Semiparametric Efficient Estimation in Dynamic Structural Models: A Least Favorable Submodel Approach

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Abstract:

In this paper we are concerned with semiparametric efficient estimation in the context of dynamic structural models relating endogenous variables, exogenous variables, and latent disturbances, through a system of dynamic structural equations. The model is cast in terms of conditional moment restrictions of the same form as in Chamberlain (1987), but without imposing independence. We characterize the efficiency bound in presence of dependent and heterogeneous random variables.

Our approach is to follow Stein's (1956) insight and look for a parametric submodel that is "as difficult" as the semiparametric model defined by the conditional moment restriction. In other words, we construct a fully parametric model that satisfies the conditional moment restriction, contains the data generating process and in which the inverse of the Fisher's information matrix is the largest. Whenever the latter equals the covariance matrix of a feasible semiparametric estimator, it also equals the semiparametric efficiency bound. When no semiparametric estimator is available, then it still remains that the inverse Fisher information matrix provides a lower bound for the semiparametric efficiency.

The main contribution of the paper is to provide a constructive way to compute the semiparametric efficiency bound in models with time series data, which in the words of Ai and Chen (2003), is a nontrivial problem.