Tank, A.; **Fox, E. B.**; **Shojaie, A.**

Identifiability and estimation of structural vector autoregressive models for subsampled and mixed-frequency time series. (English) Zbl 1442.62206

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The authors investigate dynamics of p-dimensional multivariate time series $x_t \in \mathbb{R}^p, t = 1, \ldots, T$, assuming that it is described by a combination of instantaneous effects, autoregressive effects and independent noise:

$$x_t = Bx_t + Dx_{t-1} + \varepsilon_t,$$

where $B \in \mathbb{R}^{p\times p}$ is the structural matrix that determines the instantaneous-time linear effects, $D \in \mathbb{R}^{p\times p}$ is an autoregressive matrix that specifies the lag-one effects conditional on the instantaneous effects, and $\varepsilon_t \in \mathbb{R}^p$ is a zero mean white noise process. Solving the equation in terms of x_t gives the following lag-one structural vector autoregressive process for the evolution of x_t:

$$x_t = Ax_{t-1} + C\varepsilon_t.$$

Conditions on C, or equivalently on B, for model identifiability and estimation were explored by *A. C. Harvey* [Forecasting, structural time series models, and the Kalman filter. Paperback ed. Cambridge etc.: Cambridge University Press (1990; Zbl 0725.62083)]. *M. Gong* et al. ["Discovering temporal causal relations from subsampled data", in: Proceedings of the 32nd International Conference on Machine Learning (Lille, France). New York: Association for Computing Machinery. 1898–1906 (2015)] recently explored identifiability and estimation of vector autoregressive models under subsampling with independent innovations. The authors of this article propose an exact expectation-maximization algorithm for inference in both subsampled and mixed-frequency cases. Gong et al. [loc. cit.] also use such an algorithm, but because they formulate inference directly on the subsampled process by marginalizing the missing data, their approach requires an extra approximation. The authors approach instead casts inference as a missing-data problem and use a Kalman filter for computing in both subsampled and mixed frequency cases. They apply the proposed method to evaluate causal relations in a subsampled climate dataset and a mixed frequency econometric dataset. Taken together, they present a unified theoretical analysis and estimation methodology for subsampled and mixed-frequency cases, which were studied separately.

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MSC:

62M10	Time series, auto-correlation, regression, etc. in statistics (GARCH)	Cited in **1** Document
62G08	Nonparametric regression and quantile regression	
62J12	Generalized linear models (logistic models)	
62H12	Estimation in multivariate analysis	
62P12	Applications of statistics to environmental and related topics	
62D10	Missing data	
62M20	Inference from stochastic processes and prediction	

Keywords:

mixed frequency; non-Gaussian error; structural vector autoregressive model; subsampling; time series

Full Text: DOI