

Search, Information, and Competition in IO

Rome Economics Doctorate and LUISS Ph.D. — 18h (2027)

Rome Economics Doctorate (RED) — LUISS University

Instructor: Doruk Cetemen (dcetemen@luiss.it)

This course studies recent developments in theoretical industrial organization from a game-theoretic perspective, with a focus on how search, learning and repeated interaction shape market outcomes. It begins with sequential consumer search and the equilibrium theory of price dispersion, and then asks how decision makers learn: optimal dynamic information acquisition, bandit models of experimentation, where free-riding shapes what groups learn, and Wald problems in which a regulator decides when to approve a product. The second part turns to firms that interact over time: dynamic monopoly and intertemporal price discrimination, from the Coase conjecture to pricing when buyers learn, and cartels and collusion, from collusion under imperfect monitoring to the detection of bidding rings in public procurement. The course closes with competition and innovation: preemption, patents and the direction of innovation, and price competition when consumers are informed or search. The emphasis is on the tools (Pandora's rule, continuous-time bandits, optimal stopping, recursive methods for repeated games) and on what they deliver in applications, alongside evidence on price dispersion and cartels. Assessment consists of an in-class paper presentation and a referee report.

Course Outline

1. Sequential search and price dispersion
 - a. Optimal sequential search: Pandora's rule (Weitzman)
 - b. The Diamond paradox and equilibrium price dispersion (Diamond; Reinganum, 1979; Varian; Burdett and Judd; Baye, Kovenock and de Vries)
 - c. Oligopoly pricing with sequential search and differentiated products (Stahl; Wolinsky; Anderson and Renault)
 - d. Information and prices in search markets (Bergemann, Brooks and Morris)
 - e. Evidence on price dispersion and consumer search (Lach; De los Santos, Hortaçsu and Wildenbeest)
 - f. Search on uncharted terrain; collective progress and exit waves (Urgun and Yariv; Cetemen, Urgun and Yariv)
2. Information acquisition
 - a. Optimal dynamic information acquisition and time-risk preferences (Zhong; Chen and Zhong)
 - b. The cost of optimally acquired information (Bloedel and Zhong)
 - c. Preparing to act (Georgiadis-Harris)
3. Bandit models of experimentation
 - a. Learning demand by pricing: two-armed bandits and incomplete learning (Rothschild; McLennan)

- b. Single-agent experimentation: changing environments and Lévy bandits (Keller and Rady, 1999; Cohen and Solan)
 - c. Strategic experimentation and free-riding: Brownian, exponential and Poisson bandits, good and bad news (Bolton and Harris; Keller, Rady and Cripps; Keller and Rady, 2010, 2015)
 - d. Overcoming free-riding in bandit games (Hörner, Klein and Rady)
 - e. Experimentation over correlated alternatives (Callander; Wong; Carnehl and Schneider)
 - f. Disentangling exploration from exploitation (Lizzeri, Shmaya and Yariv)
 - g. Market applications: two-sided platforms and algorithmic collusion (Peitz, Rady and Trepper; Banchio and Mantegazza)
4. Wald problems and approval
- a. Sequential sampling and the optimal level of experimentation (Moscarini and Smith)
 - b. Research and the approval process as persuasion (Henry and Ottaviani)
 - c. Experimentation and approval mechanisms (McClellan)
5. Dynamic monopoly and intertemporal price discrimination
- a. Intertemporal price discrimination with commitment (Stokey)
 - b. Durable-goods monopoly without commitment: the Coase conjecture (Gul, Sonnenschein and Wilson)
 - c. A robust Coase conjecture for differentiated goods (Nava and Schiraldi)
 - d. Coasian dynamics with learning and news (Laiho and Salmi; Daley and Green)
 - e. Dynamic pricing, trials and dynamic screening (Krasikov and Lamba; Gan and Wu; Hörner and Sanktjohanser)
6. Repeated games, cartels and collusion
- a. Collusion under imperfect monitoring and optimal cartel equilibria (Green and Porter; Abreu, Pearce and Stacchetti)
 - b. Price wars during booms; evidence from the Joint Executive Committee (Rotemberg and Saloner; Ellison)
 - c. Collusion with private information and price rigidity (Athey and Bagwell; Athey, Bagwell and Sanchirico)
 - d. Mediated collusion (Ortner, Sugaya and Wolitzky)
 - e. Detecting collusion in procurement auctions: constrained bids, robust screens and bid rotation (Chassang and Ortner; Chassang, Kawai, Nakabayashi and Ortner; Kawai, Nakabayashi, Ortner and Chassang)
 - f. Inside cartels: a bidding ring and the vitamin cartels (Kawai, Nakabayashi and Ortner; Igami and Sugaya)
7. Competition and innovation
- a. Preemption and the persistence of monopoly (Gilbert and Newbery; Reinganum, 1983; Hopenhayn and Squintani, 2011)
 - b. Patent rights, disclosure and the direction of innovation (Hopenhayn and Squintani, 2016, 2021)
 - c. Strategic exploration: pre-emption and prioritization (Liu and Wong)
 - d. Price competition with informed and searching consumers (Moscarini and Ottaviani; Choi, Dai and Kim; Armstrong and Zhou; Board and Lu)
 - e. Personalized pricing and competition (Rhodes and Zhou)

