

CONTRACT AND INFORMATION DESIGN

Class Description

Most of economics consider agents' behavior to be driven by preferences and information. If we wish to influence agents' choices, then there are two ways of doing so. One is to affect incentives by using contingent rewards and punishments, and another one is to provide persuasive evidences. These two ways correspond to economic research on contract and information design respectively. This course is designed for second-year PhD students who are interested in either doing theoretical research in related topics or receiving formal training to develop modeling skills for applied work. It will cover many techniques used in models of contracting and information economics as well as a variety of applications in finance, industrial organization, labor and personnel economics, and political economy.

Class Requirements

The course is reading-intensive. There will be weekly reading or writing assignments. In addition, each student needs to give a presentation of a recent paper and write a referee report of the paper based on his/her understanding of the literature. The student is expected to write a research proposal which has the potential to become a paper after the winter break. The paper needs to be related to the topics covered in the class. Grades for the class will be based on:

- class participation
- in-class presentation
- a research proposal

Class Logistics

The class will be offered on Tuesday and Thursday 11:00-12:15 pm at Gardner 007.

Contacting Us

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Background References

- A. Stole, Lars. "Lectures on the Theory of Contracts and Organizations."
Unpublished monograph (2001).

- B. Tadelis, Steve, and Ilya Segal. "Lectures in contract theory." *Lecture notes for UC Berkeley and Stanford University* (2005).
- C. Richard Holden. "Contract Theory: Notes." UNSW
- D. Bolton, Patrick, and Mathias Dewatripont. *Contract theory*. MIT press, 2004.
- E. Holmström, Bengt. "Pay for performance and beyond." *American Economic Review* 107, no. 7 (2017): 1753-77.
- F. Kamenica, Emir. "Bayesian persuasion and information design." *Annual Review of Economics* 11 (2018)
- G. Bergemann, Dirk, and Stephen Morris. "Information Design: A unified perspective." *Journal of Economic Literature* 57, no. 1 (2019): 44-95.
- H. Bergemann, Dirk, and Marco Ottaviani. "Information Markets and Non-markets." In *Handbook of Industrial Organization*, vol. 4, no. 1, pp. 593-672. Elsevier, 2021.
- I. Börgers, Tilman, and Daniel Krahmer. *An introduction to the theory of mechanism design*. Oxford University Press, USA, 2015.

Tentative Schedule

1. Static Moral Hazard Problems with Single Agent
2. Static Moral Hazard Problems with Multiple Agents
3. Student Presentation I (Sep 22nd)
4. Dynamic Moral Hazard Models with Commitment
5. Dynamic Moral Hazard Models without Commitment
6. Student Presentation II (Oct 18th)
7. Topics in Selling Data and Consumer Privacy
8. Topics in Bayesian Persuasion and Information Design
9. Topics in Mechanism Design
10. Student Presentation III (Nov 29 or/and Dec 1st)

Papers ¹

1. Static Moral Hazard Problems with Single Agent

- (1) Holmström, Bengt. "Moral hazard and observability." *The Bell journal of economics* (1979): 74-91.*
- (2) Grossman, Sanford J., and Oliver D. Hart. "An Analysis of the Principal-Agent Problem." *Econometrica* 51, no. 1 (1983): 7-46.
- (3) Holmstrom, Bengt, and Paul Milgrom. "Aggregation and linearity in the provision of intertemporal incentives." *Econometrica: Journal of the Econometric Society* (1987): 303-328.
- (4) Holmstrom, Bengt, and Paul Milgrom. "Multitask principal-agent analyses: Incentive contracts, asset ownership, and job design." *JL Econ. & Org.* 7 (1991): 24.*
- (5) Kim, Son Ku. "Efficiency of an information system in an agency model." *Econometrica: Journal of the Econometric Society* (1995): 89-102.
- (6) MacLeod, W. Bentley. "Optimal contracting with subjective evaluation." *American Economic Review* 93, no. 1 (2003): 216-240.*
- (7) Diamond, Peter. "Managerial incentives: On the near linearity of optimal compensation." *Journal of Political Economy* 106, no. 5 (1998): 931-957.
- (8) Carroll, Gabriel. "Robustness and linear contracts." *American Economic Review* 105, no. 2 (2015): 536-63.*
- (9) Walton, Daniel, and Gabriel Carroll. "A General Framework for Robust Contracting Models." *Econometrica* (2022). #
- (10) Garrett, Daniel, George Georgiadis, Alex Smolin, and Báalazs Szentes. "Optimal Project Design." mimeo, 2022.*
- (11) Li, Anqi, and Ming Yang. "Optimal incentive contract with endogenous monitoring technology." *Theoretical Economics* 15, no. 3 (2020): 1135-1173.
- (12) Georgiadis, George, and Balazs Szentes. "Optimal monitoring design." *Econometrica* 88, no. 5 (2020): 2075-2107.

