

Assignment 2 – ECON747 Spatial Econometric Models and Methods

((Due on 5:00pm, Saturday Week 6, September 28, 2024))

1. For the SLR model with both spatial lag (SL) and spatial error (SE) dependence, or simply the SLE model, treated in Section 3.4, Lecture 3, for hypothesis testing:

$$Y_n = \lambda W_{1n} Y_n + X_n \beta + u_n, \quad u_n = \rho W_{2n} u_n + \epsilon_n, \quad (1)$$

we are interested in three hypotheses concerning the spatial effects in the SLE model:

- (a) H_0^{SLE} : $\delta_0 = 0$ in the SLE model,
 - (b) $H_0^{\text{SL|SE}}$: $\lambda_0 = 0$ in the SLE model, and
 - (c) $H_0^{\text{SE|SL}}$: $\rho_0 = 0$ in the SLE model, where $\delta_0 = (\lambda_0, \rho_0)'$.
- (i) Following the instructions given in Slide 53, Lecture 3, and the ideas behind (3.34) and (3.35), develop fully the two variants of the standardized LM tests: $\text{SLM}_{\text{SLE}}^{\circ}$ and $\text{SLM}_{\text{SLE}}^{\text{MD}}$, for testing the joint hypothesis H_0^{SLE} : $\delta_0 = 0$.
 - (ii) Following the instructions given in Slide 54, Lecture 3, develop the two standardized LM tests, $\text{SLM}_{\text{SL|SE}}^{\circ}$ and $\text{SLM}_{\text{SE|SL}}^{\circ}$, for testing $H_0^{\text{SL|SE}}$: $\lambda_0 = 0$ and $H_0^{\text{SE|SL}}$: $\rho_0 = 0$, respectively.
 - (iii) Develop the MD variants of the two tests in (ii) above, $\text{SLM}_{\text{SL|SE}}^{\text{MD}}$ and $\text{SLM}_{\text{SE|SL}}^{\text{MD}}$.
2. Consider fitting an SLE model to the **Boston House Price** data, introduced in Lectures 1 and 2, using all the covariates listed. Refer to Section 3.4, Lecture 3. Use both Matlab and Python to carry out the following analyses:
 - (i) Based on (3.54) and the description below it, carry out the three LR tests, $\text{LR}_{\text{SL|SE}}$, $\text{LR}_{\text{SE|SL}}$ and LR_{SLE} , for testing the three hypotheses in Problem 1. Comment.
 - (ii) Based on (3.59) and the description below it, carry out the three Wald tests, $\text{T}_{\text{SL|SE}}$, $\text{T}_{\text{SE|SL}}$, and T_{SLE} , for testing the three hypotheses in Problem 1. Comment.
 - (iii) Based on (3.66) and the descriptions below it, carry out the three LM tests $\text{LM}_{\text{SLE}}^{\text{FI}}$, $\text{LM}_{\text{SL|SE}}^{\text{FI}}$ and $\text{LM}_{\text{SE|SL}}^{\text{FI}}$, for testing the three hypotheses in Problem 1. Comment.
 - (iv) Implement the six standardized LM tests developed in Problem 1, $\text{SLM}_{\text{SLE}}^{\circ}$ and $\text{SLM}_{\text{SLE}}^{\text{MD}}$, $\text{SLM}_{\text{SL|SE}}^{\circ}$ and $\text{SLM}_{\text{SL|SE}}^{\text{MD}}$, and $\text{SLM}_{\text{SE|SL}}^{\circ}$ and $\text{SLM}_{\text{SE|SL}}^{\text{MD}}$. Comment.
 - (v) Based on the tests performed, which SLR model is most suitable for the data?