An Evaluation Forecasting Techniques in Kuala Lumpur Stock Exchange (KLSE) Finance

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Abstract

The major conflict is regarding the quality of existing literatures in stock market. Evidence shows that some researchers' supports on incorporating complexity forecasting models while some of them support applied simple forecasting model in forecasting. Up to now the existing studies still far from completed. Hence, it had motivated researchers to find the best and the most accurate volatility forecasting models. This study aims to employ various types of forecasting models into Kuala Lumpur Stock Exchange (KLSE) Finance. This study uses daily volatility of KLSE Finance stock prices from the period 1 January 1991 to 31 December 2010. This aim of this paper is to examine which of the model has the potential and tend to provide the accuracy in forecasting samples. Forecasting models employed in this study include random walk, historical mean model, moving average model and simple regression model. This study uses error statistic to obtain the best forecasting models through the model comparison and rankings. There are four types of error statistic to evaluate the best forecasting models, namely Mean Error (ME); Mean Absolute Error (MAE); Root Mean Square Error (RMSE); and Mean Absolute Percent Error (MAPE). The result of this study shows that simple regression model is the best forecasting model to be implemented into KLSE Finance.

INTRODUCTION

Forecasting volatility plays crucial roles in financial markets. The growing trends of forecasting volatility over the last two decades have increased researchers and practitioners' interest and attention to extend the study. Most of them are motivated in studying, identifying and finding the importance of volatility in terms of security valuation, risk management, and monetary policy making (Chung, Lu and Lee, 2005). Definitely forecasting volatility exploited as risk measurement. Greater volatility in stock market has much of impact to stabilize financial market as well as economic (Yu, 1999). Volatility of asset portfolio selection and diversification depends on the goodness-of-fit of forecasting models in order to determine the accuracy in terms of forecasting (Poon and Granger, 2003).

Basically, volatility forecasting models are divided into different approaches. The main purpose of forecasting models is firstly to help an organization to predict the future. Secondly, it acts as an assessment tools to help investment managers in order to make better judgment decision, especially decision concerning company investment profile (Poon and Granger, 2003). There are quite large numbers of forecasting techniques in the academic literature review. At the same time, numerous methods are emerging to estimate volatility of forecasting models, which includes observation pertaining to market timing judgments; selecting the portfolio, and variance estimation to be incorporated into asset pricing models (Brailsford *et al.,* 1996). Furthermore, selections pertaining to forecasting models have to consider the availability of data, quality of forecasting models, and predefined assumptions (Abraham et al, 2007). Hence, it is critical to identify the most accurate forecasting models among the range of forecasting models because it will affect the accuracy in forecasting (Brailsford *et al.,* 1996).

This study aims to employ various types of forecasting models into Kuala Lumpur Stock Exchange (KLSE) Finance. This study uses daily volatility of stock prices from the period 1 January 1991 to 31 December 2010. This aim of this paper is to examine which of the model has the potential and tend to provide the accuracy in forecasting samples. KLSE Finance is considered to be the highest weightage sectoral category which is well correlated in Bursa Malaysia. KLSE Finance achieved the highest return compared to other sectors from Bursa Malaysia (Bursa Malaysia, 2010). The forecasters use the well defined trading strategies to predict the stock prices. However, it is not easier to determine stock market returns because the market is volatile as well as market volatility need to capture in used and implemented models (Atsalakis, Kimon, and Valavanis, 2009). According to Poon and Granger (2003), high market volatility is the main challenge in predicting the stock prices, correctly and consistently.

The study also intends to produce a comparative analysis in incorporating four different types of forecasting models to be incorporated into Kuala Lumpur Stock Exchange (KLSE) Finance daily volatility stock returns. The forecasting models employed in this study include random walk model, historical mean model, moving average model and simple regression model. This study is conducted to determine where out of four models, it is to select the most accurate forecasting models and good-of-fit data in KLSE Finance (Poon and Granger, 2003). This study uses error statistic to obtain the best forecasting models through the model comparison. There are four types of error statistic to evaluate the best forecasting models, namely Mean Error (ME); Mean Absolute Error (MAE); Root Mean Square Error (RMSE); and Mean Absolute Percent Error (MAPE).

