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Misspecification of Noncausal Order in Autoregressive Processes

Christian Gourieroux * and Joann Jasiak †

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Abstract

This paper examines noncausal order misspecification in noncausal and mixed processes. We consider the constrained maximum likelihood (ML) estimators of autoregressive parameters obtained when noncausal order s is fixed and potentially different from the true order s_0. The effect of such noncausal order misspecification on the constrained ML estimators of the autoregressive parameters is examined by means of the binding function. We find that, surprisingly, the misspecified estimators are consistent over significant regions of the parameter space. Next, we examine the properties of the unconstrained ML estimator $\hat{s}$ which is obtained when the objective function is maximized with respect to all model parameters, including the noncausal order s. In this context, we prove the consistency of $\hat{s}$ and derive its speed of convergence and asymptotic distribution. However, as the noncausal order is integer-valued, the problem of identifying s concerns rather model selection than standard estimation. We also find that mixed models of different noncausal orders and with the same total autoregressive order are non-nested. This allows us to propose a new approach for robust identification of the noncausal order from a battery of direct and indirect encompassing tests. These tests are based on the difference between the constrained maximum likelihood and indirect inference estimators of the parameters characterizing the mixed causal/noncausal dynamics.

Keywords: Noncausal Process, Misspecification, Binding Function, Nonnested Hypotheses, Indirect Inference, Encompassing.

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