Author: Justyna Mokrzycka

Title:

Bayesian comparison of the dynamic tCopula-GARCH and MGARCH models for returns of stock market indices.

Abstract:

Modelling volatility and dependence structure of financial time series is one of the most interesting areas of research for both theorists and practitioners of financial markets. The models use in the field are different types of Multivariate GARCH or SV models and hybrid models e.g. MSF-SBEKK (Osiewalski, Pajor 2009). Another approach is to use copulas as functions which capture dependence structure. Patton (2006) and Jondeau and Rocklinger (2006) combined simple univariate GARCH structures with conditional copulas, thereby formulating multivariate Copula-GARCH models.
Over the last decade quite numerous works about modelling financial time series with Copula-GARCH and MGARCH have been published (e.g. Patton, 2006, Jondeau and Rocklinger, 2006, Dias and Embrechts, 2010, Weiss, 2013). In some of them the authors attempted to empirically compare various specifications of the models at hand, usually by means of information criteria. For instance, Dias and Embrechts (2010) use Copula-GARCH and BEKK structures to model dependencies between exchange rates. Weiss (2013) compares the performance of Copula-GARCH and Dynamic Conditional Correlation GARCH (DCC-GARCH) models in the context of Value at Risk (VaR) and Expected Shortfall (ES) predictions. Bayesian comparison of bivariate MGARCH models are presented by Osiewalski and Pipień (2004), bayesian comparison of bivariate MGARCH and SV are published by Osiewalski, Pajor, Pipień (2006). To the best of our knowledge, a formal, Bayesian comparison of Copula-GARCH and MGARCH has not so fair been presented in the relevant literature.
In this work we compare four bivariate models: AR(1)-tSBEKK(1,1), AR(1)-tCCC(1,1), AR(1)-tDCC(1,1) and dynamic AR(1)-tCopula-GARCH(1,1). As the dataset we use the logarithmic daily growth rates of stock market indices: (SPX, DAX), (SPX, BUX), (SPX, WIG) over the period January 4, 2006 through December 31, 2010. We formulate formal Bayesian statistical models for the structures at hand, and then design relevant Monte Carlo methods with Importance Sampling to calculate marginal data densities. These values are crucial to perform Bayesian model comparison by means of posterior model probabilities. The results point to AR(1)-tCopula-GARCH(1,1) as *a posteriori* the most likely model for the modelled data.