057143	0.017829	-0.004032
2004M07	-0.015491	0.065084	-0.034892	-0.024541
2004M08	-0.019203	0.103830	0.002285	-0.035831
2004M09	0.031643	-0.010271	0.009320	0.019129
2004M10	-0.025944	0.118076	0.013917	-0.002107
2004M11	0.044478	-0.104247	0.037869	0.016737
2004M12	0.017165	-0.077264	0.031942	0.004141
2005M01	0.049367	0.092772	-0.025616	0.002064
2005M02	0.054937	0.038198	0.018727	-0.029291
2005M03	-0.084461	0.133616	-0.019303	-0.014974
2005M04	-0.033740	-0.005710	-0.020314	-0.004320
2005M05	0.013073	-0.057507	0.029512	0.008621
2005M06	0.011839	0.119710	-0.000143	-0.030503
2005M07	0.000252	0.044992	0.035336	-0.022372
2005M08	0.032299	0.093098	-0.011285	-0.002265
2005M09	0.035723	-0.003562	0.006925	0.004525
2005M10	-0.057789	-0.057760	-0.017900	0.017898
2005M11	-0.022024	-0.056744	0.034581	0.008830
2005M12	0.066591	0.026740	-0.000953	0.008753
2006M01	0.066268	0.099215	0.025148	-0.015368
2006M02	-0.024665	-0.043425	0.000453	-0.004435
2006M03	-0.014622	0.020226	0.011035	-0.004454
2006M04	0.046681	0.109782	0.012082	-0.029447
2006M05	-0.079705	0.008931	-0.031405	0.006873
2006M06	-0.045123	-0.004675	8.66E-05	-0.002286

2006M07	0.019510	0.059961	0.005073	-0.013825
2006M08	-0.000854	-0.009701	0.021051	-0.002323
2006M09	-0.006972	-0.147373	0.024269	0.011561
2006M10	0.051639	-0.067070	0.031022	0.024973
2006M11	0.022717	0.003101	0.016333	0.024364
2006M12	-0.083522	0.048192	0.012537	-0.015436
2007M01	-0.038689	-0.133063	0.013961	-0.024748
2007M02	0.034695	0.075365	-0.022088	-0.023042
2007M03	-0.005064	0.051120	0.009930	0.016185
2007M04	0.037080	0.071630	0.042380	-0.103833
2007M05	0.053251	0.000000	0.032031	0.112965
2007M06	0.052040	0.046373	-0.017977	-0.022990
2007M07	0.101483	0.077298	-0.032505	-0.054972
2007M08	-0.055664	-0.049245	0.012782	0.064231
2007M09	0.038939	0.092285	0.035168	0.025030
2007M10	0.070523	0.065911	0.014714	0.006719
2007M11	-0.069412	0.105275	-0.045043	0.017700
2007M12	0.013681	-0.020366	-0.008666	-0.024419
2008M01	-0.090018	0.015423	-0.063114	0.024419
2008M02	0.075533	0.031752	-0.035380	-0.017700
2008M03	-0.034560	0.082771	-0.005977	0.054302
2008M04	0.018697	0.068404	0.046451	-0.095310
2008M05	0.001440	0.118506	0.010618	0.020714
2008M06	-0.081256	0.068846	-0.089884	-0.070784
2008M07	-0.127891	0.007801	-0.009908	0.014563
2008M08	0.011935	-0.145774	0.012117	-0.019465
2008M09	-0.137455	-0.143141	-0.095181	0.007344
2008M10	-0.359188	-0.311841	-0.185636	-0.068122
2008M11	-0.035904	-0.296479	-0.077798	-0.107393
2008M12	0.113105	-0.263308	0.007791	0.070155
2009M01	-0.027648	0.055726	-0.089550	-0.016394
2009M02	-0.014197	-0.050203	-0.116457	0.029853
2009M03	-4.63E-05	0.117144	0.081953	0.067209
2009M04	0.130581	0.068524	0.198243	-0.020203
2009M05	0.130820	0.144558	-0.056750	0.146835
2009M06	0.064052	0.173823	0.000196	0.019630
2009M07	0.043430	-0.067001	0.071522	-0.028479
2009M08	0.045810	0.102526	0.033009	0.024150
2009M09	0.093214	-0.046434	0.035100	0.061007
2009M10	-0.045404	0.080065	-0.019960	0.026185
2009M11	0.005574	0.045906	0.055779	-0.026185
2009M12	0.063902	-0.035165	0.017615	0.028171
2010M01	-0.053105	0.029476	-0.037675	0.000000
2010M02	0.035013	-0.031615	0.028115	0.017700
2010M03	0.088321	0.059490	0.057133	0.082289
2010M04	-0.031546	0.059244	0.014651	-0.191339
2010M05	-0.017280	-0.107820	-0.085532	0.081380

2010M06	0.060597	-0.010781	-0.055388	0.043144
2010M07	0.070828	-0.002814	0.066516	-0.033174
2010M08	0.064872	0.018086	-0.048612	-0.001986
2010M09	0.065801	0.003027	0.083928	0.005946
2010M10	0.009348	0.071119	0.036193	-0.011929

