GARCH DIAGNOSIS WITH PORTMANTEAU BICORRELATION TEST AN APPLICATION ON THE MALAYSIA'S STOCK MARKET

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ABSTRACT

This study employed the Hinich portmanteau bicorrelation test (Hinich and Patterson, 1995; Hinich, 1996) as a diagnostic tool to determine the adequacy of the GARCH model in describing the returns generating process of Malaysia's stock market, specifically the Kuala Lumpur Stock Exchange Composite Index (KLSE CI). The bicorrelation results demonstrated that, while GARCH model is commonly applied to financial time series, this model cannot provide an adequate characterization for the underlying process of KLSE CI. Further investigation using the windowed test procedure revealed that this was due to the presence of episodic non-stationarity in the data, which could not be captured by any kind of ARCH or GARCH model, even after modifications to the specifications of the GARCH model. Thus, this study points to the need to continue the search for a parsimonious and congruent model capable of capturing the episodic features presence in the returns series of KLSE CI.

Keywords: GARCH; Non-linearity; Non-stationarity; Data generating process; Bicorrelation; Malaysian stock market.

INTRODUCTION

After the stock market crash of October 19, 1987, interest in non-linear studies has experienced a tremendous rate of development. This has come about because the frequency of large moves in stock markets has been greater than would be expected under a normal distribution (Hsieh, 1991: 1839). This observed trend was echoed by Campbell *et al*., who wrote "A natural frontier for financial econometrics is the modelling of non-linear phenomenon" (1997: 467).

The main driving forces behind this phenomenal growth are the developments in the mathematical and statistical analysis of dynamic systems. The richness of these new non-linear tests lies in their ability to uncover a more complex form of dependencies in a time series that otherwise appear to be random. This is further supported by growing views that the observable world is nonlinearly dynamic (Pesaran and Potter, 1993; Campbell *et al*., 1997; Barnett and Serletis, 2000).

However, there are literally unlimited numbers of possible non-linear models that could potentially describe the returns generating process for financial time series. It is widely accepted that the non-linear dependencies in financial time series are very well described by the Autoregressive Conditional Heteroscedasticity (ARCH) model introduced by Engle (1982) or its extension Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model by Bollerslev (1986). The GARCH model has become enormously popular for modelling financial time series over the past 15 years. This popularity is evidenced by the incorporation of GARCH estimation into major software packages (see example, Brooks, 1997; McCullough and Renfro, 1999; Brooks *et al*., 2001)

The simple GARCH (1,1) model for {y(t)}can be written as:

$$y(t) = \varepsilon_t h_t^{1/2}$$
$$\varepsilon_t | \psi_{t-1} \sim N(0, h_t)$$
$$h_t = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta_1 h_{t-1} \quad (1)$$