Chapter 1

Introduction

1.1 Statement of the Problem and the Significant of the Study

In financial markets, there are risks involving the expectation of the returns. The problem is whether the equity is emerging or less mature. For example, Figure 1.1 shows the total returns of stock markets in South-East Asia, which has high volatile growth. The dramatic changes in indexes from up trend to down trend imply that most of stock markets are volatile and changing over time. All stock markets have practically the same trend over a period of time since 1998. With respect to stock market linkages, Table 1.1 and Table 1.2 display the correlation coefficients across daily prices and daily returns of the stock markets indexes, respectively. The stock markets in South-East Asian countries have relatively high correlation in prices, but low correlation in returns. A negative shock in one or multiple markets would be followed by an increase in correlations that substantially increases portfolio risk and reduces expected returns.

In financial time series, econometricians have studied historical data to measure model and forecast the stock market volatility, especially in mature financial markets. Volatility is one way to measure risks which are important to portfolio diversification and risk hedging strategies. Volatility is also an important element in derivative pricing and a wider impact on financial regulation. The practical implement and applications of volatility models are Value-at-Risk (VaR) measurement

introduced by the Basel Committee in 1996. It is mandatory in many countries for banks to hold a minimum capital reserves calculated as a function of VaR to encounter their risks appropriately in financial investments. Financial institutions use VaR voluntarily for internal risk management as well. Therefore accuracy of volatility modelling and forecasting play an important role in the finance industries. Figure 1.2 shows the distribution of index return in Thailand. Bars represent actual return whereas the line is normal distribution. Here the normal curve is plotted against the same actual return data. In consideration of the worst 5% (-1.65) and 1% (-2.33) lie on the normal curve, VaR can be calculated easily as a function of a desirable confidence as 95% and 99% representative, and the standard deviation (σ).

From the review of ongoing substantial and sophisticated literatures in volatility modelling and forecasting, an interesting question arrives. How should theoretical advances apply to emerging financial markets? As emerging markets begin to feature sophisticated financial instruments, understanding volatility becomes even more critical.

In order to study a time series of volatilities, Engle (1982) proposed the autoregressive conditional heteroskedasticity (ARCH) model. Higher aspects of volatility modeling; for example Generalized ARCH (GARCH) model of Bollerslev (1986), Exponential GARCH (EGARCH) model of Nelson (1991), and Fractional integrated GARCH (FIGARCH) model of Baillie et al. (1996), and Bollerslev and Mikkelsen (1996) -- are introduced afterward. However, in the conditional mean, the well-known long memory model -- the autoregressive fractionally integrated moving average (ARFIMA) -- is prior introduced by Granger and Joyeux in 1980, and Hosking in 1981.

Furthermore, multivariate GARCH models are developed by Bollerslev (1990). The constant conditional correlation (CCC) model, Dynamic condition correlations (DCC) model of Engle (2002), Vector autoregressive moving-average GARCH (VARMA-GARCH) model of Ling and McAleer (2003), and the extension of the VARMA-GARCH model -- the VARMA-AGARCH model of McAleer et al. (2009) -- are also introduced. A specific feature of these models is the time-varying conditional variance which relates to time-dependent squares.

The motivation for this research is that there is still an issue to predict stock return in emerging market economies. Although, many studies have proposed a number of models to predict stock volatility, only few of them can be applied to emerging market economies. From preliminary studies, preference-based volatility models have benefits to capture critical characteristic of stock returns in emerging market economies. Therefore, this research is focusing on the application of the preference-based volatility models for predict stock volatility in emerging market economies and on the volatility forecasting performance. Well-performed models would be preferable to further analysis and practical implementation. This research is divided into three main issues. First, asymmetric effects and asymmetric spillover effects among individual stock in Thailand are examined on the basis of multivariate conditional volatility models by using daily returns. Second, the univariate conditional volatility, the fractional integration long memory and the alternative long memory Heterogeneous Autoregressive (HAR) models will be investigated for volatility modelling performance. Baillie (1996), and Bollerslev and Mikkelsen (1996) evidenced the presence of long memory in the square asset returns by using the

fractional integration model. The alternative HAR model to capture long memory of Corsi (2008) is considered for the accuracy of stock market volatility measures.

