Parallel Bayesian inference for high dimensional dynamic factor copulas

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Abstract

Copula densities are widely used to model the dependence structure of financial time series. However, the number of parameters involved becomes explosive in high dimensions which results in most of the models in the literature being static. Factor copula models have been recently proposed for tackling the curse of dimensionality by describing the behaviour of return series in terms of a few common latent factors. To account for asymmetric dependence in extreme events, we propose a class of dynamic one factor copula where the factor loadings are modelled as generalized autoregressive score (GAS) processes. We perform Bayesian inference in different specifications of the proposed class of dynamic one factor copula models. Conditioning on the latent factor, the components of the return series become independent, which allows the algorithm to run in a parallel setting and to reduce the computational cost needed to obtain the conditional posterior distributions of model parameters. We illustrate our approach with the analysis of a simulated data set and the analysis of the returns of 150 companies listed in the S&P500 index.

Keywords: Bayesian inference; Factor copula models; GAS model; Generalized hyperbolic skew Student-t copula; Parallel estimation.