The main objective of this study is to determine the best and the most accurate forecasting model among other forecasting model to be incorporated into KLSE. Research objectives of this study are as below.

- To determine the best of fit data and accurate forecasting model among other forecasting models to be incorporated into KLSE Finance.
- To examine the best of fit forecasting model which is error statistics sensitive compared to other types of forecasting models.
- To identify the best and accurate forecasting model shown in ranking way through the comparative methods between other types of forecasting models.

HISTORY OF MALAYSIA STOCK ENVIRONMENT

The first stock market in Malaysia is Bursa Malaysia. The main purpose of Bursa Malaysia is to provide a balanced economic environment. Bursa Malaysia serves as Malaysia's stock market in terms of benchmark index. Moreover, Bursa Malaysia is a source to support in terms of financing with large amount of financial instruments.

The Malaysia securities industries were developed in year 1930 which was the first organization, formally to establish securities business. It was formerly recognized as Singapore Stockbrokers Association but now it is officially registered and known as Malayan Stockbrokers Association. Malayan stock exchange was published in public on 9th May 1960.

In year 1963, Malaysia Federation was established and at that time Singapore is one of the component states of Malaysia, whereas the MSE was renamed as the Stock Exchange of Malaysia (SEM). During, Singapore secession from the federation of Malaysia in 1965, the stock exchange as usual continued daily stock activities, but the stock exchange had a separation between Malaysia and Singapore (SEMS).

KLSE has been passing through many years and it is undergoing speedy development and improvements. Basically, KLSE consist an index which is bounded in different of sectors. There are industrial, finance property, tin and plantation sectors. Bursa Malaysia Composite Index increased the components stock to 100 in year 1995. Whereas in year 1997, listed in second board companies were classified into consumer products, constructions, industrial products, trading /services, and finance sectors. The main reasons to restructure the activities are to increase the market transparency and ease to review. KLSE Finance possesses the highest weightage returns of sectors from Bursa Malaysia. In year 1996, KLSE Finance consists of 56 companies. Figure 1 shows the performance of KLSE Finance based on daily data volatility returns, from year 1991 to 2010.

Figure 1: Daily data volatility returns of KLSE Finance from year 1991 to 2010.
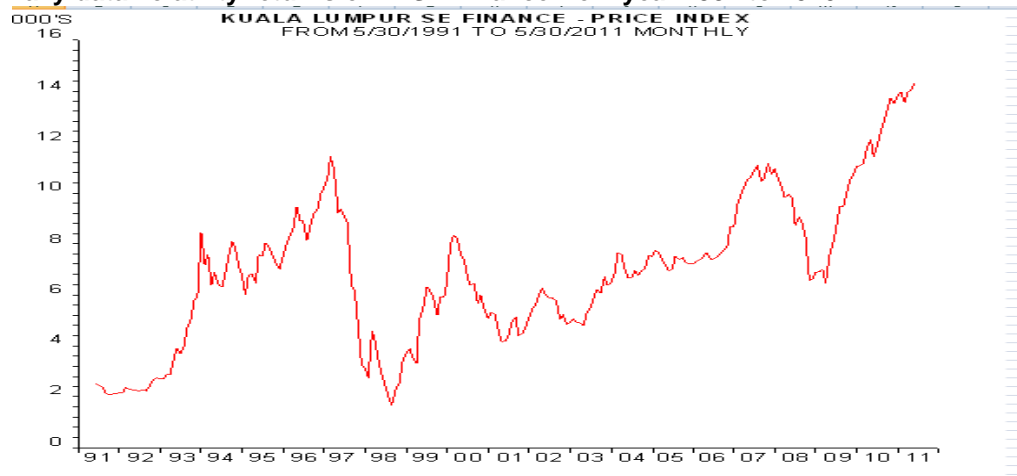
(Source: Thomsom Datastream)

EVALUATION FORECASTING MODEL
There are four types of forecasting models which will be implemented into KLSE Finance, which there are random walk model, moving average model, historical mean model, and simple regression model.

