ECO 2404
EMPIRICAL APPLICATIONS OF ECONOMIC THEORY

University of Toronto. Department of Economics. Spring 2020

Prof. Eduardo Souza-Rodrigues
Department of Economics
Office: 150 St. George St., Room 324

      Lectures: Wed 11:00am-1:00pm. Room SS1070
      Office hours: Wed 10:00am-11:00am

COURSE DESCRIPTION

The course covers methods and applications in economic theory. The focus is on structural econometric methods that are at the core of Empirical Industrial Organization. I will emphasize the interactions between economic theory and empirical methods rather than focusing just on statistical analysis.

I have divided the course in three parts. The first part covers estimation of demand functions and static oligopoly models. The second part studies static two-period models using a revealed preference approach. It normally leads to moment inequalities and to partial identification. We also will see some of the econometrics problems related to moment inequalities estimators. The third part focuses on the estimation of production functions and the use of control function methods.

COMPUTATION

Both MA and PhD students must be familiar with MATLAB and statistical packages like STATA, R or SAS, as well as some basic computer programming (or be prepared to learn them during the semester). There will be a teaching assistant who will provide an introduction to MATLAB. If you plan to apply for a PhD and are interested in empirical work, then you should seriously consider learning a computational language as soon as possible.

EVALUATION

The final grade will be based on one problem set (50%) and a final project (50%). I will give you some problems during the semester relating to each part of the course and you can return the solutions to all problems by the end of the semester. I will focus on computer based questions. You are strongly encouraged to collaborate with other students. However, you should write the final answers on your own, and submit them individually. You also must

acknowledge the help of classmates and others by citing their names in the problem set.

The final project can be either a research proposal or a referee report. You can select the paper of your preference for the referee report, but the paper must relate to the topics covered in class. Problem sets and final projects submitted within 24h after the deadline will receive 50% of the points. If they are submitted 24h after the deadline or more will receive zero points.

CONTENTS OF THE COURSE

1. Introduction to Structural Models – Early Models in IO

2. Estimation Method: GMM

3. Estimation of Demand and Supply for Homogeneous Products in Oligopoly Markets

4. Estimation of Demand for Differentiated Products: Random Coefficient Models

5. Estimation of Demand and Supply for Differentiated Products in Oligopoly Markets: Nash Equilibrium

6. Estimation of Demand and Supply for Differentiated Products in Oligopoly Markets: Computational Issues

7. Applications

8. Two-Period Empirical Models: Moment Inequalities

9. Applications of Moment Inequalities: Revealed Preference Methods

10. Estimation of Production Functions: Simultaneity and Selection

11. Production Functions: 2-Step Estimators/Control Functions

12. Extensions to Production Function Estimators

References

* Indicates required reading

1. **Introduction to Structural Models - Early Models in IO**
    - * Reiss, Peter, and Wolak, Frank (2006): "Structural Econometric Modeling: Rationales and Examples from Industrial Organization," *Handbook of Econometrics*, volume 6.
      Only Sections 1-4 and 6. Available at
      http://www.stanford.edu/~preiss/makeit.pdf
    - * Notes for Grad IO
    - Nevo, A. (2010) "Taking the Dogma Out of Economics: Structural Modelling and Credible Inference," Journal of Economic Perspectives, 24(2), 69-82.
    - 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.
    - Porter, R.H. (1983). "A study of cartel stability: The Joint Executive Committee, 1880–1886". Bell Journal of Economics 14 (2), 301–314.

2. **Estimation Method: GMM**
    - * Wooldridge, J. W. (2013) *Econometric Analysis of Cross Section and Panel Data*, MIT Press, Chapter 14
    - Newey, W. K., and D. McFadden "Large Sample Estimation and Hypothesis Testing "in *Handbook of Econometrics*. Ch 36, 2113-2245.
      Sections: 1, 2.1, 2.2, 2.5, 3.1, 3.3, 4.1, 4.3
    - Pakes, A. and D. Pollard (1989). "Simulation and the Asymptotics of Optimization Estimators" *Econometrica,* Vol. 57, No. 5, pp. 1027-1057.

3. **Estimation of demand of differentiated products.**
    - * Train, K. (2003): "Discrete Choice Methods with Simulation," Cambridge University Press.

Only Chapters 2, 3, and 6.

- * [ABBA] Ackerberg, L. Benkard, S. Berry and A. Pakes (2007). "Econometric Tools for analyzing Market Outcomes," *Handbook of Econometrics*, Volume 6, Chapt 63.

  Only Section 1.

  Available at http://www.stanford.edu/~lanierb/research/tools8l-6-8.pdf

- * Berry, S. (1994). "Estimating Discrete Choice Models of Product Differentiation," Rand Journal of Economics, 242-262.