Appendix B: Thailand and South-East Asia Stock Market Returns

obs	RSET	RSGX	RPSE	RKLSE	RJKSE
1999M02	NA	NA	NA	NA	NA
1999M03	0.031953	0.072654	0.073433	-0.075458	-0.006255
1999M04	0.266153	0.216961	0.034682	0.294421	0.229616
1999M05	-0.012597	0.009324	0.028545	0.096096	0.167020
1999M06	0.140011	0.129783	0.124255	0.087641	0.123289
1999M07	-0.132959	-0.010168	-0.006073	-0.053704	-0.101938
1999M08	-0.036879	-0.013418	0.050062	-0.002123	-0.052961
1999M09	-0.122550	-0.046028	0.001181	-0.127186	-0.034246
1999M10	0.015439	0.012396	0.057197	0.095142	0.080495
1999M11	0.065012	0.088745	0.134577	-0.011113	-0.017102
1999M12	0.132488	0.102895	0.245735	0.100499	0.147995
2000M01	-0.009067	-0.105962	-0.021907	0.126747	-0.061773
2000M02	-0.243600	-0.050475	0.205454	0.063182	-0.098735
2000M03	0.067153	0.005685	-0.005059	-0.008034	0.011623
2000M04	-0.025092	0.014672	-0.065770	-0.081242	-0.101960
2000M05	-0.188622	-0.186932	-0.089771	0.014543	-0.147883
2000M06	0.007396	0.126877	0.102001	-0.089625	0.125557
2000M07	-0.134615	0.006476	-0.069604	-0.042330	-0.045516
2000M08	0.078217	0.046000	0.130274	-0.003750	-0.053864
2000M09	-0.104484	-0.072769	-0.119261	-0.109202	-0.101561
2000M10	-0.019850	-0.010313	-0.066914	0.053018	-0.038689
2000M11	0.022120	-0.012376	-0.179337	-0.030239	0.057195
2000M12	-0.031916	-0.013096	0.002953	-0.071413	-0.030492
2001M01	0.212034	0.032907	0.119541	0.068367	0.022069
2001M02	-0.023011	-0.022288	-0.201504	-0.025525	0.006300
2001M03	-0.107892	-0.151166	-0.124953	-0.091318	-0.116893
2001M04	0.029332	0.028575	0.150782	-0.102331	-0.061755
2001M05	0.031111	-0.038866	-0.036972	-0.020081	0.124833
2001M06	0.039267	0.041057	-0.022143	0.034501	0.075343
2001M07	-0.080205	-0.035653	-0.053552	0.106153	0.071871
2001M08	0.119778	-0.028561	-0.083952	0.041237	-0.059223
2001M09	-0.191669	-0.204607	-0.201265	-0.110392	-0.121513
2001M10	-0.007064	0.035957	0.146546	-0.025129	-0.022546
2001M11	0.095380	0.077822	0.126701	0.061323	-0.008952
2001M12	0.004056	0.093591	0.011271	0.087109	0.030377
2002M01	0.114820	0.095831	-0.005049	0.032132	0.141522
2002M02	0.087028	-0.040725	-0.085349	-0.013882	0.003558
2002M03	0.005739	0.049823	0.087191	0.064445	0.061023
2002M04	-0.006789	-0.044132	-0.123748	0.048897	0.103041
2002M05	0.093836	-0.031517	-0.041159	-0.068045	-0.006142
2002M06	-0.047333	-0.073749	-0.123471	-0.022247	-0.049788
2002M07	-0.034194	-0.029153	-0.124474	-0.005321	-0.085405
2002M08	-0.040321	-0.013254	-0.012926	-0.014278	-0.044092
2002M09	-0.084819	-0.095962	-0.148848	-0.108825	-0.056471

2002M10	0.073850	0.078935	0.153976	0.033234	-0.127705
2002M11	0.021272	-0.050338	0.132739	-0.047107	0.056318
2002M12	-0.023345	-0.036966	-0.114274	0.026814	0.084748
2003M01	0.037252	-0.037680	-0.009212	0.028146	-0.089833
2003M02	-0.023766	-0.013714	0.005822	-0.027404	0.027374
2003M03	0.008900	-0.004745	-0.000811	-0.017279	-0.003061
2003M04	0.027275	0.010600	0.085613	-0.008451	0.124705
2003M05	0.075030	0.051465	0.116169	0.063147	0.092956
2003M06	0.134206	0.070744	0.006910	0.030074	0.021435
2003M07	0.047137	0.073854	0.053898	0.040501	0.004894
2003M08	0.105007	0.025574	0.061785	0.031071	0.041812
2003M09	0.073949	0.019536	-0.023690	-0.013340	0.120751
2003M10	0.099340	0.055408	0.075789	0.108027	0.045626
2003M11	0.010238	-0.005649	0.018854	-0.047416	-0.013633
2003M12	0.178333	0.029049	0.028500	0.018637	0.114443
2004M01	-0.099671	0.046420	0.051420	0.031003	0.084531
2004M02	0.024591	0.021553	-0.009450	0.071047	0.010766
2004M03	-0.101289	-0.015856	-0.017938	0.025390	-0.033943
2004M04	0.001312	-0.009127	-0.040570	-0.073180	0.062861
2004M05	-0.011015	-0.029401	0.040781	-0.033408	-0.067166
2004M06	0.008682	0.027211	0.028989	0.011273	-0.000164
2004M07	-0.015491	0.028803	-0.086586	0.017076	0.033010
2004M08	-0.019203	0.013979	-0.034751	-0.007220	-0.003017
2004M09	0.031643	0.034028	0.043393	0.026200	0.083143
2004M10	-0.025944	-0.002043	0.046192	0.013068	0.048039
2004M11	0.044478	0.023437	0.053249	0.063058	0.127772
2004M12	0.017165	0.018800	0.036146	-0.010698	0.022711
2005M01	0.049367	0.014501	-0.050147	0.009695	0.044208
2005M02	0.054937	0.010950	0.002765	-0.009750	0.026794
2005M03	-0.084461	0.010341	-0.024485	-0.040518	0.005887
2005M04	-0.033740	-0.007584	-0.033341	0.008696	-0.047938
2005M05	0.013073	0.017038	0.071097	-0.020959	0.055317
2005M06	0.011839	0.023268	-0.009937	0.031551	0.030954
2005M07	0.000252	0.061309	0.078040	0.053767	0.052010
2005M08	0.032299	-0.033335	0.003235	-0.025750	-0.118586
2005M09	0.035723	0.012972	0.012238	0.015187	0.027418
2005M10	-0.057789	-0.039090	-0.024852	-0.018257	-0.012174
2005M11	-0.022024	0.036967	0.051295	-0.016194	0.028131
2005M12	0.066591	0.020265	-0.004905	0.004076	0.058442
2006M01	0.066268	0.027207	0.042397	0.015680	0.058205
2006M02	-0.024665	0.028559	-0.003158	0.016203	-0.001348
2006M03	-0.014622	0.020514	0.005026	-0.002490	0.072329
2006M04	0.046681	0.030060	-0.001111	0.024097	0.101573
2006M05	-0.079705	-0.090897	-0.072422	-0.022856	-0.096273
2006M06	-0.045123	0.021382	-0.035217	-0.014209	-0.014953
2006M07	0.019510	0.004114	-0.018455	0.022870	0.031100
2006M08	-0.000854	0.015001	0.045682	0.023518	0.057229