2. Static Moral Hazard Problems with Multiple Agents

- (1) Holmstrom, Bengt. "Moral hazard in teams." *The Bell Journal of Economics* (1982): 324-340. *
- (2) Legros, Patrick, and Steven A. Matthews. "Efficient and nearly-efficient partnerships." *The Review of Economic Studies* 60, no. 3 (1993): 599-611.*
- (3) Legros, Patrick, and Hitoshi Matsushima. "Efficiency in partnerships." *Journal of Economic Theory* 55, no. 2 (1991): 296-322.
- (4) Rahman, David. "But who will monitor the monitor?." *American Economic Review* 102, no. 6 (2012): 2767-97.*

¹ Papers marked with (*) will be covered in lectures; while papers marked with (#) are available for presentation.

- (5) Rahman, David, and Ichiro Obara. "Mediated partnerships." *Econometrica* 78, no. 1 (2010): 285-308.
- (6) Winter, Eyal. "Incentives and discrimination." *American Economic Review* 94, no. 3 (2004): 764-773.*
- (7) Halac, Marina, Elliot Lipnowski, and Daniel Rappoport. "Rank uncertainty in organizations." *American Economic Review* 111, no. 3 (2021): 757-86.#
- (8) Matteo Camboni, Matteo, and Michael Porcellacchia, "Monitoring Team Members: Information Waste and the Self-Promotion Trap." (2022)
- (9) Dai, Tianjiao, and Juuso Toikka. "Robust incentives for teams." (2022), *Econometrica*, forthcoming #
- (10) Kambhampati, Ashwin. "Robust Performance Evaluation." (2021). #

3. Dynamic Moral Hazard Models with Commitment

- (1) Rogerson, William P. "Repeated moral hazard." *Econometrica: Journal of the Econometric Society* (1985): 69-76.*
- (2) Fudenberg, Drew, Bengt Holmstrom, and Paul Milgrom. "Short-term contracts and long-term agency relationships." *Journal of economic theory* 51, no. 1 (1990): 1-31.
- (3) Spear, Stephen E., and Cheng Wang. "When to fire a CEO: Optimal termination in dynamic contracts." *Journal of Economic Theory* 120, no. 2 (2005): 239-256.
- (4) Spear, Stephen E., and Sanjay Srivastava. "On repeated moral hazard with discounting." *The Review of Economic Studies* 54, no. 4 (1987): 599-617.*
- (5) Hopenhayn, Hugo A., and Juan Pablo Nicolini. "Optimal unemployment insurance." *Journal of political economy* 105, no. 2 (1997): 412-438.
- (6) Clementi, Gian Luca, and Hugo A. Hopenhayn. "A theory of financing constraints and firm dynamics." *The Quarterly Journal of Economics* 121, no. 1 (2006): 229-265.*
- (7) Sannikov, Yuliy. "A continuous-time version of the principal-agent problem." *The Review of Economic Studies* 75, no. 3 (2008): 957-984.*
- (8) DeMarzo, Peter M., and Yuliy Sannikov. "Optimal security design and dynamic capital structure in a continuous-time agency model." *The Journal of Finance* 61, no. 6 (2006): 2681-2724.
- (9) Edmans, Alex, and Xavier Gabaix. "Tractability in incentive contracting." *The Review of Financial Studies* 24, no. 9 (2011): 2865-2894.
- (10) Edmans, Alex, Xavier Gabaix, Tomasz Sadzik, and Yuliy Sannikov. "Dynamic CEO compensation." *The Journal of Finance* 67, no. 5 (2012): 1603-1647.#
- (11) Green, Brett, and Curtis R. Taylor. "Breakthroughs, deadlines, and self-reported progress: Contracting for multistage projects." *American Economic Review* 106, no. 12 (2016): 3660-99.*
- (12) Fudenberg, Drew, and Luis Rayo. "Training and effort dynamics in apprenticeship." *American Economic Review* 109, no. 11 (2019): 3780-3812.#

