UCLA Department of Economics
Comprehensive Examination
in
Industrial Organization

Fall 2008

Instructions:

- Answer five (5) questions only. All questions are weighted equally.
- Use a separate blue book for each question.
- You have four hours to complete the exam.
- Calculators and other electronic devices are not allowed.

1. Selling a single item

A single item is to be sold. Each buyer's valuation is an independent draw from a continuous distribution with support $[0,1]$ and c.d.f $F(v)$.

(a) The seller designs a mechanism that always allocates the item to the bidder with the highest value as long as this value exceeds r. If there are n bidders, explain why the equilibrium marginal informational rent for those with values exceeding r is

$$U'(v) = F^{n-1}(v).$$

Henceforth consider only sealed high-bid auctions with 2 bidders.

(b) If the seller sets a reserve price $r \in (0,1)$ characterize the equilibrium bid function for each type $v \in [0,1]$.

(c) Suppose instead that the seller announces that each bidder must pay an entry fee if he wishes to submit a bid. To have only those with valuations above r bidding, what must this entry fee be?

(d) Will the equilibrium payoff of each type $U(v)$ be the same in the auctions of part (b) and part (c)? HINT: You may wish to appeal to part (a)

(e) Will expected seller revenue be the same? Explain.

2) Consider the following Cobb-Douglas production function in logs

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

where y_{it}, k_{it}, and l_{it} are logs of output and the respective inputs, and ω_{it} and ϵ_{it} are two econometric unobservables. As in class, suppose that ω_{it} is potentially observed by firms when making their input choices, while ϵ_{it} is just measurement error that is uncorrelated with input choices. Suppose that in addition to observing y_{it}, k_{it}, and l_{it} , the econometrician also observes i_{it}, the investment decision of firm i in period t.

a) Describe the problem with estimating the above production function with OLS. Which way would you expect the coefficient estimates to be biased?

b) Write down the key assumptions of the Olley-Pakes (1996) methodology for estimating the above production function.

c) Describe the "first stage" of the Olley-Pakes estimation procedure.

d) Describe the "second stage" of the Olley-Pakes procedure.

3)

a) Describe the Berry/BLP "inversion" in the context of 1) the logit model, 2) the nested logit model, and 3) a random coefficients model.

b) Why is this invertibility property important for estimation? In other words, what aspects of estimation would have to change if these models were not invertible? Would you need to make additional assumptions - if so, what are they?

4) Consider the Rust model of capital replacement, as studied in class. In each period t the firm decides whether to replace their capital stock ($i_t = 1$) or not replace their capital stock ($i_t = 0$). Single period profits are given by

$$\pi(x_t, i_t, \epsilon_t; \theta) = \begin{cases} \pi(x_t, 0; \theta) + \epsilon_{0t} & \text{if } i_t = 0 \\ \pi(x_t, 1; \theta) + \epsilon_{1t} & \text{if } i_t = 1 \end{cases}$$

where x_t is a state variable that is serially correlated (in a first order Markov sense) over time and whose evolution depends on i_t. $\epsilon_t = (\epsilon_{0t}, \epsilon_{1t})$ are state variables that may or may not be serially correlated over time. β is the discount factor.

a) Write down the Bellman equation characterizing optimal investment choice.

b) Consider two possible assumptions on ϵ_t:

i) ϵ_t are independent across time

ii) ϵ_t are serially correlated across time (again, assume first order Markov)

According to the Rust methodology, why is solving the dynamic programming problem much simpler under Assumption i) than under Assumption ii)? Be specific.

1. There are two competitive markets for a homogenous good each with identical demand function $D(p)$. Entry into these markets is as follows. Firms pay a cost c_0 and then draw a productivity parameter s from a distribution with cdf G. After observing this productivity parameter firms *choose* which of the two markets to enter (only one of them) paying an additional cost of entry c_1 or c_2 depending on which one they choose, where we assume $c_1 > c_2$.A firm with productivity parameter s produces s units of output at zero cost. All firms face an exogenous death probability δ and discount flows at rate β.

   (a) Define and characterize the stationary equilibrium for this economy. What firms will enter each industry? What determines the equilibrium prices? Which market will have more firms?

   (b) Analyze the effect of an increase (in the stochastic dominance sense) of distribution G.

   (c) Now change the timing in the model so that firms must make the decision of which market to enter prior to observing their productivity shocks. Characterize the equilibrium for this case. Compare the equilibrium prices to those that correspond to case (1a).

   (d) Markets with more firms tend to exhibit higher rates of turnover. How could you modify this model so that it is consistent with that observation?

2. Firms in an economy produce a homogeneous consumption good according to the following technology:

$$q = z \min(k, n)$$

   where $z \in \{z_L, z_H\}$ is the productivity state of a firm, k its capital stock and n the amount of labor used. The economy consists of a unit mass of workers endowed with one unit of labor that is supplied inelastically. There is a cost of adjustment for the firms capital given by $c\left(\dot{k}/k\right)k$, where $c(0) = 0$, and c is strictly increasing and strictly convex. There is also the following technology for entry: e workers create a firm of productivity z_H that starts with one unit of capital. Firms of type z_H transit to state z_L with Poisson intensity δ. Firms of type z_L cannot change their state.

(a) Consider a stationary equilibrium where the wage rate w is constant (suppose the consumption good is the numeraire.) Write down the Bellman equations defining the value of the firms and the first order conditions for their investment. Define the stationary equilibrium.

(b) Explain why if the cost of entry is high enough there will be no entry of new firms in the stationary equilibrium. Be as precise as you can.

(c) What does the stationary equilibrium look like as $e \downarrow 0$?

(d) Suppose $e > 0$ and the stationary equilibrium has entry. What effect would a small increase in the cost of entry have on the rate of turnover? (explain with as much detail as you can)