2006M09	-0.006972	0.034240	0.028173	0.009794	0.069721
2006M10	0.051639	0.050437	0.033782	0.021219	0.030812
2006M11	0.022717	0.049387	0.027491	0.089341	0.082631
2006M12	-0.083522	0.050591	-0.006482	0.014314	0.049129
2007M01	-0.038689	0.045736	0.018503	0.081521	-0.027093
2007M02	0.034695	-0.006874	-0.010228	0.005952	-0.009313
2007M03	-0.005064	0.040126	-0.001259	0.041278	0.050376
2007M04	0.037080	0.039459	0.056976	0.058698	0.087914
2007M05	0.053251	0.043613	0.018345	0.018463	0.041711
2007M06	0.052040	0.010503	-0.005277	0.005546	0.026027
2007M07	0.101483	-0.000152	-0.001440	0.014171	0.093380
2007M08	-0.055664	-0.044600	0.001588	-0.075408	-0.067968
2007M09	0.038939	0.088327	0.036249	0.047798	0.072445
2007M10	0.070523	0.026485	0.035562	0.056270	0.113773
2007M11	-0.069412	-0.077678	-0.062480	-0.011862	0.016820
2007M12	0.013681	-0.011129	-0.016476	0.033817	0.021163
2008M01	-0.090018	-0.155183	-0.092368	-0.036491	-0.044146
2008M02	0.075533	0.014880	-0.019865	-0.026068	0.035407
2008M03	-0.034560	-0.006328	-2.38E-05	-0.084414	-0.106359
2008M04	0.018697	0.045638	0.048518	0.025593	-0.060113
2008M05	0.001440	0.014141	0.062673	-0.002942	0.058907
2008M06	-0.081256	-0.079871	-0.089469	-0.072742	-0.039747
2008M07	-0.127891	-0.006088	0.028169	-0.019987	-0.019164
2008M08	0.011935	-0.066943	0.019887	-0.055316	-0.062014
2008M09	-0.137455	-0.149740	-0.137328	-0.077257	-0.167168
2008M10	-0.359188	-0.273640	-0.190547	-0.165142	-0.377197
2008M11	-0.035904	-0.034953	-0.095823	0.002925	-0.012137
2008M12	0.113105	0.016594	0.035521	0.012175	0.087751
2009M01	-0.027648	-0.008603	-0.013366	0.008744	-0.016920
2009M02	-0.014197	-0.090804	-0.072324	0.007008	-0.036052
2009M03	-4.63E-05	0.063830	0.088669	-0.020554	0.109384
2009M04	0.130581	0.121849	0.098575	0.127032	0.183417
2009M05	0.130820	0.193002	0.051643	0.052468	0.106739
2009M06	0.064052	0.001742	0.008514	0.029379	0.055776
2009M07	0.043430	0.130810	0.076907	0.088639	0.136514
2009M08	0.045810	-0.025248	0.013339	-0.000536	0.007846
2009M09	0.093214	0.030264	0.050349	0.023407	0.052433
2009M10	-0.045404	-0.008055	-0.049891	0.033659	-0.041323
2009M11	0.005574	0.030092	0.047501	0.012692	0.020128
2009M12	0.063902	0.058812	0.058937	0.010798	0.047894
2010M01	-0.053105	-0.053981	-0.054817	-0.010759	0.029716
2010M02	0.035013	0.002005	0.050618	0.009186	-0.023944
2010M03	0.088321	0.048464	0.062494	0.038433	0.085766
2010M04	-0.031546	0.029736	0.012824	0.019356	0.067504
2010M05	-0.017280	-0.077567	-0.058853	-0.046653	-0.060450
2010M06	0.060597	0.029676	-0.043573	0.022325	0.040884
2010M07	0.070828	0.052282	0.061617	0.035070	0.052026

2010M08	0.064872	-0.012587	-0.042904	0.044248	0.004097
2010M09	0.065801	0.048720	0.110924	0.028422	0.127595
2010M10	0.009348	0.014420	0.056053	0.028401	0.037563

