Take Home Exam
Graduate Industrial Organization.

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Please pay attention to the instructions as to group work versus solo work. This exercise could be turned in early next term.

I Solo Work

Please work on the following exercises on your own.

1. Find some data on the size (by sales, employment, or output) of firms within an industry and estimate (or at least display) the distribution of firm sizes. What do you learn about the size distribution of firms?

2. Consider the production function

\[ q_{it} = \beta_0 + \beta_1 l_{it} + \beta_2 k_{it} + \epsilon_{it}, \]  

where \((q, l, k)\) are the logs of quantity, labor and capital and \(\epsilon\) is unobserved and follows an AR(1) process:

\[ \epsilon_{it} = \rho \epsilon_{it-1} + \nu_{it}. \]

Propose a set of pure timing assumptions on the unobservables (i.e., when are the unobservables seen by the firm?) that will allow consistent estimation.

3. Consider an empirical model of advertising. Firm \(j\) in market \(t\) has the demand function

\[ q_{jt} = f(a_{jt}, p_t, x_t) + \epsilon_{jt}, \]

where \(q_{jt}\) is the observed quantity demanded, \(a_{jt}\) is the observed level of advertising by the firm, \(p_t\) is the vector of firms’ prices \((p_{1t}, \ldots, p_{2t})\) and \(x_t\) is the vector product characteristics \((x_{1t}, \ldots, x_{2t})\). The unobserved demand characteristics are captured by \(\epsilon_{jt}\).

Marginal cost is

\[ mc_{jt} = w_{jt} \gamma + \omega_{jt}, \]
while the “price of advertising” is

\[ r_{jt} = z_t \lambda + \nu_{jt} \]  

(5)

where \( z_t \) and \( \nu_{jt} \) are observed and unobserved factors, respectively. The total cost of advertising to the firm is then \( r_{jt}a_{jt} \).

(a) Show that the optimal level of advertising sets the Lerner index times the ad-elasticity of demand equal to the advertising-to-sales ratio.

(b) Set out a set of assumptions and an estimation procedure that allows one to estimate \( \theta, \gamma \) and \( \lambda \).

4. Find a recent (within the last 3 years) empirical paper on either “static” or dynamic entry and offer a 2-page summary and critique of that paper.

II Estimation Exercise.

You can work on this in groups, but you should in the end write up your own answer. Data on a cross-section of 1990 automobile prices, quantities and characteristics is at

http://www.econ.yale.edu/~steveb/Econ600/auto90.dat

Consider a model similar to Bresnahan’s model of the auto industry. Each consumer \( i \) has utility for product \( j \) as a function of price and product quality, \( \delta_j \), of

\[ u_{ij} = \alpha_i \delta_j - p_j. \]

The distribution of consumer tastes for quality, \( \alpha_i \), is uniform on \( [a,b] \). Assume that \( \delta_j = x_j \beta + \xi_j \) and that marginal cost is given by \( mc_j = x_j \gamma + \lambda q_j + \omega_j \). Assume that \( \xi \) and \( \omega \) are uncorrelated with all the characteristics of all the products.

1. Propose an estimation strategy, perhaps based on Berry 1994, to estimate the parameters of the model. Can you identify all the parameters of the model (hint, hint)?

2. Estimate the identified parameters of the model under the 3 assumptions: (i) marginal cost pricing (ii) multiproduct firms setting prices in a Nash Equilibrium (iii) perfect collusion by the firms (joint profit maximization.) Present the results of your work.

3. What sort of results might help you to decide what model fits the data best? (Don’t run any sort of formal test here, just give a few ideas.)

4. Offer a several paragraph critique of the model – what would you like to improve.