8. Student presentations

References

- Abreu, D., Pearce, D., & Stacchetti, E. (1986). Optimal Cartel Equilibria with Imperfect Monitoring. *Journal of Economic Theory*, 39(1), 251–269.
- Anderson, S. P., & Renault, R. (1999). Pricing, Product Diversity, and Search Costs: A Bertrand-Chamberlin-Diamond Model. *RAND Journal of Economics*, 30(4), 719–735.
- Armstrong, M., & Zhou, J. (2022). Consumer Information and the Limits to Competition. *American Economic Review*, 112(2), 534–577.
- Athey, S., & Bagwell, K. (2001). Optimal Collusion with Private Information. *RAND Journal of Economics*, 32(3), 428–465.
- Athey, S., Bagwell, K., & Sanchirico, C. (2004). Collusion and Price Rigidity. *Review of Economic Studies*, 71(2), 317–349.
- Banchio, M., & Mantegazza, G. (2026). Artificial Intelligence and Spontaneous Collusion. Working paper (conditionally accepted, *American Economic Review*).
- Baye, M. R., Kovenock, D., & de Vries, C. G. (1992). It Takes Two to Tango: Equilibria in a Model of Sales. *Games and Economic Behavior*, 4(4), 493–510.
- Bergemann, D., Brooks, B., & Morris, S. (2021). Search, Information, and Prices. *Journal of Political Economy*, 129(8), 2275–2319.
- Bloedel, A. W., & Zhong, W. (2025). The Cost of Optimally Acquired Information. Working paper (R&R, *American Economic Review*).
- Board, S., & Lu, J. (2018). Competitive Information Disclosure in Search Markets. *Journal of Political Economy*, 126(5), 1965–2010.
- Bolton, P., & Harris, C. (1999). Strategic Experimentation. *Econometrica*, 67(2), 349–374.
- Burdett, K., & Judd, K. L. (1983). Equilibrium Price Dispersion. *Econometrica*, 51(4), 955–969.
- Callander, S. (2011). Searching and Learning by Trial and Error. *American Economic Review*, 101(6), 2277–2308.
- Carnehl, C., & Schneider, J. (2025). A Quest for Knowledge. *Econometrica*, 93(2), 623–659.
- Cetemen, D., Urgun, C., & Yariv, L. (2023). Collective Progress: Dynamics of Exit Waves. *Journal of Political Economy*, 131(9), 2402–2450.
- Chassang, S., Kawai, K., Nakabayashi, J., & Ortner, J. (2022). Robust Screens for Noncompetitive Bidding in Procurement Auctions. *Econometrica*, 90(1), 315–346.
- Chassang, S., & Ortner, J. (2019). Collusion in Auctions with Constrained Bids: Theory and Evidence from Public Procurement. *Journal of Political Economy*, 127(5), 2269–2300.
- Chen, D., & Zhong, W. (2025). Information Acquisition and Time-Risk Preference. *American Economic Review: Insights*, 7(2), 213–230.
- Choi, M., Dai, A. Y., & Kim, K. (2018). Consumer Search and Price Competition. *Econometrica*, 86(4), 1257–1281.
- Cohen, A., & Solan, E. (2013). Bandit Problems with Lévy Processes. *Mathematics of Operations Research*, 38(1), 92–107.
- Daley, B., & Green, B. (2012). Waiting for News in the Market for Lemons. *Econometrica*, 80(4), 1433–1504.
- De los Santos, B., Hortaçsu, A., & Wildenbeest, M. R. (2012). Testing Models of Consumer Search Using Data on Web Browsing and Purchasing Behavior. *American Economic Review*, 102(6), 2955–2980.

