Tests for Spatial Error Component Regression Model

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1. Introduction

This paper derives several Lagrange Multiplier tests for the panel data regression model wih spatial error correlation. The idea is to allow for both spatial error correlation as well as random region effects in the panel data regression model and to test for their joint significance. Additionally, this paper derives conditional LM tests, which test for random regional effects given the presence of spatial error correlation as well as spatial error correlation given the presence of random regional effects.

2. Model and Hypothesis

Consider the following panel data regression model, see Baltagi(1995),

$$y_{it} = X'_{it}\beta + u_{it},\ i = 1, .., N; t = 1, \cdots, T, \tag{1}$$

In vector form, the disturbance vector of (1) is assumed to have random region effects as well as spatially autocorrelated residual disturbances, see Anselin (1988, 2000):

$$u_t = \mu + \epsilon_t, \quad \text{with} \quad \epsilon_t = \lambda W \epsilon_t + \nu_t, \tag{2}$$

where $\mu' = (\mu_1, \cdots, \mu_N)$ denote the vector of random region effects which are assumed to be $IIN(0, \sigma_\mu^2)$. λ is the scalar spatial autoregressive coefficient with $|\lambda| < 1$. W is a known $N \times N$ spatial weight matrix whose diagonal elements are zero and each row sum is 1.

The hypotheses under consideration in this paper are the following:

(a) $H_0^a : \lambda = \sigma_\mu^2 = 0$, and the alternative H_1^a is that at least one component is not zero.

(b) $H_0^d : \lambda = 0$ (assuming $\sigma_\mu^2 > 0$), and the alternative is $H_1^d : \lambda \neq 0$ (assuming $\sigma_\mu^2 > 0$).

(c) $H_0^e : \sigma_\mu^2 = 0$ (assuming $\lambda \neq 0$), and the alternative is $H_1^e : \sigma_\mu^2 > 0$ (assuming $\lambda \neq 0$).

3. Test Statistics

We derived two-sided and one-sided LM, LR and LM-type tests for the Joint, Conditional and marginal situations.

4. Monte Carlo Results

The matrix W is either a rook or a queen type weight matrix, and the rows of this matrix are standardized so that they sum to one. We fix $\sigma_\mu^2 + \sigma_\nu^2 = 20$ and let $\rho = \sigma_\mu^2/(\sigma_\mu^2 + \sigma_\nu^2)$ vary over the set (0, 0.2, 0.5, 0.8). The spatial autocorrelation factor λ is varied over a positive range from 0 to 0.9 by increments of 0.1. Two values for $N = 25$ and 49, and two values for $T = 3$ and 7 are chosen. In total, this amounts to 320 experiments.

5. Conclusion

It is clear from the extensive Monte Carlo experiments performed that the spatial econometric model should not ignore the heterogeneity across cross-sectional units when testing for the presence of spatial error correlation. Similarly, the panel data model should not ignore the spatial error correlation when testing for the presence of random regional effects.

REFERENCES

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