

ECO 2901 INDUSTRIAL ORGANIZATION II

University of Toronto. Department of Economics. Winter 2017

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Class meetings: Fridays, 9:00-11:00am. Room: SS-1086 (Sidney Smith Hall)
Office hours: Tuesdays and Thursdays 3:00pm-4:00pm

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, 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 Friday from 9:00am to 11:00am in room SS-1086.
- There is NO class on January 6th, and our first class meeting is on Friday, **January 13th**.
- There is class on Friday, February 24th [Reading Week].

EVALUATION

Your final grade will be based on the following requirements.

- **Final exam (50%).** The final exam will cover all the material in the course and it is closed-book. The exam will be during the University Exam Period.
- **Problem set (50%).** I will distribute the problem set online by Friday, February 24th. Your completed problem set is **due on Friday, March, 10.**

TOPICS

1. Basic Ideas in 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 Behavior
8. Structural Models of Dynamic Demand
9. Empirical Dynamic Games of Oligopoly Competition

GENERAL REFERENCES

- Class Notes: “Empirical Industrial Organization: Models, Methods and Applications,” by Victor Aguirregabiria.
- Akerberg, D., L. Benkard, S. Berry, and A. Pakes (2006): “Econometric Tools for Analyzing Market Outcomes,” *Handbook of Econometrics*, volume 6.
- Aguirregabiria, V. and P. Mira (2010): “Dynamic Discrete Choice Structural Models: A Survey,” *Journal of Econometrics*, 156(1), 38-67.
- Aguirregabiria, V. and A. Nevo (2013): "Recent Developments in Empirical IO: Dynamic Demand and Dynamic Games," in *Advances in Economics and Econometrics*, Volume 3, D. Acemoglu, M. Arellano, and E. Dekel (eds.)
- Aguirregabiria, V. and J. Suzuki (2015): “Empirical Models of Market Entry and Spatial Competition in Retail Industries,” in *Handbook on the Economics of Retail and Distribution*, Emek Basker (editor). Forthcoming.
- 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.
- Pakes, A. (1994): "Dynamic structural models, problems and prospects," in C. Sims (ed.) *Advances in Econometrics*. Sixth World Congress, Cambridge University Press.
- Reiss, P., and Wolak, F. (2007): “Structural Econometric Modeling: Rationales and Examples from Industrial Organization,” *Handbook of Econometrics*, volume 6.
- Rust, J. (1994): “Structural estimation of Markov decision processes,” in R. E. Engle and McFadden (eds.) *Handbook of Econometrics Volume 4*, North-Holland. Amsterdam.
- Rust, J. (1994): “Estimation of dynamic structural models, problems and prospects: discrete decision processes,” in C. Sims (ed.) *Advances in Econometrics*. Sixth World Congress, Cambridge University Press.

OUTLINE AND REFERENCES

1. BASIC IDEAS IN EMPIRICAL IO

- 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

Required Readings:

- * Class Notes. Chapter 1.

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

- 2.1 Introduction
- 2.2 Simultaneity Problem
- 2.3 Endogenous Exit

Required Readings:

- * Class Notes. Chapter 2.
- * Akerberg, D., K. Caves and G. Frazer (2006): "Structural Estimation of Production Functions," manuscript. Department of Economics, UCLA.
- * 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.
- * 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.
- * Olley, S., and A. Pakes (1996): "The Dynamics of Productivity in the Telecommunications Equipment Industry", *Econometrica*, 64, 1263-97.

Other Readings:

- 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 J. Van Reenen (2007): "Microeconomic Models of Investment and Employment," in J. Heckman and E. Leamer (editors) *Handbook of Econometrics*, Vol. 6A. North Holland. Amsterdam.
- Doraszelski, U. and J. Jaumandreu (2013): "R&D and Productivity: Estimating Endogenous Productivity," *Review of Economic Studies*, 80, 1338 - 1383.
- 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.
- Wooldridge, J. (2009): "On Estimating Firm-level Production Functions using Proxy Variables to Control for Unobservables", *Economics Letters*, 104, 112–114.

