# ECO 2404
# EMPIRICAL APPLICATIONS OF ECONOMIC THEORY

**University of Toronto. Department of Economics. Spring 2021**

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Lectures: Tuesdays, 3:00pm-5:00pm, online synchronous
Office hours: Tuesdays, 2:00pm-3:00pm, online synchronous

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## 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.

In terms of background, it is advisable to know beforehand microeconomics and game theory. It is also useful to know linear regression models, instrumental variables, simultaneous equations model, panel data, and discrete choice models (probit/logit), as well as the standard estimation techniques: ordinary least squares, maximum likelihood, and methods of moments. The econometric technique I will use the most is the generalized method of moments (GMM); I will give one extra class just to cover it (to be scheduled).

## LECTURE SCHEDULE AND RECORDING

Weekly lectures will be live-streamed via Zoom every Tuesday, from 3pm to 5pm. The office hours will be via Zoom as well, every Tuesday, from 2pm to 3pm. The link to the Zoom meetings will be announced and posted on the course Quercus website. Each lecture

will also be recorded and posted on Quercus. Students have the option of either attending the lecture live-stream or watching the recordings according to their own schedule (though I strongly recommend participating in the live-streams). All classes begin at 10 minutes after the hour. Note that there will be no in-person lectures.

During the online sessions, please mute your microphone when you are not speaking. I also encourage (but do not require) students to maintain their cameras turned on, as nonverbal cues provide immediate useful feedback during the lectures. My goal is to make the virtual classes as close as possible to presential classes.

All lecture times, tutorial times, exam times, deadlines, etc. are stated in local Toronto time. Please note that Toronto adheres to Eastern Daylight Time, starting Sunday, March 14, 2021, 2:00 am. It is your responsibility to convert correctly local Toronto time to your time zone: I will not accept confusion about deadlines as an excuse for lateness or missed tests/work.

## 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.

## COMMUNICATION

Email can be a useful tool in facilitating communication between faculty and students, but there are serious limitations to how useful email can be to address questions in econometrics:

- If the response requires more than one sentence, email is not the appropriate medium

for discussion of course materials. If it takes more, class time or office hours are the more appropriate venue;

- In conformance with university policy, students are advised to ONLY use their utoronto email addresses. (Note that it avoids having your email trapped by my spam filter.)
- Always identify yourself in your email. You should include "ECO2404" and a brief statement of the subject matter in the subject heading. Please avoid sending attachments of any kind, and never use email to submit term work.
- While I endeavor to respond to emails within 48 hours (except on weekends), if you do not get a response to your email, please attempt to contact me again.
- Please also note that it is not appropriate to request marks or the solutions to problem set or midterm questions by email.
- Email should NOT be seen as a means to receive private tutorials or review material that was covered in class but you missed.
- Do not use the Quercus Inbox Application; I do not answer these.
- I do not respond to phone calls.
- The TA is under no obligation to respond to your email, so please limit your questions for him/her to the tutorials.

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
    - * Haile, Phil (2019). "Structural vs. Reduced Form: Language and Models in Empirical Economics" (Slides)
      *Available at* www.econ.yale.edu/~pah29/intro.pdf
    - Pakes A. (2020) "A Helicopter Tour of Empirical Industrial Organization," Working Paper.
    - Berry, S., Martin Gaynor, and Fiona Scott-Morton (2019). "Do Increasing Markups Matter? Lessons from Empirical Industrial Organization," *Journal of Economic Perspectives*, Vol 33(3), pages 44-68.
    - 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.
      *Only Chapter 14.*

- Newey, W. K., and D. McFadden (1994) "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 1, 2, 3, and 6. (Feel free to read chapters 4 and 5 if you want.)*
  *Available at* https://eml.berkeley.edu/books/choice2.html
- * [ABBA] Ackerberg, L. Benkard, S. Berry and A. Pakes (2007). "Econometric Tools for analyzing Market Outcomes," *Handbook of Econometrics*, Volume 6A, Chapter 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*, Vol 25(2), pp. 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.
- 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," Working Paper.
- 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.
- Nocke, V. and Schutz, N. (2018). "Multiproduct-firm Oligopoly: An Aggregative Games Approach," *Econometrica*, 86(2), pp. 523-557.

## 5. Estimation of Demand and Supply of Differentiated Products: Estimation and Computational Issues

- * Conlon, C. and J. Gortmaker (2020) "Best Practices for Demand Estimation with pyBLP," *Rand Journal of Economics* (forthcoming).
- 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.
- 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.
- 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*
- 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.

- 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.
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- Su, C. and K. Judd (2011). "Constrained Optimization Approaches to Estimation of Structural Models," *Econometrica*, 80(5), pp. 2213-2230.
- 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. (2012). "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), pp. 333-342.

- **Books on Numerical Methods:**
  - Miranda and Fackler (2002). *Applied Computational Economics and Finance*, MIT Press.
  - Judd, K. (1998) *Numerical Methods in Economics*, MIT Press.

