ESTIMATION OF VECTOR ERROR CORRECTION MODEL WITH GARCH ERRORS: MONTE CARLO SIMULATION AND APPLICATIONS

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ABSTRACT

The standard vector error correction (VEC) model assumes the iid normal distribution of disturbance term in the model. This paper extends this assumption to include GARCH process. We call this model as VEC-GARCH model. However as the number of parameters in a VEC-GARCH model is large, the maximum likelihood (ML) method is computationally demanding. To overcome these computational difficulties, the first part of this paper searches for alternative estimation methods and compares them by Monte Carlo simulation based on a relatively small scale VEC-GARCH model; an unrestricted VECM equation system with three variables and lag of 1. After rewriting VEC-GARCH model into Seemingly Unrelated Regression (SUR) model we apply a feasible generalized least square (FGLS) estimator. As a result FGLS estimator shows comparable performance to ML estimator. Furthermore a small scale of empirical study is presented to see the applicability of the FGLS. In our simulation we found that the performance of FGLS-GARCH estimator is as good as that of MLE and both estimators are better than OLS and the standard VECM that ignore the error structure.

In the second part, we apply a VEC-GARCH model to real international asset pricing data and test conditional CAPM by using FGLS-GARCH estimation strategy. Since our model is relatively large; it is involving 12 stock market indexes, computational problems arise in estimating the expected returns under VEC-GARCH model and in testing the conditional CAPM by using MLE.

Considering the heteroscedasticity and cross-correlation in the error terms of international stock market returns, International Capital Asset Pricing Model (CAPM) is reinvestigated under SUR with GARCH (SUR-GARCH) errors. We modified FGLS estimator to take into account multivariate GARCH error structure in estimating the model. World market portfolio was constructed to ensure that the market portfolio is mean-variance efficient under no restriction on short selling and borrowing at riskless rate. CAPM fits well only on ex-post SUR test, but it is rejected on SUR-GARCH for both ex-ante and ex-post test. However, this paper found that CAPM could be applied for most stock market indexes when each equation in the SUR system was analyzed individually.