4. Dynamic Moral Hazard Models with Limited Commitment: Relational Contracts

- (1) Radner, Roy, Roger Myerson, and Eric Maskin. "An example of a repeated partnership game with discounting and with uniformly inefficient equilibria." *The Review of Economic Studies* 53, no. 1 (1986): 59-69.
- (2) Abreu, Dilip, David Pearce, and Ennio Stacchetti. "Toward a theory of discounted repeated games with imperfect monitoring." *Econometrica: Journal of the Econometric Society* (1990): 1041-1063.*
- (3) Thomas, Jonathan, and Tim Worrall. "Self-enforcing wage contracts." *The Review of Economic Studies* 55, no. 4 (1988): 541-554.
- (4) Kocherlakota, Narayana R. "Implications of efficient risk sharing without commitment." *The Review of Economic Studies* 63, no. 4 (1996): 595-609.
- (5) Baker, George, Robert Gibbons, and Kevin J. Murphy. "Relational Contracts and the Theory of the Firm." *The Quarterly Journal of Economics* 117, no. 1 (2002): 39-84.*
- (6) Levin, Jonathan. "Relational incentive contracts." *American Economic Review* 93, no. 3 (2003): 835-857.*
- (7) Rayo, Luis. "Relational incentives and moral hazard in teams." *The Review of Economic Studies* 74, no. 3 (2007): 937-963.
- (8) Fuchs, William. "Contracting with repeated moral hazard and private evaluations." *American Economic Review* 97, no. 4 (2007): 1432-1448.²
- (9) Board, Simon. "Relational contracts and the value of loyalty." *American Economic Review* 101, no. 7 (2011): 3349-67.#
- (10) Halac, Marina. "Relational contracts and the value of relationships." *American Economic Review* 102, no. 2 (2012): 750-79.
- (11) Li, Jin, and Niko Matouschek. "Managing conflicts in relational contracts." *American Economic Review* 103, no. 6 (2013): 2328-51.#
- (12) Chassang, Sylvain. "Building routines: Learning, cooperation, and the dynamics of incomplete relational contracts." *American Economic Review* 100, no. 1 (2010): 448-65.#
- (13) Garicano, Luis, and Luis Rayo. "Relational knowledge transfers." *American Economic Review* 107, no. 9 (2017): 2695-2730.*
- (14) Li, Jin, Arijit Mukherjee, and Luis Vasconcelos. "Learning to game the system." *The Review of Economic Studies* 88, no. 4 (2021): 2014-2041.#
- (15) Dilmé, Francesc, and Daniel Ferguson Garrett. "Relational Contracts: Public versus Private Savings." (2020). #

5. Dynamic Moral Hazard Models with Limited Commitment: More

- (1) Harris, Milton, and Bengt Holmstrom. "A theory of wage dynamics." *The Review of Economic Studies* 49, no. 3 (1982): 315-333.
- (2) Holmström, Bengt. "Managerial incentive problems: A dynamic perspective." *The review of Economic studies* 66, no. 1 (1999): 169-182.*
- (3) Meyer, Margaret A., and John Vickers. "Performance comparisons and dynamic incentives." *Journal of political economy* 105, no. 3 (1997): 547-581.