Random Walk Model
Somanath (1986) re-examined the paper of Meese and Rogoff about the random walk forecasting model who exposed better forecasting performance compared to other structural models. The sample data of this study included reused previous study by German mark within the period from January 1975 to December 1983. This study has improved in some aspects that are different from Meese and Rogoff study. This study considers extend research period, add two more statistical structural models, lagged adjustment, execute in-sample models and out of sample model results. In addition, some distinction in this study is sample data and model estimation methods. However, it still has some similarities, for instance the use of same error forecast statistic model which is RMSE, MAE, and ME. Another similarity is implementing rolling regression in forecasting. The result showed that some statistical models controlled the random walk therefore if took consideration lagged adjustment that determined better forecast results. The researcher finds that the result strongly opposed the dominance of random walk model. The main reason is lagged model not only control random walk model as well as non-lagged counterpart.

Darrat and Zhong (2000) examined the daily stock prices of Shanghai and Shenzhen Exchanges and whether to follow the random walk process or not. The study demonstrated that if both stock markets follow the random walk process while it is considered quite efficient market. They implemented two types of method to execute this study, firstly is common variance-ratio test to quote the ideas from Lo and Mackinlay (1998), and secondly is to run the model comparison test. There are four types of forecasting models involved in model comparison test, which are Random Walk, Autoregressive Moving Average (ARIMA), GARCH, and ANN model. In this study, they apply three types of error statistic models to evaluate the most accurate result compared to other forecasting models. The error statistic models are RMSE, MAE, and Theil's U. The results show that Chinese stock market is not feasible with random walk model. Through the model comparison test, ARIMA model is best forecasting model in both Chinese stock markets and followed by NAÏVE model.

Historical Mean Model
Kumar (2006) examined the capabilities and potential of ten types of statistical and forecasting models employed into Indian stock and forex markets. To evaluate the models comparison are based on two divisions of measurement which are symmetric and asymmetric error statistics. The empirical result showed that historical mean model presented the worst performance in both the markets. The researcher used error statistical test model to determine the most accurate forecasting models. Under MAE and MAPE error statistical test model, historical mean model was considered to have worst performance in forecasting and it is ranked last position on accuracy compared to other competitors. Historical mean model shows the worst forecasting performance under MAE and MAPE error statistic measurement.

Moving Average Model
Lai and Lau (2005) examined forecasting capabilities between two types of moving average models. There are fixed moving averages (FMAs) and variable moving averages (VMAs) on nine daily stock markets from 1st January 1988 to 31st December 2003. The nine Asian stock markets are Kuala Lumpur Stock Exchange Composite Index, Straits Times Index, Hang Seng Index, Taiwan Weighted Index, Nikkei 225 Index, Seoul Composite Index, and Shanghai Composite Index, Stock Exchange of Thailand Index, and Jakarta Composite Index. As an overall, the result showed that fixed moving averages (FMAs) is performed well in China, Thailand, Taiwan, Malaysian, Singaporean, Hong Kong, Korean, and Indonesian stock markets. They also distress that simple moving average is the best and popular forecasting model in stock market. They found that moving average model can provide accuracy in terms of forecasting information for investors and it is an outstanding forecasting model compared to other forecasting models.

Simple Regression Model
Dimson and Marsh (1990) investigated volatility daily data stock market of United Kingdom (UK) from year 1955 to 1989. There are five types of volatility models involved in this study which are random walk model, historical mean model, moving average model, exponential smoothing and regression models. They applied straightforward methods to be executed in the study. They found that data-snooping can enhance quality in forecasting. They also found that normally without data- snooping models will get the poor forecasting results if benchmarked with naïve models. As a conclusion, they conclude that there are two types of recommended

forecasting models that can be implied into UK daily stock market, namely exponential smoothing model and simple regression models. Both of forecasting models in fact have been provided some ability to estimate the accuracy of forecasting. The simple regression model provides equal weight in recent volatility observation and long-term average volatility.

Brailsford and Faff (1996) examined various forecasting models abilities in Australia's monthly stock market. The forecasting models included in this study is random walk model, an historical mean model, a moving average model, an exponential smoothing model, an exponentially weighted moving average (EWMA) model, a simple regression model, two standard GARCH models and two asymmetric Glosten-Jagannathan-Runkle Generalized Autoregressive Conditional Heteroskedasticity (GJR-GARCH) models. The best of forecasting model is selected through the sensitive test of error statistic models. The highest ranking of forecasting model provided the most accurate result compared to other forecasting models. The result shows that simple regression model and ARCH category models provided best performance compared to the rest of forecasting models.

