E C O N O M I C S   B U L L E T I N

Autoregressive Lag Length Selection Criteria in the Presence of ARCH Errors

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Abstract

We study the effects of ARCH errors on the performance of the commonly used lag length selection criteria. The most important finding of this study is that SIC, FPE, HQC and BIC perform considerably well in estimating the true autoregressive lag length, even in the presence of ARCH errors. Thus, we conclude that these criteria are applicable to empirical data such as stock market returns and exchange rate volatility that exhibit ARCH effects.

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1. Introduction

Recently, Başçi and Zaman (1998) has done a simulation study to see the effects of nonnormal errors on various autoregressive (AR) lag length selection criteria. In the past, the performance of these criteria has been studied based on the assumptions that the error terms are normal in nature. Liew (2004) for instance, study the performance of few commonly used selection criteria in the presence of normal errors. Başçi and Zaman (1998) argued that it is important for applied econometricians to understand the behaviour of various criteria under nonnormal errors. They further demonstrate via a simulation study that the performances of some criteria are affected by kurtosis but not skewness. In the spirit of Başçi and Zaman (1998), our main objective is to investigate via a simulation study, the effects autoregressive conditional heteroscedastic (ARCH) (Engle, 1982) errors on the performance of the aforementioned criteria in the estimation of true lag length. Specifically, we are interested to know whether the application of these criteria is still appropriate in the presence of ARCH effects, as it is widely known that many empirical data especially financial variables such as stock price returns and exchange rate volatility are actually better characterized by the ARCH models (Engle 1982; Engle *et al*. 1990; Bollerslev *et al*. 1992; Speight and McMillan 2001; Bautista 2003; Li and Lin 2004 and many more).

We note that the current study differs from the former in threefold. First, rather than studying the general form of nonnormality, we include the specific ARCH errors, which is a common form of nonnormal errors attributed to most economic data sets. Second, besides evaluating the probability of correctly picking up the true lag length, we are also interested to know the probabilities of under- and over-estimating the true lag length, in which the estimated lag length based on the selection criteria is less than and more than the true lag length, respectively. Thirdly, to obtain a clearer picture on the effects of ARCH errors over the homoscedastic errors, we contrast the performance of various criteria under both errors.

The most important finding of this study is that the commonly used selection criteria like SIC, FPE, HQC and BIC perform considerably well in estimating the true autoregressive lag length, even in the presence of ARCH errors. Thus, we conclude that these criteria are applicable to empirical data that exhibits ARCH effects.

2. Methodology

To accomplish our objective discussed in the preceding section we simulate AR (p) process with ARCH (q) errors, which is defined for a given set of data $\{X_1, \ldots, X_T\}$ that is in fact observations of an AR process of lag length p as:

$$X_t = c + \sum_{i=1}^{p} \phi_i X_{t-i} + \varepsilon_t \qquad (1)$$

where c is a constant, ϕ_i, $i = 1, \ldots, p$ are autoregressive parameters to be estimated and $\varepsilon_t = z_t \sigma_t$, where z_t is a standard normal variable and

$$\sigma_t = \sqrt{\alpha_0 + \sum_{i=1}^{q} \alpha_i \varepsilon_{t-i}^2} \qquad (2)$$