Chapter 1

Introduction

1.1 Statement of the Problem and the Signification of the Study

Investments in financial market are connected with risk, or volatility of returns. Therefore, forecasting volatility is important follow several reasons. To begin with, a good method for estimating volatility is important for portfolio analysis. For example, the Markowitz Portfolio Theory suggests that portfolio manager may construct an optimum portfolio with maximum portfolio returns subject to fixed level of portfolio risk or minimum portfolio risk subject to fixed level of portfolio returns. Moreover, Capital Asset Pricing Model (CAPM) and Arbitrage Pricing Model (APT) are able to find out the optimum relationship between return and risk.

The second reason forecasting volatility is important is because is one important ingredient to compute Value-at-Risk (VaR) which financial institution would like to known. If the number of realize returns which less than Value-at-Risk more than reasonable expectation so the financial institution will hold a high daily capital charge. Third reason, volatility is important ingredient to analysis option valuation follow the Black and Scholes model. (see Ślepaczuk and Zakrzewski, 2008)

In 1993, the Chicago Board Options Exchange (CBOE) introduced the CBOE volatility index, namely VIX (currently renamed to VXO) that is based on the S&P 100 index options. VXO was constructed using implied volatility at-the-money of 8 different S&P 100 options. In 1994, the German futures and options exchange launched an implied volatility index (VDAX) based on DAX index options. In 1997, the French exchange market MONEP created two volatility indices (VX1, VX6) that reflect the synthetic at-the money implied volatility of the CAC-40 index options. In 2000, CBOE introduced the Nasdaq volatility index (VXN) that is derived from the implied volatility of Nasdaq-100 index (NDX) options. (Skiadopoulos, 2004)

In 2003, CBOE changed VIX to provide a more precise and robust measure of expected market volatility, and to create a viable underlying index for tradable volatility products. The New VIX is more robust because it pools information from option prices over a wide range of strike prices so it can capture the whole volatility skew, rather than just the volatility implied by at-the-money options. Moreover, the New VIX is calculated using options on the S&P 500 index, the widely benchmark for U.S. equities, and the reference point for the performance of many stock funds, with over $800 billion in indexed assets. In addition, the S&P 500 is the domestic index most often used in over-the-counter volatility trading. (CBOE, 2003) In 2005, the VSTOXX volatility index, which calculated with the same method as CBOE's, was introduced. It has provided a key measure market expectation of near-term volatility based on the Dow Jones EURO STOXX 50 options prices.

Volatility indexes have negative correlations with index options and the daily returns of the related stock indexes shows in Table 1.1 and Figure 1.1. The price of VIX often moves in the opposite direction from S&P 500. For example, when stock prices drop, implied volatility often rises. Figure 1.2 shows asymmetric correlations between VIX and S&P 500. For example, average price change on the 26 days when S&P 500 fall by 3.8%, while VIX rose 16.8% and average price change on the 33 days when S&P 500 increase by 3.9%, while VIX decrease 9.2% in 1990 - 2005. (McAleer, M., 2008b) Therefore, Investor could apply this information to hedge and speculate from the fluctuations in volatility. Profitable volatility trades can be developed in the currency and index option markets, respectively.

Therefore, volatility is an important aspect to be aware of, and volatility indexes show expected volatility. However, volatility indexes are not based on a specific volatility model, so this dissertation would like to construct an index of volatility. An index of volatility can be defined in two ways. In the first way, index of volatility is univariate volatility of portfolio return (hereafter called the single index model. For second way, forecast variances and covariances by using multivariate volatility then compute portfolio risk, which is index of volatility (hereafter called the portfolio model). (see McAleer, M. and da Veiga, B., 2008a; 2008b)

Moreover, international stock markets have had increasing interaction with one another during the past decade. For example, the Asian crisis in 1997 that started in Thailand and spread out to the entire region. Therefore, it is an important for the investors, portfolio managers and policy makers to understand the volatility spillover and conditional correlation across markets or across regions because investors or the portfolio managers can diversify risks of their portfolios. Policy makers can protect national markets and economies from international shocks.

1.2 Objectives of the Study

1.2.1 To estimate the portfolio model using a multivariate volatility model for the USA, Europe, and ASEAN.

1.2.2 To estimate spatial aggregate using univariate volatility model to the portfolio returns (hereafter called the single index model) for the USA, Europe, and ASEAN.

1.2.3 To construct indexes of volatility for the USA, Europe, and ASEAN.

1.2.4 To compare volatility index and index of volatility using predictive power of Value-at-Risk.

1.2.5 To explore volatility spillover from the USA and Europe to ASEAN.

1.2.6 To test the effects of the Asian crisis to Value-at-Risk and to test the conditional correlation between the pair of ASEAN and the USA and the pair of ASEAN and Europe.