DATA AND METHODOLOGY

Source of Data and Sample
This research study employs secondary data. The sources of data were retrieved from Data Stream, Bursa Malaysia, online published journals, online articles, and official government websites. The sample of this study is KLSE Finance. For this study, KLSE Finance data was gathered from Data Stream on a daily basis. There are 5220 daily data observations in this study which was derived from 1 January 1991 to 31 December 2010.

Analytical Framework
Random Walk Model
Random walk model describes the best forecasts volatility stock prices that results in this month which is equal to volatility stock prices that was examined last month (Brailsford and Faff, 1996).

$\hat{\sigma}_T^2(\text{Random Walk}) = \sigma_{T-1}^2$ $\qquad$ T = 121, 122….240

Where

σ_T^2 = measurement of monthly volatility clarifies in expression (1)

σ_{T-1}^2= This month total forecast monthly return is similar to last month actual forecast monthly return.

Historical Mean Model
Based on assumption of a stationary mean, the best volatility of forecast in this month is examined from past volatility stock prices. (Brailsford and Faff, 1996).

$\hat{\sigma}_T^2(\text{Long} - \text{Term Mean}) = \frac{1}{T-1}\sum_{j=1}^{T-1}\sigma_j^2$ $\qquad$ T = 121, 122….240

Where,

σ_T^2 = measurement of monthly volatility clarifies in expression (1)

σ_j^2 = sum of squared monthly returns

Moving Average Model
Normally, market analysts employ moving average act as a predictor to determine means returns (Brailsford and Faff, 1996). This model is applied in conventional time series analysis. The estimation time of this model is arbitrary. Basically, this model separates the estimation period into three different time periods which consists of three years (short term), five years (mid term) and ten years (long term). The main purpose is to separate the time period to ensure data can be constant with estimation period. The expression of ten-year moving average model (Brailsford and Faff, 1996) is as shown below:

$\hat{\sigma}_T^2(\text{Moving Average}) = \frac{1}{120}\sum_{j=1}^{120}\sigma_{T-j}^2$ T = 121, 122 …., 240

Where,

σ_T^2 = measurement of monthly volatility clarifies in expression (1)

σ_{T-j}^2 = This month total forecast monthly return is similar to last month actual forecast monthly return.

Whereby to derive three years and five-years moving average model in months, which is in 36 months and 60 months respectively.

Simple Regression Model
This model implemented ordinary least squares (OLS) to examine volatility of stock price in KLSE Finance (Brailsford and Faff, 1996). Simple regression model can be formally expressed and shown as follows:

$$\hat{\sigma}_T^2 \text{ (Simple Regression)} = \hat{\gamma}_0 + \hat{\gamma}_1\, \sigma_{T-1}^2 \quad T = 121, 122…., 240$$
Where,
$\hat{\sigma}_T^2$ = actual sum of squared daily returns
$\hat{\gamma}_0$ = intercept coefficient
$\hat{\gamma}_1$ = independent variable coefficient
σ_{T-1}^2 = sum of squared daily returns

Out of Sample Error Statistics Model
The main purpose of employing the out-of–sample forecast is to help the forecasters to determine the most suitable forecasting model, in order to be implemented into KLSE Finance.

<u>ME</u>
$$\text{ME} = \frac{1}{119}\sum_{T=1}^{119}(\hat{\sigma}_T^2 - \sigma_T^2)$$
Where
T = 1, 2 ….119
$\hat{\sigma}_T^2$ = actual sum of squared daily returns
σ_T^2 = sum of forecast squared monthly returns

<u>MAE</u>
$$\text{MAE} = \frac{1}{246}\sum_{T=1}^{246}|\hat{\sigma}_T^2 - \sigma_T^2|$$
Where
T = 1, 2 ….119
$\hat{\sigma}_T^2$ = actual sum of squared daily returns
σ_T^2 = sum of forecast squared daily returns

<u>RMSE</u>
$$\text{RMSE} = \sqrt{\frac{1}{119}\sum_{T=1}^{119}(\hat{\sigma}_T^2 - \sigma_T^2)^2}$$
Where
T = 1, 2 ….119
$\hat{\sigma}_T^2$ = actual sum of squared daily returns
σ_T^2 = sum of forecast squared daily returns