Appendix C: GARCH Family of RSET for Low-Volatility Period

GARCH (1, 1) of RSET, period 1999:03 to 2006:10 (n=92)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.003009	0.000954	3.152996	0.0016
ROIL	0.158857	0.073260	2.168409	0.0301
RBSI	0.513518	0.213091	2.409848	0.0160
RSP500	0.864965	0.188852	4.580123	0.0000
Variance Equation				
C	-4.04E-05	6.41E-05	-0.629285	0.5292
RESID(-1)^2	-0.064609	0.053727	-1.202536	0.2292
GARCH(-1)	1.063987	0.064180	16.57812	0.0000

R-squared	0.299474	Mean dependent var	0.008163
Adjusted R-squared	0.275593	SD dependent var	0.081892
SE of regression	0.069700	Akaike info criterion	-2.712346
Sum squared resid	0.427515	Schwarz criterion	-2.520471
Log likelihood	131.7679	Hannan-Quinn criter	-2.634904
F-statistic	6.269991	Durbin-Watson stat	2.203541
Prob (F-statistic)	0.000016		

GARCH (2, 1) of RSET, period 1999:03 to 2006:10 (n=92)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.006788	0.006684	1.015577	0.3098
ROIL	0.151560	0.088843	1.705927	0.0880
RBSI	0.614076	0.181066	3.391450	0.0007
RSP500	0.698101	0.101116	6.903949	0.0000
Variance Equation				
C	0.000309	0.000258	1.196953	0.2313
RESID(-1)^2	-0.088822	0.060774	-1.461513	0.1439
RESID(-2)^2	0.198584	0.100864	1.968829	0.0490
GARCH(-1)	0.789350	0.109067	7.237317	0.0000

R-squared	0.287715	Mean dependent var	0.008163
Adjusted R-squared	0.263432	SD dependent var	0.081892
SE of regression	0.070283	Akaike info criterion	-2.550436
Sum squared resid	0.434692	Schwarz criterion	-2.331150
Log likelihood	125.3201	Hannan-Quinn criter	-2.461931
F-statistic	5.078004	Durbin-Watson stat	2.252207
Prob (F-statistic)	0.000071		

GARCH (2, 2) of RSET, period 1999:03 to 2006:10 (n=92)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.004832	0.007421	0.651150	0.5149
ROIL	0.109766	0.096161	1.141486	0.2537
RBSI	0.612519	0.186230	3.289035	0.0010
RSP500	0.704891	0.121009	5.825130	0.0000
Variance Equation				
C	0.002153	0.000782	2.751933	0.0059
RESID(-1)^2	-0.066889	0.022544	-2.967038	0.0030
RESID(-2)^2	0.465086	0.192360	2.417787	0.0156
GARCH(-1)	0.257333	0.171825	1.497645	0.1342
GARCH(-2)	-0.067928	0.123088	-0.551861	0.5810
R-squared	0.294715	Mean dependent var		0.008163
Adjusted R-squared	0.270671	SD dependent var		0.081892
SE of regression	0.069937	Akaike info criterion		-2.496170
Sum squared resid	0.430420	Schwarz criterion		-2.249474
Log likelihood	123.8238	Hannan-Quinn criter		-2.396601
F-statistic	4.596532	Durbin-Watson stat		2.256902
Prob (F-statistic)	0.000104			

GARCH (2, 3) of RSET, period 1999:03 to 2006:10 (n=92)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.001424	0.007314	0.194639	0.8457
ROIL	0.095402	0.083868	1.137529	0.2553
RBSI	0.662829	0.190855	3.472938	0.0005
RSP500	0.653551	0.195495	3.343065	0.0008
Variance Equation				
C	0.000718	0.000613	1.171862	0.2413
RESID(-1)^2	-0.054446	0.057068	-0.954053	0.3401
RESID(-2)^2	0.442072	0.277839	1.591106	0.1116
GARCH(-1)	0.183755	0.145644	1.261678	0.2071
GARCH(-2)	-0.039617	0.160774	-0.246413	0.8054
GARCH(-3)	0.316883	0.204649	1.548422	0.1215

R-squared	0.286719	Mean dependent var	0.008163
Adjusted R-squared	0.262403	SD dependent var	0.081892
SE of regression	0.070332	Akaike info criterion	-2.520886
Sum squared resid	0.435299	Schwarz criterion	-2.246778
Log likelihood	125.9607	Hannan-Quinn criter	-2.410253
F-statistic	3.930394	Durbin-Watson stat	2.268257
Prob (F-statistic)	0.000312		

Summary of the various GARCH models estimated for RSET, period 1999:03 to 2006:10 (n=92)

GARCH (p, q)	Schwarz criterion	$\alpha + \beta < 1$	$\omega > 0$
GARCH (1, 1)	-2.520471	0.003009	-4.04E-05
GARCH (2, 1)	**-2.331150**	**0.899112**	**0.000309**
GARCH (2, 2)	-2.249474	0.587602	0.002153
GARCH (2, 3)	-2.246778	0.848647	0.000718

Appendix D: GARCH Family of RSET for High Volatility Period

GARCH (1, 1) of RSET, period 2006:11 to 2010:10 (n=47)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.007791	0.013103	0.594589	0.5521
ROIL	0.160876	0.106644	1.508528	0.1314
RBSI	0.341009	0.217740	1.566130	0.1173
RSP500	0.639919	0.240030	2.665997	0.0077
Variance Equation				
C	0.000940	0.003962	0.237159	0.8125
RESID(-1)^2	0.087448	0.250018	0.349765	0.7265
GARCH(-1)	0.675472	1.141389	0.591798	0.5540
R-squared	0.420231	Mean dependent var		0.006100
Adjusted R-squared	0.379782	SD dependent var		0.084538
SE of regression	0.066577	Akaike info criterion		-2.387772
Sum squared resid	0.190598	Schwarz criterion		-2.112218
Log likelihood	63.11263	Hannan-Quinn criter		-2.284079
F-statistic	5.194585	Durbin-Watson stat		2.120489
Prob (F-statistic)	0.000429			