1.3 Overviews

Volatility forecasting is an important task in financial markets as the results become a key factor to many investment decisions and portfolio creations because investors and portfolio managers want to know certain levels of risk. Moreover, volatility is an important ingredient to calculate Value-at-Risk (VaR). Therefore, financial institutions would like to know about volatility because if a financial institution's VaR forecasts are violated more than can reasonably be expected, given the confidence level, the financial institution will hold a higher level of capital.

In 1993, the Chicago Board Options Exchange (CBOE) introduced the CBOE volatility index, VIX, and it quickly became the benchmark for stock market volatility. After 2003, the CBOE reported a new VIX, and changed the original VIX to VXO. The new VIX estimates reflect expected volatility from the prices of stock index options for a wide range of strike prices, not just at-the money strikes, as in the original VIX, so that the model-free implied volatility is more likely to be informationally efficient than the Black-Scholes implied volatility. However, the new VIX uses the model-free implied volatility, which is not based on a specific volatility model.

This dissertation constructs an index of volatility for Europe, the USA and ASEAN by using a single index model (fitted univariate volatility for portfolio return) and a portfolio model (forecasted variances and covariances by using multivariate volatility then compute portfolio risk). Data used to construct an index of volatility are major sectors of S&P index (U.S.A) because CBOE introduced volatility index that calculate from S&P 500, STOXX sector indices (Europe) because the annual report 2007 of World Federation of Exchange showed that Euronext exchange is the largest exchange in Europe – Africa –Middle East and statistics data 2007 of Euronext exchange showed that Dow Jones Euro STOXX ® 50 index option has largest volume in Europe and three countries that have the highest level of volatility, namely, Indonesia, the Philippines, and Thailand (ASEAN) because ASEAN countries do not have a volatility index that is a benchmark for stock market volatility. A comparison between the volatility index and the index of volatility using predictive power of Value-at-Risk will be made to determine the practical usefulness of these indexes.

Moreover, shocks in one stock market or in one region are very likely to transmit disturbances to other market and regions (for example, the Asian crisis in 1997 that started in Thailand and spread out to the entire region). International diversification enables the investors to shift to investments of high risk and expected returns without altering the overall risks of their portfolios. Therefore, it is very critical for the investors, portfolio managers and policy managers to understand the behavior of the volatility and mean spillover.

Therefore, this dissertation will explore the volatility spillover and conditional correlations between ASEAN, Europe, and the USA by using only the VARMA-AGARCH model of McAleer, M., et al. (2009), which have volatility spillover and asymmetric effect and can be used to estimate the covariance matrix. Then we test for change in the correlation between ASEAN and Europe and between ASEAN and the USA following the Asian economic crisis. In this part, we focus on five countries in ASEAN, namely, Indonesia, Malaysia, the Philippines, Singapore, and Thailand. Moreover, we use the 'rolling windows' approach to examine the time-varying nature of the conditional correlation. We also use a Value-at-Risk (VaR) threshold for a portfolio, which includes countries in ASEAN, Europe and the USA to examine the effects from the Asian crisis to Value-at-Risk.

The detail about comparing volatility index and index of volatility for the USA and Europe in chapter 2, The detail about index of volatility for ASEAN and modeling the volatility spillover and conditional correlations between ASEAN, Europe, and the USA in forecasting Value-at-Risk in chapter 3 and 4, respectively.

Table 1.1 The Correlations between Volatility Index and Index Options

Volatility Index	**Index Options**	**Correlations**
VIX = New Volatility Index	SPX = S&P Index Options	-0.86
VXD = DJIA Volatility Index	DJX = DJIA Index Options	-0.85
RVX = Russell 2000 Volatility Index	RUT = Russell 2000 Index Options	-0.86
VXN = Nasdaq-100 Volatility Index	NDX = Nasdaq-100 Index Options	-0.78