3. DEMAND ESTIMATION

- 3.1. Introduction
- 3.2. Demand systems in product space
- 3.3. Demand systems in characteristics space

Required Readings:

- * Class Notes. Chapter 3.
- * Berry, S. (1994): "Estimating Discrete Choice Models of Product Differentiation," *RAND Journal of Economics*, 25, 242-262.

- * Berry, S., J. Levinsohn and A. Pakes (1995): "Automobile Prices in Market Equilibrium," *Econometrica*, 60(4), 889-917.
- Hausman, J. (1996): "Valuation of New Goods Under Perfect and Imperfect Competition," in Bresnahan and Gordon (eds), *The Economics of New Goods, Studies in Income and Wealth*, Vol. 58, Chicago: NBER. Including comment by Bresnahan (in the same volume).
- * Nevo, A. (2011): "Empirical Models of Consumer Behavior," *Annual Review of Economics*, 3, 51-75.

Other Readings:

- Berry, S. and P. Haile (2013): "Identification in Differentiated Products Markets Using Market Level Data," manuscript. Department of Economics. Yale University.
- 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 Product Demand Systems," *The Review of Economic Studies*, 71, 613-654.
- 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.
- Pakes, A. (2010): "Alternative Models for Moment Inequalities". *Econometrica*, 78, 1783-1822.
- Trajtenberg, M. (1989): "The Welfare Analysis of Product Innovations, with an Application to Computed Tomography Scanners," *Journal of Political Economy*, 97, 444-79.

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)
- 4.4. Nevo on Cereals (Nevo, 2001)

Required Readings:

- * Class Notes. Chapter 4.
- * 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.
- * Corts, K. (1999): "Conduct Parameters and the Measurement of Market Power," *Journal of Econometrics* 88 (2), 227-250.

- * 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.
- * Nevo, A. (2001): "Measuring Market Power in the Ready-to-Eat Cereal Industry," *Econometrica*, 69(2), 307-342.

Other Readings:

- 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. (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.
- Bresnahan, T. (1989): "Empirical Studies of Industries with Market Power," *Handbook of Industrial Organization*, vol. II., Schmalensee, R. and Willig, R. (eds.), North-Holland.
- Campbell, J. and H. Hopenhayn: (2005): "Market size matters," *Journal of Industrial Economics*, 53(1), 1-25.
- Ellison, G. (1994): "Theories of Cartel Stability and the Joint Executive Committee," *Rand Journal of Economics*, 25, 37-57.
- Reiss, P., and Wolak, F. (2007): "Structural Econometric Modeling: Rationales and Examples from Industrial Organization," *Handbook of Econometrics*, volume 6. Sections 1-4.
- Green, E., and R. Porter (1984): "Noncooperative Collusion Under Imperfect Price Information," *Econometrica*, 52, 87-100.
- Graddy, K. 1995. "Testing for Imperfect Competition at the Fulton Fish Market," *Rand Journal of Economics* 26(Spring): 75-92.
- 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

Required Readings:

- * Class Notes. Chapter 5.

- * Bajari, P., H. Hong, J. Krainer and D. Nekipelov (2007): "Estimating Static Models of Strategic Interactions," *Journal of Business & Economic Statistics*, 28(4), 469-482.
- * 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.
- * 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.
- * Seim, K. (2006): "An Empirical Model of Firm Entry with Endogenous Product-Type Choices," *RAND Journal of Economics* 37(3).
- * 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.

