ECO 2901
INDUSTRIAL ORGANIZATION II

University of Toronto. Department of Economics. Spring 2012

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Class meetings: Thursdays, 2:00-4:00pm. Room: GE 106
Office hours: Tuesdays and Thursdays 4:00pm-5:00pm

COURSE DESCRIPTION

This course deals with Empirical Industrial Organization (EIO) and it covers topics related to the empirical analysis of firms' competition in oligopoly industries. We study empirically the determinants of firms' and consumers' behaviour and market outcomes in the context of problems of price competition, inventories, store location, investment, product positioning, network competition, mergers, or market entry-exit, among others. The course emphasizes the importance of combining good data, reasonable economic models, and appropriate econometric techniques to answer empirical questions in Industrial Organization, and in Economics in general.

MEETINGS

We have a 2-hours lecture every Thursday at 2:00-4:00pm in room GE 106 (Economics Building).

EVALUATION

Your final grade will be based on your grades in two *Problem Sets* (50% of the final grade) and a *Final Exam* (the other 50%).

GENERAL REFERENCES

- Class Notes: "Empirical Industrial Organization: Models, Methods and Applications," by Victor Aguirregabiria.
- Bresnahan, T. (1989): "Empirical Studies of Industries with Market Power," Handbook of Industrial Organization, vol. II., Schmalensee, R. and Willig, R. (eds.), North-Holland.
- Ackerberg, D., L. Benkard, S. Berry, and A. Pakes (2006): "Econometric Tools for Analyzing Market Outcomes," *Handbook of Econometrics*, volume 6.

- Reiss, P., and Wolak, F. (2007): "Structural Econometric Modeling: Rationales and Examples from Industrial Organization," *Handbook of Econometrics*, volume 6.
- Perloff, J., L. Karp, and A. Golan (2007): "Estimation Market Power and Strategies," Cambridge University Press.
- Davis, P. and E. Garcés (2009): "Quantitative Techniques for Competition and Antitrust Analysis," Princeton University Press.

TOPICS

1. Some General Ideas on Empirical IO
2. Econometric Issues and Methods in the Estimation of Production Functions
3. Demand Estimation
4. Static Models of Cournot and Bertrand Competition
5. Empirical Models of Market Entry
6. Dynamic Structural Models of Industrial Organization: Some General Ideas
7. Single-Agent Models of Firm Investment
8. Structural Models of Dynamic Demand
9. Empirical Dynamic Games of Oligopoly Competition
10. Empirical Models of Auctions

OUTLINE AND REFERENCES

<u>1. SOME GENERAL IDEAS ON EMPIRICAL IO</u>

1.1. Measuring and explaining market power

1.2. Data in Empirical IO

1.3. Structural models in Empirical Industrial Organization: An Example

1.4. An overview of the rest of the course

Readings:

- Class Notes. Chapter 1.
- Nevo, A., and M. Whinston (2010): "Taking the Dogma Out of Econometrics: Structural Modeling and Credible Inference," The Journal of Economic Perspectives, Spring 2010, 69-82.

2. ECONOMETRIC ISSUES AND METHODS IN THE ESTIMATION OF PRODUCTION FUNCTIONS

2.1 Introduction

2.2. Simultaneity Problem

2.3 Endogenous Exit

2.4. Conclusions

Readings:

- Class Notes. Chapter 2.
- Ackerberg, D., K. Caves and G. Frazer (2006): "Structural Estimation of Production Functions,"manuscript. Department of Economics, UCLA.
- Blundell, R., and S. Bond (2000): "GMM estimation with persistent panel data: an application to production functions," Econometric Reviews, 19(3), 321-340.
- Bond, S., and M. Söderbom (2005): "Adjustment costs and the identification of Cobb Douglas production functions," IFS Working Papers W05/04, Institute for Fiscal Studies.
- Bond, S. and J. Van Reenen (2007): "Microeconometric Models of Investment and Employment," in J. Heckman and E. Leamer (editors) Handbook of Econometrics, Vol. 6A. North Holland. Amsterdam.
- Griliches, Z., and J. Mairesse (1998): " Production Functions: The Search for Identification," in Econometrics and Economic Theory in the Twentieth Century: The Ragnar Frisch Centennial Symposium. S. Strøm (editor). Cambridge University Press. Cambridge, UK.
- Kasahara, H. (2009): "Temporary Increases in Tariffs and Investment: The Chilean Case," Journal of Business and Economic Statistics, 27(1), 113-127.
- Levinshon, J., and A. Petrin (2003): "Estimating Production Functions Using Inputs to Control for Unobservables," Review of Economic Studies , 70, 317-342.
- Marshak, J., and W. Andrews (1944): "Random simultaneous equation and the theory of production," Econometrica, 12, 143—205.
- Mundlak, Y. (1961): "Empirical Production Function Free of Management Bias," Journal of Farm Economics, 43, 44-56.
- Mundlak, Y., and I. Hoch (1965): "Consequences of Alternative Specifications in Estimation of Cobb- Douglas Production Functions," Econometrica, 33, 814-828.
- Olley, S., and A. Pakes (1996): " The Dynamics of Productivity in the Telecommunications Equipment Industry", Econometrica, 64, 1263-97.

3. DEMAND ESTIMATION

3.1. Introduction

3.2. Demand systems in product space

3.3 Demand systems in characteristics space

Readings:

- Class Notes. Chapter 3.
- Berry, S. (1994): "Estimating Discrete Choice Models of Product Differentiation," RAND Journal of Economics, 25, 242-262.
- Berry, S. and P. Haile (2009): "Identification in Differentiated Products Markets Using Market Level Data," manuscript. Department of Economics. Yale University.
- Berry, S., J. Levinsohn and A. Pakes (1995): "Automobile Prices in Market Equilibrium," Econometrica, 60(4), 889-917.
- Berry, S., J. Levinsohn and A. Pakes (1999): "Voluntary Export Restraints on Automobiles: Evaluating a Strategic Trade Policy," American Economic Review, 89(3), 400-430.
- Berry, S., J. Levinsohn and A. Pakes (2004): "Differentiated Products Demand Systems from a Combination of Micro and Macro Data: The New Vehicle Market," Journal of Political Economy, 112(1), 68-104.
- Berry, S., O. Linton, and A. Pakes (2004): "Limit Theorems for Estimating the Parameters of Differentiated
- Goldberg, P. (1995): "Product Differentiation and Oligopoly in International Markets: The Case of the U.S. Automobile Industry," Econometrica, 63, 891-951.
- Hausman, J., G. Leonard, and J. Zona (1994): "Competitive Analysis with Differentiated Products," Annales D'Economie et de Statistique, 34.
- McFadden, D. (1974): "Conditional Logit Analysis of Qualitative Choice Behavior," in P. Zarembka (ed.), Frontiers in Econometrics, 105-142, Academic Press. New York.
- Nevo, A. (2001): "Measuring Market Power in the Ready-to-Eat Cereal Industry," Econometrica,69(2), 307-342.
- Nevo, A. (2011): Empirical Models of Consumer Behavior, Annual Review of Economics, forthcoming
- Pakes, A. (2010): "Alternative Models for Moment Inequalities". Econometrica, 78, 1783-1822.

4. STATIC MODELS OF COURNOT AND BERTRAND COMPETITION

4.1. The Conjectural Variation Approach

4.2. Testing static oligopoly models (Genesove and Mullin: RAND 1998)

4.3. Cartel stability (Porter, 1983)

Readings:

- Class Notes. Chapter 4.
- Bresnahan, T. (1981): "Departures from Marginal-Cost Pricing in the American Automobile Industry: Estimates for 1977-1978," Journal of Econometrics, 17, 201-227.
- Bresnahan, T. (1982): "The Oligopoly Solution Concept is Identified," Economics Letters, 10, 87-92.
- Bresnahan, T. (1987): "Competition and Collusion in the American Automobile Market: The 1955 Price War," Journal of Industrial Economics, 35, 457-482.
- Bresnahan, T. (1989): "Empirical Methods for Industries with Market Power," chapter 17 in Handbook of Industrial Organization, Volume II, Richard Schmalensee and Robert Willig, eds., Amsterdam: Elsevier Science Publishers.
- Campbell, J. and H. Hopenhayn: (2005): "Market size matters," Journal of Industrial Economics .
- Reiss, P., and Wolak, F. (2007): "Structural Econometric Modeling: Rationales and Examples from Industrial Organization," *Handbook of Econometrics*, volume 6. Sections 1-4.
- Bresnahan, T. (1989): "Empirical Studies of Industries with Market Power," Handbook of Industrial Organization, vol. II., Schmalensee, R. and Willig, R. (eds.), North-Holland.
- Corts, K. (1999): "Conduct Parameters and the Measurement of Market Power," Journal of Econometrics 88 (2), 227-250.
- Green, E., and R. Porter (1984): "Noncooperative Collusion Under Imperfect Price Information," Econometrica, 52, 87-100.
- Genesove, D. and W. P. Mullin (1998): Testing static oligopoly models: Conduct and cost in the sugar industry, 1890-1914. The Rand Journal of Economics 29 (2), 355–377.
- Porter, R. (1983): "A Study of Cartel Stability: The Joint Executive Committee, 1880-1886," Bell Journal of Economics, 15, 301-314.
- Porter, R. (1985): "On the Incidence and Duration of Price Wars," Journal of Industrial Economics, 33, 415-426.
- Schmalensee, R. (1989): "Inter-industry Studies of Structure and Performance," Handbook of Industrial Organization, vol. II., Schmalensee, R. and Willig, R. (eds.), North-Holland.
- * Sutton, John (1991): "Sunk Costs and Market Structure: Price Competition, Advertising and the Evolution of Concentration," Cambridge, Mass., MIT Press.

5. EMPIRICAL MODELS OF MARKET ENTRY

5.1. Some general ideas

5.2. Bresnahan and Reiss (JPE, 1991)

5.3. Nonparametric identification of Bresnahan-Reiss model

5.4. Dynamic version of Bresnahan-Reiss model

5.5. Empirical Models of Market Entry with Heterogeneous firms

5.6 Entry and Spatial Competition

Readings:

- Class Notes. Chapter 5.
- Bajari, P., H. Hong, and S. Ryan (2007): "Identification and Estimation of Discrete Games of Complete Information," Working Paper. University of Minnesota.
- Bajari, P., H. Hong, J. Krainer and D. Nekipelov (2007): "Estimating Static Models of Strategic Interactions," Working Paper. University of Minnesota.
- Berry, Steven and Reiss, Peter (2007): "Empirical Models of Entry and Market Structure" Chapter for Volume III of the *Handbook of Industrial Organization.*
- Berry, S. and E. Tamer (2007): "Identification in Models of Oligopoly Entry," in Advances in Economics and Econometrics: Theory and Applications, Ninth World Congress, vol. 2, R. Blundell, W.K. Newey and T. Persson, eds., Cambridge Univ. Press.
- Berry, S. and J. Waldfogel (2006): "Product Quality and Market Size," Working Paper. Yale University.
- Bresnahan, T. and P. Reiss (1987): "Do Entry Conditions Vary across Markets? Brookings Papers on Economic Activity: Special Issue on Microeconomics, no. 3, Martin Baily and Clifford Winston, eds., 833-871.
- Bresnahan, T. and P. Reiss (1990): "Entry into Monopoly Markets," Review of Economic Studies, 57, 531-553.
- Bresnahan, T. and P. Reiss (1991): "Econometric Models of Discrete Games," Journal of Econometrics, 48, 57-81.
- Bresnahan, T. and P. Reiss (1991): "Entry and Competition in Concentrated Markets," Journal of Political Economy, 95, 977-1009.
- Bresnahan, T. and P. Reiss (1994): "Measuring the Importance of Sunk Costs," Annales D'Économie et de Statistique, 31, 183-217.
- Ciliberto, F. and E. Tamer (2009): "Market Structure and Multiple Equilibria in Airline Markets," Econometrica, forthcoming