<u>MAPE</u>
$$\text{MAPE} = \frac{1}{119}\sum_{T=1}^{119}|(\hat{\sigma}_T^2 - \sigma_T^2)/\sigma_T^2|$$
Where
T = 1, 2 ….119
$\hat{\sigma}_T^2$ = actual sum of squared daily returns
σ_T^2 = sum of forecast squared daily returns

RESULTS AND DISCUSSION

Forecasts Error Statistics Results
Actual and relative forecast error statistics results are shown in Table 1. The error statistics results are for each forecasting model and at the same time, there are also across four error statistics models measurement, namely ME, MAE, RMSE, and MAPE respectively.

Table 1 : Error statistics from forecasting monthly volatility

Forecasting Models	ME			MAE			RMSE			MAPE		
	Actual	Relative	% Accurate	Actual	Relative	% accurate	Actual	Relative	% accurate	Actual	Relative	% accurate
Random Walk	0.00001	0.00214	99.74%	0.00162	0.32670	67.33%	0.00302	0.54486	45.51%	1.04157	0.18393	81.61%
Historical Mean	0.00447	0.95980	4.02%	0.00488	0.98304	1.70%	0.00513	0.92653	7.35%	5.14110	0.90788	9.21%
Moving Average												
3 year	0.00106	0.22831	77.17%	0.00216	0.43579	56.42%	0.00328	0.59246	40.75%	1.65159	0.29166	70.83%
5 years	0.00271	0.58167	41.83%	0.00379	0.76404	23.60%	0.00543	0.98056	1.94%	2.94144	0.51944	48.06%
10 years	0.00443	0.95123	4.88%	0.00488	0.98428	1.57%	0.00554	1.00000	0.00%	5.05062	0.89190	10.81%
Simple Regression Model												
First Regression (Based on 1/1/91 - 1/12/00	0.00440	0.94532	5.47%	0.00479	0.96567	3.43%	0.00500	0.90320	9.68%	5.08393	0.89779	10.22%
Second Regression (Based on 1/2/93 - 1/2/03	0.00466	1.00000	0.00%	0.00496	1.00000	0.00%	0.00516	0.93187	6.81%	5.66274	1.00000	0.00%
Third Regression (Based on 1/3/95 - 1/2/05	0.00373	0.80022	19.98%	0.00426	0.85824	14.18%	0.00451	0.81431	18.57%	5.13738	0.90722	9.28%
Fourth Regression (Based on 1/4/97 - 1/3/07	0.00338	0.72564	27.44%	0.00416	0.83909	16.09%	0.00448	0.80943	19.06%	4.20259	0.74215	25.79%
Fifth Regression (Based on 3/5/99 - 1/4/09	0.00141	0.30316	69.68%	0.00141	0.28456	71.54%	0.00148	0.26797	73.20%	2.20620	0.38960	61.04%

ME
The main function of ME is act as guideline to determine the direction of forecasting profile whether it is under prediction or over prediction. The result shows that four types of forecasting models found to over-predict volatility results. The random walk model is the most over prediction volatility result among three of the rest models

MAE
Refer to Table 1, fifth simple regression model is the most accurate forecast model among three of the rest forecasting models under MAE error statistic models measurement

RMSE
Refer to Table 1.the RMSE error statistic test shows that fifth simple regression model is the most accurate model. Under MAPE error statistic measurement, random walk model is the best forecasting model with 81.61 percent compared to benchmark model

As a conclusion, the ranking of any one forecasting model varies depending upon the choice of error statistic. This sensitivity in rankings highlights the potential hazard of selecting the best model on the basis of an arbitrarily chosen error statistic. However, based on table 4.1 above, historical mean model shows the worst accuracy result compared to the three other of forecasting models.

Discussion about Simple Regression Model in KLSE Finance
The result shows that simple regression model is the best forecasting model in KLSE Finance. There are four types of error statistic models namely ME, MAE, RMSE, and MAPE. Out of four types of error statistic model, MAE and RMSE showed the same ranking in simple regression model. In statistical point of view, MAE examined the closest forecast between actual outcomes whereas RMSE which was observed has the same units as the quantity being estimated. MAE and RMSE are two different error statistic models, but both of them have some similarity characteristic which can explain that simple regression model is the most excellent forecasting model in KLSE Finance.