- Diamond, P. A. (1971). A Model of Price Adjustment. *Journal of Economic Theory*, 3(2), 156–168.
- Ellison, G. (1994). Theories of Cartel Stability and the Joint Executive Committee. *RAND Journal of Economics*, 25(1), 37–57.
- Gan, T., & Wu, N. (2026). From Doubt to Devotion: Trials and Learning-Based Pricing. *Journal of Political Economy*, 134(9), 2683–2739.
- Georgiadis-Harris, A. (forthcoming). Preparing to Act. *Econometrica*.
- Gilbert, R. J., & Newbery, D. M. G. (1982). Preemptive Patenting and the Persistence of Monopoly. *American Economic Review*, 72(3), 514–526.
- Green, E. J., & Porter, R. H. (1984). Noncooperative Collusion under Imperfect Price Information. *Econometrica*, 52(1), 87–100.
- Gul, F., Sonnenschein, H., & Wilson, R. (1986). Foundations of Dynamic Monopoly and the Coase Conjecture. *Journal of Economic Theory*, 39(1), 155–190.
- Henry, E., & Ottaviani, M. (2019). Research and the Approval Process: The Organization of Persuasion. *American Economic Review*, 109(3), 911–955.
- Hopenhayn, H. A., & Squintani, F. (2011). Preemption Games with Private Information. *Review of Economic Studies*, 78(2), 667–692.
- Hopenhayn, H. A., & Squintani, F. (2016). Patent Rights and Innovation Disclosure. *Review of Economic Studies*, 83(1), 199–230.
- Hopenhayn, H. A., & Squintani, F. (2021). On the Direction of Innovation. *Journal of Political Economy*, 129(7), 1991–2022.
- Hörner, J., Klein, N., & Rady, S. (2022). Overcoming Free-Riding in Bandit Games. *Review of Economic Studies*, 89(4), 1948–1992.
- Hörner, J., & Sanktjohanser, A. (2026). Dynamic Screening of Buyers with Heterogeneous Purchase Frequency. *Econometrica*, 94(4), 1245–1278.
- Igami, M., & Sugaya, T. (2022). Measuring the Incentive to Collude: The Vitamin Cartels, 1990–99. *Review of Economic Studies*, 89(3), 1460–1494.
- Kawai, K., Nakabayashi, J., & Ortner, J. (2026). The Value of Privacy in Cartels: An Analysis of the Inner Workings of a Bidding Ring. *Review of Economic Studies*, 93(1), 600–628.
- Kawai, K., Nakabayashi, J., Ortner, J., & Chassang, S. (2023). Using Bid Rotation and Incumbency to Detect Collusion: A Regression Discontinuity Approach. *Review of Economic Studies*, 90(1), 376–403.
- Keller, G., & Rady, S. (1999). Optimal Experimentation in a Changing Environment. *Review of Economic Studies*, 66(3), 475–507.
- Keller, G., & Rady, S. (2010). Strategic Experimentation with Poisson Bandits. *Theoretical Economics*, 5(2), 275–311.
- Keller, G., & Rady, S. (2015). Breakdowns. *Theoretical Economics*, 10(1), 175–202.
- Keller, G., Rady, S., & Cripps, M. (2005). Strategic Experimentation with Exponential Bandits. *Econometrica*, 73(1), 39–68.
- Krasikov, I., & Lamba, R. (2026). On Dynamic Pricing. *American Economic Journal: Microeconomics*, 18(1), 174–207.
- Lach, S. (2002). Existence and Persistence of Price Dispersion: An Empirical Analysis. *Review of Economics and Statistics*, 84(3), 433–444.
- Laiho, T., & Salmi, J. (2026). Coasian Dynamics and Endogenous Learning. *Journal of Economic Theory*, 232, 106136.
- Liu, Q., & Wong, Y. F. (2024). Strategic Exploration: Pre-emption and Prioritization. *Review of Economic Studies*, 91(4), 2425–2461.