4. **Estimation of demand and supply functions: Nash Equilibrium**

- * Berry, S., J. Levinsohn, and A. Pakes (1995), "Automobile Prices in Market Equilibrium," Econometrica, 63, 841-890.

- Berry, S., J. Levinsohn, and A. Pakes (2004). "Differentiated Products Demand Systems from a Combination of Micro and Macro Data: The New Car Market," Journal of Political Economy, 112, 68—105.

- Berry, S. and A. Pakes (2007), "The Pure Characteristics Demand Model," International Economic Review, Vol. 48, 1193-1225.

- Berry, S.T., O.B. Linton and A. Pakes (2004). "Limit theorems for estimating the parameters of differentiated product demand systems." Review of Economic Studies, Vol. 71, 613-654.

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

- Bajari, P. and L. Benkard (2003). "Discrete Choice Models as Structural Models of Demand: Some Economic Implications of Common Approaches"

- Conlon, C. T. (2013): "The Empirical Likelihood MPEC Approach to Demand Estimation," SSRN Scholarly Paper ID 2331548, Social Science Research Network, Rochester, NY.

- Armstrong, T. (2016). "Large market asymptotics for differentiated product demand estimators with economic models of supply." Econometrica, 84(5), 1961-1980.

- Reynaert, M and F. Verboven (2014) "Improving the performance of random coefficients demand models: The role of optimal instruments", *Journal of Econometrics*, Volume 179 (1), 83-98.

- Freyberger, J. (2014). "Asymptotic theory for differentiated products demand models with many markets," forthcoming *Journal of Econometrics*

- Gandhi, A. and J.-F. Houde (2017). "Measuring Substitution Patterns in Differentiated Products Markets," Working paper, University of Wisconsin.

- Caplin, A. and B. Nalebuff (1991) "Aggregation and Imperfect Competition: On the Existence of Equilibrium," *Econometrica*, Vol 59, Issue 1, pp 25-59.

- Konovalov, A. and Z. Sándor (2010). "On price equilibrium with multi-product firms," *Economic Theory*, Volume 44, Issue 2, pp 271–292.

- Aksoy-Pierson, M., G. Allon, and A. Federgruen (2013). "Price Competition Under Mixed Multinomial Logit Demand Functions," *Management Science*, Vol. 59, No. 8, pp. 1817–1835.

5. **Estimation of demand and supply of differentiated products: Computational Issues**

- * Conlon, C. and J. Gortmaker (2019) "Best Practices for Demand Estimation with pyBLP," working paper.

- * Knittel, C. R. and K. Metaxoglou (2014) "Estimation of Random Coefficient Demand Models: Challenges, Difficulties and Warnings," The Review of Economics and Statistics, 96(1), 666-685.

- Judd, K. (1998) *Numerical Methods in Economics*, MIT Press.

- Miranda and Fackler (2002). *Applied Computational Economics and Finance*, MIT Press

- Dube, J.-P., J. Fox, and C.-L. Su (2012): "Improving the Numerical Performance of BLP Static Coefficients Demand Estimation," Econometrica, 80(5), 2231-2267.

- Nevo, A. (2000). "A Practitioner's Guide to Estimation of Random Coefficients Logit Models of Demand," Journal of Economics and Management Strategy, 9, 513-548.

- Su, C. and K. Judd (2011). "Constrained Optimization Approaches to Estimation of Structural Models," Econometrica.

- Skrainka, B. S. and K. L. Judd (2011). "High Performance Quadrature Rules: How Numerical Integration Affects a Popular Model of Product Differentiation," working paper.

- Skrainka, B. (2011): "A Large Scale Study of the Small Sample Performance of Random Coefficient Models of Demand," Working Paper.
- Kalouptsidi, M. (2012): "From Market Shares to Consumer Types: Duality in Differentiated Product Demand Estimation," *Journal of Applied Econometrics*, 27(2): 333-342.