² See the working paper version.

- (4) Cetemen, Doruk, Ilwoo Hwang, and Ayça Kaya. "Uncertainty-driven cooperation." *Theoretical Economics* 15, no. 3 (2020): 1023-1058.
- (5) Admati, Anat R., and Motty Perry. "Joint projects without commitment." *The Review of Economic Studies* 58, no. 2 (1991): 259-276.
- (6) Marx, Leslie M., and Steven A. Matthews. "Dynamic voluntary contribution to a public project." *The Review of Economic Studies* 67, no. 2 (2000): 327-358.
- (7) Yildirim, Huseyin. "Getting the ball rolling: Voluntary contributions to a large-scale public project." *Journal of Public Economic Theory* 8, no. 4 (2006): 503-528.
- (8) Georgiadis, George. "Projects and team dynamics." *The Review of Economic Studies* 82, no. 1 (2015): 187-218.
- (9) Keller, Godfrey, Sven Rady, and Martin Cripps. "Strategic experimentation with exponential bandits." *Econometrica* 73, no. 1 (2005): 39-68.
- (10) Bonatti, Alessandro, and Johannes Hörner. "Collaborating." *American Economic Review* 101, no. 2 (2011): 632-63. #
- (11) Gieczewski, Germán, and Svetlana Kosterina. "Endogenous Experimentation in Organizations." *Princeton University Typescript* (2020) #
- (12) Cetemen, Doruk. "Efficiency in Repeated Partnerships." *Available at SSRN 3724923* (2020).

6. Information Theory

- (1) Blackwell, David. "Comparison of Experiments." In *Proceedings of the Second Berkeley Symposium on Mathematical Statistics and Probability*. The Regents of the University of California, 1951.
- (2) de Oliveira, Henrique. "Blackwell's informativeness theorem using diagrams." *Games and Economic Behavior* 109 (2018): 126-131.
- (3) Green, Jerry Richard, and Nancy Stokey. *Two representations of information structures and their comparisons*. Institute for Mathematical Studies in the Social Sciences, (1978).
- (4) Brooks, Benjamin, Alexander P. Frankel, and Emir Kamenica. "Information hierarchies." *Available at SSRN 3448870* (2019).
- (5) Frankel, Alexander, and Emir Kamenica. "Quantifying information and uncertainty." *American Economic Review* 109, no. 10 (2019): 3650-80.
- (6) Rothschild, Michael, and Joseph E. Stiglitz. "Increasing risk: I. A definition." *Journal of Economic theory* 2, no. 3 (1970): 225-243.*

7. Bayesian Persuasion: Concavification Approach

- (1) Kamenica, Emir, and Matthew Gentzkow. "Bayesian persuasion." *American Economic Review* 101, no. 6 (2011): 2590-2615.*
- (2) Alonso, Ricardo, and Odilon Câmara. "Persuading voters." *American Economic Review* 106, no. 11 (2016): 3590-3605.
- (3) Ely, Jeffrey C. "Beeps." *American Economic Review* 107, no. 1 (2017): 31-53.
- (4) Ely, Jeffrey C., and Martin Szydlowski. "Moving the goalposts." *Journal of Political Economy* 128, no. 2 (2020).*

