Assignment 1 – ECON747 Spatial Econometric Models and Methods

(Due on 5:00pm, Saturday Week 3, September 7, 2024)

1. Consider the spatial linear regression (SLR) model with spatial lag and error (SLE) dependence: $Y_n = \lambda W_{1n} Y_n + X_n \beta + u_n, \quad u_n = \rho W_{2n} u_n + \epsilon_n$ (Sec. 2.4, Lecture 2).
   (a) Give **detailed derivations** of the quasi Gaussian loglikelihood $\ell_n(\theta)$ in (2.26).
   (b) Give **detailed derivations** of the quasi score function $S_n(\theta)$ in (2.27).
   (c) Give **detailed derivations** of the concentrated quasi score $S_n^c(\delta)$ in (2.31).
   (d) Give **detailed derivations** of the Hessian matrix $\mathcal{J}_n(\theta)$ in (2.33).
   (e) Give **detailed derivations** of the information marix $\mathcal{I}_n(\theta)$ in (2.34).
2. Consider the GMM estimation of SLR model with SLE (Sec. 2.4.2, Lecture 2).
   (a) Verify the expression for Σ_n given in (2.35).
   (b) Verify that Γ_n has an identical expression as that given in (2.24) for the SLR model with only spatial lag dependence.
3. Consider the **Boston House Price** data considered in Sec. 2.4.4.
   (a) Extend the Matlab code provided for the QML estimation of SLR model with SLE, and fit an SLR model with SLE and spatial Durbin (SD) effects using covariates 'crime' and 'access'.
   (b) Extend the Matlab code in part (a) to implement the OGMM procedure outlined in Slide 41, Lecture 2 on the data.
   (c) Compare the QML and OGMM procedures in terms of point estimates and the standard error estimates of an SLE model on Boston House Price data.
4. Repeat Question 3, but using Python program language.