Multivariate Stochastic Volatility Model with Realized Volatilities and Pairwise Realized Correlations

Yuta Yamauchi* and Yasuhiro Omori†

Abstract

Although stochastic volatility and GARCH models have been successful to describe the volatility dynamics of univariate asset returns, their natural extension to the multivariate models with dynamic correlations has been difficult due to several major problems. Firstly, there are too many parameters to estimate if available data are only daily returns, which results in unstable estimates. One solution to this problem is to incorporate additional observations based on intraday asset returns such as realized covariances. However, secondly, since multivariate asset returns are not traded synchronously, we have to use largest time intervals so that all asset returns are observed to compute the realized covariance matrices, where we fail to make full use of available intraday informations when there are less frequently traded assets. Thirdly, it is not straightforward to guarantee that the estimated (and the realized) covariance matrices are positive definite.

Our contributions are : (1) we obtain the stable parameter estimates for dynamic correlation models using the realized measures, (2) we make full use of intraday informations by using pairwise realized correlations, (3) the covariance matrices are guaranteed to be positive definite, (4) we avoid the arbitrariness of the ordering of asset returns, (5) propose the flexible correlation structure model (e.g. such as setting some correlations to be identically zeros if necessary), and (6) the parsimonious specification for the leverage effect is proposed. Our proposed models are applied to daily returns of nine U.S. stocks with their realized volatilities and pairwise realized correlations, and are shown to outperform the existing models with regard to portfolio performances.

*Graduate School of Economics, The University of Tokyo, Tokyo, Japan. E-mail:mchyuta@gmail.com.

†Faculty of Economics, The University of Tokyo, Tokyo, Japan. E-mail:omori@e.u-tokyo.ac.jp. Phone: +81-3-5841-5516. Fax: +81-3-5841-5521.