- (5) Galperti, Simone. "Persuasion: The art of changing world views." *American Economic Review* 109, no. 3 (2019): 996-1031. #
- (6) Lipnowski, Elliot, and Doron Ravid. "Cheap talk with transparent motives." *Econometrica* 88, no. 4 (2020): 1631-1660.#
- (7) Arieli, Itai, Yakov Babichenko, Fedor Sandomirskiy, and Omer Tamuz. "Feasible joint posterior beliefs." *Journal of Political Economy* 129, no. 9 (2021): 2546-2594.#
- (8) de Clippel, Geoffroy, and Xu Zhang. *Non-bayesian persuasion*. *Journal of Political Economy* forthcoming. #
- (9) Gentzkow, Matthew, and Emir Kamenica. "Bayesian persuasion with multiple senders and rich signal spaces." *Games and Economic Behavior* 104 (2017): 411-429.
- (10) Li, Fei, and Peter Norman. "Sequential persuasion." *Theoretical Economics* 16, no. 2 (2021): 639-675.
- (11) Au, Pak Hung, and Keiichi Kawai. "Competitive information disclosure by multiple senders." *Games and Economic Behavior* 119 (2020): 56-78.
- (12) Au, Pak Hung, and Mark Whitmeyer. "Attraction Versus Persuasion." *Journal of Political Economy*, forthcoming.#

8. Information Design Approach

- (1) Aumann, Robert J. "Correlated equilibrium as an expression of Bayesian rationality." *Econometrica: Journal of the Econometric Society* (1987): 1-18.
- (2) Bergemann, Dirk, and Stephen Morris. "Bayes correlated equilibrium and the comparison of information structures in games." *Theoretical Economics* 11, no. 2 (2016): 487-522.
- (3) Taneva, Ina. "Information design." *American Economic Journal: Microeconomics*, 11, no. 4 (2019): 151-85.*
- (4) Chan, Jimmy, Seher Gupta, Fei Li, and Yun Wang. "Pivotal persuasion." *Journal of Economic theory* 180 (2019): 178-202.
- (5) Morris, Oyama and Takahashi. "Adversarial Information Design in Binary-Action Supermodular Games" working paper (2020).

9. Linear Persuasion Approach

- (1) Gentzkow, Matthew, and Emir Kamenica. "A Rothschild-Stiglitz approach to Bayesian persuasion." *American Economic Review* 106, no. 5 (2016): 597-601.
- (2) Dworzak, Piotr, and Giorgio Martini. "The simple economics of optimal persuasion." *Journal of Political Economy* 127, no. 5 (2019): 1993-2048.
- (3) Kolotilin, Anton, Tymofiy Mylovanov, Andriy Zapechelnyuk, and Ming Li. "Persuasion of a privately informed receiver." *Econometrica* 85, no. 6 (2017): 1949-1964.

10. Information and Pricing

- (1) Anderson, Simon P., and Régis Renault. "Advertising content." *American Economic Review* 96, no. 1 (2006): 93-113.

- (2) Roesler, Anne-Katrin, and Balázs Szentes. "Buyer-optimal learning and monopoly pricing." *American Economic Review* 107, no. 7 (2017): 2072-80. *
- (3) Roesler, Anne-Katrin, and Rahul Deb. "Multi-Dimensional Screening: Buyer-Optimal Learning and Informational Robustness." (2021).
- (4) Armstrong, Mark, and Jidong Zhou. "Consumer information and the limits to competition." *American Economic Review* 112, no. 2 (2022): 534-77.
- (5) Hwang, Ilwoo, Kyungmin Kim, and Raphael Boleslavsky. "Competitive Advertising and Pricing." Working Paper (2019).
- (6) Ravid, Doron, Anne-Katrin Roesler, and Balázs Szentes. "Learning before trading: on the inefficiency of ignoring free information." *Journal of Political Economy* 130, no. 2 (2022): 000-000.
- (7) Elliott, Matthew, Andrea Galeotti, Andrew Koh, and Wenhao Li. "Market segmentation through information." *Available at SSRN 3432315* (2021).

