

University of Oslo
Department of Economics
The Theory of Collusion and Cartels

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This course will examine the theory of collusion with an emphasis on recent advancements which take account of private monitoring, competition policy, and coordination without communication. Motivated by the practical problems faced by cartels, research has explored how firms collude when they have private information relevant to monitoring for compliance with the collusive agreement. The resulting theories match the observed practices of recent cartels reasonably well, including those in citric acid, lysine, and vitamins. Recognizing the illegality of explicit collusion, there is a growing body of research examining collusion when there is the prospect of detection and penalties. Of particular importance is assessing the impact of corporate leniency programs on the frequency and intensity of collusion. Finally, we will cover some recent work on tacit collusion and collusion by autonomous agents (also known as algorithmic collusion), both of which present serious challenges to enforcement. In covering the existing body of work, there will be a discussion of topics in need of research.

- **Course Pre-requisites:** One-semester course in game theory and comfort in working with repeated games.
- **Research Proposal or Paper:** Each student will submit a written report proposing a research project. The project need not be fully executed but there should be some progress in its implementation. It must have five parts: i) statement of the research question(s); ii) brief survey of the literature addressing that question; iii) description of the theoretical model; iv) how you plan to use that model to address the research question (that is, the types of results you plan to derive, e.g., comparative statics); and v) some progress in executing the project. If it were successfully executed, the project must be an original contribution which means either that you've proposed an original research question or you've proposed a new approach to tackling an existing research question. I anticipate a length of around 10-15 pages.

- Topics
 1. Introduction and collusion with perfect monitoring
 2. Collusion with imperfect public monitoring
 3. Collusion with private monitoring
 4. Collusion and competition policy
 5. Coordination without communication: Tacit collusion and algorithmic collusion

Reading List

*Indicates papers that will be covered in class.

- General background on theory, cases, and the law
 - Harrington, Joseph E. Jr., “How Do Cartels Operate?,” *Foundations and Trends in Microeconomics*, Vol. 2, Issue 1, July 2006.
 - Harrington, Joseph E. Jr., “Thoughts on Why Certain Markets are More Susceptible to Collusion and Some Policy Suggestions for Dealing with Them,” OECD Background Paper, Global Forum on Competition, October 19, 2015.
 - Harrington, Joseph E., Jr., *The Theory of Collusion and Competition Policy*, The MIT Press, 2017.
 - Levenstein, Margaret C. and Valerie Y. Suslow, “What Determines Cartel Success?,” *Journal of Economic Literature*, 44 (2006), 43-95.
 - Kaplow, Louis, *Competition Policy and Price Fixing*, Princeton, N.J.: Princeton University Press, 2013.
 - Marshall, Robert C. and Leslie M. Marx, *The Economics of Collusion - Cartels and Bidding Rings*, Cambridge, Mass.: The MIT Press, 2012.
 - Motta, Massimo, *Competition Policy: Theory and Practice*, Cambridge: Cambridge University Press, 2004.
- Collusion with perfect monitoring
 - Abreu, Dilip, “Extremal Equilibria of Oligopolistic Supergames,” *Journal of Economic Theory*, 39 (1986), 191-225.
 - Bernheim, B. Douglas and Michael D. Whinston, “Multimarket Contact and Collusive Behavior,” *RAND Journal of Economics*, 21 (1990), 1-26.

- *Bernehim, B. Douglas and Erik Madsen, “Price Cutting and Business Stealing in Imperfect Cartels,” *American Economic Review*, 107 (2017), 387-424.
 - *Bos, Iwan and Joseph E. Harrington, Jr. “Endogenous Cartel Formation with Heterogeneous Firms,” *RAND Journal of Economics*, 41 (2010), 92-117.
 - Bagwell, Kyle and Robert Staiger, “Collusion over the Business Cycle,” *RAND Journal of Economics*, 28 (1997), 82-106.
 - *Chassang, Sylvain and Juan Ortner, “Collusion in Auctions with Constrained Bids: Theory and Evidence from Public Procurement,” Boston University, February 2017.
 - Haltiwanger, John and Joseph E. Harrington, Jr., “The Impact of Cyclical Demand Movements on Collusive Behavior,” *RAND Journal of Economics*, 22 (1991), 89-106.
 - Harrington, Joseph E. Jr., Kai Hüschelrath, Ulrich Laitenberger, and Florian Smuda, "The Discontent Cartel Member and Cartel Collapse: The Case of the German Cement Cartel," *International Journal of Industrial Organization*, 42 (2015), 106-119.
 - Obara, Ichiro and Federico Zincenko, “Collusion and Heterogeneity of Firms,” *RAND Journal Economics*, 48 (2017), 230-249.
 - Rotemberg, Julio J. and Garth Saloner, “A Supergame-Theoretic Model of Price Wars During Booms,” *American Economic Review*, 76 (1986), 390-407.
- Collusion with imperfect public monitoring
 - Abreu, Dilip, David Pearce and Ennio Stacchetti, “Optimal Cartel Equilibria with Imperfect Monitoring,” *Journal of Economic Theory*, 39 (1986), 251-269.
 - Green, Edward J. and Robert H. Porter, “Noncooperative Collusion under Imperfect Price Information,” *Econometrica*, 52 (1984), 87-100.
 - *Harrington, Joseph E. Jr. and Andrzej Skrzypacz, “Collusion with Monitoring of Sales,” *RAND Journal of Economics*, 38 (2007), 314-331.
 - *Porter, Robert H., “Optimal Cartel Trigger Price Strategies,” *Journal of Economic Theory*, 29 (1983), 313-338.
 - *Skrzypacz, Andrzej and Yuliy Sannikov, “Impossibility of Collusion under Imperfect Monitoring with Flexible Production,” *American Economic Review*, 97 (2007), 1794-1823.
 - Stigler, George, “A Theory of Oligopoly,” *Journal of Political Economy*, 72 (1964), 44-61.

