Empirical likelihood estimation and tests for spatial autoregressive models

We consider generalized empirical likelihood (GEL) estimation and tests of spatial autoregressive (SAR) models. Our moment conditions at the true parameters are martingale differences; thus they can cover spatial models. The GEL estimator has the same asymptotic distribution as the generalized method of moments (GMM) estimator explored with same moment conditions for estimation, but it circumvents the estimation step of the optimal weighting matrix with a preliminary estimator, and can be robust to unknown heteroskedasticity and non-normality.

We consider also sequential GEL estimation and tests when there is a computationally simple consistent estimator of nuisance parameters or the nuisance parameters can be eliminated with an estimating function of parameters of interest. Typically, when an initial estimate creates generated regressors, it would have asymptotic impact on final estimates. To overcome such an issue, we propose a $C(\alpha)$-type formulation to eliminate the asymptotic impact of generated regressors, so it is suitable to be used in the GEL framework to construct estimation and tests. This two step estimation can save computational burden as the numbers of moments and parameters are reduced. The resulting sequential GEL (SGEL) estimator can be as efficient as the corresponding joint GMM estimator.

We investigate tests for parameter restrictions in both the ordinary and sequential GEL frameworks. We also formulate Moran's I test for spatial dependence, and GEL ratio tests for parameter restrictions and non-nested hypotheses. While some conventional tests might not be robust to non-normality and/or unknown heteroskedasticity, corresponding GEL tests can be so. Tests in the sequential framework can be locally powerful as those with joint moments, when the sequential estimators are efficient.