KPHD-525: Data-Driven Economic Theory

Spring 2024

Instructor: George Georgiadis

Meeting Time & Location: Wednesdays 9-12pm (GH 5301)

Office Hours: Stop by GH4223 or email me at g-georgiadis@kellogg.northwestern.edu to schedule an appointment.

Course Description:
Over the past 50 years, applied theorists have tackled many important and practical questions: For example, how should an employer design an incentive scheme when workers' efforts are not contractible? How should a government design its tax schedule? How should a firm design a selling mechanism for a basket of goods? How should a planning authority match medical residents to hospitals? While many papers shed light on novel mechanisms, analyze important trade-offs, and help rationalize economic phenomena, most stop short of providing a compelling way to use available data to answer these questions in real settings. This course focuses on "data-driven" economic theory—papers whose models have been designed to answer such prescriptive questions given the realities of available data and the knowledge available to a designer. We will cover papers from several literatures including contract theory, mechanism design, auctions, market design, internal labor markets, taxation, and social insurance. Deliverables include several presentations—a central goal of this course is to hone your presenting skills, and a paper project that may form the basis for a 2nd or 3rd-year paper.

Target Audience:
MECS and economics Ph.D students, as well as marketing, operations, accounting, and finance students interested in applied economics.

Goals:
This class has three main objectives. The first is to familiarize you with research across various literatures that straddles theory and empirics. The second is to teach you to become a thoughtful applied theory researcher. The final objective is to hone your presentation skills. Presenting your work at seminars and conferences is the primary way to disseminate it, making this a crucial skill. Towards these goals, you will give several 45' presentations of published or late-stage working papers, and do a data-driven theory project (in teams of up to 2), where you must motivate a problem, develop a framework and explain what data is needed to operate it, provide preliminary results, and present a plan to complete the paper. (The aim is to help you kickstart a data-driven theory paper.)

Format: Each 3h class will consist of app. 90' lecture and two 45' student presentations.

Deliverables:

- Five (give or take) 45' presentations during weeks 2-9. You can pick among the papers below marked with (*).
- A paper project: You (in teams of up to 2) must come up with an idea for a data-driven theory paper, explain why it is interesting, design a framework, explain what data is needed to *operate* it, provide preliminary results, and come up with a plan to complete the paper. The write-up of the project is due at the end of week 9, and you will present it in week 10.

Topics:

i. Contract theory (draws papers from economics and marketing)
ii. Mechanism design and auctions (draws papers from economics and computer science)
iii. Market design, matching, and internal labor markets
iv. Taxation & social insurance
v. Artificial intelligence

Guest Lecture:

On May 8, Martino Banchio (Google Research) will give a guest lecture on algorithmic pricing, artificial intelligence, and reinforcement learning.

List of Papers: *(preliminary & incomplete)*

Methodology & Survey Papers (Mandatory readings)

- Andre, C.P. and Salanie, B., 2003. Testing Contract Theory: a survey of some recent work. Advances in Economics and Econometrics, 1.
- Chetty, R., 2009. Sufficient statistics for welfare analysis: A bridge between structural and reduced-form methods. *Annual Review of Economics*, 1(1), pp.451-488.
- Gibbs, M., 2016. Past, present and future compensation research: Economist perspectives. Compensation & Benefits Review, 48(1-2), pp.3-16.
- Holmström, B., 2017. Pay for performance and beyond. *American Economic Review*, 107(7), pp.1753-1777.
- Hortaçsu, A. and McAdams, D., 2018. Empirical work on auctions of multiple objects. *Journal of Economic Literature*, 56(1), pp.157-184.
- Kominers, S.D., Teytelboym, A. and Crawford, V.P., 2017. An invitation to market design. *Oxford Review of Economic Policy*, 33(4), pp.541-571.
- Milgrom, P., 2021. Auction research evolving: Theorems and market designs. *American Economic Review*, 111(5), pp.1383-1405.
- Roth, A.E., 2008. Deferred acceptance algorithms: History, theory, practice, and open questions. *International Journal of Game Theory*, 36, pp.537-569.
- Roth, A.E., 2018. Marketplaces, markets, and market design. *American Economic Review*, 108(7), pp.1609-1658.
- Saez, E., Slemrod, J. and Giertz, S.H., 2012. The elasticity of taxable income with respect to marginal tax rates: A critical review. *Journal of Economic Literature*, 50(1), pp.3-50.

Recommended readings:

- *Textbook:* On writing well: The classic guide to writing nonfiction by William Zinsser [Link]
- How to write an introduction, a theory paper, and a model by Simon Board and Moritz Meyer-ter-Vehn [Link]

ChatGBT–Personnel & Organization Economics chatbot: https://chat.openai.com/g/g-Zs323kPtm-personnel-organization-economics-insights

Contract theory (draws paper from economics and marketing)

