Ec141, Spring 2020

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Problem Set 3

Due: March 20th, 2020

Problem sets are due at 5PM in the GSIs mailbox. You may work in groups, but each student should turn in their own write-up (including a narrated/commented and executed Jupyter Notebook). Please use markdown boxes within your Jupyter notebook for narrative answers to the questions below.

1 Supply and Demand

Consider the following model of supply and demand:

$$\begin{aligned} \ln Q_i^D(p) &= \alpha_1 + \alpha_2 \ln(p) + U_i^D \\ \ln Q_i^S(p) &= \beta_1 + \beta_2 \ln(p) + U_i^S, \end{aligned}$$

with i indexing a generic random draw from a population of 'markets' ; U_i^D and U_i^S are market-specific demand and supply shocks. We assume that $\left(U_i^S, U_i^D\right) \overset{i.i.d}{\sim} F$ for $i = 1, 2, \ldots, N$. In each market the observed price and quantity pair (P_i, Q_i) coincides with the solution to market clearing condition

$$Q_i^D(P_i) = Q_i^S(P_i) = Q_i.$$

[a] Provide an economic interpretation of the parameters α_2 and β_2. What signs do you expect them to take? Why?

[b] Depict the market equilibrium graphically. Solve for the equilibrium values of $\ln Q_i$ and $\ln P_i$ algebraically. How is the market price and quantity related to the demand and supply shocks, U_i^D and U_i^S? Provide some economic content for your answer. Can you use a figure to illustrate it?

[c] Calculate $\mathbb{E}^*[\ln Q|\ln P]$. You may assume that $\mathbb{C}\left(U^D, U^S\right) = 0$. Evaluate the coefficient on $\ln(P)$, does it coincide with an economically interpretable parameter? Assume that $\mathbb{V}\left(U_i^S\right) / \left(\mathbb{V}\left(U_i^S\right) + \mathbb{V}\left(U_i^D\right)\right) \approx 1$, does your answer change? Why?

[d] Assume that $\alpha_1 = \beta_1 = \alpha_2 = \beta_2 = 1$ and that $U_i^D \sim \mathcal{N}\left(0, \sigma_D^2\right)$ and $U_i^S \sim \mathcal{N}\left(0, \sigma_S^2\right)$. For each of the following configurations of σ_D^2 and σ_S^2 simulate $N = 100$ equilibrium log price and log quantity pairs $\{(\ln P_i, \ln Q_i)\}_{i=1}^2$. Plot these simulated points with $\ln Q_i$ on the horizontal axis and $\ln P_i$ on the vertical one. Also plot on each figure the true log demand and supply schedules. Finally comment on the patterns you observe in each figure.

[i] $\sigma_D = 3/\sqrt{10}$ and $\sigma_S = 1/\sqrt{10}$. What would you recover from the least squares fit of log price on log quantity in this case?

[ii] $\sigma_D = 1/\sqrt{10}$ and $\sigma_S = 3/\sqrt{10}$. What would you recover from the least squares fit of log price on log quantity in this case?

[iii] $\sigma_D = 1/\sqrt{2}$ and $\sigma_S = 1/\sqrt{2}$. What would you recover from the least squares fit of log price on log quantity in this case?

2 Demand for fish

The dataset `fish.csv` includes the daily amount of Whiting (an inexpensive fish that is oily with no close substitutes) sold by a Fulton Fish Market dealer over the course of $i = 1, \ldots, 119$ days in 1992. The dataset includes (the log of) the daily total quantity sold, `q`, and (the log of) the average quantity-weighted daily price, `p`. Also included are four day of week dummy variables, and four weather indicators: `stormy` and `mixed` indicate varying degrees of bad weather at sea (high waves and wind), `cold` and `rainy` are indicators for "bad" weather on shore. The former set of dummies arguably shift the supply curve for Whiting, while the latter may shift the demand schedule. For more information about these data see Graddy (1995) and Angrist et al. (2000).

[a] Calculate the least squares fit of `q` onto a constant and `p`. Does the slope coefficient on `p` consistently estimate the demand elasticity? Why or why not? Do you expect the absolute value of the OLS estimate to be too low or too high? Why?

[b] Compute the linear instrumental variables fit of `q` onto a constant, `p`, `cold, rainy` and the day of week dummy variables using `storm` and `mixed` as excluded instruments for `p`. Under what assumptions is the coefficient on p a consistent estimate of the demand elasticity? Are these assumptions reasonable? If you can test any of these assumptions do so.

[c] Compute the least squares fit of `p` onto a constant, `cold, rainy, storm, mixed` and the day of week dummy variables. Also Compute the least squares fit of `q` onto a constant, `cold, rainy, storm` and `mixed` and the day of week dummy variables. Can you construct an estimate of the demand elasticity from these "reduced form" regression fits?

[d] Compute the linear instrumental variables fit of `q` onto a constant, `p`, `storm` and `mixed` using `cold`, `rainy` and the day of week dummies as excluded instruments for `p`. Under what assumptions is the coefficient on p a consistent estimate of the supply elasticity? Are these assumptions reasonable? If you can test any of these assumptions do so.

[e] New York City plans to introduce a small seller tax on Fulton Fish Market Sales. Using your answers from parts [b] and [d] predict the effect of this tax on Whiting prices. Is pass through of the tax to consumers complete or partial?

References

Angrist, J. D., Graddy, K., and Imbens, G. W. (2000). The interpretation of instrumental variables estimators in simultaneous equations models with an application to the demand for fish. *Review of Economic Studies*, 67(3):499 – 527.

Graddy, K. (1995). Testing for imperfect competition at the fulton fish market. *Rand Journal of Economics,*, 26(1):75 – 92.