Empirical Analysis of Innovation in Oligopoly Industries

CEMFI SUMMER SCHOOL – 2018

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OBJECTIVES

This course deals with empirical studies of firms' innovation. We will cover state-of-the-art structural models and econometric methods to measure the productivity effects of R&D, consumer valuation of product innovations, the value of patents, and dynamic strategic behavior in firms' innovation. We will examine data through the eyes of three classes of structural models which are workhorses in empirical industrial organization: production function, demand of differentiated products, dynamic discrete choice models, and dynamic games.

TOPICS

1. Innovation and productivity growth: evidence from the estimation of production functions

2. Consumer valuation of product innovations: evidence from the estimation of demand of differentiated products

3. Measuring the value of patents: evidence from dynamic structural models

4. Dynamic strategic behavior in firms' innovation: evidence from dynamic games

OUTLINE AND REFERENCES

1. <u>Innovation and productivity growth: Production functions</u>

1.1. Productivity and productivity differences
1.2. Measuring the productivity effects of R&D
1.3. Endogenous productivity: Technology Choice
1.4. Endogenous productivity: investment in R&D

<u>Main Readings (sorted by recommended reading order)</u>

- SYVERSON, C. (2011): "What Determines Productivity?" *Journal of Economic Literature*, 49:2, 326–365
- HALL, B., J. MAIRESSE, and P. MOHNEN (2010): "Measuring the Returns to R&D", in Hall, B. and Rosenberg, N. (eds), *Handbook of the Economics of Innovation*. North-Holland.
- CRÉPON, B., E. GUGUET, and J. MAIRESSE (1998): "Research, Innovation and Productivity: An Econometric Analysis at the Firm Level," *Economics of Innovation and new Technology*, *7*(2), 115-158.
- VAN BIESEBROECK, J. (2003): "Productivity Dynamics with Technology Choice: An Application to Automobile Assembly," Review of Economic Studies 70 (2003), 167–198.
- DORASZELSKI, U. and J. JAUMANDREU (2013): "R&D and Productivity: Estimating Endogenous Productivity," *Review of Economic Studies*, 80, 1338 - 1383.
- AW, B., ROBERTS, M. and XU, D. (2011), "R&D Investment, Exporting, and Productivity Dynamics", *American Economic Review*, 101, 1312-1344.

<u>Other Readings: Production function estimation</u>

- Ackerberg, D., K. Caves and G. Frazer (2015): " Identification properties of recent production function estimators," *Econometrica*, *83*(6), 2411-2451.
- Blundell, R., and S. Bond (2000): "GMM estimation with persistent panel data: an application to production functions," *Econometric Reviews*, 19(3), 321-340.
- Gandhi, A., S. Navarro, and D. Rivers (2017): "On the identification of production functions: How heterogeneous is productivity?" *Journal of Political Economy*, forthcoming,
- Levinshon, J., and A. Petrin (2003): "Estimating Production Functions Using Inputs to Control for Unobservables," *Review of Economic Studies*, 70, 317-342.
- Olley, S., and A. Pakes (1996): "The Dynamics of Productivity in the Telecommunications Equipment Industry", *Econometrica*, 64, 1263-97.
- Wooldridge, J. (2009): "On Estimating Firm-level Production Functions using Proxy Variables to Control for Unobservables", *Economics Letters*, 104, 112–114.

2. <u>Consumer valuation of product innovations</u>

<u>Main Readings (sorted by recommended reading order)</u>

- BERRY, S. (1994): "Estimating Discrete Choice Models of Product Differentiation," *RAND Journal of Economics*, 25, 242-262.
- TRAJTENBERG, M. (1989): "The welfare analysis of product innovations, with an application to computed tomography scanners," *Journal of political Economy*, *97*(2), 444-479.
- PETRIN, A. (2002): "Quantifying the benefits of new products: The case of the minivan," *Journal of political Economy*, *110*(4), 705-729.
- GENTZKOW, M. (2007). Valuing new goods in a model with complementarity: Online newspapers. *American Economic Review*, *97*(3), 713-744.
- GOWRISANKARAN, G., and M. RYSMAN (2012): "Dynamics of consumer demand for new durable goods," *Journal of political Economy*, *120*(6), 1173-1219.
- CARRANZA, J. E. (2010): "Product innovation and adoption in market equilibrium: The case of digital cameras," *International Journal of Industrial Organization*, 28(6), 604-618.

