Rotman School of Management
University of Toronto
RSM 3055: Econometrics Methods in Marketing
Fall, 2014

Professor Andrew Ching
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Course Description:
This course focuses on recent developments in quantitative marketing and empirical industrial organization, with an emphasis on dynamic structural models. We will study techniques for developing and estimating models of demand and competition in both static and dynamic settings. In these types of models, an economic agent's decision today can have an impact on how he and other players make their decisions in the future. In many situations, economic agents recognize this relationship and make strategic choices. Examples of dynamic demand models include consumer learning models, inventory and stockpiling problems, durable goods adoption and replacement decisions. Examples of dynamic competition models include dynamic price competition, entry-exit, store location and product positioning. We will emphasize the importance of combining theory, institutional details and econometric techniques to answer these types of questions in marketing, industrial organization and other applied microeconomics areas. By discussing several empirical applications in detail, we will illustrate how to apply basic modeling techniques to problems at hand. There is no text. The course will be a mixture of lecture notes and discussion of specific papers.

Meetings:
In each class, I will also assign several papers to students to read, typically oriented around a particular topic, estimation or modeling approach. I will give lectures in some classes. But in other classes, if you are assigned to read one paper (or more than one occasionally) carefully, you will be responsible for making a comprehensive presentation to the class about it and leading a discussion of the paper's strengths, weaknesses, and opportunities for future research. *Please note that attendance at all class sessions is a course requirement.*

Each student presentation of an assigned paper should provide:
- An analysis of what the research has accomplished its contribution, and a clear explanation of any potentially confusing aspects. At this time the key modeling elements and empirical results of the paper should be reviewed and evaluated.
- A careful critique of the research, including a discussion of the paper's major strengths and weaknesses.
- An agenda for future research in the problem area.

So you essentially need to prepare a detailed referee report when you are assigned to read a paper carefully. Students who audit the course will also be assigned readings and be responsible for presenting.

Term Project

Students who take this class for credits are required to complete a term project. It should develop a clear research question(s), and at least an empirical modeling framework that can be used to answer the research question(s). Ideally, it should also include data analysis. The empirical framework needs to be at the advanced level, either the ones that we covered in the class, or those at the similar level of sophistication. A research topic needs to be determined by the 4th week of the classes. Ideally, preliminary data analysis should be conducted by the 4th week of the class as you explore the feasibility of research questions. By the 5th week of the classes, you should determine your research question(s), and give a presentation on your progress. By the 8-9th week of the classes, you should develop the basic empirical framework for your paper. For the rest of the course, you should fine tune your model, and implement it to the data. The deadline of submitting the term project is Dec 13 (if students have many final exams to prepare, I might extend the deadline).

Basis for Grading
- 35% Assignments (incl. presentations)
- 15% Participation in Class Discussions
- 50% Term Project

Class Schedule

Session 1: Introduction: Choice Models (Sep 9)

- Train, Kenneth (2009), Discrete Choice Methods with Simulation, Ch.2, 3, 4 (sections 4.1, 4.2 and 4.3), 6.
- Matt Shum's notes on "Single-agent dynamic optimization models."

Session 2: Finite horizon single agent dynamic problem (Sep 16)

- Diermeier, Daniel, Michael Keane and Antonio Merlo (2005) "A Political Economy Model of Congressional Careers," *American Economic Review*, vol.95(1), pp.347-373.
- Keane, Michael P., Petra Todd and Kenneth Wolpin (2011), "The Structural Estimation of Behavioral Models: Discrete Choice Dynamic Programming Methods and Applications," Handbook of Labor Economics, vol.2. http://athena.sas.upenn.edu/~petra/papers/handbook_labor.pdf
- Yang, Botao and Andrew Ching, "Dynamics of Consumer Adoption of Financial Innovation: The Case of ATM Cards," working paper. Available at SSRN: http://ssrn.com/abstract=1434722
- Ishihara, M. and A.T. Ching (2012), "Dynamic demand for new and used durable goods without physical depreciation: The case of Japanese video games," working paper, Available at SSRN: http://ssrn.com/abstract=2189871

Session 3: Dynamic stockpiling (Sep 23)

- Ching, Andrew, Tulin Erdem and Michael Keane (2009), "The Price Consideration Model of Brand Choice," *Journal of Applied Econometrics*, vol. 24, pp. 393-420. http://onlinelibrary.wiley.com/doi/10.1002/jae.1053/pdf
- Hendel, Igal and Aviv Nevo (2006), "Measuring the Implications of Sales and Consumer Inventory Behavior," *Econometrica*, 74(6): 1637-73.
- Erdem, Tulin, Susumu Imai, and Michael P. Keane (2003), "Brand and Quantity Choice Dynamics Under Price Uncertainty," *Quantitative Marketing and Economics*, 1 (1), 5-64.
- Seiler, Stephan (2013), "The Impact of Search Costs on Consumer Behavior: A Dynamic Approach," *Quantitative Marketing and Economics*, vol.11(2), pp.155-203.
- Slonim, Robert and Ellen Garbarino (2009), "Similarities and Differences between Stockpiling and Reference Effects," *Managerial and Decision Economics*, vol.30, 351-371.
- Hendel, Igal and Aviv Nevo (2013), "Intertemporal Price Discrimination in Storable Goods Markets," *American Economic Review*, vol.103(7), pp.2722-2751.

