Standing on the Shoulders of Dwarfs: Dominant Firms and Innovation Incentives

Luís Cabral
New York University and *CEPR*

NYU | STERN

Outline

- Some received wisdom regarding innovation
- Innovation in "digital" industries
- Some theory results
- Some empirical results
- Concluding remarks

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Received wisdom

- A selective summary of prior theory research
- Key ideas in the form of "effects"
- Very focused on IO tradition (market structure and firm size)
- Three ideas only!
- Will reappear (in some form) in remainder of presentation

Replacement effect

- By innovating, technology leader cannibalizes own product, hence has lower incentives
- Also known as Arrow effect (Arrow Mark I)
- Important refs: Schumpeter (1934), Arrow (1962), Reinganum (1983)

- Schumpeter, J. (1934). *The Theory of Economic Development*. New York: Harper
- Arrow, K. J. (1962). Economic Welfare and the Allocation of Resources for Invention. In *The Rate and Direction of Inventive Activity: Economic and Social Factors*, pages 609–626. National Bureau of Economic Research, Inc
- Reinganum, J. F. (1983). Uncertain Innovation and the Persistence of Monopoly. *American Economic Review*, 73(4):741–48

Joint-profit effect

- Market leader has more to lose from not innovating than challenger has to gain from innovating
- Important ref: Gilbert and Newbery (1982)
- Closely related to Schumpeter's creative destruction (Schumpeter Mark I)
- Also known as efficiency effect.
  Variation: escape-competition effect
- Classical mechanics equivalent: principle of least action

- Gilbert, R. J. and Newbery, D. M. G. (1982). Preemptive Patenting and the Persistence of Monopoly. *American Economic Review*, 72(3):514–26 d
- Budd, C., Harris, C., and Vickers, J. (1993). A Model of the Evolution of Duopoly: Does the Asymmetry between Firms Tend to Increase or Decrease? *Review of Economic Studies*, 60(3):543–73 d
- Cabral, L. and Riordan, M. H. (1994). The Learning Curve, Market Dominance, and Predatory Pricing. *Econometrica*, 62(5):1115–40 d
- Aghion, P., Bloom, N., Blundell, R., Griffith, R., and Howitt, P. (2005). Competition and Innovation: An Inverted-U Relationship. *Quarterly Journal of Economics*, 120(2):701–728

Innovator-size effect

- The higher the output level, the greater the value of a quality increase or a cost decrease
- Also known as Arrow effect (Arrow Mark II)
- Related to Schumpeter Mark II (ability vs incentive)
- Important refs: Schumpeter (1942), Arrow (1962)

- Schumpeter, J. (1942). *Capitalism, Socialism and Democracy*. Cambridge, Mass: Harvard University Press
- Arrow, K. J. (1962). Economic Welfare and the Allocation of Resources for Invention. In *The Rate and Direction of Inventive Activity: Economic and Social Factors*, pages 609–626. National Bureau of Economic Research, Inc

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Digital industries

- By "digital" industries I primarily mean high tech, platform-based industries (broad notion of platform)
- Examples: IBM, Apple, Microsoft, Google, Facebook, Intel
- What is special about these industries, namely in terms of previous discussion regarding innovation

Dominant firms

- Many digital industries characterized by a dominant firm (a.k.a. industry leader)
- Industry leader: everything else, higher market profits
  - complementary assets
  - network effects
- Industry leader not always technology leader
- Technology leader may be acquired by industry leader

Examples: Instagram and Facebook; AMD in some segments/years; Google and Waze

Standing on the shoulders of dwarfs

- Interpretation I: imitation, sequential innovation
  - Examples: Google Play and Spotify; Microsoft IE and Netscape; Intel and AMD
- Interpretation II: markets for technology
  - Examples: Eli Lilly and Genentech; Google and Waze; Facebook and Instagram

Newton: if I have seen far, it is by standing on the shoulders of giants.

Imitation

Microsoft has rarely been the innovator . . . Excel, the Microsoft spreadsheet, is an imitation of Lotus 123, which was in turn an imitation of VisiCalc . . . Microsoft Word was introduced into the market long after several other popular word processors. Microsoft's Power Point imitated programs such as Harvard Graphics or Freelance.[1]

If imitation is the sincerest form of flattery, then Google must love streaming music rivals like Pandora, Spotify and Rdio. That's because Google Play Music All Access looks pretty similar to them.[2]

In some niches of the software business, Google is casting the same sort of shadow over Silicon Valley that Microsoft once did. "You've got people who don't even feel they can launch a product for fear that Google will get in."[3]

1. Nader and Love (1997)
2. http://www.wallstreetdaily.com/2013/05/16/google-streaming-music-service/
3. *The New York Times*, May 2, 2006.

Acquisition

- Eli-Lilly and Genentech; Google and Android; Google and Adsense; Facebook and Instagram; Google and Waze
- Innovator has little or no commercial capabilities: business model is innovation for buyout
- Innovation incentives are given by technology price

Currently, Eli-Lilly is third in the market, behind Novo Nordisk and Sanofi-Aventis.
In June 2013 Google bought Waze for $1.1 billion from founder Uri Levine

Imitation or acquisition?

- Google acquired Applied Semantics to get Adsense
- Google attempted to to acquire Idealab, but target did not sell. Google imitated (IP issues settled in court)
- More generally, value of technology transfer by acquisition (vs imitation) depends on merger policy, patent policy, etc. Not an obvious choice.

