Competition and Innovation in Pharmaceuticals

Proposal for NBER PIE Program: Innovation Policy Group

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My research explores the relationship between competition and innovation in pharmaceuticals. I examine three main questions: (1) How does competition affect the incentive for firms to innovate? (2) How do market conditions affect the firms' decision to invest in novel innovation (creating treatments from new molecules) versus follow-on or incremental innovation (creating treatments from already-approved molecules)? (3) What are the effects of antitrust policies, FDA approvals, and pharmaceutical mergers on the health value of innovation in disease categories with different levels of competition?

I start by modeling the decisions of pharmaceutical firms which have two R&D choices. First, a firm can invest in novel innovation, which involves the innovation of a new molecule that is both costly and risky but produces a new treatment that is more differentiated from existing treatments. Second, a firm can invest in follow-on or incremental innovation, which involves taking an existing FDA-approved molecule that the firm has under patent or has licensed, and produce a new treatment by modifying the dosage, formulation, or indication or by combining it with other molecules. Follow-on innovation has several benefits over novel innovation: it requires one-twentieth the R&D expenditures to produce an innovation, it is less risky, and it requires a shorter approval period. However, follow-on innovation produces a product that is less differentiated from existing treatments.

I show that in less competitive disease categories, as measured by the number of FDA-approved treatments, there is a higher incentive for novel innovation and in more competitive disease categories, there is a higher incentive for follow-on innovation. I also show how even in disease categories with one treatment, treatment heterogeneity (including issues such as treatment resistance and comorbidity) gives firms an incentive to continue producing follow-on innovation even if they do not have an incentive for novel innovation.

Next, I use two sources of exogenous variation to examine how the increased incentive for innovation differentially affects markets with different levels of competition and other market conditions, and I examine how competition affects the tradeoff between novel and follow-on innovation. The two sources of variation I examine are changes in demographics similar to Acemoglu and Linn (2004) and the introduction of Medicare Part D. Both of these sources of variation produced an increased incentive to create innovation in certain disease categories relative to others. I examine how whether disease categories with a high incentive to innovate had different levels of innovation based on the level of competition in the disease category and what type of innovation firms invested in. I also address the role of generic competitors versus brand-name competitors and the effect that biosimilars could have on competition.

Finally, I discuss my results in the context of antitrust policy, FDA regulatory policy, and mergers in pharmaceuticals. To understand the role of policy, I incorporate the model of Hult (2015) which measures the value of both novel and follow-on innovation to findings of how competition affects innovation. I show that ignoring follow-on innovation improperly measures the effect of competition on innovation because even in markets without competition there can be incentives to continue investing in follow-on innovation independent of the threat of entry. I discuss which types of firm activities can stifle competition and how antitrust policy can affect these activities. I also discuss how the FDA can optimally create the incentive for innovation in different market conditions. Finally, I hope to show how mergers can alter the amount and value of innovation depending on the level of competition between treatments of the two merging firms.

The funding of this research grant would mainly go towards data collection. Although I have data on innovations that are approved by the FDA, I do not have any data on the pipeline of innovations before FDA-approval. It is costly and time-consuming to gather information about the treatments that have not or do not get approved by the FDA. However, these pipeline innovations tell a vital part of the story about how innovation is being affected.

References

Acemoglu, Daron, and Joshua Linn. "Market Size in Innovation: Theory and Evidence from the Pharmaceutical Industry." *Quarterly Journal of Economics* 3 (2004): 1049-1090.

Hult, Kristopher J. "Incremental Innovation and Pharmaceutical Productivity." (2015).

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Employment

Senior Associate, Charles River Associates — 2015 to Present
Research Professional, Becker Center, Chicago Booth, University of Chicago — 2007-2009

Education

Ph.D. Economics, University of Chicago — 2015
M.A. Economics, University of Chicago — 2011
B.A. Mathematics, University of Chicago — 2007
B.S. *with honors* Economics, University of Chicago — 2007

Research Fields Health Economics, Applied Microeconomics, Industrial Organization

Working Papers

Incremental Innovation and Pharmaceutical Productivity
(Job Market Paper, Submitted)

Public Liabilities and Health Care Policy
with Tomas J. Philipson (NBER w18571)

How Does Technological Change Affect Quality-Adjusted Prices in Health Care?
with Tomas J. Philipson and Sonia Jaffe

Measuring the Value of Incremental Innovation Using Evidence from Medicare Part D

Works in Progress

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Conferences and Seminars

2016: Conference of the American Society of Health Economists
2015: University of Chicago, Tufts University CEVR, FDA Center for Drug Evaluation and Research
2013: Annual Health Economics Conference

Honors, Scholarships, and Fellowships

Social Science Fellowship — 2011-2014
Munk Fellowship — 2010-2011
Lawrence G. Goldberg Prize for Best Honors Thesis in Economics, University of Chicago — 2007