**6. Nonparametric Identification of Simultaneous Equations**

- * Berry, S. and P. Haile (2014). "Identification in Differentiated Products Markets using Market Level Data," *Econometrica*, 82(5), pp. 1749-1798.
- Berry, S. and P. Haile (2020). "Nonparametric Identification of Differentiated Products Demand Using Micro Data," Working Paper.
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## 7. Applications

- **Merger Analysis:**
  - * Fan, Y. (2013). "Ownership Consolidation and Product Quality: A Study of the U.S. Daily Newspaper Market," *American Economic Review*, 103(5), 1598-1628.
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- **New Product:**
  - Petrin, A. (2001). "Quantifying the Benefits of New Products: The Case of the Minivan," *Journal of Political Economy*, 110(4), 705-729.
- **Advertising:**
  - Goeree, M. (2008). "Limited Information and Advertising in the U.S. Personal Computer Industry," *Econometrica*, 76(5), pp. 1017-1074.
- **Environmental Policy:**
  - Goldberg, P. (1998) "The Effects of the Corporate Average Fuel Economy Standards in the Automobile Industry," *Journal of Industrial Economics*, 1-33.
  - Grigolon, L., M. Reynaert and Frank Verboven (2018) "Consumer Valuation of Fuel Costs and Tax Policy: Evidence from the European Car Market," *American Economic Journal: Economic Policy*, 10(3), pp. 193-225.
  - Reynaert, M. (2020) "Abatement Strategies and the Cost of Environmental Regulation: Emission Standards on the European Car Market", *Review of Economic Studies*, forthcoming
- **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, Cable TV, Smartphones, Apps:**
  - Gentzkow, M., and J. Shapiro (2009). "What Drives Media Slant? Evidence from U.S. Newspapers," *Econometrica*.
  - Crawford, G. S., O. Shcherbakov, and M. Shum. (2019). "Quality Overprovision in Cable Television Markets." *American Economic Review*, 109 (3): 956-95.
  - Fan, Y. and C. Yang (2020), "Competition, Product Proliferation and Welfare: A Study of the US Smartphone Market," *American Economic Journal: Microeconomics*, 12(2), pp. 99-134.
  - Ershov, D. (2020) "Consumer Product Discovery Costs, Entry, Quality and Congestion in Online Markets," Working Paper.
- **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 Survery," *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.

- **Health:**
  - Gaynor, M., K. Ho, and R. J. Town (2015). "The Industrial Organization of Health Care Markets," *Journal of Economic Literature*, 53(2): 235-284.
  - Coughlin, M. (2020) "Insurance Choice with Non-Monetary Plan Attributes: Limited Consideration in Medicare Part D," Working Paper.
  - Ho, K., J. Hogan, and F. Scott-Morton (2017). "The impact of Consumer Inattention on Insurer Pricing in the Medicare Part D Program," *The RAND Journal of Economics*, 48, 877-905.
  - Tebaldi, P., A. Torgovitsky, and H. Yang (2019) "Nonparametric Estimates of Demand in the California Health Insurance Exchange," Working Paper.
- **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.
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  - Blum, B., S. Claro, I. Horstmann, and D. Rivers (2018) "The ABCs of Firm Heterogeneity: The Effects of Demand and Cost Differences on Exporting," Working Paper, University of Toronto.
- **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. (2020). "Targeted Vouchers, Competition among Schools, and the Academic Achievement of Poor Students," working paper.
  - Kapor, A. J., C. A. Neilson, and S. D. Zimmerman. (2020). "Heterogeneous

Beliefs and School Choice Mechanisms." *American Economic Review*, 110 (5): 1274-1315.

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## 8. Two Period Empirical Models: Moment Inequalities

- * Ho, K. and A. Rosen (2017). "Partial Identification in Applied Research: Benefits and Challenges," In B. Honore, A. Pakes, M. Piazzesi, L. Samuelson (Eds.), *Advances in Economics and Econometrics: Eleventh World Congress (Econometric Society Monographs) (Volume II)*, pp. 307-359. (Also NBER Working Paper 21641.)
- * Pakes, A. (2010): "Alternative Models for Moment Inequalities," *Econometrica*, 78, 1783-1822.

## 9. Applications of Moment Inequalities: Revealed Preference Methods

- * Ho, K. (2009). "Insurer-Provider Networks in the Medical Care Market," *American Economic Review*, 99 (1), 393-430.
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- 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 (2014). "Hospital Choices, Hospital Prices and Financial Incentives to Physicians", *American Economic Review*, 104(12): 3841-84.
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- **The Econometrics of Partial Identification:**
  - Canay, I. A. and A. M. Shaikh (2017). "Practical and Theoretical Advances in Inference for Partially Identified Models," In B. Honoré, A. Pakes, M. Piazzesi, & L. Samuelson (Eds.), *Advances in Economics and Econometrics: Eleventh World Congress* (Econometric Society Monographs, pp. 271-306). Cambridge: Cambridge University Press.
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**10. Estimation of Production Functions: Simultaneity and Endogenous Firm Exit**

- * [ABBA]. Section 2.
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115-143.

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

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## 12. Extensions to Production Function Estimators


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