GARCH (1, 2) of RSET, period 2006:11 to 2010:10 (n=47)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.010584	0.009518	1.111931	0.2662
ROIL	0.198182	0.095705	2.070762	0.0384
RBSI	0.342132	0.085855	3.984976	0.0001
RSP500	0.513233	0.200416	2.560835	0.0104
Variance Equation				
C	0.001182	0.000318	3.715410	0.0002
RESID(-1)^2	0.015908	0.043794	0.363252	0.7164
GARCH(-1)	1.762586	0.134811	13.07447	0.0000
GARCH(-2)	-1.083954	0.080020	-13.54598	0.0000

R-squared	0.402582	Mean dependent var	0.006100
Adjusted R-squared	0.360902	SD dependent var	0.084538
SE of regression	0.067583	Akaike info criterion	-2.492276
Sum squared resid	0.196401	Schwarz criterion	-2.177357
Log likelihood	66.56848	Hannan-Quinn criter	-2.373770
F-statistic	4.139485	Durbin-Watson stat	2.119589
Prob (F-statistic)	0.001474		

GARCH (2, 1) of RSET, period 2006:11 to 2010:10 (n=47)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.008630	0.012558	0.687168	0.4920
ROIL	0.162305	0.112954	1.436911	0.1507
RBSI	0.315253	0.251272	1.254629	0.2096
RSP500	0.638224	0.247191	2.581903	0.0098
Variance Equation				
C	0.001134	0.004688	0.241841	0.8089
RESID(-1)^2	0.033523	0.297637	0.112630	0.9103
RESID(-2)^2	0.065852	0.415610	0.158446	0.8741
GARCH(-1)	0.612605	1.375855	0.445254	0.6561

R-squared	0.420025	Mean dependent var	0.006100
Adjusted R-squared	0.379561	SD dependent var	0.084538
SE of regression	0.066589	Akaike info criterion	-2.347071
Sum squared resid	0.190666	Schwarz criterion	-2.032152
Log likelihood	63.15616	Hannan-Quinn criter	-2.228565
F-statistic	4.448727	Durbin-Watson stat	2.100263
Prob (F-statistic)	0.000856		

GARCH (2, 2) of RSET, period 2006:11 to 2010:10 (n=47)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.012795	0.009089	1.407761	0.1592
ROIL	0.153773	0.102099	1.506111	0.1320
RBSI	0.442729	0.126037	3.512697	0.0004
RSP500	0.737816	0.163419	4.514879	0.0000
Variance Equation				
C	0.001971	0.008358	0.235850	0.8135
RESID(-1)^2	0.260439	0.203577	1.279315	0.2008
RESID(-2)^2	-0.058506	0.381987	-0.153162	0.8783
GARCH(-1)	-0.397060	1.102212	-0.360239	0.7187
GARCH(-2)	0.717065	1.210895	0.592178	0.5537

R-squared	0.405787	Mean dependent var	0.006100
Adjusted R-squared	0.364330	SD dependent var	0.084538
SE of regression	0.067401	Akaike info criterion	-2.472370
Sum squared resid	0.195347	Schwarz criterion	-2.118086
Log likelihood	67.10069	Hannan-Quinn criter	-2.339050
F-statistic	3.670577	Durbin-Watson stat	2.180177
Prob (F-statistic)	0.002430		

GARCH (2, 3) of RSET, period 2006:11 to 2010:10 (n=47)

Variable	Coefficient	Std Error	Z-statistic	Prob
C	0.014777	0.009718	1.520671	0.1283
ROIL	0.069949	0.131748	0.530927	0.5955
RBSI	0.351417	0.000785	447.3929	0.0000
RSP500	0.558285	0.252314	2.212662	0.0269
Variance Equation				
C	0.000158	0.000227	0.696915	0.4859
RESID(-1)^2	0.111946	0.353440	0.316733	0.7514
RESID(-2)^2	-0.243640	0.402629	-0.605123	0.5451
GARCH(-1)	1.210894	1.076541	1.124800	0.2607
GARCH(-2)	0.477304	1.806656	0.264192	0.7916
GARCH(-3)	-0.596102	0.907699	-0.656718	0.5114

R-squared	0.393596	Mean dependent var	0.006100
Adjusted R-squared	0.351289	SD dependent var	0.084538
SE of regression	0.068089	Akaike info criterion	-2.481998
Sum squared resid	0.199355	Schwarz criterion	-2.088349
Log likelihood	68.32694	Hannan-Quinn criter	-2.333865
F-statistic	3.101090	Durbin-Watson stat	1.999883
Prob (F-statistic)	0.005863		

Summary of the various GARCH models estimated for RSET, period 2006:11 to 2010:10 (n=47)

GARCH (p, q)	Schwarz criterion	$\alpha + \beta < 1$	$\omega > 0$
GARCH (1, 1)	-2.112218	0.76292	0.000940
GARCH (1, 2)	**-2.177357**	**0.69454**	**0.001182**
GARCH (2, 1)	-2.032152	0.71198	0.001134
GARCH (2, 2)	-2.118086	0.521938	0.001971
GARCH (2, 3)	-2.088349	0.960402	0.000158

