Assignment 3 – ECON747 Spatial Econometric Models and Methods

(Due on 10:00pm, Monday Week 10, October 21, 2024)

1. Consider the spatial panel data (SPD) model (7.1) studied in Lecture 7, where $\boldsymbol{\mu}_{n0}$ and $\boldsymbol{\alpha}_{T0}$ are considered as fixed effects (FE).

   (i) Verify that the quasi score function $S_N(\theta)$ is given in (7.10) and simplifies to (7.12) at the true θ_0.

   (ii) Verify that the expected negative Hessian (divided by N), $\Sigma_N(\theta_0)$, takes the form given in (7.11).

   (iii) Verify that the VC matrix of the quasi score at θ_0 (divided by N), $\Gamma_N(\theta_0)$, takes the form given in (7.14).

2. Consider testing the spatial effects in the FE-SPD model given in (7.1), Lecture 7. Suppose we are interested in the following three hypotheses:

$$H_0^{\mathtt{SL}} : \lambda = 0 | \rho = 0; \;\; H_0^{\mathtt{SE}} : \rho = 0 | \lambda = 0; \;\; H_0^{\mathtt{SLE}} : \lambda = \rho = 0.$$

   (i) Verify and report the standardized LM test, $\mathtt{SLM}^{\circ}_{\mathtt{SE}}$, given in Baltagi and Yang (2013a) for testing $H_0^{\mathtt{SE}} : \rho = 0 | \lambda = 0$. This test is a standardized version of the LM test given in (7.16).

   (ii) Following the ideas leading to $\mathtt{SLM}^{\circ}_{\mathtt{SE}}$ in (i), derive a standardized version of the LM test given in (7.15), $\mathtt{SLM}^{\circ}_{\mathtt{SL}}$, for testing $H_0^{\mathtt{SL}} : \lambda = 0 | \rho = 0$.

   (iii) Combine the ideas in (i) and (ii) to give a standardized version of the LM test given in (7.17), $\mathtt{SLM}^{\circ}_{\mathtt{SLE}}$, for testing $H_0^{\mathtt{SLE}} : \lambda = \rho = 0$.

3. Consider the **Cigarette Demand** data introduced in Lecture 1 (p.37), with the original data in `cigar.xlsx`, variables being described in `cigar_readme.txt`, and the spatial weights in `weight_cigarette.xls`, all available on course website. Matlab codes analyzing the Munnell data are in the zip-folder `FE_SPD_App.zip`, Computing Lab 5.

   Using both Matlab and Python,

   (i) estimate the FE-SPD model (7.1) by the QML method based on the full data. Report the results (point estimates, standard errors (non-robust and robust), and t-ratios), and interpret.

   (ii) estimate the FE-SPD model (7.1) by the QML method based on the data covering the years 1972-1992. Report the results (point estimates, standard errors (non-robust and robust), and t-ratios), and interpret.

   (iii) compute the three LM tests given in (7.15), (7.16), and (7.17) in Lecture 7 (updated version).

   (iii) compute the three SLM tests developed in Question 2.