Asymmetric Forecast Densities for U.S. Macroeconomic Variables from a Gaussian Copula Model of Cross-Sectional and Serial Dependence

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Most existing reduced-form macroeconomic multivariate time series models employ elliptical disturbances, so that the forecast densities produced are symmetric. In this paper, we use a copula model with asymmetric margins to produce forecast densities with the scope for severe departures from symmetry. Empirical and skew t distributions are employed for the margins, and a high-dimensional Gaussian copula is used to jointly capture cross-sectional and (multivariate) serial dependence. The copula parameter matrix is given by the correlation matrix of a latent stationary and Markov vector autoregression (VAR). We show that the likelihood can be evaluated efficiently using the unique partial correlations, and estimate the copula using Bayesian methods. We examine the forecasting performance of the model for four U.S. macroeconomic variables between 1975:Q1 and 2011:Q2 using quarterly real-time data. We find that the point and density forecasts from the copula model are competitive with those from a Bayesian VAR. We show that during the recent recession the forecast densities exhibit substantial asymmetry, and that this avoids some of the pitfalls of the symmetric forecast densities of the Bayesian VAR. The asymmetries in the predictive distributions of GDP growth and inflation are similar to those found in the probabilistic forecasts from the Survey of Professional Forecasters. Last, we find that unlike the linear VAR model, our Gaussian copula model can capture nonlinear dependence between U.S. macroeconomic variables.