Appendix E: ADF Unit Roots Tests

ADF Unit Roots Test on ROIL

Null Hypothesis ROIL has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		T-statistic	Prob*
ADF test statistic		-8.994783	0.0000
Test critical values:	1% level	-3.477835	
	5% level	-2.882279	
	10% level	-2.577908	

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

ADF Test Equation
Dependent Variable: D(ROIL)
Method: Least Squares
Date: 10/04/12 Time: 13:22
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
ROIL(-1)	-0.731928	0.081372	-8.994783	0.0000
C	0.009529	0.007483	1.273373	0.2050

R-squared	0.371289	Mean dependent var	-0.000778
Adjusted R-squared	0.366700	SD dependent var	0.109554
SE of regression	0.087183	Akaike info criterion	-2.027329
Sum squared resid	1.041322	Schwarz criterion	-1.985106
Log likelihood	142.8994	Hannan-Quinn criter	-2.010171
F-statistic	80.90611	Durbin-Watson stat	2.055816
Prob (F-statistic)	0.000000		

ADF Unit Roots Test on RBSI

Null Hypothesis RBSI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		T-statistic	Prob*
ADF test statistic		-16.07699	0.0000
Test critical values:	1% level	-3.477835	
	5% level	-2.882279	
	10% level	-2.577908	

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

ADF Test Equation
Dependent Variable: D(RBSI)
Method: Least Squares
Date: 10/04/12 Time: 13:33
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
RBSI(-1)	-1.307435	0.081323	-16.07699	0.0000
C	0.000923	0.003520	0.262263	0.7935

R-squared	0.653576	Mean dependent var	-0.000118
Adjusted R-squared	0.651048	SD dependent var	0.070245
SE of regression	0.041495	Akaike info criterion	-3.512187
Sum squared resid	0.235895	Schwarz criterion	-3.469965
Log likelihood	246.0970	Hannan-Quinn criter	-3.495029
F-statistic	258.4697	Durbin-Watson stat	1.983787
Prob (F-statistic)	0.000000		

ADF Unit Roots Test on RSP500

Null Hypothesis RSP500 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		T-statistic	Prob*
ADF test statistic		-10.54560	0.0000
Test critical values:	1% level	-3.477835	
	5% level	-2.882279	
	10% level	-2.577908	

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

ADF Test Equation
Dependent Variable: D(RSP500)
Method: Least Squares
Date: 10/04/12 Time: 13:37
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
RSP500(-1)	-0.895891	0.084954	-10.54560	0.0000
C	-0.000540	0.004231	-0.127610	0.8986

R-squared	0.448048	Mean dependent var	-1.34E-05
Adjusted R-squared	0.444019	SD dependent var	0.066893
SE of regression	0.049878	Akaike info criterion	-3.144184
Sum squared resid	0.340832	Schwarz criterion	-3.101961
Log likelihood	220.5208	Hannan-Quinn criter	-3.127026
F-statistic	111.2098	Durbin-Watson stat	1.969622
Prob (F-statistic)	0.000000		

ADF Unit Roots Test on RSET

Null Hypothesis RSET has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		T-statistic	Prob*
ADF test statistic		-11.33659	0.0000
Test critical values:	1% level	-3.477835	
	5% level	-2.882279	
	10% level	-2.577908	

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

ADF Test Equation
Dependent Variable: D(RSET)
Method: Least Squares
Date: 10/04/12 Time: 13:41
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
RSET(-1)	-0.967739	0.085364	-11.33659	0.0000
C	0.007155	0.007047	1.015270	0.3118

R-squared	0.484028	Mean dependent var	-0.000163
Adjusted R-squared	0.480262	SD dependent var	0.114764
SE of regression	0.082737	Akaike info criterion	-2.132024
Sum squared resid	0.937814	Schwarz criterion	-2.089801
Log likelihood	150.1757	Hannan-Quinn criter	-2.114866
F-statistic	128.5183	Durbin-Watson stat	1.947272
Prob (F-statistic)	0.000000		

ADF Unit Roots Test on RSGX

Null Hypothesis RSGX has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		T-statistic	Prob*
ADF test statistic		-10.05186	0.0000
Test critical values:	1% level	-3.477835	
	5% level	-2.882279	
	10% level	-2.577908	

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

ADF Test Equation
Dependent Variable: D(RSGX)
Method: Least Squares
Date: 10/04/12 Time: 13:43
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
RSGX(-1)	-0.845300	0.084094	-10.05186	0.0000
C	0.004359	0.005606	0.777574	0.4382

R-squared	0.424466	Mean dependent var	-0.000419
Adjusted R-squared	0.420265	SD dependent var	0.086493
SE of regression	0.065856	Akaike info criterion	-2.588417
Sum squared resid	0.594166	Schwarz criterion	-2.546194
Log likelihood	181.8950	Hannan-Quinn criter	-2.571259
F-statistic	101.0400	Durbin-Watson stat	2.021789
Prob (F-statistic)	0.000000		

ADF Unit Roots Test on RPSE

Null Hypothesis RPSE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		T-statistic	Prob*
ADF test statistic		-10.86004	0.0000
Test critical values:	1% level	-3.477835	
	5% level	-2.882279	
	10% level	-2.577908	

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

ADF Test Equation
Dependent Variable: D(RPSE)
Method: Least Squares
Date: 10/04/12 Time: 13:44
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
RPSE(-1)	-0.923994	0.085082	-10.86004	0.0000
C	0.004765	0.006598	0.722134	0.4714

