Thursday, June 18, 2009

UCLA

Department of Economics

Ph. D. Preliminary Exam

Industrial Organization Field Exam
(Spring 2009)

Instructions:

- You have 4 hours for the exam.
- Answer any 5 out the 6 questions. All questions are weighted equally. Answering fewer than 5 questions is not advisable, so do not spend too much time on any question. DO NOT answer all questions.
- Use SEPARATE booklets to answer each question.
- Calculators and other electronic devices are not allowed.

1. Monopoly and Product Quality

Consumers vary in their willingness to pay for higher quality. A type t consumer is willing to pay $B_t(q)$ for a unit of quality level q, where $B_t(\cdot)$ is an increasing concave function bounded from above. For a higher type the marginal willingness to pay $B_t'(q)$ is higher. Each consumer either purchases one unit or nothing at all.

The fraction of the population of type t is f_t, $t = 1,...,T$. The cost of producing a unit of quality q is cq. Any offer made to one customer must be made to all customers.

Let $r = R(q)$ be the indifference curve for type s through (q',r') and (q'',r'') where $q'' > q'$.

(a) With the help of a graph, explain why any type $t > s$ strictly prefers (q'',r'') and any type $t < s$ strictly prefers (q',r').

(b) Explain why the slope of $R(q)$ satisfies $R'(q) = B_t'(q)$. Hence or otherwise prove that the statement in part (a) is true.

(c) Explain briefly why, for the plans for the T types $\{(q_t, r_t)\}_{t=1}^{T}$ to be incentive compatible, $\{q_t\}_{t=1}^{T}$ must be increasing.

(d) Consider any set of plans $\{(q_t, r_t)\}_{t=1}^{T}$. Suppose that (i) $\{q_t\}_{t=1}^{T}$ is increasing and (ii) the "local downward constraints" are binding. Show that this mechanism is incentive compatible.

(e) Solve for the profit maximizing quality choices if $(f_1, f_2, f_3) = (\frac{1}{2}, 0, \frac{1}{2})$, $u_t(q,r) = \theta_t q - \frac{1}{2}q^2 - r$, where $(\theta_1, \theta_2, \theta_3) = (10, 20, 30)$ and $c = 2$.

(e) Suppose instead that $(f_1, f_2, f_3) = (\frac{5}{8}, \frac{1}{8}, \frac{2}{8})$. Show that profit is maximized by offering 2 quality levels. What is the intuition?

2. There is unit mass of customers that buy the product of any one firm. Incumbent firms can have either one or two customers. To enter the industry, a firm pays a cost F to steal a customer from an incumbent firm. Let ε denote the flow of entrants. At an exogenous arrival rate λ an incumbent firm with one customer steals the customer of another firm, obtaining an additional flow profit π from this second customer.

   (a) Derive the equilibrium conditions and prove there is a unique equilibrium.

   (b) Show that $v_2 - v_1 > v_1$ if and only if $\lambda > 0$ and give an intuitive explanation for this result.

   Suppose now that Incumbent firms can invest c per customer to prevent losing this customer: a firm with two customers must invest $2c$ and a firm with one customer only c. If a fraction α of customers are protected by their respective firms and ρ is the flow of customer stealing, then the hazard rate for losing an unprotected customer is $\rho / (1 - \alpha)$.

   (c) Consider an equilibrium where all firms with one customer invest in protection while the firms with two customers do not. Derive the equilibrium conditions.

   (d) Consider an equilibrium where there is no entry, all firms with one customer invest in protection while only a fraction of those with two customers do so. Derive the equilibrium conditions.

3. Suppose in a market there is a total mass of firms equal to $m \leq 1$. A fraction l produce one unit of a low quality good and $1 - l$ a unit of the high quality good. There is a unit mass of consumers indexed by $x \in [0, 1]$ with utilities xL and xH for the low and high quality goods, respectively, where $L < H$. Suppose consumers buy at most one unit, either of low or high quality. There is no cost of entry, but to enter an entrant must purchase a right of entry from an incumbent firm that after selling this right must exit the industry. The price of this right is determined competitively so that the expected value of an entrant is zero. After paying this cost of entry, the quality of the entrant is revealed and the probabilities of low or high quality are λ and $1 - \lambda$, respectively.

   (a) Prove that in the long run, the fraction of low quality firms $l \to 0$.

(b) Suppose that aside from paying for the entry rights, there is a cost of entry $c_e > 0$. Give conditions so that in the long run $\lambda > l > 0$. Define the value functions of the firms and the conditions determining the equilibrium fraction l.

(c) Consider again the case where there is no cost of entry and suppose that $m = 1$. Let $H - L = 1$ and suppose initially the fraction of low quality firms is l_0. Characterize the equilibrium path for the price of the entry rights.

(d) Suppose $c_e > 0$ and conditions are such that in the long run $\lambda > l > 0$ and $l_0 > l$. Characterize the best that you can the equilibrium path.

4) Consider the following production function

$$y_{it} = \beta_0 + \beta_1 k_{it} + \beta_2 l_{it} + \alpha_i + \omega_{it} + \varepsilon_{it}$$

Suppose the unobservables have the following properties:

- α_i is constant over time and known by the firm at all t.

- ω_{it} follows an AR(1) process, i.e. $\omega_{it} = \rho\, \omega_{it-1} + \eta_{it}$ where ω_{i0} is known at time 0 and η_{it} is not observed by the firm until time $t+1$.

- ε_{it} is iid over time and observed by the firm at time t.

Suppose that l_{it} is decided by the firm at time t, and k_{it} is decided by the firm at time $t-1$.

a) Construct a moment condition that can be used to consistently estimate this model.

b) Alternatively, suppose that η_{it} is learned by the firm at time t. Construct a new moment condition that can be used to estimate the model.

c) Which of the above estimators do you expect to have lower variance? Why?

5) True, False, or Uncertain – You must explain your answer.

a) The random coefficient model is a generalization of the nested logit model.

b) The Hotz-Miller methodology breaks the curse of dimensionality in the dimension of the state space.

c) Unlike Maximum Likelihood, the BLP GMM estimator is consistent for a fixed number of simulation draws.

6) Consider the following dynamic entry game:

- There are 4 firms i who are potentially operating in the market.

- There are 2 possible locations j in the market for these firms to situate their retail stores. A firm can have two retail stores – one in each location, but they can have at most one retail store in each location.

- The cost of firm i setting up a retail store in location j at time t is $\delta_{ijt} + \gamma_{jt}$, where δ_{ijt} is iid over time and private information to firm i, and γ_{jt} is iid over time and locations and is common information to all firms.

- The cost of withdrawing a retail store from a location is λ – this is fixed across time and common across firms and locations.

- Entry and exit occur immediately (e.g. if firm i decides to exit retail location j, they immediately leave the location and do not operate in the location in that period) .

- The variable profits firm i earns operating a retail store in location j is given by:

$$\Pi\left(Q_{jt}\right)+\eta_{jt}$$

where Q_{jt} is the total number of retail stores in the location at t, and η_{jt} is a location specific, iid shock to profits that is observed by all firms at t.

- This is an infinite horizon game with discount factor β.

a) Set up the Bellman equation for this problem. Be sure to describe exactly what variables are in the state space, and exactly what densities all expectations are over.

b) Suppose that γ_{jt} is correlated across time t according to a first order markov process. How does your answer to question a) change? Would this change affect the feasibility of estimating the model using the BBL methodology (assume that γ_{jt} is not observed by the econometrician)? Why exactly?

c) Redo part b) supposing that γ_{jt} is correlated across locations j (rather than across time t)