Econ 3385: Measuring Market Power

Problem Set 3

In this problem set, we'll generate simulated quantity and price data for a two-good market.

Questions

1. Consider the following two-good demand and supply system:

$$Q_m^{D1} = \beta_{10} + \beta_{11} P_m^1 + \beta_{12} P_m^2 + \varepsilon_m^{D1}$$
$$Q_m^{D2} = \beta_{20} + \beta_{21} P_m^2 + \beta_{22} P_m^1 + \varepsilon_m^{D2}$$
$$Q_m^{S1} = \gamma_{10} + \gamma_{11} P_m^1 + \gamma_{12} Z_m^A + \gamma_{13} Z_m^B + \varepsilon_m^{S1}$$
$$Q_m^{S2} = \gamma_{20} + \gamma_{21} P_m^2 + \gamma_{22} Z_m^A + \gamma_{23} Z_m^B + \varepsilon_m^{S2}$$

   - m indexes market. Each market clears so prices P_m^1 and P_m^2 are determined by $Q_m^{D1} = Q_m^{S1}$ and $Q_m^{D2} = Q_m^{S2}$.
   - Solve for P_m^1 as a function of ε_m^{D1}, ε_m^{D2},ε_m^{S1},ε_m^{S2},Z_m^1, and Z_m^2. This is simply a case of doing some tedious algebra.
   - Interpret this equation. What are the roles of Z_m^1 and Z_m^2?
   - Notice there is an analogous expression for P_m^2 (just switch the 1 indices to 2 on the coefficients and ε terms and vice versa),

2. Now take a look at sim_market.csv. This file contains the following simulated data:

   - market_id: index corresponding to m
   - `eps_d_1` $= \varepsilon_m^{D1}$
   - `eps_d_2` $= \varepsilon_m^{D2}$
   - `eps_s_1` $= \varepsilon_m^{S1}$
   - `eps_s_2` $= \varepsilon_m^{S2}$
   - `z_a` $= Z_m^A$
   - `z_b` $= Z_m^B$
   - Using the expressions derived in (1), generate two variables recording the equilibrium prices and quantities for goods 1 and 2 in each market. Assume that the market parameters are:

Demand 1		Demand 2		Supply 1		Supply 2	
β_{10}	10	β_{20}	15	γ_{10}	0	γ_{20}	0
β_{11}	-1	β_{21}	-1	γ_{11}	1.5	γ_{21}	1.5
β_{12}	0.5	β_{22}	0.5	γ_{12}	-0.5	γ_{22}	-1
				γ_{13}	-1	γ_{23}	-0.5

3. Now we have a data set with prices, quantities, and supply shifter, so we should be able to estimate the demand parameters using 2SLS.

   - Perform two first stage OLS regressions of the endogenous prices on the instruments. Report the coefficients and standard errors in a table. Do the estimates make sense?
   - Now generate the predicted values of the two prices using that estimated first stage regressions.

- Finally, perform the second stage OLS regressions to estimate the two demand equations using the predicted prices. Report the estimated coefficients and standard errors in a table. Do we recover the true parameters? Do the true parameters fall within 95% confidence intervals of the estimates ($\hat{\beta} \pm 1.96 \times SE(\hat{\beta})$)?

4. Suppose we add a third product to the market. Write down demand equations for a three product demand system.

5. Assume the supply equation for product 3 is:

$$Q_m^{S3} = \gamma_{30} + \gamma_{31} P_m^3 + \gamma_{32} Z_m^A + \gamma_{33} Z_m^B + \varepsilon_m^{S3}$$

- Can we obtain consistent estimates of the demand coefficients β in this system? Explain. HINT: We would need to run three first stage regressions and get 3 predicted prices.