Semi-Parametric Estimation of Multivariate Possibly Non-Causal and Possibly Non-Invertible Time Series Models

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Abstract

We propose a semi-parametric two-step estimation strategy for possibly non-causal vector autoregressive (VAR) systems and possibly non-invertible vector autoregressive moving average (VARMA) systems driven by non-Gaussian i.i.d. shocks. First, we obtain an initial estimate based on second moment information (e.g. a Gaussian quasi maximum likelihood estimator). Subsequently, multivariate all-pass filters are used to generate the finite set of systems with the same second moment properties, i.e. the same spectral density, but with different determinantal AR or MA roots. Last, we use an objective function based on the Fourier transform of the third and fourth order cumulants, i.e. the bi- and trispectral density, of the residuals to identify the true root and pole locations among the set of models with identical second moment properties.