Assignment 1 will be given.

Session 4: Consumer Learning: A survey (Sep 30)

- Ching, Andrew T., Tulin Erdem and Michael Keane (2013), "Learning Models: An Assessment of Progress, Challenges and New Developments," *Marketing Science*, 32(6): pp.913-938. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1910839
- Ackerberg, D. (2003) "Advertising, Learning and Consumer Choice in Experience Good Markets: An Empirical Examation," *International Economic Review*, vol.44(3), pp.1007-1040.
- Ching, Andrew and Masakazu Ishihara (2010), "The Effects of Detailing on Prescribing Decisions under Quality Uncertainty," *Quantitative Marketing and Economics*, vol.8(2), pp.123-165.
- Keane and Wolpin (1994), "The Solution and Estimation of Discrete Choice Dynamic Programming Models by Simulation and Interpolation: Monte Carlo Evidence," *Review of Economics and Statistics*, vol.76, pp.648-672.
- Osborne, Matthew (2011), "Consumer Learning, switching costs, and heterogeneity: A structural examination," *Quantitative Marketing and Economics*, 9(1): 25-46.
- Crawford, G. and M. Shum (2004), "Uncertainty and learning in pharmaceutical demand," *Econometrica*, vol.73(4), pp.1137-1173.
- Grubb, Michael and Matthew Osborne (2015), "Cellular Service Demand: Biased Beliefs, Learning, and Bill Shock," forthcoming in *AER*.

Session 5: Student's presentation on research progress (Oct 7)

Session 6: Bayesian Estimation of Dynamic Programming Models (Oct 14)

- Train, Kenneth (2009), Chapter 11, 12; Geweke, John (2003), Chapter 2, 3

- Imai, Susumu, Neelam Jain and Andrew Ching (2009), "Bayesian Estimation of Dynamic Discrete Choice Models," *Econometrica*, vol.77(6), pp.1865-1899.
- Ching, Andrew, S. Imai, M. Ishihara, and N. Jain (2012), "A Practitioner's Guide to Bayesian Estimation of Discrete Choice Dynamic Programming Models," *Quantitative Marketing and Economics*, vol.10(2), pp.151-196.
- Ishihara, M. and A. Ching, "Bayesian Estimation of non-stationary dynamic programming problems," working paper, Stern School of Business, NYU.

Assignment 2 will be given.

Session 7: Other approaches to estimate dynamic models (Oct 21)

- Geweke, John F. and Michael P. Keane. 2000. Bayesian Inference for Dynamic Discrete Choice Models without the Need for Dynamic Programming. In Mariano, Schuermann, and Weeks, editors, *Simulation Based Inference and Econometrics: Methods and Applications*, pp.100-131. Cambridge University Press.
- Houser, Daniel, Michael P. Keane, Kevin McCabe (2004), "Behavior in a dynamic decision problem: an analysis of experimental evidence using a Bayesian type classification algorithm," *Econometrica*, vol.72(3), pp.781-822.
  http://mason.gmu.edu/~dhouser/behavior.pdf
- Ching, Andrew, Tulin Erdem and Michael Keane (2014), "A Simple Method to Estimate the Roles of Learning, Inventories and Category Consideration in Consumer Choice," Rotman School of Management Working Paper No. 2450679, Available at SSRN: http://ssrn.com/abstract=2450679

Session 8: Identification of Dynamic Models (Oct 28)

- Yao, Song, Carl Mela, Jeongwen Chiang and Yuxin Chen (2013), "Determining Consumers," *Journal of Marketing Research*, 49(6): 822-841.
- Fang, Hanming and Yang Wang (2014) "Estimating Dynamic Discrete Choice Models with Hyperbolic Discounting, with an application to Mammography Decisions," working paper, U of Pennsylvania, forthcoming in *International Economic Review*.
- Chung, Doug, Thomas Steenburgh and K. Sudhir (2013), "A Dynamic Structural Analysis of Bonus-Based Compensation Plans," working paper, Harvard Business School.
- Magnac, Thierry and David Thesmar (2002), "Identifying dynamic discrete choice models," *Econometrica*, vol.70(2), pp.801-816.
- Dube, J-P, G.J. Hitsch and P. Jindal (2014), "The Joint Identification of Utility and Discount Functions from Stated Choice Data: An application to durable goods adoption," forthcoming in *Quantitative Marketing and Economics*.