R-squared	0.462620	Mean dependent var	-0.000125
Adjusted R-squared	0.458697	SD dependent var	0.105482
SE of regression	0.077607	Akaike info criterion	-2.260039
Sum squared resid	0.825126	Schwarz criterion	-2.217816
Log likelihood	159.0727	Hannan-Quinn criter	-2.242881
F-statistic	117.9405	Durbin-Watson stat	2.003767
Prob (F-statistic)	0.000000		

ADF Unit Roots Test on RKLSE

Null Hypothesis RKLSE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		T-statistic	Prob*
ADF test statistic		-10.38160	0.0000
Test critical values:	1% level	-3.477835	
	5% level	-2.882279	
	10% level	-2.577908	

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

ADF Test Equation
Dependent Variable: D(RKLSE)
Method: Least Squares
Date: 10/04/12 Time: 13:45
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
RKLSE(-1)	-0.873662	0.084155	-10.38160	0.0000
C	0.006988	0.004916	1.421337	0.1575

R-squared	0.440309	Mean dependent var	0.000747
Adjusted R-squared	0.436223	SD dependent var	0.076618
SE of regression	0.057529	Akaike info criterion	-2.858781
Sum squared resid	0.453409	Schwarz criterion	-2.816559
Log likelihood	200.6853	Hannan-Quinn criter	-2.841623
F-statistic	107.7777	Durbin-Watson stat	1.716788
Prob (F-statistic)	0.000000		

ADF Unit Roots Test on RJKSE

Null Hypothesis RJKSE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic based on SIC, MAXLAG=13)

		T-statistic	Prob*
ADF test statistic		-9.060143	0.0000
Test critical values:	1% level	-3.477835	
	5% level	-2.882279	
	10% level	-2.577908	

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

ADF Test Equation
Dependent Variable: D(RJKSE)
Method: Least Squares
Date: 10/04/12 Time: 13:57
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
RJKSE(-1)	-0.749342	0.082707	-9.060143	0.0000
C	0.012063	0.006751	1.786867	0.0762

R-squared	0.374675	Mean dependent var	0.000315
Adjusted R-squared	0.370111	SD dependent var	0.098422
SE of regression	0.078113	Akaike info criterion	-2.247031
Sum squared resid	0.835929	Schwarz criterion	-2.204808
Log likelihood	158.1687	Hannan-Quinn criter	-2.229873
F-statistic	82.08619	Durbin-Watson stat	1.905962
Prob (F-statistic)	0.000000		

Appendix F: Philips Perron Unit Roots Tests

PP Unit Roots Test on ROIL

Null Hypothesis ROIL has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob*
PP test statistic		-8.994783	0.0000
Test critical values:	1% level	-3.477835	
	5% level	-2.882279	
	10% level	-2.577908	

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

Residual variance (no correction)	0.007492
HAC corrected variance (Bartlett kernel)	0.007492

PP Test Equation
Dependent Variable: D(ROIL)
Method: Least Squares
Date: 10/04/12 Time: 13:32
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
ROIL(-1)	-0.731928	0.081372	-8.994783	0.0000
C	0.009529	0.007483	1.273373	0.2050

R-squared	0.371289	Mean dependent var	-0.000778
Adjusted R-squared	0.366700	SD dependent var	0.109554
SE of regression	0.087183	Akaike info criterion	-2.027329
Sum squared resid	1.041322	Schwarz criterion	-1.985106
Log likelihood	142.8994	Hannan-Quinn criter	-2.010171
F-statistic	80.90611	Durbin-Watson stat	2.055816
Prob (F-statistic)	0.000000		

PP Unit Roots Test on RBSI

Null Hypothesis RBSI has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob*
PP test statistic		-15.85945	0.0000
Test critical values:	1% level	-3.477835	
	5% level	-2.882279	
	10% level	-2.577908	

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

Residual variance (no correction)	0.001697
HAC corrected variance (Bartlett kernel)	0.001871

PP Test Equation
Dependent Variable: D(RBSI)
Method: Least Squares
Date: 10/04/12 Time: 13:35
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
RBSI(-1)	-1.307435	0.081323	-16.07699	0.0000
C	0.000923	0.003520	0.262263	0.7935

R-squared	0.653576	Mean dependent var	-0.000118
Adjusted R-squared	0.651048	SD dependent var	0.070245
SE of regression	0.041495	Akaike info criterion	-3.512187
Sum squared resid	0.235895	Schwarz criterion	-3.469965
Log likelihood	246.0970	Hannan-Quinn criter	-3.495029
F-statistic	258.4697	Durbin-Watson stat	1.983787
Prob (F-statistic)	0.000000		

PP Unit Roots Test on RSP500

Null Hypothesis RSP500 has a unit root
Exogenous: Constant
Bandwidth: 5 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob*
PP test statistic		**-10.55281**	0.0000
Test critical values:	1% level	**-3.477835**	
	5% level	**-2.882279**	
	10% level	**-2.577908**	

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

Residual variance (no correction)	0.002452
HAC corrected variance (Bartlett kernel)	0.002481

PP Test Equation
Dependent Variable: D(RSP500)
Method: Least Squares
Date: 10/04/12 Time: 13:40
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
RSP500(-1)	-0.895891	0.084954	-10.54560	0.0000
C	-0.000540	0.004231	-0.127610	0.8986

R-squared	0.448048	Mean dependent var	-1.34E-05
Adjusted R-squared	0.444019	SD dependent var	0.066893
SE of regression	0.049878	Akaike info criterion	-3.144184
Sum squared resid	0.340832	Schwarz criterion	-3.101961
Log likelihood	220.5208	Hannan-Quinn criter	-3.127026
F-statistic	111.2098	Durbin-Watson stat	1.969622
Prob (F-statistic)	0.000000		