6. **Nonparametric Identification of Simultaneous Equations**

- * Berry, S. and P. Haile (2013). "Identification in Differentiated Products Markets using Market Level Data," *Econometrica*, 82, September 2014, 1749-1798.
- Berry, S. and P. Haile (2009). "Nonparametric Identification of Multinomial Choice Demand Models with Heterogeneneous Consumers," working paper.
- Berry, S., A. Gandhi, and P. Haile (2013). "Connected Substitutes and Invertibility of Demand," *Econometrica*, 81, 2087-2111.
- Chernozhukov, V., and C. Hansen (2005): "An IV Model of Quantile Treatment Effects," *Econometrica*, 73(1), 245-261.
- Matzkin, R. L. (2007). "Nonparametric Identification." In *Handbook of Econometrics*, vol. 6, edited by J.J. Heckman and E. Leamer. Amsterdam: Elsevier.
- Matzkin, R. L. (2008). "Identification in Nonparametric Simultaneous Equations," *Econometrica*, 76, 945ñ978.
- Matzkin, R. L. (2010): "Estimation of Nonparametric Models with Simultaneity," Discussion paper, UCLA.
- Newey, W. K. and J. L. Powell (2003). "Instrumental Variable Estimation in Non-parametric Models," Econometrica, 71(5), 1565-1578.
- Fox, J. and A. Gandhi (2016) "Nonparametric Identification and Estimation of Random Coefficients in Multinomial Choice Models", *RAND Journal of Economics*, Vol. 47, No. 1, pp. 118–139.
- Fox, J., K. Kimb, S. P. Ryan, and P. Bajari (2012) "The random coefficients logit model is identified*," Journal of Econometrics*, 166, pp. 204–212.
- Compiani, G. (2019) "Market Counterfactuals and the Specification of Multi-Product Demand: A Nonparametric Approach," Working paper
- Lu, Z., X. Shi and J. Tao (2019) "Semi-Nonparametric Estimation of Random Coefficient Logit Model for Aggregate Demand," working paper

- Gandhi, A., Z. Lu, and X. Shi (2019) "Estimating Demand for Differentiated Products with Zeroes in Market Share Data," Working paper

7. Applications

- **Merger Analysis:**
  - * Fan, Y. (2010). "Ownership Consolidation and Product Quality: A Study of the U.S. Daily Newspaper Market," working paper.
  - Nevo, A. (2000). "Mergers with Differentiated Products: The Case of the Ready-to-Eat Breakfast Cereal Industry," Rand Journal of Economics, 31, 395-421.

- **New Product:**
  - Petrin, A. (2001). "Quantifying the Benefits of New Products: The Case of the Minivan," Journal of Political Economy.

- **Advertising:**
  - Goeree, M. (2008). "Limited Information and Advertising in the U.S. Personal Computer Industry," *Econometrica*.

- **Environmental Policy:**
  - Goldberg, P. (1998) "The Effects of the Corporate Average Fuel Economy Standards in the Automobile Industry," *Journal of Industrial Economics*, pp. 1–33.

- **Vertical Contracting**:
  - Crawford, G., R. Lee, M. Whinston, and A. Yurukoglu (2018). "The Welfare Effects of Vertical Integration in Multichannel Television Markets," *Econometrica*, 86, 891-954.
  - Villas-Boas, S. B. (2007). "Vertical Relationships between Manufacturers and Retailers: Inference with Limited Data," *Review of Economic Studies*, 74, 625–652.

- **Media Bias:**
  - Gentzkow, M., and J. Shapiro (2009). "What Drives Media Slant? Evidence from U.S. Newspapers," *Econometrica*.

- **Asymmetric Information and Insurance:**
  - Cardon, J., and I. Hendel (2001). "Asymmetric Information in Health Care and Health Insurance Markets" Evidence from the National Medical Expenditure Survey," *RAND Journal of Economics*, 32, 408–427.
  - Bundorf, K., J. Levin, and N. Mahoney (2010). "Pricing and Welfare in Health

Plan Choice," Discussion paper, Stanford University.

- Lustig, J. (2008) "The Welfare Effects of Adverse Selection in Privatized Medicare," Discussion paper, Boston University.

- **Trade:**
  - Golberg, P. K. (1995). "Product Differentiation and Oligopoly in International Markets: The Case of the U.S. Automobile Industry," *Econometrica*, 63(4), 891–951.
  - Goldberg, P., and F. Verboven (2001). "The Evolution of Price Dispersion in the European Car Market," *The Review of Economics Studies*, 68(4), 811–848.

- **Residential Sorting:**
  - Bayer, P., F. Ferreira, and R. McMillan (2007). "A Unified Framework for Measuring Preferences for Schools and Neighborhoods," *Journal of Political Economy*, 115(5), 588–638

- **School Choice:**
  - Neilson, C. (2013). "Targeted Vouchers, Competition among Schools, and the Academic Achievement of Poor Students," working paper.
  - Hastings, J., T. Kane, and D. Staiger (2007). "Preferences and Heterogeneous Treatment Effects in a Public School Choice Lottery," Discussion paper, Yale University.

8. **Two Period Empirical Models: Moment Inequalities**
   - * Ho and Rosen (2016): "Partial Identification in Applied Research: Benefits and Challenges," NBER Working Paper 21641.
   - * Pakes, A. (2010): "Alternative Models for Moment Inequalities". *Econometrica*, 78, 1783-1822.