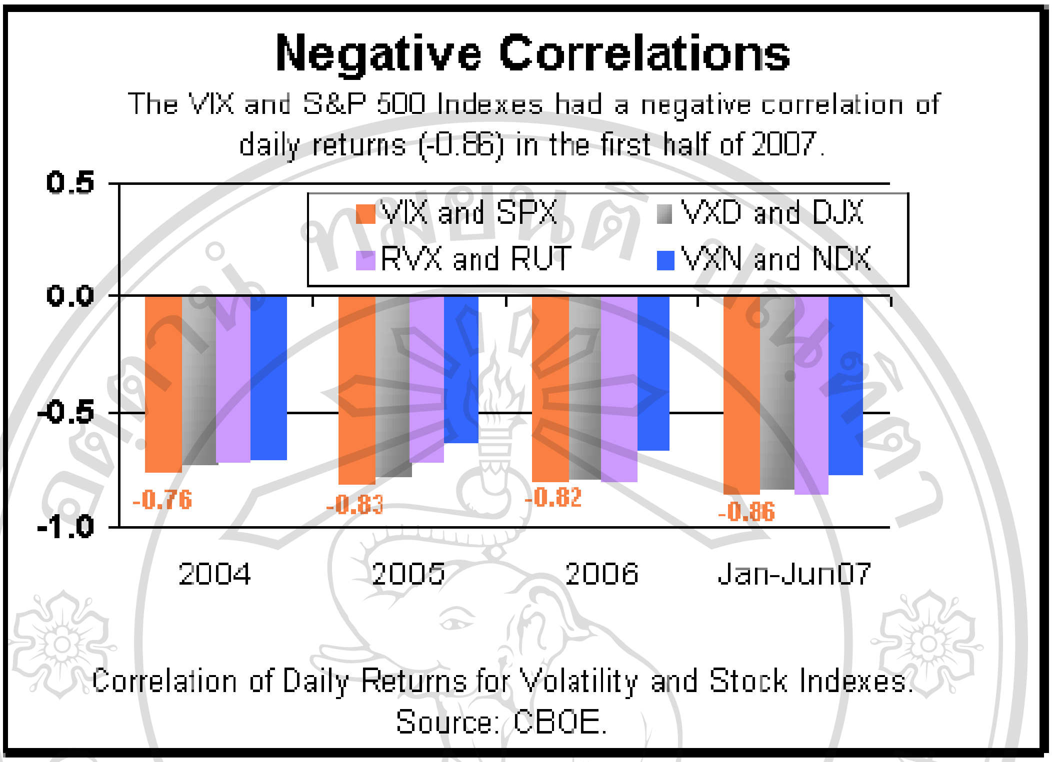
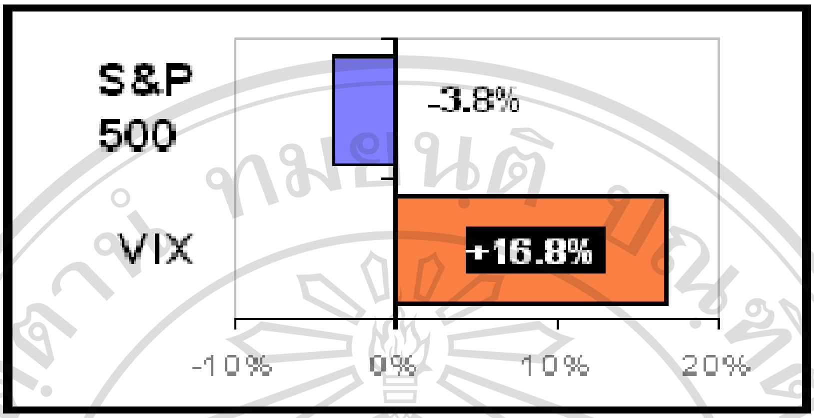
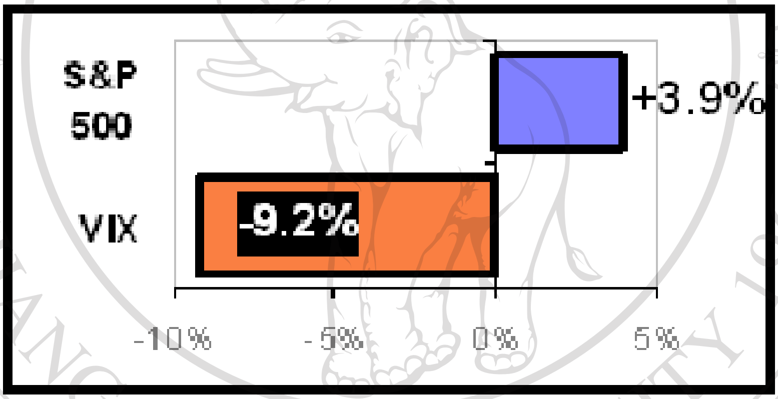


Figure 1.1 The Correlations of Daily Returns for Volatility and Stock Indexes



Note: average price change on the 26 days average price change on the 33 days



Note: average price change on the 26 days average price change on the 33 days

Figure 1.2 Asymmetric correlations between VIX and S&P 500