Other Readings:

- Bajari, P., H. Hong, and S. Ryan (2010): "Identification and Estimation of Discrete Games of Complete Information," *Econometrica*, 78(5), 1529–1568.
- Berry, S. (1992): "Estimation of a Model of Entry in the Airline Industry," *Econometrica* , 60(4), 889-917.
- Berry, S., and P. Reiss (2007): "Empirical Models of Entry and Market Structure" Chapter for Volume III of the *Handbook of Industrial Organization*.
- Berry, S. and J. Waldfogel (2010): "Product Quality and Market Size," *Journal of Industrial Economics*, 58(1), 1-31.
- 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 (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*, 77(6), 1791-1828.
- Ellickson, P., and S. Misra (2008): "Supermarket Pricing Strategies," *Marketing Science*, 27(5), 811-828.
- 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*, 29(4), 564-578.
- Jia, P. (2008): "What Happens when Wal-Mart comes to town? Empirical Analysis of the Discount Retailing Industry," *Econometrica*,
- Mazzeo, M. (2002): "Product Choice and Oligopoly Market Structure," *The RAND Journal of Economics*, 33(2), 221-242.

- Reiss, P. (1996): "Empirical Models of Discrete Strategic Choices", *American Economic Review*, 86(2), 421-426.
- Seim, K. (2006): "An Empirical Model of Firm Entry with Endogenous Product-Type Choices," *RAND Journal of Economics*.
- Sweeting, A. (2006): "Coordination, Differentiation and the Timing of Radio Commercials, *Journal of Economics and Management Strategy*, 15(4), 909-942.
- 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

Required Readings:

- * Class Notes. Chapter 6.
- * Aguirregabiria, V. and P. Mira (2010): "Dynamic Discrete Choice Structural Models: A Survey," *Journal of Econometrics*, 156(1), 38-67.
- Pakes, A. (1994): "Dynamic structural models, problems and prospects," in C. Sims (ed.) *Advances in Econometrics. Sixth World Congress*, Cambridge University Press.
- Rust, J. (1994): "Structural estimation of Markov decision processes," in R. E. Engle and McFadden (eds.) *Handbook of Econometrics Volume 4*, North-Holland. Amsterdam.

Other Readings:

- 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 (2011): "CCP Estimation of Dynamic Discrete Choice Models with Unobserved Heterogeneity," *Econometrica*, 79(6), 1823-1867.
- Hong, H. and M. Shum (2010): "Pairwise-Difference Estimation of a Dynamic Optimization Model," *Review of Economic Studies*, 77, 273-304.
- Holmes, T. (2011): "The Diffusion of Wal-Mart and Economies of Density," *Econometrica*, 79(1), 253-302.
- 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. Smith (eds.) *Handbook of Applied Econometrics: Microeconomics*. Blackwell.
- Rust, J. (1994): “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 AND SUPPLY

- 7.1. Basic Model and Assumptions
- 7.2. Solving the dynamic programming (DP) problem
- 7.3. Estimation
- 7.4. Extensions
- 7.5. Estimation using Euler equations.

Required 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.
- * 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.
- Schiraldi, P. (2011): "Automobile Replacement: a Dynamic Structural Approach," *RAND Journal of Economics*.

Other Readings:

- Aguirregabiria, V. and A. Magesan (2013): “Euler Equations for Estimation of Dynamic Discrete Choice Structural Models,” with Arvind Magesan. *Advances in Econometrics*, 31, *Structural Microeconometrics*, E. Choo and M. Shum, eds., 3-44.
- 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.
- Doraszelski, U. and J. Jaumandreu (2013): “R&D and Productivity: Estimating Endogenous Productivity,” *Review of Economic Studies*, 80, 1338 - 1383.
- Kasahara, H. (2009): “Temporary Increases in Tariffs and Investment: The Chilean Case,” *Journal of Business and Economic Statistics*, 27(1), 113-127.
- 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.
- 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.
- 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.
- Bond, S. and J. Van Reenen (2007): "Microeconomic Models of Investment and Employment," in J. Heckman and E. Leamer (editors) Handbook of Econometrics, Vol. 6A. North Holland. Amsterdam.

