

Assignment 2 Simultaneous Equation Models

From the data set assign2.dta:

Demand and Supply Equations

$$\ln S_t = \beta_{10} + \beta_{11} \ln P_{Dt} + \beta_{12} \ln P_{X2t} + \beta_{13} \ln P_{X3t} + \beta_{14} \ln P_{X4t} + \varepsilon_{1t} \quad (1)$$

$$\ln D_t = \beta_{20} + \beta_{21} \ln P_{Dt} + \beta_{22} \ln GDP_t + \varepsilon_{2t} \quad (2)$$

Equilibrium condition can be achieved by $D_t = S_t$ through the price P_{Dt} mechanism.

where: S_t = Domestic Supply at time t

D_t = Domestic Demand at time t

P_{Dt} = Domestic Price at time $t = P_{Mt} + T_t$

T_t = Tariff at time t

P_{X2t} = Price of Input 2 at time t

P_{X3t} = Price of Input 3 at time t

P_{X4t} = Price of Input 4 at time t

GDP_t = Gross Domestic Product (Representing Income) at time t

Endogenous variables in this system include S_t , D_t , and P_{Dt}

Exogenous variables in this system include P_{X2t} , P_{X3t} , P_{X4t} , and GDP_t

- State reduce form models of this system. Estimate reduce form models using OLS and prediction of the endogenous variables.
- Estimate structural form using predicted endogenous variables as independent variables in the structural form models.
- Estimate this system equations model using OLS, 2SLS, 3SLS, and I3SLS. Determine whether there exists endogeneity bias in the estimated results. Concerning on the asymptotic property, which model is the most appropriated model? Why? What do β_{21} and β_{22} mean?

Additional Issue:

If equilibrium doesn't hold $D_t \neq S_t$, when $D_t > S_t$; then $Q_t = S_t$ but when $D_t < S_t$; then $Q_t = D_t$, where Q_t is transaction quantity at time t .

$$\ln Q_t = \beta_{10} + \beta_{11} \ln P_{Dt} + \beta_{12} \ln P_{X2t} + \beta_{13} \ln P_{X3t} + \beta_{14} \ln P_{X4t} + \varepsilon_{1t} \quad (3)$$

$$\ln Q_t = \beta_{20} + \beta_{21} \ln P_{Dt} + \beta_{22} \ln GDP_t + \varepsilon_{2t} \quad (4)$$

- Generate $\ln Q_t$ and estimate the above system equations (model (3) and model (4)) using OLS, 2SLS, and 3SLS using Q_t , and P_{Dt} as endogenous variables and P_{X2t} , P_{X3t} , P_{X4t} , and GDP_t as exogenous variables.
- What are the problems, in term of economic concept and econometric technique, of the estimated results in d?

- All estimated models are in log file (hw2 426 and 426 2.2)

$$\ln S_t = \beta_{10} + \beta_{11} \ln P_{Dt} + \beta_{12} \ln P_{X2t} + \beta_{13} \ln P_{X3t} + \beta_{14} \ln P_{X4t} + \varepsilon_{1t}$$

$$\ln D_t = \beta_{20} + \beta_{21} \ln P_{Dt} + \beta_{22} \ln GDP_t + \varepsilon_{2t}$$

- a. State reduced form models of this system. Estimate reduced form models using OLS and prediction of the endogenous variables.

$$\begin{aligned} \ln S_t &= \pi_{10} + \pi_{11} \ln GDP_t + \pi_{12} \ln P_{X2t} + \pi_{13} \ln P_{X3t} + \pi_{14} \ln P_{X4t} + w_{1t} \\ \ln D_t &= \pi_{20} + \pi_{21} \ln GDP_t + \pi_{22} \ln P_{X2t} + \pi_{23} \ln P_{X3t} + \pi_{24} \ln P_{X4t} + w_{2t} \end{aligned}$$

- c. Estimate this system equations model using OLS, 2SLS, 3SLS, and I3SLS. Determine whether there exists endogeneity bias in the estimated results. Concerning on the asymptotic property, which model is the most appropriated model? Why? What do β_{21} and β_{22} mean?

H_0 : No Endogeneity

H_1 : Endogeneity

Supply Model

p-value = 0.3659

$\therefore$ Accept H_0

Therefore, there is no endogeneity problem

Demand Model

p-value = 0.3667

$\therefore$ Accept H_0

Therefore, there is no endogeneity problem

• If the asymptotic property is concerned, 3SLS might be the most appropriated. The reason is because 3SLS provides more asymptotically efficient estimators than the others. However, 3SLS might not be a good choice if the specification occurs and spread through all the system.

• β_{21} is the coefficient of $\ln P_{Dt}$. It means that if domestic price increase by 1%, domestic demand will decrease by β_{21} %, holding other factors constant

• β_{22} is the coefficient of $\ln GDP$. It means that if GDP increases by 1%, domestic demand will increase by β_{22} %, holding other factors constant

- e. What are the problems, in term of economic concept and econometric technique, of the estimated results in d?

→ Quantity demand by consumer is not affected by the price of input. So, it does not make sense to use demand as supply.

As a result, this may cause specification error.