Problem Set 1
ECON-GA 1802 Spring 2023

Due Monday, February 27

1 Estimating Entry Costs

We are going to simulate and estimate a two-period entry model where firms decide whether to enter in the first period and firms that enter realize profits in the second period.

1.1 Model

First Period

- m denotes a market, f a firm. The number of potential entrants in market m is $\mathcal{F}_m$
- The fixed cost of entry of firm f to market m, ϕ_{fm}, is given by

$$\phi_{fm} = Z_{fm}\alpha + u_{fm}\,, \tag{1}$$

  where $u_{fm} \sim N(\mu, \sigma^2)$ and Z_{fm} are observed firm-market characteristics.
- Firms observe all the variables in the model
- Firms enter the market sequentially: the firm with the lowest realized fixed cost enters the market first, if it wants to. Then, the firm with the second-lowest realized fixed cost enters, if it wants to. And so on.
- The payoff from staying out is normalized to zero

Second Period

- Firms realize their profit (including fixed costs),

$$\pi_{fm} = \beta X_m - \delta \log N_m - \phi_{fm}\,, \tag{2}$$

  where N_m denotes the number of firms that enter market m. The firm's profit when staying out is normalized to zero.

1.2 Exercise

The distributions of observable characteristics are

- $X_m \sim N(3, 1)$
- $Z_{fm} \sim N(0, 1)$
- $\mathcal{F}_m$ takes values 2,3,4 with equal (1/3) probability

Let the true parameter values be

- $(\alpha, \beta, \delta) = (1, 1, 1)$
- $(\mu, \sigma^2) = (2, 1)$

All observables and unobservables are drawn *iid* across markets and firms.

1. Simulate a dataset of $M = 250$ markets. Describe your dataset.

   Now your goal is to estimate the model parameters (δ, μ, σ^2) based on the market observables from the simulated dataset. Throughout, you may assume that (α, β) are known. You observe the characteristics of all potential entrants $(X_m, \{Z_{fm}\}_{f \in \mathcal{F}_m})_{m=1,\ldots,M}$ in each market, as well as their entry decisions. For questions 2-4, report point estimates and valid confidence intervals. For question 5, report confidence sets that contain the true parameter with a guaranteed minimum probability.

2. Construct a maximum likelihood estimator for (δ, μ, σ^2), and estimate these parameters using the simulated data. Do you need to make any equilibrium selection assumptions? [Hint: a version of this specification is estimated in Berry '92]

3. Construct a method of simulated moments estimator for (δ, μ, σ^2) and estimate these parameters using information about both the number and the identities of the entrants (and potential entrants) in a market. Do this under two equilibrium selection assumptions:

   (a) The correctly specified model

   (b) A misspecified model where the researcher assumes that firms enter sequentially in *reverse order* of profitability: the firm with the highest realized fixed cost enters first if it wants to; then the firm with the second greatest realized fixed cost enters if it wants to; and so on.

   Discuss how your estimates differ under the two assumptions. Explain any other decisions you made in implementing your MSM estimator, including your choice of moments.

4. Construct an MSM estimator for (δ, μ, σ^2) and estimate these parameters using only information about the number of entrants. How do your estimates compare to those from 3(a) and 3(b)?

5. Construct a moment inequality estimator for (δ, μ, σ^2) that does not assume an order of entry, and estimate these parameters. How do your estimates compare to those from questions 2-4? Discuss the advantages and disadvantages of the four estimators you have implemented.