Table 2: MAE and RMSE error statistic based on simple regression model

Simple Regression Model	MAE				RMSE			
	Actual	Relative	% Accurate	ranking	Actual	Relative	% Accurate	ranking
First Regression (Based on 1/1/91 - 1/12/00	0.00479	0.96567	3.43	4	0.00500	0.90320	9.68%	4
Second Regression (Based on 1/2/93 – 1/2/03	0.00496	1.00000	0.00	5	0.00516	0.93187	6.81%	5
Third Regression (Based on 1/3/95 - 1/2/05	0.00426	0.85824	14.18	3	0.00451	0.81431	18.57%	3
Fourth Regression (Based on 1/4/97 - 1/3/07	0.00416	0.83909	16.09	2	0.00448	0.80943	19.06%	2
Fifth Regression (Based on 3/5/99 - 1/4/09	0.00141	0.28456	71.54	1	0.00148	0.26797	73.20%	1

Based on the Table 2 shown as above, the figures show that simple regression model improves its forecasting capabilities from year to year. The most up to date data shows the best results in forecasting. In fact, there are four main factors to influence the forecasting capabilities of simple regression model that have improved from year to year. The four main factors are technology advancement; improvement in the rules and regulations; liberation government policy, and upgrading the accounting system.

Impact of Outdated Historical Data
The major issue that should be concerned and discussed in this study is about the historical data. There is twenty years daily volatility KLSE Finance data collected in this study. But, the forecasting models capabilities in terms of accuracy measurement tend to reduce when applied out-of-date historical data into the models. It exactly can be clarified through comparison foresting models accuracy from year 1991 to year 2010. Even though historical data information is good for investors to retrieve the data for their investment purpose, in forecasting, the theory is addressed that the longer time in forecasting, the more the risk should be bear by the investors. It is because forecasting is uncertainty, thus investors will have a hard time to predict, for instance at the next minutes, what will happen in the world. Furthermore, since stock price is

volatile from time to time, investors will have hard time to predict the real return of stock prices. Actually in fact, forecasting model is a tool to help investors and investment managers to make better judgment, it can be said that it totally rely on prediction outcomes of forecasting model. However, it is a guideline for investors and investment managers to initial their forecasting profile.

CONCLUSIONS

As an overview the result of this study, historical mean model shows the worst accuracy result compared to the three other of forecasting models. The result of this study shows that simple regression model is the best forecasting model. Actually, it is hard to determine which forecasting model is the best to provide accuracy in terms of forecasting results. It is because different error statics model is specific in volatility terms. In additional, there are some factors to influence the forecasting capabilities. There are technology advancement; improvement in the rules and regulations; liberation government policy, and upgrading the accounting system. Hence, in this study, the simple regression model was found to be is the most suitable forecasting model to be implemented into KLSE Finance. This finding is supported by Dimson and Marsh (1990) who stated that simple regression model is the best forecasting model among other comparative models.

Limitation of the study

The limitation of this study firstly is where this study employs the historical data in forecasting. It is hard to predict the future market return if it uses prior historical data. In fact, historical data does not reflect the future market return. Secondly, the limitation in this study is less of forecasting models which was already being implemented in KLSE Finance. There is only four types of forecasting models being incorporated into KLSE Finance. Actually, the finding is not so strong and enough to choose the best forecasting models. Lastly, stock market is affected by behavioral of finance. It indicates that the volatility stock prices is highly correlated and rely highly on investment of people who hold, buy, and sell their stocks.

Future Study

In future, there are several aspects which needed to be improved. Firstly, on the discussion on how to employ more forecasting models and error statistics test. It can accurately determine the forecasts results compared to other forecasting models. ARCH class of models which is from naïve models to complexity models is highly recommended to be applied in future study. Secondly, is to employ different types of forecasting models in Malaysia Stock market to forecast monthly volatility stock returns. It is not just to be incorporated in KLSE Finance only but also in Malaysia stock market, which includes Bursa Malaysia Composite Index (KLCI); Bursa Malaysia Emas Index (EMAS); Bursa Malaysia Top 100 index, and Bursa Malaysia Palm Oil Plantation Index. If different sample data are applied, it would be easier in selecting the best predicting model to be adapted in Malaysia stock market.

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