- Collusion with private monitoring
 - Aoyagi, Masaki, “Collusion in Dynamic Bertrand Oligopoly with Correlated Private Signals and Communication,” *Journal of Economic Theory*, 102 (2002), 229-248.
 - *Awaya, Yu and Vijay Krishna, “On Communication and Collusion,” *American Economic Review*, 106 (2016), 285-315.
 - Chan, Jimmy and Wenzhang Zhang, “Collusion Enforcement with Private Information and Private Monitoring,” *Journal of Economic Theory*, 157 (2015), 188-211.
 - *Harrington, Joseph E. Jr. and Andrzej Skrzypacz, “Private Monitoring and Communication in Cartels: Explaining Recent Cartel Practices,” *American Economic Review*, 101 (2011), 2425-2449.
 - Spector, David, “Facilitating Collusion by Exchanging Non-verifiable Sales Reports,” Paris School of Economics, February 2015
 - *Sugaya, Takuo and Alexander Wolitzky, “Maintaining Privacy in Cartels,” Stanford University, May 2017 (*Journal of Political Economy*, forthcoming)

- Collusion and competition policy
 - Chen, Zhijun and Patrick Rey, “On the Design of Leniency Programs,” *Journal of Law and Economics*, 56 (2013), 917-957.
 - Harrington, Joseph E., Jr., “Optimal Cartel Pricing in the Presence of an Antitrust Authority,” *International Economic Review*, 46 (2005), 145-169.
 - *Harrington, Joseph E., Jr., “Cartel Pricing Dynamics in the Presence of an Antitrust Authority,” *RAND Journal of Economics*, 35 (2004), 651-673.
 - Harrington, Joseph E. Jr. and Joe Chen, “Cartel Pricing Dynamics with Cost Variability and Endogenous Buyer Detection,” *International Journal of Industrial Organization*, 24 (2006), 1185-1212.
 - Harrington, Joseph E., Jr., “Corporate Leniency Programs when Firms have Private Information: The Push of Prosecution and the Pull of Preemption,” *Journal of Industrial Economics*, 61 (2013), 1-27.
 - *Harrington, Joseph E., Jr. and Myong-Hun Chang, “When Should We Expect a Corporate Leniency Program to Result in Fewer Cartels?,” *Journal of Law and Economics*, 28 (2015), 417-449.
 - Motta, Massimo and Michele Polo, “Leniency Programs and Cartel Prosecution,” *International Journal of Industrial Organization*, 21 (2003), 347-379.

- Coordination without communication: Tacit collusion and algorithmic collusion
 - Calvano, Emilo, Giacomo Calzolari, Vincenzo Denicolo, and Sergio Pastorello, "Algorithmic Pricing and Collusion: What Implications for Competition Policy?," University of Bologna, working paper, March 2018.
 - Hanaki, Nobuyuki, Rajiv Sethi, Ido Erev, and Alexander Peterhansl, "Learning Strategies," *Journal of Economic Behavior & Organization*, 56 (2005), 523-542.
 - Harrington, Joseph E., Jr., "Developing Competition Law for Collusion by Autonomous Price-Setting Agents," August 2017.
 - Harrington, Joseph E., Jr. and Wei Zhao, "Signaling and Tacit Collusion in an Infinitely Repeated Prisoners' Dilemma," *Mathematical Social Sciences*, 64 (2012), 277-289.
 - Harrington, Joseph E., Jr., "A Theory of Collusion with Partial Mutual Understanding," *Research in Economics*, 71 (2017), 140-158.
 - Salcedo, Bruno, "Pricing Algorithms and Tacit Collusion," Cornell University, July 2016.