"Empirical Methods in Management Science"

Instructor: Marcelo Olivares

Course Schedule: Monday 4.00-7.15 pm, Spring A Term.

Dates: January 26, February 2, 9, 16, 23 and March 2.

Course Description

The main objective of this doctoral course is to provide students with broad set of empirical methods to conduct research in disciplines related to Management Science, including Operations Management, Marketing, Strategy, Accounting and Applied Economics, and interdisciplinary research among these fields. This course does not substitute the formal training of a statistics and econometrics courses. A typical statistics and econometrics class will cover in detail the mechanics and statistical properties of different estimators, which is beyond the scope of this class. However, many times students fulfill their statistics/econometrics classes without a clear understanding on how to apply these methods to answer an empirical research question. This course aims to fill that gap by providing a problem-oriented approach, where the focus is on learning how to identify a suitable empirical strategy to tackle a research question. Because of the limited time, this course does not cover in detail the properties and implementation of the econometric methods used, and students are encouraged to learn those details by taking a series of statistics/econometrics class.

The course format combines lectures (a few) and a seminar-style class, where students and the instructor present and discuss published articles and working papers. Students need to prepare before each class by reading selected texts, including papers and book chapters. Two books will be covered in detail:

- Train, Kenneth E. 2009. *Discrete choice methods with simulation*. Cambridge university press
- Angrist, Joshua D, Jörn-Steffen Pischke. 2008. *Mostly harmless econometrics: An empiricist's companion*. Princeton university press.

In addition, we will have some computer assignments using statistical software (preferably Stata). During the course, the students will develop a research idea that can be approached with some of the tools covered in class. By the end of the course, students are expected to submit a research proposal that describes the research question and the potential data and empirical methodology that can be used to answer it.

The course final grade combines the students' paper presentations, the computer assignments and the research proposal.

1 Causal analysis with regression

This section provides an overview of methodologies that use different empirical strategies to identify causal effects using field data. We also discuss different data sources, data structures and data collection techniques which are useful in general to conduct empirical research.

- Dif-in-Dif, Panel data:
  - Angrist, Joshua D, Jörn-Steffen Pischke. 2008. *Mostly harmless econometrics: An empiricist's companion*. Princeton university press, Chapters 1-3, 5.
  - Hsiang, Solomon M, Marshall Burke, Edward Miguel. 2013. Quantifying the influence of climate on human conflict. *Science* **341**(6151) 1235367
  - Gallino, Santiago, Antonio Moreno. 2014. Integration of online and offline channels in retail: The impact of sharing reliable inventory availability information. *Management Science*
  - David, Dranove, Kessler Daniel, McClellan Mark, Satterthwaite Mark. 2003. Is more information better? the effects of report cards on health care. *The Journal of Political Economy* **111** 555–88
  - Jin, Ginger Zhe, Phillip Leslie. 2003. The effect of information on product quality: Evidence from restaurant hygiene grade cards. *The Quarterly Journal of Economics* 409–451
  - Milyo, Jeffrey, Joel Waldfogel. 1999. The effect of price advertising on prices: Evidence in the wake of 44 liquormart. *American Economic Review* 1081–1096
  - Matsa, David A. 2010. Competition and product quality in the supermarket industry. *Quarterly Journal of Economics, forthcoming*
- Instrumental Variables:
  - Angrist, Joshua D, Jörn-Steffen Pischke. 2008. *Mostly harmless econometrics: An empiricist's companion*. Princeton university press Chapter 4.
  - Kim, Song-Hee, Carri Chan, Marcelo Olivares, Gabriel J Escobar. 2013. Icu admission control: An empirical study of capacity allocation and its implication on patient outcomes. *Columbia Business School research paper* (12/34)
  - Oberholzer-Gee, Felix, Koleman Strumpf. 2007. The effect of file sharing on record sales: An empirical analysis. *Journal of political economy* **115**(1) 1–42

  - Cachon, Gerard, Santiago Gallino, Marcelo Olivares. 2013. Does adding inventory increase sales? evidence of a scarcity effect in us automobile dealerships. *Evidence of a Scarcity Effect in US Automobile Dealerships (June 28, 2013). Columbia Business School Research Paper* (13-60)
  - KC, Diwas Singh, Christian Terwiesch. 2011. The effects of focus on performance: Evidence from california hospitals. *Management Science* **57**(11) 1897–1912
  - Berry, Steven T, Joel Waldfogel. 2001. Do mergers increase product variety? evidence from radio broadcasting. *Quarterly Journal of Economics* 1009–1025
  - Anderson, Michael L, David A Matsa. 2011. Are restaurants really supersizing america? *American Economic Journal: Applied Economics* 152–188