- Ellickson, P., and S. Misra (2008): “Supermarket Pricing Strategies,” Marketing Science.
- Han, L. and S-H. Hong (2011): "Testing Cost Inefficiency Under Free Entry in the Real Estate Brokerage Industry," Journal of Business and Economic Statistics, forthcoming.
- Jia, P. (2008): “What Happens when Wal-Mart comes to town? Empirical Analysis of the Discount Retailing Industry,” *Econometrica*,
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- Sweeting, A. (2006): "Coordination, Differentiation and the Timing of Radio Commercials, Journal of Economics and Management Strategy, 15(4), 909-942.
- Sweeting, A. (2009): "The Strategic Timing of Radio Commercials: An Empirical Analysis Using Multiple Equilibria", RAND Journal of Economics, 40(4), Winter 2009.
- Tamer, E. (2003): “Incomplete Simultaneous Discrete Response Model with Multiple Equilibria,” *Review of Economic Studies*, 70(1), 147-165.
- Toivanen, O. and M. Waterson (2005): "Market Structure and Entry: Where’s the Beef?," RAND Journal of Economics, 36(3), 680-699.

6. DYNAMIC STRUCTURAL MODELS OF INDUSTRIAL ORGANIZATION: SOME GENERAL IDEAS

6.1. Introduction

6.2 Example 1: Demand of storable goods

6.3. Example 2: Demand of a new durable product

6.4. Example 3: Product repositioning in differentiated product markets

6.5. Example 4: Evaluating the effects of a policy change

6.6. Example 5: Explaining the cross-sectional dynamics of prices in a retail market

Readings:

- Class Notes. Chapter 6.
- Aguirregabiria, V. and P. Mira, 2002, Swapping the nested fixed point algorithm: A class of estimators for discrete Markov decision models. Econometrica 70, 1519-1543.
- Arcidiacono, P. and R. Miller, 2008, CCP Estimation of Dynamic Discrete Choice Models with Unobserved Heterogeneity. Manuscript. Duke University.
- Holmes, T., 2008, The Diffusion of Wal-Mart and Economies of Density. NBER Working Paper No. 13783.
- Hong, H. and M. Shum (2010): "Pairwise-Difference Estimation of a Dynamic Optimization Model," Review of Economic Studies, 77, 273-304.
- Hotz, J., and R.A. Miller (1993): "Conditional choice probabilities and the estimation of dynamic models," Review of Economic Studies, 60, 497-529.
- Hotz, J., R.A. Miller, S. Sanders, and J. Smith (1994): "A simulation estimator for dynamic models of discrete choice," Review of Economic Studies, 61, 265-89.
- Imai, S., N. Jain, and A. Ching (2009): "Bayesian Estimation of Dynamic Discrete Choice Models," Econometrica, 77(6), 1865-1899.
- Miller, R., 1997, Estimating Models of Dynamic Optimization with Microeconomic Data. In H. Pesaran and P. Smidth (eds.) Handbook of Applied Econometrics: Microeconomics. Blackwell.
- Pakes, A. (1994): "Dynamic structural models, problems and prospects," in C. Sims (ed.) Advances in Econometrics. Sixth World Congress, Cambridge University Press.
- Rust, J., 1994a, Structural estimation of Markov decision processes. In R. E. Engle and McFadden (eds.) Handbook of Econometrics Volume 4, North-Holland. Amsterdam.
- Rust, J., 1994b, Estimation of dynamic structural models, problems and prospects: discrete decision processes, in C. Sims (ed.) Advances in Econometrics. Sixth World Congress, Cambridge University Press.

7. SINGLE-AGENT MODELS OF FIRM INVESTMENT

7.1. Model and Assumptions

7.2. Solving the dynamic programming (DP) problem

7.3. Estimation

Readings:

- Class Notes. Chapter 7.
- Aguirregabiria, V. (1999): "The dynamics of markups and inventories in retailing firms," The Review of Economic Studies, 66, 275-308.
- Das, M. , 1992, A Micro-econometric Model of Capital Utilization and Retirement: The Case of the Cement Industry. Review of Economic Studies 59, 277-297.
- Kennet, M., 1993, Did Deregulation Affect Aircraft Engine Maintenance? An Empirical Policy Analysis. RAND Journal of Economics 24, 542-558.
- Kennet, M., 1994, A Structural Model of Aircraft Engine Maintenance. Journal of Applied Econometrics 9, 351-368.
- Pakes, A. (1986): "Patents as Options: Some Estimates of the Value of Holding European Patent Stocks," Econometrica, 54, 755-784.
- Rust, J., 1987, Optimal replacement of GMC bus engines: An empirical model of Harold Zurcher. Econometrica 55, 999-1033.
- Rust, J. and G. Rothwell, 1995, Optimal Response to a Shift in Regulatory Regime: The Case of the US Nuclear Power Industry. Journal of Applied Econometrics 10, S75-S118.
- Schiraldi, P. (2011): "Automobile Replacement: a Dynamic Structural Approach," RAND Journal of Economics.
- Slade, M., 1998, Optimal Pricing with Costly Adjustment: Evidence from Retail Grocery Stores. Review of Economic Studies 65, 87-108.
- Sturm, R., 1991, A Structural Economic Model of Operating Cycle Management in European Nuclear Power Plants. Manuscript, RAND Corporation.

8. STRUCTURAL MODELS OF DYNAMIC DEMAND

8.1. Introduction

8.2 Data and descriptive evidence

8.3. Model

8.4. Estimation

8.5. Empirical Results

Readings:

- Class Notes. Chapter 8.
- Aguirregabiria, V. and A. Nevo (2010): "Recent Developments in Empirical IO: Dynamic Demand and Dynamic Games," forthcoming. Econometric Society World Congress Monographs.
- Carranza, J. (2006): "Demand for durable goods and the dynamics of quality," Unpublished manuscript, University of Wisconsin.
- Chen, J., S. Esteban, and M. Shum (2008): "Estimation Biases of Omitting Durability," Journal of Econometrics, 147, 247-257.
- Erdem, T., S. Imai and M. P. Keane (2003): "Brand and Quantity Choice Dynamics under Price Uncertainty," Quantitative Marketing and Economics 1, 5-64.
- Esteban, S. & Shum, M. (2007). "Durable goods oligopoly with secondary markets: The case of automobiles," RAND Journal of Economics, 38, 332-354.
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- Hendel, I. and A. Nevo (2004): "Intertemporal Substitution and Storable Products," Journal of the European Economic Association, 2(2-3), pages 536-547.
- Hendel, I., and A. Nevo (2006a): "Measuring the Implications of Sales and Consumer Inventory Behavior. Econometrica 74, 1637-1674.
- Hendel, I. and A. Nevo (2006b): "Sales and Consumer Inventory," RAND Journal of Economics, 37(3), 543-561.
- Hendel, I. and A. Nevo (2010): "A Simple Model of Demand Anticipation," manuscript. Department of Economics. Northwestern University.
- Melnikov, O., 2000, Demand for Differentiated Durable Products: The Case of the U.S. Computer Printer Market. Manuscript. Department of Economics, Yale University.
- Pesendorfer, M. (2002): "Retail Sales: A Study of Pricing Behavior in Supermarkets," Journal of Business, 75(1), pages 33-66.

9. EMPIRICAL DYNAMIC GAMES OF OLIGOPOLY COMPETITION

9.1. Introduction

9.2. The structure of dynamic games of oligopoly competition

9.3. Identification

9.4. Estimation

9.5. Reducing the State Space

9.5. Counterfactual experiments with multiple equilibria

9.6. Empirical Application: Environmental Regulation in the Cement Industry

9.7. Product repositioning in differentiated product markets

9.8. Dynamic Game of Airlines Network Competition

Readings:

- Class Notes. Chapter 9.
- Aguirregabiria, V. and P. Mira (2010): "Dynamic Discrete Choice Structural Models: A Survey," *Journal of Econometrics,* forthcoming.
- Aguirregabiria, V. and P. Mira (2007): "Sequential Estimation of Dynamic Discrete Games," *Econometrica*, 75, 1-53.
- Aguirregabiria, V. and C-Y. Ho (2011): "A dynamic oligopoly game of the US airline industry: Estimation and policy experiments," Journal of Econometrics, forthcoming.
- Aguirregabiria, V. and A. Nevo (2010): "Recent Developments in Empirical IO: Dynamic Demand and Dynamic Games," forthcoming. Econometric Society World Congress Monographs.
- Bajari, P., L. Benkard, and J. Levin (2007): "Estimating Dynamic Models of Imperfect Competition," *Econometrica*.
- Benkard, L., G. Weintraub and B. Van Roy (2008): "Markov Perfect Industry Dynamics with Many Firms," Econometrica, November 2008.
- Collard-Wexler, A. (2006): "Productivity Dispersion and Plant Selection in the Ready-Mix Concrete Industry," Manuscript. New York University.
- Collard-Wexler, A. (2006): "Demand Fluctuations in the Ready-Mix Concrete Industry," Manuscript. New York University.
- Doraszelski, U., and Satterthwaite, M. (2010): "Computable Markov-Perfect Industry Dynamics," RAND Journal of Economics, 41(2), 215—243.
- Dunne, T., M. Roberts and L. Samuelson (1988): "Patterns of Entry and Exit in U.S. Manufacturing," *Rand Journal of Economics,* 19, 495-515.

- Dunne, T., S. Klimek, M. Roberts and Y. Xu (2006): 'Entry and Exit in Geographic Markets," Manuscript. Penn State University.
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- Nevo, A. and Rossi, F. (2008): "An approach for extending dynamic models to settings with multiproduct firms," Economics Letters, 100(1), 49-52.
- Pakes, A. and P. McGuire (1994): "Computing Markov Perfect Nash Equilibrium: Numerical Implications of a Dynamic Differentiated Product Model," RAND Journal of Economics, 25, 555-589.
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- Pakes, A. and R. Ericson (1998): "Empirical Implications of Alternative Models of Firm Dynamics," *Journal of Economic Theory,* 79, 1-45.
- Pakes, A., M. Ostrovsky, and S. Berry (2007), "Simple Estimators for the Parameters of Discrete Dynamic Games, with Entry/Exit Examples", RAND Journal of Economics, 38(2), 373-399.
- Pesendorfer, M. and M. Jofre-Bonet (2003): "Estimation of a Dynamic Auction Game," Econometrica, 71(5), 1443-1489.
- Pesendorfer, M. and P. Schmidt-Dengler (2008): "Asymptotic Least Squares Estimators for Dynamic Games," Review of Economic Studies, 75(3), pages 901-928.
- Pesendorfer, M. and P. Schmidt-Dengler (2010): "Sequential Estimation of Dynamic Discrete Games: A Comment," Econometrica, 78(2), pages 833-842.
- Ryan, S. (2012): "The Costs of Environmental Regulation in a Concentrated Industry," forthcoming. Econometrica.
- Schmidt-Dengler, P. (2006): "The Timing of New Technology Adoption: The Case of MRI," manuscript.
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- Snider, C. (2009): "Predatory incentives and predation policy: the American Airlines case," manuscript. Department of Economics. UCLA.
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- Toivanen, O. and M. Waterson (2011): "Retail Chain Expansion: The Early Years of McDonalds in Great Britain," CEPR Discussion Papers 8534, C.E.P.R. Discussion Papers.

10. EMPIRICAL MODELS OF AUCTIONS

Readings:

- Class Notes. Chapter 10.
- Guerre, E., I. Perrigne, and Q. Vuong (2000): "Optimal Nonparametric Estimation of First-Price Auctions," Econometrica, 68, 525-574.
- Hendricks, K., and H. Paarsch (1995): "A Survey of Recent Empirical Work Concerning Auctions," Canadian Journal of Economics, 403—426.
- Hendricks, K., and R. Porter (1988): "An Empirical Study of an Auction with Asymmetric Information," American Economic Review, 78 (5), 865—883.
- Hendricks, K., and R. Porter (1996): "Determinants of the Timing and Incidence of Exploratory Drilling on Offshore Wildcat Tracts," American Economic Review, 86 (3), 388—407.
- Hendricks, K., and R. Porter (2007): "A Survey of Empirical Work in Auctions," Handbook of Industrial Organization, Vol. III, edited by R. Porter and M. Armstrong, Vickers, Amsterdam: North-Holland.
- Hong, H., and H. Paarsch: Book
- Jofre-Bonet, M. and M. Pesendorfer, 2003, Estimation of a Dynamic Auction Game. Econometrica 71, 1443—1489.