The empirical evidence in this issue uses daily returns for indexes from four emerging markets in the South-East Asian region consisting of Indonesia, Malaysia, Thailand, and Singapore. The practical implementation of volatility modelling and forecasting is represented as a final point. The estimations of preference models are used to get an appropriate VaR forecasts for the portfolio returns calculated from four indexes in South-East Asia, namely JKSE (Indonesia), KLCI (Malaysia), SETI (Thailand), and STI (Singapore). As mentioned in McAleer (2009), and McAleer, Jiménez-Martin and Peréz-Amaral (2009), in order to optimize the capital charges, the number of violations and the VaR forecasts are taken into account. Therefore, the size of the average capital charge and the magnitude of the average violations are used as comparable indicators. The empirical results would contribute to the policymakers and the regulators who concern about the capital calculation. The motivation of volatility models for emerging markets as the South-East Asian Stock Exchanges are certainly fundamental in carrying out the balancing between achieving greater efficiency for risk management and maintaining the stability in stock markets.

1.2 Objectives of the Study

1. To estimate volatility using the conditional volatility, the fractionally integrated, the alternative long memory HAR models, and also the multivariate conditional volatility models based on daily financial asset returns.

2. To investigate the performances of between the conditional volatility and the long memory models, and the univariate and the multivariate conditional volatility models.
3. To examine the asymmetric and the spillover effects among the financial asset returns using the multivariate conditional volatility models.
4. To define the accuracy of the conditional volatility and the long memory models in VaR forecasts that required in risk management by considering the number of violations under the Basel II Accord and the minimized daily capital charges.

1.3 Overviews

Volatility is a way to measure risks. It is changing over time. Consequently, measuring and modelling volatility are exceptionally challenging tasks in financial time series. This research studies financial market volatility modelling and application. The material presented in the research is revealed by three papers: 'Multivariate GARCH volatility models for financial portfolio in Thailand', 'Long Memory in volatility of Stock Markets in South-East Asia', and 'Forecasting Value-at-Risk and Optimizing Capital Charges using Single Index and Long Memory Models'.

The main purpose of this research is to model volatility and VaR forecasts for practical implementation and application. Three papers are developed by applying the conditional volatility models including the univariate and multivariate GARCH, the fractional integration long memory, and the Heterogeneous Autoregressive (HAR) models. This dissertation is organized as follows:

First, the volatility of return series is determined using the univariate conditional volatility models. Then the multivariate conditional volatility models are applied for a portfolio returns in Thailand computed from the ten most active trading value stocks in the Stock Exchange of Thailand. For investigating volatility spillover effects among assets in the portfolio, the VARMA-GARCH model of Ling and McAleer (2003) are used. The VARMA-AGARCH model of McAleer et al. (2009) is used instead of the VARMA-GARCH model to contribute to the presence of asymmetric effects and spillover effects on the conditional correlations.

Second, the daily index returns from stock markets in South-East Asia namely Indonesia, Malaysia, Thailand, and Singapore are tested for fractional integration by the FIGARCH model of Baillie (1996), and Bollerslev and Mikkelsen (1996) who evidenced the presence of long memory in the square asset returns. Corsi (2008) also purposed an alternative model -- the Heterogenous Autoregressive (HAR) model -- to capture long memory in volatility persistence. Moreover, the time-dependent heteroskedasticity of the returns will be examined by the autoregressive fractionally integrated moving average with a generalized autoregressive conditional heteroskedasticity (ARFIMA-GARCH) models. The ARFIMA-FIGARCH, ARFIMA-FIEGARCH, and HAR models are used to determine the performances of the other models for asset returns and volatility measures.

Third, the application of volatility is introduced by Value-at-Risk measurement. Since, the variance of a portfolio or the volatility is the key item to get an appropriate VaR forecasts. The more accuracy in volatility model, the easier optimizing the capital charges or minimize problem. Based on the penalties imposed under the Basel Accord, the size of the average capital charge and the magnitude of

the average violations are used to compare the forecasting performance of the Single Index and the long memory models. However, the numbers of violations would be highly considered in the sense of accuracy VaR forecasts.

Lastly, concluding remarks and suggestions for further research are given in the last chapter. The descriptive statistic of the series and the estimated results summarized in tables and figures are presented after each chapter.