- Antic, N. and Georgiadis, G., 2022. Robust Contracts: A Revealed Preference Approach.
- Chan, T.Y., Li, J. and Pierce, L., 2014. Compensation and peer effects in competing sales teams. *Management Science*, 60(8), pp.1965-1984.
- (*) Chung, D.J., Kim, B. and Park, B.G., 2021. The comprehensive effects of sales force management: A dynamic structural analysis of selection, compensation, and training. *Management Science*, 67(11), pp.7046-7074.
- (*) Chung, D.J., Steenburgh, T. and Sudhir, K., 2014. Do bonuses enhance sales productivity? A dynamic structural analysis of bonus-based compensation plans. *Marketing Science*, 33(2), pp.165-187.
- Cowgill, B. and Zitzewitz, E., 2009. Incentive effects of equity compensation: Employee level evidence from Google.
- (*) D'Haultfœuille, X. and Février, P., 2020. The provision of wage incentives: A structural estimation using contracts variation. *Quantitative Economics*, 11(1), pp.349-397.
- Edmans, A., Gabaix, X. and Landier, A., 2009. A multiplicative model of optimal CEO incentives in market equilibrium. The Review of Financial Studies, 22(12), pp.4881-4917.
- Georgiadis, G. and Powell, M., 2022. A/B contracts. *American Economic Review*, 112(1), pp.267-303.
- (*) Gibbons, R. and Murphy, K., 1992. Optimal Incentive Contracts in the Presence of Career Concerns: Theory and Evidence. *Journal of Political Economy*, 100(3), pp.468-505.
- Kim, M., Sudhir, K. and Uetake, K., 2022. A structural model of a multitasking salesforce: incentives, private information, and job design. *Management Science*, 68(6), pp.4602-4630.
- Misra, S. and Nair, H.S., 2011. A structural model of sales-force compensation dynamics: Estimation and field implementation. *Quantitative Marketing and Economics*, 9, pp.211-257.

Mechanism design and auctions (draws papers from economics and computer science)

- (*) Braverman, M. and Chassang, S., 2022. Data-driven incentive alignment in capitation schemes. *Journal of Public Economics*, 207, p.104584.
- Brooks, B. and Du, S., 2021. Optimal auction design with common values: An informationally robust approach. *Econometrica*, 89(3), pp.1313-1360.
- (*) Bulow, J., Levin, J. and Milgrom, P., 2009. Winning play in spectrum auctions.
- Caillaud, B. and Robert, J., 2005. Implementation of the revenue-maximizing auction by an ignorant seller. *Review of Economic Design*, 9, pp.127-143.
- (*) Caro, F. and Gallien, J., 2012. Clearance pricing optimization for a fast-fashion retailer. Operations research, 60(6), pp.1404-1422.

- (*) Carroll, G., 2017. Robustness and separation in multidimensional screening. *Econometrica*, 85(2), pp.453-488.
- (*) Chawla, S., Hartline, J.D., Nekipelov, D. and Shah, A., 2017. Mechanism Redesign.
- (*) Chassang, S., Kawai, K., Nakabayashi, J. and Ortner, J., 2022. Robust screens for noncompetitive bidding in procurement auctions. *Econometrica*, 90(1), pp.315-346.
- (*) Del Carpio, L., Kapon, S. and Chassang, S., 2022. Using Divide-and-Conquer to Improve Tax Collection: Evidence from the Field.
- Devanur, N.R., Hartline, J.D. and Yan, Q., 2015. Envy freedom and prior-free mechanism design. *Journal of Economic Theory*, 156, pp.103-143.
- (*) Edelman, B., Ostrovsky, M. and Schwarz, M., 2007. Internet advertising and the generalized second-price auction: Selling billions of dollars' worth of keywords. *American Economic Review*, 97(1), pp.242-259.
- Eeckhout, J., Persico, N. and Todd, P.E., 2010. A theory of optimal random crackdowns. *American Economic Review*, 100(3), pp.1104-1135.
- (*) Kawai, K., Nakabayashi, J., Ortner, J. and Chassang, S., 2023. Using bid rotation and incumbency to detect collusion: A regression discontinuity approach. *The Review of Economic Studies*, 90(1), pp.376-403.
- (*) Lopomo, G., Persico, N. and Villa, A.T., 2023. Optimal procurement with quality concerns. *American Economic Review*, 113(6), pp.1505-1529.
- McAfee, R.P. and te Velde, V., 2008. Dynamic pricing with constant demand elasticity. Production and operations Management, 17(4), pp.432-438.
- (*) Prendergast, C., 2022. The allocation of food to food banks. *Journal of Political Economy*, 130(8), pp.1993-2017.
- (*) Rosenthal, M., 2019. A Revealed Preference Approach to Multidimensional Screening.
- Segal, I., 2003. Optimal pricing mechanisms with unknown demand. *American Economic Review*, 93(3), pp.509-529.

Market Design, Matching & Internal Labor Markets

- (*) Cowgill, B., Davis, J., Montagnes, B.P. and Perkowski, P., 2021. Matchmaking Principals: Theory and Evidence from Internal Labor Markets.
- Hatfield, J.W. and Milgrom, P.R., 2005. Matching with contracts. *American Economic Review*, 95(4), pp.913-935.
- Hatfield, J.W. and Kojima, F., 2008. Matching with contracts: Comment. *American Economic Review*, 98(3), pp.1189-1194.
- (*) Hatfield, J.W., Kojima, F. and Narita, Y., 2016. Improving schools through school choice: A market design approach. *Journal of Economic Theory*, 166, pp.186-211.
- (*) Prendergast, C., 2022. The allocation of food to food banks. *Journal of Political Economy*, 130(8), pp.1993-2017.
- Sönmez, T. and Switzer, T.B., 2013. Matching with (branch-of-choice) contracts at the United States Military Academy. *Econometrica*, 81(2), pp.451-488.

Taxation & Social Insurance (draws papers from public economics)

- Chetty, R., 2006. A general formula for the optimal level of social insurance. *Journal of Public Economics*, 90(10-11), pp.1879-1901.

- Diamond, P.A., 1998. Optimal income taxation: an example with a U-shaped pattern of optimal marginal tax rates. *American Economic Review*, pp.83-95.
- (*) Golosov, M., Tsyvinski, A. and Werquin, N., 2014. A variational approach to the analysis of tax system.
- (*) Saez, E., 2001. Using elasticities to derive optimal income tax rates. *Review of Economic Studies*, 68(1), pp.205-229.
- (*) Shimer, R. and Werning, I., 2007. Reservation wages and unemployment insurance. The Quarterly Journal of Economics, 122(3), pp.1145-1185.