- Field Experiments:
  - Anderson, Eric T, Gavan J Fitzsimons, Duncan Simester. 2006. Measuring and mitigating the costs of stockouts. *Management Science* **52**(11) 1751–1763
  - Bandiera, Oriana, Iwan Barankay, Imran Rasul. 2005. Social preferences and the response to incentives: Evidence from personnel data. *The Quarterly Journal of Economics* 917–962

- Regression Discontinuity:
  - Angrist, Joshua D, Jörn-Steffen Pischke. 2008. *Mostly harmless econometrics: An empiricist's companion*. Princeton university press Chapter 6.
  - Lacetera, Nicola, Devin G Pope, Justin R Sydnor. 2011. Heuristic thinking and limited attention in the car market. Tech. rep., National Bureau of Economic Research
  - Hartmann, Wesley, Harikesh S Nair, Sridhar Narayanan. 2011. Identifying causal marketing mix effects using a regression discontinuity design. *Marketing Science* **30**(6) 1079–1097,

2 Static models of consumer choice

Many research questions in economics, marketing, operations and management involve analyzing demand. Examples include the effect of promotions on sales (Marketing), the effect of a product stock-out on category sales (Operations), the consumer welfare effects of new product introductions (Economics), among many other examples. This section focuses in applications where regression and reduced form models are inadequate to capture essencial aspects of a demand system – in particular, problems where consumers can choose among a discrete

set of alternatives. We start with basic discrete choice models (Multinomial Probit and Logit), discuss its limitations and move to more flexible models. Different estimation techniques are discussed through different applications, using individual level data and aggregate data.

- Discrete Choice models and estimation with individual level data:
  - Train, Kenneth E. 2009. *Discrete choice methods with simulation*. Cambridge university press
  - Lu, Yina, Andrés Musalem, Marcelo Olivares, Ariel Schilkrut. 2013. Measuring the effect of queues on customer purchases. *Management Science* **59**(8) 1743–1763
  - Bell, David R, James M Lattin. 1998. Shopping behavior and consumer preference for store price format: Why large basket shoppers prefer edlp. *Marketing Science* **17**(1) 66–88
- Estimation with aggregate data:
  - Bodapati, Anand V, Sachin Gupta. 2004. The recoverability of segmentation structure from store-level aggregate data. *Journal of Marketing Research* **41**(3) 351–364.
  - Zenor, Michael J, Rajendra K Srivastava. 1993. Inferring market structure with aggregate data: A latent segment logit approach. *Journal of Marketing Research* 369–379
  - Stockouts: Vulcano, Gustavo, Garrett Van Ryzin, Richard Ratliff. 2012. Estimating primary demand for substitutable products from sales transaction data. *Operations Research* **60**(2) 313–334
  - Musalem, Andrés, Marcelo Olivares, Eric T Bradlow, Christian Terwiesch, Daniel Corsten. 2010. Structural estimation of the effect of out-of-stocks. *Management Science* **56**(7) 1180–1197.

3 Price endogeneity in consumer choice models

- Individual level data
  - Train, Kenneth E. 2009. *Discrete choice methods with simulation*. Cambridge university press, Chapter 13
  - Control Function approach: Petrin, Amil, Kenneth Train. 2010. A control function approach to endogeneity in consumer choice models. *Journal of Marketing Research* **47**(1) 3–13
  - Phillips, Robert, A Serdar Simsek, Garrett van Ryzin. 2014. The effectiveness of field price discretion: Empirical evidence from auto lending. *Forthcoming in Management Science*

  - Albuquerque, Paulo, Bart J Bronnenberg. 2012. Measuring the impact of negative demand shocks on car dealer networks. *Marketing Science* **31**(1) 4–23

- Aggregate data:
  - Berry, Steven T. 1994. Estimating discrete-choice models of product differentiation. *The RAND Journal of Economics* 242–262
  - Berry, Steven, James Levinsohn, Ariel Pakes. 1995. Automobile prices in market equilibrium. *Econometrica: Journal of the Econometric Society* 841–890
  - Dubé, Jean-Pierre, Jeremy T Fox, Che-Lin Su. 2012. Improving the numerical performance of static and dynamic aggregate discrete choice random coefficients demand estimation. *Econometrica* **80**(5) 2231–2267
  - Nevo, Aviv. 2000. A practitioner's guide to estimation of random-coefficients logit models of demand. *Journal of Economics & Management Strategy* **9**(4) 513–548
  - Besanko, David, Jean-Pierre Dubé, Sachin Gupta. 2003. Competitive price discrimination strategies in a vertical channel using aggregate retail data. *Management Science* **49**(9) 1121–1138
  - Spatial competition: Davis, Peter. 2006. Spatial competition in retail markets: movie theaters. *The RAND Journal of Economics* **37**(4) 964–982