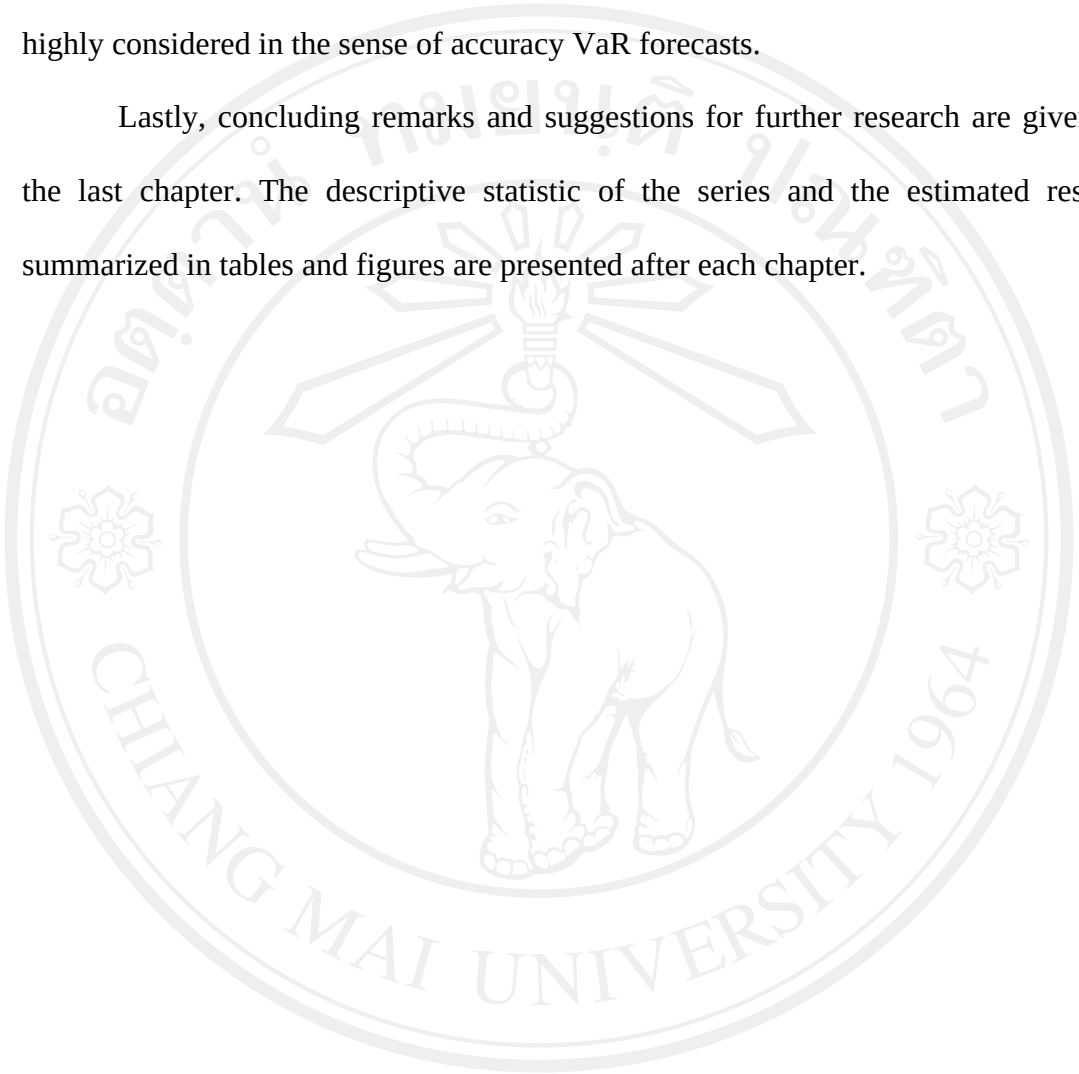
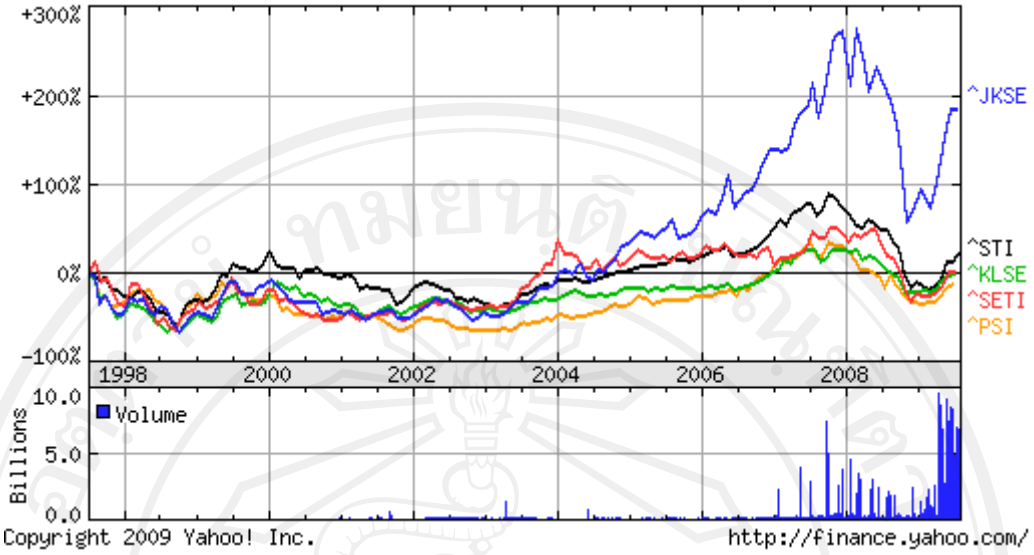