9. **Applications of Moment Inequalities: Revealed Preference Methods**
   - * Wollmann, T. (2014) "Trucks without Bailouts: Equilibrium Product Characteristics for Commercial Vehicles," Working Paper.
   - Eizenberg, A. (2014) "Upstream Innovation and Product Variety in the United States Home PC Market," *Review of Economics Studies*, 81, 1003-1045.
   - Ho, K. (2009). "Insurer-Provider Networks in the Medical Care Market," *American Economic Review*, 99 (1), 393-430.

- Crawford, G. S and A. Yurukoglu (2012). "The welfare effects of bundling in multichannel television markets," *American Economic Review*, 102.2, pp. 643-685.

- Ho, K. and A. Pakes (2013). "Hospital Choices, Hospital Prices and Financial Incentives to Physicians", working paper.

- Ho, K., and Lee, R. S. (2017). "Insurer Competition in Health Care Markets," *Econometrica*, 85(2), 379-417.

- Jia, P. (2008). "What Happens When Wal-Mart Comes to Town: An Empirical Analysis of the Discount Retailing Industry," *Econometrica* 76.6, pp. 1263–1316.

- Morales, E., G. Sheu, and A, Zahler (2011). "Gravity and Extended Gravity: Estimating a Structural Model of Export Entry," Working Paper.

- Andrews, D., and G. Soares (2010). "Inference for Parameters Defined by Moment Inequalities Using Generalized Moment Selection Procedures," *Econometrica*, pp 119-157.

- Chernozhukov, V., H. Hong and E. Tamer (2007). "Estimation and Confidence Regions for Parameter Sets in Econometric Models," *Econometrica*, Vol. 75 (5), pp. 1243-1284.

- Kaido, H., F. Molinari, and J. Stoye (2016): "Inference for Projections of Identified Sets," Manuscript. Cornell Univerisity.

- Canay, I. A. and A. M. Shaikh (2016). "Practical and Theoretical Advances in Inference for Partially Identified Models," forthcoming in *Advances in Economics and Econometrics: 11th World Congress of the Econometric Society*.

10. Estimation of Production Functions: Simultaneity and Endogenous firm exit

- * [ABBA]. Section 2.

- * Griliches, Zvi, and Jacques Mairesse (1995): "Production Functions: The Search for Identification," NBER Working Paper No. 5067. http://www.nber.org/papers/W5067

- Marschak, Jacob, and William Andrews (1944) "Random Simultaneous Equations and the Theory of Production," *Econometrica*, 12, 3/4, 143-205. See Also Marschak and Andrews, 1945, Errata, 13, 1, 91.

- Blundell, R. and S. Bond (1999): "GMM estimation with persistent panel data: An application to production functions," The Institute for Fiscal

Studies. Working Paper Series No. W99/4. http://www.ifs.org.uk/wps/wp9904.pdf

- Bond, S., and M. Söderbom (2004): "Adjustment costs and the identification of Cobb Douglas production functions," Manuscript, Institute for Fiscal Studies, London.

11. Production Function : 2-Step Estimator/Control Function

- * Olley, S., and A. Pakes (1996), "The dynamics of productivity in the telecommunications equipment industry", *Econometrica*, 64, 1263-97.
- * Levinsohn, J. and A. Petrin (2003): "Estimating production functions using inputs to control for unobservables," *Review of Economic Studies*, pp. 317-342. http://www.nber.org/papers/w7819.pdf
- Pakes, A. and S. Olley (1995). "A Limit Theorem for a Smooth Class of Semiparametric Estimators," *Journal of Econometrics*, 65, 295-332.

12. Extensions to Production Function Estimators

- * Ackerberg, D., K. Caves and G. Frazer (2003): "Structural Identification of Production Functions," manuscript.
- De Loecker, J. (2011). "Product Differentiation, Multi-Product Firms and Estimating the Impact of Trade Liberalization on Productivity," *Econometrica*, 79, 1407-1451.
- De Loecker, J., P.K. Goldberg, A.K. Khandelwal, and N. Pavcnik (2014). "Prices, Markups and Trade Reform," NBER Working Paper No. 17925.
- Doraszelski, U. and J. Jaumandreu (2013): "R&D and Productivity: Estimating Endogenous Productivity," *Review of Economic Studies*, 80(4), 1338-1383.
- Gandhi, A., S. Navarro and D. Rivers (2013), "On the Identification of Production Functions: How Heterogeneous is Productivity?" Working Paper.
- Balat, J., I. Brambilla and Y. Sasaki (2016). "Heterogeneous Firms: Skilled-Labor Productivity and Export Destinations"