# Chapter 6

## Conclusions and Suggestions

### 6.1    Conclusions

Recently, options have become a significant diversification tool for investors to hedge their portfolios in both expected uptrend and (especially) downturn markets. In September 2008, options trading become an even more important profit tool than a risk diversification tool from investors. Investors have used options for a variety of purposes over the past two decades, including investing, hedging, asset allocation, and the management of risk. Investors appreciate many features of the options, including: the fact that the options are tied to the world's leading benchmark for institutional investors. It is a flexible tool that allows investors to synthetically adjust their positions to a stock portfolio; these listed options minimize counterparty risk. With the significance and benefits in trading options, this dissertation studies on volatility index, VIX, this is calculated from options price.

Importantly, this dissertation proposed a new and simplified expected volatility, SEV, index from the seemingly complicated expected volatility formula established by the Chicago Board Options Exchange (CBOE). With the VIX and SEV index, we substitute the expected volatilities into the Black-Scholes model to predict call and put option prices. The results show that TVIX provided more accurate predictions of option prices than the SEV index as the percent error is in a lower range of errors. This suggests that TVIX is more accurate in formulating predictions.

However, the results show that the SEV index is more reliable than TVIX from the viewpoint of higher adjusted R-squared values, AIC and SBIC. Therefore, the SEV index would seem to be a superior tool as a hedging diversification tool because of the high negative correlation with the volatility index. This means that the new SEV index is more functional and valuable for a risk diversification tool.

Regarding to time series data, the conditional variance and the prediction of return and variance, The Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests were used to test the null hypothesis of a unit root against the alternative hypothesis of stationarity. The tests yield large negative values in all cases for levels such that the individual returns series reject the null hypothesis at the 1% significance level, hence, the returns are stationary.

We examines FIGARCH model which is effectively capture both volatility clustering and long memory because GARCH model exhibit short memory and cannot analyze hyperbolic memory in conditional volatility process and capture asymmetries in equity market volatility. Also, FIAPARCH model, which allows for long memory and asymmetries in volatility, was examined. The empirical results shows that that ARMA-FIGARCH is better fit to the data by using AIC and SBIC criteria values, however, ARMA-FIAPARCH is the best accuracy in forecasting returns of TVIX with larger memory than ARMA-FIGARCH and capture asymmetric effect.

In addition, the various models of GARCH family, GARCH, EGARCH, GJR and PARCH model, were examined in order to study ARCH and GARCH effects, the sign and size effects of the standardized shocks, and the impact of asymmetries between positive and negative shocks on the conditional variance. The results from

all of the models show the volatility with statistically significant asymmetry effect with all the models but without leverage effects. The ARMA-PGARCH is found to be the best model with the lowest AIC criteria values but the EGARCH model has the lowest SBIC criteria value. Regarding MAPE and RMSE criteria, GJR-GARCH is the best fitting model for TVIX.

