First Problem Set

October 22, 2024

Instructions

- Due to 12th of November.
- Print outs:
  - Results for both questions plus computer codes used to estimate the results.

Data and Model

- Panel: 50 products in 20 geographic markets.
- For each product we have:
  - Market share (for each market).
  - 4 characteristics (X1-X4) and prices.
  - 6 instrumental variables (IV1-IV6).
- Consumer utility is:

$$U_{ijm} = -\alpha p_{jm} + \sum_{k=1}^{3} \beta_k x_{jmk} + \beta_{4i} x_{jm4} + \xi_j + \xi_{jm} + \varepsilon_{ijm},$$

  - where, i denotes individuals, j choices and m markets, $\beta_{4i} = \beta_4 + \sigma_1 v_i$ and $v_i \overset{iid}{\sim} N(0,1)$, ξ_j is a product fixed-effect, ξ_{jm} denotes characteristics of product j at market m that is observed by consumers and firms (but not by the econometrician) and ε_{ijm} is iid EV across (i,j,m).
- Assume that there is an outside good such that $U_{im0} = \varepsilon_{im0}$ for each m.

Problem 1: Multinomial Logit.

Assume that $\sigma_1 = 0$ and $\varepsilon_{ijm} \overset{iid}{\sim} EV(\mu, \theta)$ where $\mu > 0$ is the scale parameter and θ is the location parameter of the distribution, i.e. $F_\varepsilon(x) = exp\{-exp[-\mu(x-\theta)]\}$.

1. Derive the share of each choice in each market.
2. Is μ identified? Why? And θ?
3. Suppose that $\mu = 1$, $\theta = 0$. Suppose that you want to estimate the model using OLS.

(a) Derive the equation you will use to estimate the model.

(b) Under what conditions the OLS estimator is consistent?

4. Assume that $\xi_j = 0$. Estimate the parameters of the model by OLS and IV. Compare the estimates of α. Does the OLS bias have the expected sign? Explain.

5. Based on the IV parameters estimated above compute own- and cross-price elasticities for each good in market one. Discuss the results.

Problem 2: Random Coefficients Logit.

Assume that $\sigma_1 \neq 0$ and $\varepsilon_{ijm} \overset{iid}{\sim} EV(1,0)$. Assume that prices are correlated with ξ_{jm}.

1. Derive the choice probabilities.

2. Assume for simplicity that $\xi_j = 0$. Estimate the parameters of the model (including σ_1 and a constant) using a consistent estimator.

3. Compute own- and cross-price elasticities for each good in market one. Compare with the elasticities obtained in 1.5.