4 Dynamic models of demand

In many situations, consumer make decisions in order to maximize their utility in the long term, which can affect not only their product choice but also the "timing" of their purchases. This type of choices requires a dynamic decision model, which accounts for consumers "forward-looking" (a.k.a. "strategic") behavior. We review a general framework to model dynamic decisions (which is applicable to consumers but also to firms) and discuss several applications in the context of retail, airlines and services.

- Framework of dynamic models: Rust, John. 1987. Optimal replacement of gmc bus engines: An empirical model of harold zurcher. *Econometrica: Journal of the Econometric Society* 999–1033

- Strategic customers in retail:
  - Survey on Sales Promotion Models: Van Heerde, Harald J, Scott A Neslin. 2008. Sales promotion models. *Handbook of marketing decision models*. Springer, 107–162

  - Post-promotion dip: Hendel, Igal, Aviv Nevo. 2006. Measuring the implications of sales and consumer inventory behavior. *Econometrica* **74**(6) 1637–1673.
  - Markdown pricing, Soysal, Gonca P, Lakshman Krishnamurthi. 2012. Demand dynamics in the seasonal goods industry: An empirical analysis. *Marketing Science* **31**(2) 293–316

- Intertemporal price discrimination in airlines and durable goods:
  - Li, Jun, Nelson Granados, Serguei Netessine. 2014. Are consumers strategic? structural estimation from the air-travel industry. *Management Science*
  - Lazarev, John. 2012. The welfare effects of intertemporal price discrimination: an empirical analysis of airline pricing in us monopoly markets. *New York University, working paper*
  - Nair, Harikesh. 2007. Intertemporal price discrimination with forward-looking consumers: Application to the us market for console videogames. *Quantitative Marketing and Economics* **5**(3) 239–292

- Customer abandonments in call centers: Aksin, Zeynep, Baris Ata, Seyed Morteza Emadi, Che-Lin Su. 2013. Structural estimation of callers delay sensitivity in call centers. *Management Science* **59**(12) 2727–2746

5 Structural models of firm behavior

The analysis of an industry, from a public or business policy perspective, requires understanding the underlying mechanisms through which firms make decisions and compete in a market. We begin studying firm's managerial decisions from a single-agent perspective, with no strategic interactions. Next, we study methodologies that can be used to understand firms' equilibrium behavior in a competitive setting.

- Inventory and Production Management:
  - Olivares, Marcelo, Christian Terwiesch, Lydia Cassorla. 2008. Structural estimation of the newsvendor model: an application to reserving operating room time. *Management Science* **54**(1) 41–55
  - Bray, Robert L, Haim Mendelson. 2013. Disentangling production smoothing from the bullwhip effect
  - Benkard, C Lanier. 1999. Learning and forgetting: The dynamics of aircraft production. Tech. rep., National bureau of economic research

- Firm's Strategic behavior in pricing and product assortment.
  - Draganska, Michaela, Michael Mazzeo, Katja Seim. 2009. Beyond plain vanilla: Modeling joint product assortment and pricing decisions. *QME* **7**(2) 105–146

  - Seim, Katja. 2006. An empirical model of firm entry with endogenous product-type choices. *The RAND Journal of Economics* **37**(3) 619–640
  - Thomadsen, Raphael. 2007. Product positioning and competition: The role of location in the fast food industry. *Marketing Science* **26**(6) 792–804
  - Allon, Gad, Awi Federgruen, Margaret Pierson. 2011. How much is a reduction of your customers' wait worth? an empirical study of the fast-food drive-thru industry based on structural estimation methods. *Manufacturing & Service Operations Management* **13**(4) 489–507

- Bidding behavior in auctions:
  - Hendricks, Ken, Robert H Porter. 2007. An empirical perspective on auctions. *Handbook of Industrial Organization* **3** 2073–2143
  - Kim, Sang Won, Marcelo Olivares, Gabriel Y Weintraub. 2014. Measuring the performance of large-scale combinatorial auctions: A structural estimation approach. *Management Science* **60**(5) 1180–1201