Singular conditional autoregressive Wishart model for realized covariance matrices

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Abstract

Realized covariance matrices are often constructed under the assumption that richness of intra-day return data is greater than the portfolio size, resulting in non-singular matrix measures. However, when for example the portfolio size is large, assets suffer from illiquidity issues, or market microstructure noise deters sampling on very high frequencies, this relation is not guaranteed. Under these common conditions, realized covariance matrices may obtain as singular by construction. Motivated by this situation, we introduce the Singular Conditional Autoregressive Wishart (SCAW) model to capture the temporal dynamics of time series of singular realized covariance matrices, extending the rich literature on econometric Wishart time series models to the singular case. This model is furthermore developed by covariance targeting adapted to matrices and a sectorwise BEKK-specification, allowing excellent scalability to large and extremely large portfolio sizes. Finally, the model is estimated to a 20 year long time series containing 50 stocks, and evaluated using out-of-sample forecast accuracy. It outperforms the benchmark Multivariate GARCH model with high statistical significance, and the sectorwise specification outperforms the baseline model, while using much fewer parameters.

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