- Lizzeri, A., Shmaya, E., & Yariv, L. (forthcoming). Disentangling Exploration from Exploitation. *American Economic Review*.
- McClellan, A. (2022). Experimentation and Approval Mechanisms. *Econometrica*, 90(5), 2215–2247.
- McLennan, A. (1984). Price Dispersion and Incomplete Learning in the Long Run. *Journal of Economic Dynamics and Control*, 7(3), 331–347.
- Moscarini, G., & Ottaviani, M. (2001). Price Competition for an Informed Buyer. *Journal of Economic Theory*, 101(2), 457–493.
- Moscarini, G., & Smith, L. (2001). The Optimal Level of Experimentation. *Econometrica*, 69(6), 1629–1644.
- Nava, F., & Schiraldi, P. (2019). Differentiated Durable Goods Monopoly: A Robust Coase Conjecture. *American Economic Review*, 109(5), 1930–1968.
- Ortner, J., Sugaya, T., & Wolitzky, A. (2024). Mediated Collusion. *Journal of Political Economy*, 132(4), 1247–1289.
- Peitz, M., Rady, S., & Trepper, P. (2017). Experimentation in Two-Sided Markets. *Journal of the European Economic Association*, 15(1), 128–172.
- Reinganum, J. F. (1979). A Simple Model of Equilibrium Price Dispersion. *Journal of Political Economy*, 87(4), 851–858.
- Reinganum, J. F. (1983). Uncertain Innovation and the Persistence of Monopoly. *American Economic Review*, 73(4), 741–748.
- Rhodes, A., & Zhou, J. (2024). Personalized Pricing and Competition. *American Economic Review*, 114(7), 2141–2170.
- Rotemberg, J. J., & Saloner, G. (1986). A Supergame-Theoretic Model of Price Wars during Booms. *American Economic Review*, 76(3), 390–407.
- Rothschild, M. (1974). A Two-Armed Bandit Theory of Market Pricing. *Journal of Economic Theory*, 9(2), 185–202.
- Stahl, D. O. (1989). Oligopolistic Pricing with Sequential Consumer Search. *American Economic Review*, 79(4), 700–712.
- Stokey, N. L. (1979). Intertemporal Price Discrimination. *Quarterly Journal of Economics*, 93(3), 355–371.
- Urgun, C., & Yariv, L. (2025). Contiguous Search: Exploration and Ambition on Uncharted Terrain. *Journal of Political Economy*, 133(2), 522–567.
- Varian, H. R. (1980). A Model of Sales. *American Economic Review*, 70(4), 651–659.
- Weitzman, M. L. (1979). Optimal Search for the Best Alternative. *Econometrica*, 47(3), 641–654.
- Wolinsky, A. (1986). True Monopolistic Competition as a Result of Imperfect Information. *Quarterly Journal of Economics*, 101(3), 493–511.
- Wong, Y. F. (2025). Forward-looking Experimentation of Correlated Alternatives. *Theoretical Economics*, 20(3), 883–909.
- Zhong, W. (2022). Optimal Dynamic Information Acquisition. *Econometrica*, 90(4), 1537–1582.