11. Selling Data and Consumer Privacy

- (1) Taylor, Curtis R. "Consumer privacy and the market for customer information." *RAND Journal of Economics* (2004): 631-650.
- (2) Bergemann, Dirk, Benjamin Brooks, and Stephen Morris. "The limits of price discrimination." *American Economic Review* 105, no. 3 (2015): 921-57.
- (3) Bergemann, Dirk, Alessandro Bonatti, and Alex Smolin. "The design and price of information." *American economic review* 108, no. 1 (2018): 1-48.
- (4) Yang, Kai Hao. "Selling consumer data for profit: Optimal market-segmentation design and its consequences." *American Economic Review* 112, no. 4 (2022): 1364-93.
- (5) Ichihashi, Shota. 2020. "Online Privacy and Information Disclosure by Consumers." *American Economic Review*, 110 (2): 569-95.
- (6) Hidir, Sinem, and Nikhil Vellodi. "Privacy, Personalization and Price Discrimination." *Journal of the European Economic Association* (2020).
- (7) Ali, S. Nageeb, Nima Haghpanah, Xiao Lin, and Ron Siegel. "How to Sell Hard Information." *The Quarterly Journal of Economics* 137, no. 1 (2022): 619-678.#
- (8) Ali, S. Nageeb, Greg Lewis, and Shoshana Vasserman. "Voluntary disclosure and personalized pricing." *Review of Economic Studies*, forthcoming.#
- (9) Bergemann, Dirk, and Alessandro Bonatti. "Selling cookies." *American Economic Journal: Microeconomics* 7, no. 3 (2015): 259-94.
- (10) Doval, Laura, and Vasiliki Skreta. "Purchase history and product personalization." (2021).
- (11) Rhodes, Andrew, and Jidong Zhou. "Personalized Pricing and Competition." *Available at SSRN 4103763* (2022).#
- (12) Ball, Ian. "Scoring strategic agents." *arXiv preprint arXiv:1909.01888* (2019).
- (13) Segura-Rodriguez, Carlos. "Selling Data." (2022).#

12. Topics in Mechanism Design

- (1) Gershkov, Alex, Benny Moldovanu, and Xianwen Shi. "Optimal voting rules." *The Review of Economic Studies* 84.2 (2017): 688-717.

- (2) Jackson, M. and H. Sonnenschein (2007), "Overcoming Incentive Constraints by Linking Decisions," *Econometrica* 75, 241–258.
- (3) Bergemann, Dirk, and Juuso Välimäki. "Dynamic mechanism design: An introduction." *Journal of Economic Literature* 57.2 (2019): 235-74.
- (4) Bergemann, Dirk, and Juuso Välimäki. "The dynamic pivot mechanism." *Econometrica* 78.2 (2010): 771-789.
- (5) Pavan, Alessandro, Ilya Segal, and Juuso Toikka. "Dynamic mechanism design: A Myersonian approach." *Econometrica* 82.2 (2014): 601-653.
- (6) Mailath, George J., and Andrew Postlewaite. "Asymmetric information bargaining problems with many agents." *The Review of Economic Studies* 57.3 (1990): 351-367.
- (7) Loertscher, Simon, and Leslie M. Marx. "Bilateral Trade with Multiunit Demand and Supply." *Management Science* (2022).

13. Mechanism Design with Limited Commitment

- (1) Laffont, Jean-Jacques, and Jean Tirole. "The dynamics of incentive contracts." *Econometrica: Journal of the Econometric Society* (1988): 1153-1175.
- (2) Bester, Helmut, and Roland Strausz. "Contracting with imperfect commitment and the revelation principle: the single agent case." *Econometrica* 69, no. 4 (2001): 1077-1098.
- (3) Skreta, Vasiliki. "Sequentially optimal mechanisms." *The Review of Economic Studies* 73, no. 4 (2006): 1085-1111.
- (4) Deb, Rahul, and Maher Said. "Dynamic screening with limited commitment." *Journal of Economic Theory* 159 (2015): 891-928.
- (5) Gerardi, Dino, and Lucas Maestri. "Dynamic contracting with limited commitment and the ratchet effect." *Theoretical Economics* 15, no. 2 (2020): 583-623.
- (6) Doval, Laura, and Vasiliki Skreta. "Mechanism Design with Limited Commitment." *Econometrica* 90, no. 4 (2022): 1499-1536.