PP Unit Roots Test on RSET

Null Hypothesis RSET has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob*
PP test statistic		-11.39327	0.0000
Test critical values:	1% level	-3.477835	
	5% level	-2.882279	
	10% level	-2.577908	

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

Residual variance (no correction)	0.006747
HAC corrected variance (Bartlett kernel)	0.007733

PP Test Equation
Dependent Variable: D(RSET)
Method: Least Squares
Date: 10/04/12 Time: 13:42
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
RSET(-1)	-0.967739	0.085364	-11.33659	0.0000
C	0.007155	0.007047	1.015270	0.3118

R-squared	0.484028	Mean dependent var	-0.000163
Adjusted R-squared	0.480262	SD dependent var	0.114764
SE of regression	0.082737	Akaike info criterion	-2.132024
Sum squared resid	0.937814	Schwarz criterion	-2.089801
Log likelihood	150.1757	Hannan-Quinn criter	-2.114866
F-statistic	128.5183	Durbin-Watson stat	1.947272
Prob (F-statistic)	0.000000		

PP Unit Roots Test on RSGX

Null Hypothesis RSGX has a unit root
Exogenous: Constant
Bandwidth: 4 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob*
PP test statistic		-10.12382	0.0000
Test critical values:	1% level	-3.477835	
	5% level	-2.882279	
	10% level	-2.577908	

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

Residual variance (no correction)	0.004275
HAC corrected variance (Bartlett kernel)	0.004639

PP Test Equation
Dependent Variable: D(RSGX)
Method: Least Squares
Date: 10/04/12 Time: 13:43
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
RSGX(-1)	-0.845300	0.084094	-10.05186	0.0000
C	0.004359	0.005606	0.777574	0.4382

R-squared	0.424466	Mean dependent var	-0.000419
Adjusted R-squared	0.420265	SD dependent var	0.086493
SE of regression	0.065856	Akaike info criterion	-2.588417
Sum squared resid	0.594166	Schwarz criterion	-2.546194
Log likelihood	181.8950	Hannan-Quinn criter	-2.571259
F-statistic	101.0400	Durbin-Watson stat	2.021789
Prob (F-statistic)	0.000000		

PP Unit Roots Test on RPSE

Null Hypothesis RPSE has a unit root
Exogenous: Constant
Bandwidth: 3 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob*
PP test statistic		-10.87463	0.0000
Test critical values:	1% level	-3.477835	
	5% level	-2.882279	
	10% level	-2.577908	

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

Residual variance (no correction)	0.005936
HAC corrected variance (Bartlett kernel)	0.006119

PP Test Equation
Dependent Variable: D(RPSE)
Method: Least Squares
Date: 10/04/12 Time: 13:45
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
RPSE(-1)	-0.923994	0.085082	-10.86004	0.0000
C	0.004765	0.006598	0.722134	0.4714

R-squared	0.462620	Mean dependent var	-0.000125
Adjusted R-squared	0.458697	SD dependent var	0.105482
SE of regression	0.077607	Akaike info criterion	-2.260039
Sum squared resid	0.825126	Schwarz criterion	-2.217816
Log likelihood	159.0727	Hannan-Quinn criter	-2.242881
F-statistic	117.9405	Durbin-Watson stat	2.003767
Prob (F-statistic)	0.000000		

PP Unit Roots Test on RKLSE

Null Hypothesis RKLSE has a unit root
Exogenous: Constant
Bandwidth: 0 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob*
PP test statistic		-10.38160	0.0000
Test critical values:	1% level	-3.477835	
	5% level	-2.882279	
	10% level	-2.577908	

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

Residual variance (no correction)	0.003262
HAC corrected variance (Bartlett kernel)	0.003262

PP Test Equation
Dependent Variable: D(RKLSE)
Method: Least Squares
Date: 10/04/12 Time: 13:46
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
RKLSE(-1)	-0.873662	0.084155	-10.38160	0.0000
C	0.006988	0.004916	1.421337	0.1575

R-squared	0.440309	Mean dependent var	0.000747
Adjusted R-squared	0.436223	SD dependent var	0.076618
SE of regression	0.057529	Akaike info criterion	-2.858781
Sum squared resid	0.453409	Schwarz criterion	-2.816559
Log likelihood	200.6853	Hannan-Quinn criter	-2.841623
F-statistic	107.7777	Durbin-Watson stat	1.716788
Prob (F-statistic)	0.000000		

PP Unit Roots Test on RJKSE

Null Hypothesis RJKSE has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob*
PP test statistic		-9.081823	0.0000
Test critical values:	1% level	-3.477835	
	5% level	-2.882279	
	10% level	-2.577908	

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

Residual variance (no correction)	0.006014
HAC corrected variance (Bartlett kernel)	0.006124

PP Test Equation
Dependent Variable: D(RJKSE)
Method: Least Squares
Date: 10/04/12 Time: 13:58
Sample (adjusted): 1999M04 2010M10
Included observations: 139 after adjustments

Variable	Coefficient	Std Error	T-statistic	Prob
RJKSE(-1)	-0.749342	0.082707	-9.060143	0.0000
C	0.012063	0.006751	1.786867	0.0762

R-squared	0.374675	Mean dependent var	0.000315
Adjusted R-squared	0.370111	SD dependent var	0.098422
SE of regression	0.078113	Akaike info criterion	-2.247031
Sum squared resid	0.835929	Schwarz criterion	-2.204808
Log likelihood	158.1687	Hannan-Quinn criter	-2.229873
F-statistic	82.08619	Durbin-Watson stat	1.905962
Prob (F-statistic)	0.000000		