

INDUSTRIAL ORGANIZATION II (ECO 2901S)
University of Toronto. Department of Economics. Winter 2018
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FINAL EXAM. Tuesday, April 17, 2018. From 9:00am-12:00pm (3 hours)

INSTRUCTIONS:

- This is an open-book exam.
- Please, answer all the questions.

TOTAL MARKS = 100

PROBLEM 1 (50 points). Consider an industry with J firms (indexed by j), each selling a differentiated product (that we also index by j). These firms compete in M geographic markets (indexed by m). For the sake of concreteness, you can think in the airline industry with J airlines competing in the local markets defined by M city-pairs.

At every market m and period t (discrete time), firms compete in a two-stage game. In a first stage, firms choose simultaneously whether to be active or not in the market and, if active, the design of its product in this market-period. Let $a_{jmt} \in \{0, 1\}$ be the binary variable that represents the event "firm j is active in market m at period t ". A firm's product design can be described by a vector of product characteristics x_{jmt} , e.g., non-stop or stop flight, flight frequency/time. In a second stage, those firms active in the market compete in prices a la Nash-Bertrand. Let p_{jmt} be the price of product j in market m at period t .

Each market has its own consumer demand system for differentiated products, e.g., a logit or a BLP demand model. A consumer's utility of purchasing product j in market m at period t is $x_{jmt} \beta_x + z_{mt} \beta_z - \alpha p_{jmt} + \xi_{jmt} + \varepsilon_{imt}$. The utility of the outside alternative is normalized to zero. The firm's marginal cost is $x_{jmt} \gamma_x + z_{mt} \gamma_z + \omega_{jmt}$. And the fixed/entry cost is $x_{jmt} \delta_x + z_{mt} \delta_z + \kappa_{jmt}$. Random variables $(\xi_{jmt}, \omega_{jmt}, \kappa_{jmt})$ are unobservable to the researcher.

Each local market is highly concentrated. Only a few of the J potential entrants are active in each local market. Furthermore, each firm is active only in some of the M markets.

Define the set of firms $\mathcal{J} \equiv \{1, 2, \dots, J\}$, set of markets $\mathcal{M} \equiv \{1, 2, \dots, M\}$, and set of time periods $\mathcal{T} \equiv \{1, 2, \dots, T\}$. The researcher has a panel dataset with the following information: $\{a_{jmt}, z_{mt} : j \in \mathcal{J}, m \in \mathcal{M}, t \in \mathcal{T}\}$ and $\{x_{jmt}, p_{jmt} : \text{if } a_{jmt} = 1\}$.

Question 1.1. [Demand] (15 points). Consider the estimation of demand parameters. Suppose that the demand unobservable (for the researcher) ξ_{jmt} is common knowledge to all the firms. Or at least, some of its components are common knowledge.

- (a) [5 points] Explain the selection problem in the estimation of demand.

(b) [10 points] Propose a model/method that deals with this selection problem and provides a consistent estimator of demand parameters. You can include all the additional assumptions that you consider necessary, i.e., assumptions on firms' information, on the timing of firms' decisions, on the structure of the unobservables, exclusion restrictions, etc.

Question 1.2. [Price competition] (10 points). Suppose that you have estimated the demand parameters. Now, consider the estimation of marginal cost parameters. Suppose that the marginal cost unobservable ω_{jmt} (or some of its components) is common knowledge to all the firms.

Explain the selection problem in the estimation of marginal costs. Propose a model/method that deals with this selection problem and provides a consistent estimator of marginal cost parameters. Again, you can include all the additional assumptions that you consider necessary.

Question 1.3. [Entry and product design] (15 points). Suppose that you have estimated the structural parameters in demand and marginal cost functions. Now, consider the estimation of fixed costs. Suppose that the vector of product characteristics x_{jmt} has discrete support such that entry and product design can be described as a discrete choice game.

(a) [5 points] Explain the selection problem in the construction of variable profit, $\pi_{jmt} \equiv (p_{jmt} - c_{jmt}) q_{jmt}$, if firm j was not active in market-period (m, t) .

(b) [10 points] Propose a model/method that deals with this selection problem and provides a consistent estimator of the fixed cost parameters. You can include all the additional assumptions that you consider necessary.

Question 1.4. (10 points). Suppose that you have consistent estimates of all the parameters of the model. You are interested in using the estimated model to predict the effects on prices, market shares, consumer surplus, and firms' profits of an hypothetical merger between firms A and B .

Describe in detail how would you implement this prediction exercise. Explain the different issues in generating this prediction. Make explicit your assumptions to deal with these issues.

PROBLEM 2 (50 points). Consider the industry of hard drive disks (HDD) as in Igami (2017). Suppose that the different generations of HDD technologies/products (generation 1, 2, 3, ...) arrive exogenously at time periods t_1, t_2, t_3, \dots . Every period t , firms decide to be active or not in the market. Let $a_{igt} \in \{0, 1\}$ be the binary variable that represents the event "firm i is active in the market for product g at period t ". If active, firms choose the portfolio of products (generations) to produce and sell, and the quantity to produce of each product. There is only one market (the world market) where firms in this industry compete. The researcher has a panel dataset with information on firms' activity and output decisions $\{a_{igt}, q_{igt}\}$, market prices $\{p_{gt}\}$, and exogenous variables affecting demand or/and costs $\{x_{gt}\}$.

Question 2.1. [Descriptive evidence] (5 points). A researcher is interested in studying the potential difference between incumbent firms and potential entrants in their adoption rate of new products/generations. Using the data described above, explain how to obtain robust descriptive evidence on this point.

Suppose that, in Question 2.1, the researcher finds substantial differences in adoption rates. The purpose of the researcher is to quantify the contribution of different economic factors to explain this difference. Questions 2.2 to 2.4 deal with this empirical question.

Question 2.2. [Empirical model] (15 points).

(a) [5 points] Propose different hypotheses that may explain this observed difference.

(b) [10 points] Propose a structural model of oligopoly competition that incorporates the hypotheses in point (a). Describe in detail the different elements of the model (demand, variable costs, entry costs, etc) and your assumptions.

Question 2.3. [Estimation] (15 points). Describe a procedure to estimate consistently the structural parameters of your model in Question 2.2 using the data described above. Explain in detail how to estimate the different components of the model. You can include all the additional assumptions that you consider necessary.

Question 2.4. [Counterfactuals] (15 points). The researcher wants to use the estimated structural model to quantify the contribution of the different hypotheses proposed in Question 2.2(a). Describe in detail a set of counterfactual experiments that provides these quantitative measures.

END OF THE EXAM