Table 1.1 The correlation for the stock prices in South-East Asian countries

	JKSE	KLCI	SETI	STI
JKSE	1.00	0.95	0.93	0.93
KLCI	0.95	1.00	0.89	0.93
SETI	0.93	0.89	1.00	0.85
STI	0.93	0.93	0.85	1.00

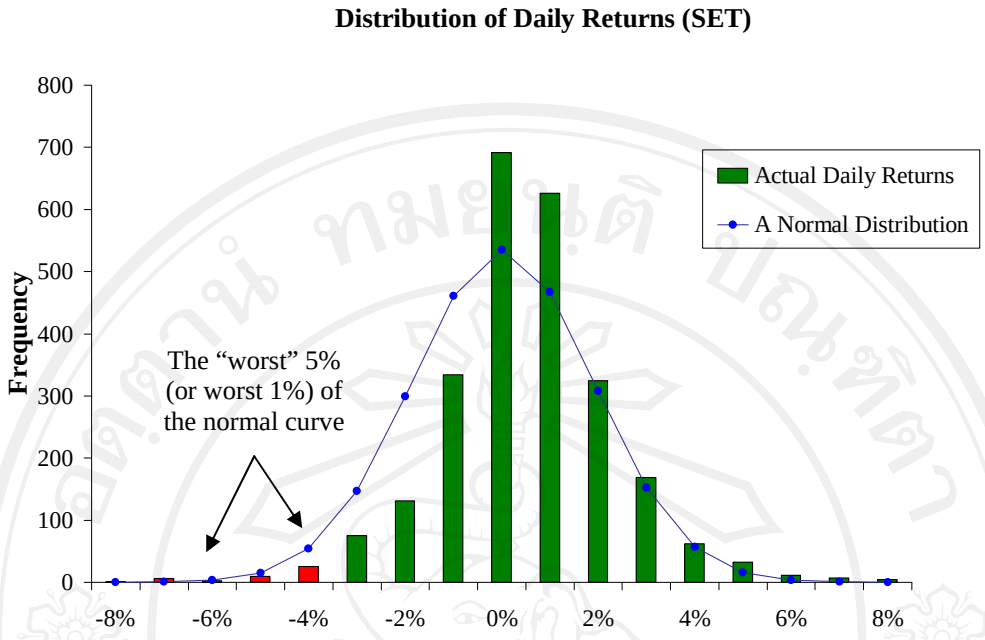
Table 1.2 The correlation for the stock returns in South-East Asian countries

	JKSE	KLCI	SETI	STI
JKSE	1.00	0.32	0.35	0.43
KLCI	0.32	1.00	0.35	0.46
SETI	0.35	0.35	1.00	0.47
STI	0.43	0.46	0.47	1.00



Source: Yahoo Finance (July 2009)

Figure 1.1 The total returns of Stock Markets in South-East Asia



Source: Calculation

Figure 1.2 The distribution of daily returns in Thailand