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Comparing the performances of GARCH-type models in capturing the stock market volatility in Malaysia

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Abstract

We conduct empirical analyses to model the volatility of stock market in Malaysia. The GARCH type models (symmetric and asymmetric GARCH) are used to model the volatility of stock market in Malaysia. Their performances are compared based on three statistical error measures tools, i.e. mean squared error, root means squared error and mean absolute percentage error for in sample and out sample analyses. Apart from that, we also determine the factors contribute to the stock market movements. The data is ranging from January 1990 to December 2010. The data is divided into three time frames, i.e. pre-crisis 1997, during crisis and post-crisis 1997. Our results reveal that symmetric and asymmetric GARCH models have different performances in different time frames. In general, for the normal period (pre and post-crisis), symmetric GARCH model perform better than the asymmetric GARCH but for fluctuation period (crisis period), asymmetric GARCH model is preferred. Our results also show that exchange rate and crude oil price have significant impacts on the Malaysia stock market volatility in the pre-crisis and post-crisis periods and but the impact is not significant in the crisis period.

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***Keywords*: stock market volatility; GARCH modeling; financial crisis**

1. Introduction

The study on the volatility of stock market is closely linked to the risk of assets. Indeed, volatility is the measurement of risk. Higher volatility leads to large variations of return, hence higher risk. As volatility of

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stock market provide useful information in measuring risk, many models/ theory are applied in forecasting stock market movement and evaluating the performance of the stock market. Many studies show that random walk model is superior in explaining the stock market movement. However, more recent studies reveal results that stock market deviates from the random walk behaviour. We further the investigation on stock market movement by looking at different aspects (i.e. different models and different time frames).

Among the models that have been applied to capture the stock market volatility include ARCH which was proposed by Engle (1982) and generalized ARCH proposed by Bollerslev (1986) and Taylor (1986). After the introduction of ARCH and GARCH models, many researchers have proposed the extensions and alternative specifications on the models such as GARCH-M, IGARCH, EGARCH (Nelson (1991)), Threshold GARCH (Glosten *et al.* (1993)), Asymmetric GARCH model AGARCH (Engle (1990)) and Fractionally Integrated FIGARCH (Baillie *et al.* (1996)). These alternative models seek to improve the GARCH model in capturing the characteristics of return series. However, previous studies show no consensus on the best model in capturing volatility. Some studies show preferable results using simple GARCH (p,q) models but some show extensions of GARCH models perform better. The performance of these models varies across markets and time period. The performance of these forecast models is affected by error measures.

In this study, we seek to identify the superior model in capturing the characteristics of Malaysia's stock market. The models to be compared are symmetric GARCH and asymmetric GARCH (EGARCH and TGARCH). In particular, we evaluate the performance of these models using the error measurement approaches such as MSE, RMSE and MAPE. Apart from this, we also seek to investigate if exchange rate can influence the stock market movement in Malaysia. The results are compared for three different time frames i.e. pre-crisis, crisis period and post-crisis periods. Our results show that the performance of GARCH-type models is dependent on the time/ periods, i.e. during pre-crisis, crisis and post-crisis and also the error measures. In general, the total rank show that GARCH/ TGARCH model perform the best in the pre-crisis period while GARCH model works well during the crisis and TGARCH model work well in the post-crisis period in capturing the stock market volatility in Malaysia.

The remaining paper is organized as follows: section two provides some concepts and literature reviews. Section three is about the data and methodology. Section four is about model evaluations while section five summarizes the findings. Section six concludes.

2. Literature review

The study on stock market volatility is broad. Empirical studies apply GARCH and ARCH models in capturing the stock market volatility. These studies cover different regions/ countries. The studies that focus on stock market in developed countries (United States, United Kingdom, Germany, and Japan) include Claessen & Mittnik (2008), Ou & Wang (2011), Choo & Lee (2011), and Mootamri (2011). These studies applied different frequency data. Among the studies that focused on the stock market in developing countries (Malaysia, Singapore, India, Saudi, China, Egypt and Vietnam) are Mishra (2010), Alshogeathri (2011), Abdalla (2012), Wong & Kok (2005) and Liu *et al*. (2009), Hien (2008).

In evaluating the performance of models, previous studies apply different evaluation measures. The most widely applied measures include Mean Square Error (MSE), Root Mean Square Error (RMSE), and Mean Absolute Percent Error (MAPE). In practice, when comparing the different models, it is rarely the case that one model dominate the other with respect to all evaluation measures. The common way to solve the problem is to carry out the average figures of some statistical measures and then compare the forecast models based on the parameter obtained.

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