However, this dissertation is just a piece of work if the Stock Exchange of Thailand does not introduce VIX to the investors in Thai financial market. Both the Stock Exchange of Thailand and Security Exchange Commission should firstly introduce, develop, and launch TVIX as a hedging diversification tool in the market in order, for the investors, to learn and be acquainted with TVIX for a few years primarily, and apply the forecasted model to forecast TVIX and predict options price.
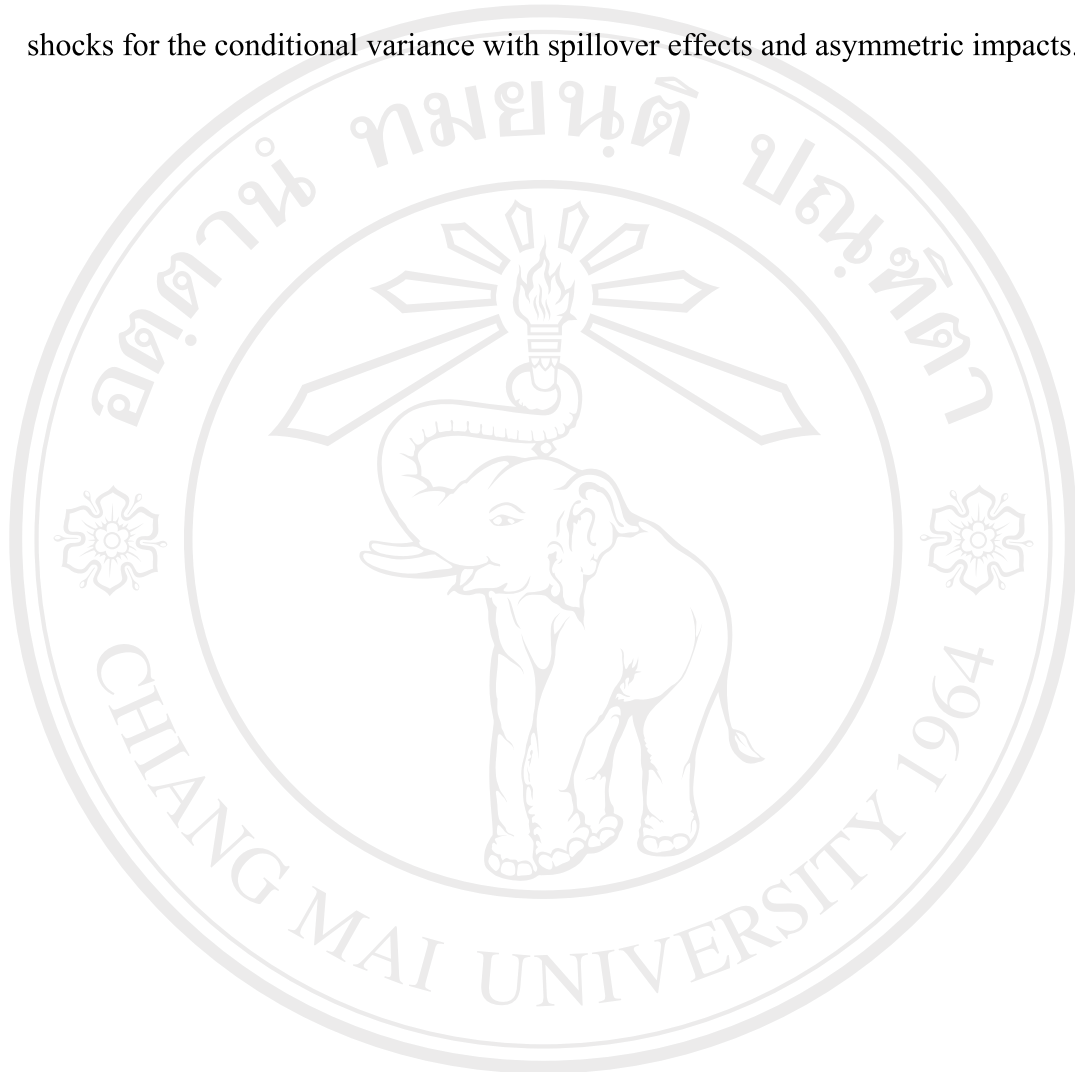
## 6.2    Limitations of the Study and Suggestions for Further Study

First, the SET and TFEX launched the European-style SET50 Index options in October 2007 and option trading volume is illiquidity. The range of data might not be reliable. However, the researcher collected the high-frequency data for every contract month, therefore, there is no study on this topic.

Second, this study applies with only SET50 Index options. Other markets should be applied to calculate for VIX and compare for the reliable of the models. Also, other volatility indexes on FTSE, Nifty 50, Kospi200, and Nikkei 225, which are VFTSE, INVIX, VKospi, and VXJ, respectively, are interested for further study.

Lastly, univariate GARCH was only examined for the conditional variance. Multivariate conditional volatility models, for example, constant conditional correlation (CCC), dynamic conditional correlation (DCC), VARMA-GARCH and

VARMA-AGARCH should be considered for further estimation in order to capture the dynamic of time-varying conditional correlation and explain positive and negative shocks for the conditional variance with spillover effects and asymmetric impacts.