<u>Other Readings: Demand of differentiated products</u>

- Aguirregabiria, V. and A. Nevo (2013): "Recent Developments in Empirical IO: Dynamic Demand and Dynamic Games," in Advances in Economics and Econometrics, Volume 3, D. Acemoglu, M. Arellano, and E. Dekel (eds.)
- Berry, S., and P. Haile (2014): "Identification in differentiated products markets using market level data," *Econometrica*, *82*(5), 1749-1797.
- Berry, S., J. Levinsohn and A. Pakes (1995): "Automobile Prices in Market Equilibrium," Econometrica, 60(4), 889-917.
- Nevo, A. (2011): "Empirical Models of Consumer Behavior," Annual Review of Economics, 3, 51-75.

3. Measuring the value of patents

3.1.   Valuation of patents using patent renewal decisions.
3.2.   Value of patent protection
3.3.   The trade of patents

Main Readings (sorted by recommended reading order)

- PAKES, A. (1986): "Patents as Options: Some Estimates of the Value of Holding European Patent Stocks," *Econometrica*, 54, 755-784.
- SCHANKERMAN, M. (1998). How valuable is patent protection? Estimates by technology field. *the RAND Journal of Economics*, 77-107.
- LANJOW, J. (1998): "Patent Protection in the Shadow of Infringement: Simulation Estimations of Patent Value," *Review of Economic Studies*, 65, 671-710.
- SERRANO, C. (2018): "Estimating the Gains from Trade in the Market for Patent Rights," *International Economic Review*, forthcoming.

Other Readings: Dynamic discrete choice structural models

- Aguirregabiria, V. and P. Mira (2010): "Dynamic Discrete Choice Structural Models: A Survey," *Journal of Econometrics,* 156(1), 38-67.
- Rust, J. (1987): "Optimal replacement of GMC bus engines: An empirical model of Harold Zurcher," Econometrica 55, 999-1033.
- Rust, J. (1994): "Structural estimation of Markov decision processes," in R. E. Engle and McFadden (eds.) Handbook of Econometrics Volume 4, North-Holland. Amsterdam.

4. **Dynamic strategic behavior in firms' innovation**

4.1.   The structure of dynamic games of oligopoly competition.
4.2.   Dynamic structural models of investment in R&D
4.3.   Market structure, competition, and the incentives to innovate.
4.4.   Creative destruction and the incentives to innovate of incumbents and new entrants

Required Readings:
- VIVES, X. (2008): "Innovation and competitive pressure," *Journal of Industrial Economics*, 56(3): 419-469
- ERICSON, R., and A. PAKES (1995): "Markov-Perfect Industry Dynamics: A Framework for Empirical Work," *Review of Economic Studies,* 62, 53-82.
- XU, D. (2018): "A Structural Empirical Model of R&D, Firm Heterogeneity, and Industry Evolution," *Journal of Industrial Economics*, forthcoming.
- HASHMI, A. and J. VAN BIESEBROECK (2016): "The relationship between market structure and innovation in industry equilibrium: a case study of the global automobile industry," *Review of Economics and Statistics*, *98*(1), 192-208.
- AW, B., ROBERTS, M. and XU, D. (2011), "R&D Investment, Exporting, and Productivity Dynamics", *American Economic Review*, 101, 1312-1344.
- PETERS, B., M. ROBERTSs, V. VUONG, and H FRYGES (2017): "Estimating dynamic R&D choice: an analysis of costs and long-run benefits," *The RAND Journal of Economics*, *48*(2), 409-437.
- GOETLER, R. and B. GORDON (2011): "Does AMD spur Intel to innovate more?" *Journal of Political Economy*, 119(6), 1141-1200.
- IGAMI, M (2017): "Estimating the innovator's dilemma: Structural analysis of creative destruction in the hard disk drive industry, 1981–1998," *Journal of Political Economy*, 125(3), 798-847.

Other Readings: (Empirical dynamic games).
- Aguirregabiria, V. and P. Mira (2007): "Sequential Estimation of Dynamic Discrete Games," *Econometrica*, 75, 1-53.
- Aguirregabiria, V. and A. Nevo (2013): "Recent Developments in Empirical IO: Dynamic Demand and Dynamic Games," in Advances in Economics and Econometrics, Volume 3, D. Acemoglu, M. Arellano, and E. Dekel (eds.)
- Bajari, P., L. Benkard, and J. Levin (2007): "Estimating Dynamic Models of Imperfect Competition," *Econometrica*, 75(5), 1331–1370.
- Pakes, A. and P. McGuire (1994): "Computing Markov-perfect Nash Equilibria: Numerical Implications of a Dynamic Differentiated Product Model," *Rand Journal of Economics*, 25, 555-589.