Policy relevance

- Many antitrust cases pertain to dominant firms
  - IBM, AT&T, Microsoft, Intel, Google
- Central issues typically include market power, consumer protection
- Equally important: impact on innovation

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Research questions

- A Martian lands on earth at a random time in history; what innovation rate will it find?
- How does this rate differ from a different planet where dominant firms are curbed (e.g. EU vs US)?
- How does this rate differ from a different planet where efficient technology transfer is possible (e.g health vs software)?
- What about radical innovation (new "platform" vs to new "app")?

The "shadow of Google" effect

- Absent technology transfer, an increase in the degree of firm dominance leads to a decrease in innovation.
- Relevant incentives: technology laggard ("replacement" effect)
- Dominant firm has greater incentives ("innovator-size" effect)
- Rival firm has lower incentives ("innovator-size" effect)
- Positive effect greater in absolute value ("joint-profit" effect)
- Lower weight in the steady state (positive "innovator-size" effect enhances negative one)

Digression: US vs Microsoft

- Important pillar in Microsoft's defense: because we are big, we have bigger incentives to improve quality
- Innovator-size effect type of argument
- True, but this is only part of the story:
- Discouragement effect, while small in absolute value, is the most relevant in the steady state

The "innovation for buyout" effect

- If firm asymmetry is sufficiently large, then the ability to transfer technology leads to an increase in innovation
- Relevant incentives: technology laggard ("replacement" effect)
- Innovation more valuable for dominant firm ("joint-profit" effect)
- Nash bargaining $\Rightarrow$ "incentive transfer"
  Fringe firm partly internalizes dominant firm's higher incentives

The "bargaining power" effect

- If firm asymmetry is sufficiently small, then the ability to transfer technology leads to a decrease in innovation
- Close to symmetry, "joint-profit" effect is of second order
- Decrease in fringe's bargaining power is of first order
- Asymmetry lowers transfer price

Extension: radical innovation

- Firms can also invest in radical innovation
- Success in radical innovation: become the next dominant firm
- Technology transfer leads to an increase in incremental innovation at the expense of radical innovation
- Intuition: complacency effect: difference between value of dominant firm and value of fringe firm drops with technology transfer

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Empirical evidence

- Selected recent empirical studies that feature a "giant"
- Relation to theory results
- Relation to theory model's assumptions

Moser and Wong (2016)

- Monsanto buys DeKalb Genetics in 1996–98, thus entering soy seed breeding market
- Aggressive patenting by Monsanto; incumbents react by patenting too (equilibrium switch?)
- Industry innovation declines: triple-differences regressions: incumbents perform 81% fewer field trials for soy per firm compared with other crops
- Decline offsets Monsanto's increase
- Consistent with "shadow-of-Google" effect

Moser, P. and Wong, P. (2016). Patents and Innovation: Evidence from Monsanto's Entry Into GMO Crops. Working Paper, Stern School of Business, New York University

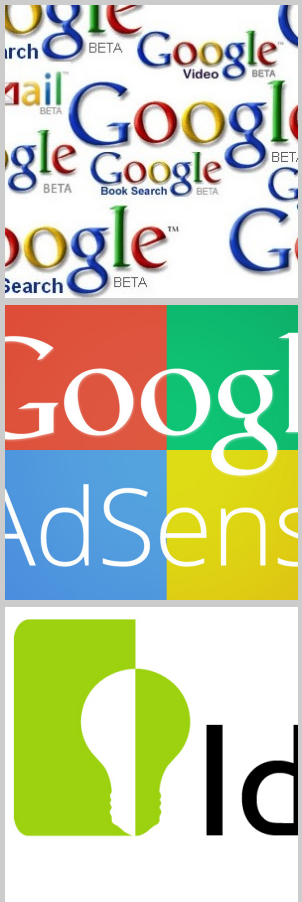
Watzinger et al. (2016)

- 1956 Consent Decree allows Bell to remain telecommunications monopolist but forces royalty-free patent licencing
- Follow-on innovation increases by 11% on average
- Effect driven by young and small firms
- Effect only outside telecommunication industry
- Consistent with "shadow-of-Google" effect: fringe firms have little incentive to innovate if they face a dominant firm in the product market

Watzinger, M., Fackler, T., Nagler, M., and Schnitzer, M. (2016). How Antitrust Can Spur Innovation: Bell Labs and the 1956 Consent Decree. Working Paper, University of Munich

Galasso and Schankerman (2015)

- Natural experiment from US courts
  - Federal Circuit US Court of Appeal
  - Judges randomly assigned to patent cases
- Effect patent invalidation (↓ barrier to innovation)
  - 50% increase subsequent citations
  - especially strong patents
  - especially fields with complex technology; high fragmentation of patent ownership; large firms
- Effect is entirely driven by invalidation of patents owned by large patentees
- Consistent with "bargaining-power" effect



Galasso, A. and Schankerman, M. (2015). Patents and Cumulative Innovation: Causal Evidence from the Courts. *Quarterly Journal of Economics*, 130:317–369

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Welfare analysis

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- Central issues typically include market power, consumer protection
- Equally important: impact on innovation
- Margrethe Vestager vs Joaquin Almunia