Empirical Industrial Organization: Implementing Frontier Methodologies in Matlab

University of Aarhus, February 24 to February 26, 2014

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Course Description. This seminar will cover three papers in empirical industrial organization in detail to show how frontier methodologies can be implemented in Matlab. By the end of the class, the students will be able to adapt and extend the methodologies to new problems. We will begin with the estimation of complete information, static, discrete games. Then, we will consider the estimation of static models of demand and supply with complete information. We will conclude with the estimation of dynamic models of strategic interaction with incomplete information, with a particular focus on discrete choice dynamic models. Each lecture will consist of two parts: in the first part we will go over selected parts of the articles, where the article makes the fundamental methodological advances; in the second part we will go in detail over how the methodological advances are actually implemented in Matlab.


Grading. If needed, there would be an exam where the students have two weeks to write a matlab code for an application. The grade is Pass/Fail.

Outline and References

Day 1 Topic: Estimation of Complete Information, Static, Discrete Games.
On the first day of this course we will cover in detail the paper by Ciliberto, F. and E. Tamer (2009): “Market Structure and Multiple Equilibria in Airline Markets,” Econometrica, 77(6), 1791-1828. This paper provides a practical method to estimate the payoff functions of players in complete information, static, discrete games. The method allows for general forms of heterogeneity across players without making equilibrium selection assumptions. The identified features of the model are sets of parameters (partial identification) such that the choice probabilities predicted by the econometric model are consistent with the empirical choice probabilities estimated from the data. We will first illustrate the basic idea behind the proposed methodology, which consists of minimizing an appropriately defined distance between the empirical choice probability of each equilibrium outcome and the smallest and largest probability that the theoretical model predicts that that equilibrium outcome can occur; then, we will investigate the type of exogenous variation needed to identify the parameters of the model; next, we will go over the simulation strategy; finally, we will go in detail over how the simulation strategy is implemented in Matlab.

References
Day 2 Topic: Estimation of Complete Information, Static Models of Demand and Supply with Complete Information.

On the second day of class we will go over the paper by Berry S., Levinsohn J., Pakes A., “Automobile Prices in Market Equilibrium,” Econometrica, 63 (4), 841-890. Even after 15 years, this paper still remains the frontier as far as the estimation of demand and supply in differentiated products markets is concerned. This method is based on the representation of consumer preferences over products as a function of individual characteristics and of the of the attributes of those products, first developed by Lancaster, K.J. (1971), Consumer Demand: A New Approach, New York, Columbia University Press. The key novelty is to simulate consumer tastes and demographic characteristics from, respectively, maintained distributions of consumer preferences over products, or empirical distributions estimated from auxiliary datasets. We will first illustrate how to derive a demand system from a discrete choice model, and how the interactions between individual consumer preferences and product attributes enter in a nonlinear way in the demand system; we will then study what type of variation in the consumer preferences and in the product attributes is necessary to identify the parameter of the model; next, we will study how the simulation of consumer preferences and demographic characteristics is executed in Matlab.

References


Day 3 Topic: Estimation of Incomplete Information, Dynamic Models of Strategic Interaction.

On the last day of this course we will cover the paper by Bajari P., Benkard C.L., Levin J. (2007), “Estimating Dynamic Models of Imperfect Competition,” Econometrica, Volume 75 (5), 1331–1370. This paper provides a two-step algorithm for estimating dynamic incomplete information games under the assumption that behavior is consistent with Markov perfect equilibrium and under the assumption that there is a unique equilibrium. First, the method requires that the policy functions and the law of motion for the state variables are estimated. Next, the remaining structural “dynamic” parameters are estimated under the assumption that the observed policy function used by the firms is optimal. The second step estimator is a simple simulated minimum distance estimator. We will first define Markov strategies and a Markov perfect equilibrium; then, we will go over the basic idea of this methodology and how the parameters of the models are identified; next, we will go over the simulation strategy and we will see how it is implemented in Matlab applying the methodology to the problem studied in “Optimal Replacement of GMC Bus Engines: An Empirical Model of Harold Zurcher,” by Rust J., Econometrica, Vol. 55 (5), 1987, 999-1033.

References