8. STRUCTURAL MODELS OF DYNAMIC DEMAND

- 8.1. Introduction
- 8.2. Data and descriptive evidence
- 8.3. Dynamic Demand of Differentiated Storable Products
- 8.4. Dynamic Demand of Differentiated Durable Products

Required Readings:

- * Class Notes. Chapter 8.
- * Aguirregabiria, V. and A. Nevo (2013): "Recent Developments in Empirical IO: Dynamic Demand and Dynamic Games," in Advances in Economics and Econometrics, Volume 3, D. Acemoglu, M. Arellano, and E. Dekel (eds.)
- Erdem, T., S. Imai and M. P. Keane (2003): "Brand and Quantity Choice Dynamics under Price Uncertainty," Quantitative Marketing and Economics 1, 5-64.
- * Gowrisankaran, G. and M. Rysman (2012): "Dynamics of Consumer Demand for New Durable Goods," Journal of Political Economy, 120, 1173-1219.
- * Hendel, I., and A. Nevo (2006): "Measuring the Implications of Sales and Consumer Inventory Behavior. Econometrica, 74, 1637-1674.

Other Readings:

- 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.
- Esteban, S. & Shum, M. (2007). "Durable goods oligopoly with secondary markets: The case of automobiles," RAND Journal of Economics, 38, 332-354.
- 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 (2006): "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.
- 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. A Dynamic version of Bresnahan-Reiss model
- 9.3. The structure of dynamic games of oligopoly competition: Ericson-Pakes
- 9.4. Identification
- 9.5. Estimation
- 9.6. Reducing the State Space
- 9.7. Counterfactual experiments with multiple equilibria
- 5.8. Empirical Application: Environmental Regulation in the Cement Industry
- 5.9. Product repositioning in differentiated product markets
- 5.10. Dynamic Game of Airlines Network Competition
- 5.11. Other Applications
- 5.12. Estimation using Euler equations

Required Readings:

- * Class Notes. Chapter 9.
- * Aguirregabiria, V. and P. Mira (2010): "Dynamic Discrete Choice Structural Models: A Survey," *Journal of Econometrics*, 156(1), 38-67.
- * Aguirregabiria, V. and P. Mira (2007): "Sequential Estimation of Dynamic Discrete Games," *Econometrica*, 75, 1-53.
- Aguirregabiria, V. and C-Y. Ho (2012): "A dynamic oligopoly game of the US airline industry: Estimation and policy experiments," *Journal of Econometrics*, 168(1), 156-173.
- * Aguirregabiria, V. and A. Nevo (2013): "Recent Developments in Empirical IO: Dynamic Demand and Dynamic Games," in *Advances in Economics and Econometrics*, Volume 3, D. Acemoglu, M. Arellano, and E. Dekel (eds.)
- Bresnahan, T. and P. Reiss (1994): "Measuring the Importance of Sunk Costs," *Annales D'Économie et de Statistique*, 31, 183-217.
- * Ericson, R. and A. Pakes (1995): "Markov-Perfect Industry Dynamics: A Framework for Empirical Work," *Review of Economic Studies*, 62, 53-82.
- Goettler, R. and B. Gordon (2011): "Does AMD spur Intel to innovate more?" *Journal of Political Economy*, 119(6), 1141-1200.
- Igami, M (2014): "Estimating the Innovator's Dilemma: Structural Analysis of Creative Destruction in the Hard Disk Drive Industry," Mimeo.
- Pakes, Ariel and Paul McGuire. 1994. "Computing Markov-perfect Nash Equilibria: Numerical Implications of a Dynamic Differentiated Product Model," *Rand Journal of Economics*, 25, 555-589.
- Ryan, S. (2012): "The Costs of Environmental Regulation in a Concentrated Industry," *Econometrica*, 80(3), 1019-1061.
- Schiraldi, P., H. Smith and Y. Takahashi (2014): "Supermarket Competition with a Social Planner: The Effects of Entry Regulation," Mimeo.
- Sweeting, A. (2013): "Dynamic Product Positioning in Differentiated Product Industries: The Effect of Fees for Musical Performance Rights on the Commercial Radio Industry", *Econometrica*, 81(5), 1763–1803.