Session 9: Dynamic oligopoly model (Nov 4)

- Pakes, Ariel; McGuire, Paul (2002), "Stochastic Algorithms for Dynamic Models: Markov Perfect Equilibrium, and the 'Curse' of Dimensionality," *Econometrica*, vol.69(5), pp.1261-1281.
- Ericson, Richard; Pakes, Ariel (1995), "Markov-Perfect Industry Dynamics: A Framework for Empirical Work," *Review of Economic Studies*, vol.62(1), pp.53-82.

- Pakes, Ariel; McGuire, Paul, "Computing Markov-Perfect Nash Equilibria: Numerical Implications of a Dynamic Differentiated Product Model," *RAND Journal of Economics*, vol.25(4): pp.555-89, Winter 1994.
- Weintraub, G.Y., C.L. Benkard, B. Van Roy (2008), "Markov Perfect Industry Dynamics With Many Firms," *Econometrica*, vol.76(6), pp.1375-1411.
- Ching, Andrew (2010), "A dynamic oligopoly structural model for the prescription drug market after patent expiration," *International Economic Review*, vol.51(4), pp.1175-1207.
- Borkovsky, Ron, Avi Goldfarb, Avery Haviv, Sridhar Moorthy (2014) "An Empirical Study of the Dynamics of Brand Building," working paper. http://www-2.rotman.utoronto.ca/facbios/file/brandbuilding.pdf

Session 10: Endogeneity Problem (Nov 11)
- Rossi, Peter E. (2014) "Even the Rich Can Make Themselves Poor: A Critical Examination of IV Methods in Marketing Applications," *Marketing Science*, vol.33(5), pp.655-672.
- Train, Kenneth (2009), Discrete Choice Methods with Simulation, Ch.13.
- Villas-Boas, J.M. and Russell Winer (1999) "Endogeneity in brand choice models," *Management Science*, vol.45(10), pp.1324-1338.
- Ching, Andrew, Robert Clark, Ig Horstmann, Hyunwoo Lim (2014) "The Effects of Publicity on Demand: The Case of Anti-Cholesterol Drugs," working paper. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1782055

Session 11: Take a Deeper Look at Random Utility Models (Nov 18)
- Fudenberg, Drew and Tomasz Strzalecki (2014) "Dynamic Logit with Choice Aversion," forthcoming in Econometrica.
- Swait, Joffre and A.A.J. Marley (2013) "Probabilistic choice (models) as a result of balancing multiple goals," Journal of Mathematical Psychology, vol.57, pp.1-14.
- Matejka, Filip and Alisdair McKay (2014) "Rational Inattention to Discrete Choices: A New Foundation for the Multinomial Logit Model," forthcoming in *Econometrica*.
- Gul, Faruk, Paulo Natenzon and Wolfgang Pesendorfer (2014) "Random Choice as Behavioral Optimization," *Econometrica*, vol.82(5), pp.1873-1912.
- Webb, Ryan, "Dynamic Constraints on the Distribution of Stochastic Choice: Drift Diffusion implies Random Utility," working paper.

Session 12: Structural estimation vs. Atheoretic approach (Nov 25)

- Angrist, J.D. and J-S Pischke (2010), "The Credibility Revolution in Empirical Economics: How Better Research Design is Taking Con out of Econometrics," *Journal of Economic Perspective*, vol.24(2), pp.3-30.
- Leamer, E. (1983), "Let's Take the Con out of Econometrics," *American Economic Review*, vol.73(1), pp.31-43.
- Leamer, E. (2010), "Tantalus on the Road to Asymptopia," *Journal of Economic Perspective*, vol.24(2), pp.31-46.
- Keane, M.P. (2010), "A structural perspective on the experimentalist school," *Journal of Economic Perspective*, vol.24(2), pp.47-58.

- Keane, M.P. (2010), "Structural vs. atheoretic approaches to econometrics," Journal of Econometrics, vol.156, pp.3-20.
- Sims, C.A. (2010), "But Economics is Not an Experimental Science," *Journal of Economic Perspective*, vol.24(2), pp.59-68.
- Rust, John (2014) "The Limits of Inference with Theory: A Review of Wolpin (2013)," *Journal of Economic Literature*, vol.52(3), pp.820-850.

Session 13: Students' presentations (Dec 2)