Other Readings:

- Aguirregabiria, V. and G. Vicentini (2013): "Dynamic Spatial Competition between Multi-Store Firms."
- Bajari, P., L. Benkard, and J. Levin (2007): "Estimating Dynamic Models of Imperfect Competition," *Econometrica*, 75(5), 1331–1370.
- Benkard, L., G. Weintraub and B. Van Roy (2008): "Markov Perfect Industry Dynamics with Many Firms," *Econometrica*, 76(6), 1375–1411.
- Cabral, L., Zhu Wang, and D. Xu (2014): "Competitors, Complementors, Parents and Places: Explaining Regional Agglomeration in the U.S. Auto Industry," NBER Working Paper 18973.
- Collard-Wexler, A. (2013): "Demand Fluctuations in the Ready-Mix Concrete Industry," *Econometrica*, 81(3), 1003–1037.
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- 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.
- Einav, L. (2010): "Not All Rivals Look Alike: Estimating an Equilibrium Model of the Release Date Timing Game," *Economic Inquiry* 48(2), 369-390.
- Hashmi, A. and J. Van Biesebroeck (2014): "Market Structure and Innovation: A Dynamic Analysis of the Global Automotive Industry," *Review of Economics and Statistics*, forthcoming.
- Huang, L., and M. Smith (2012): "The Dynamic Efficiency Costs of Common-Pool Resource Exploitation," manuscript.
- Kalouptsi, M. (2014): "Detection and Impact of Industrial Subsidies: The Case of World Shipbuilding", NBER Working Paper 20119.
- 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 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.
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- Suzuki, J. (2013): "Land Use Regulation as a Barrier to Entry: Evidence from the Texas Lodging Industry," *International Economic Review*, 54(2), 495-523.
- Toivanen, O. and M. Waterson (2011): "Retail Chain Expansion: The Early Years of McDonalds in Great Britain," CEPR Discussion Papers 8534.

CLASS SCHEDULE & REQUIRED READINGS BEFORE CLASS

<u>WEEK- DATE</u>	<u>TOPIC & READINGS</u>
Week 1: Jan. 13	Topic: Introduction Readings: Class Notes: Ch. 1
Week 2: Jan. 20	Topic: General concepts on identification and estimation of Empirical IO Models Readings: Class Notes: Ch. 1 / Reiss & Wolak (Handbook, 2007)
Week 3: Jan. 27	Topic: Production Function Estimation Readings: Class Notes – Ch. 2 / Griliches & Mairesse (98) / Olley & Pakes (96)
Week 4: Feb. 3	Topic: Production Function Estimation Readings: Class Notes: Akerberg, Caves, & Frazer (2016)
Week 5: Feb. 10	Topic: Demand Estimation Readings: Class Notes: Ch. 3 / Berry (94) / Berry, Levinsohn & Pakes (95)
Week 6: Feb. 17	Topic: Static Models of Cournot and Bertrand Competition Readings: Class Notes: Ch. 4 / Bresnahan (1987) / Nevo (2001)
Week 7: Feb. 24	Topic: Empirical Models of Market Entry Readings: Class Notes: Ch. 5 / Bresnahan & Reiss (JPE 90; RESTud 91) / Berry & Tamer (2007) I'll distribute the Problem set.
Week 8: Mar. 3	Topic: Empirical Models of Market Entry Readings: Class Notes: Ch. 5 / Aguirregabiria & Suzuki (Handbook 2015) / Seim (2006) / Sweeting (2009)
Week 9: Mar. 10	Topic: Dynamic Structural Models in IO Readings: Class Notes: Ch. 6 / Aguirregabiria & Mira (JoE 2010) Your Problem set is due.
Week 10: Mar. 17	Topic: Models of Firm Investment Readings: Class Notes: Ch. 7 / Rust (1987) / Aguirregabiria (1999) / Aguirregabiria and Luengo (2015)
Week 11: Mar. 24	Topic: Models of Dynamic Demand Readings: Class Notes: Ch. 8 / Aguirregabiria & Nevo (2013) / Hendel & Nevo (Ectca 2006)
Week 12: Mar. 31	Topic: Dynamic Games of Oligopoly Competition Readings: Class Notes: Ch. 8 / Aguirregabiria-Mira (07) / Ericson-Pakes (95) / Ryan (2012) / Sweeting (2013)