NBER Innovation Policy Grant Proposal

The Unequal Gains from Product Innovations

Xavier Jaravel, Harvard University

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1. Research Question and Preliminary Results

Does economic inequality influence the kinds of innovations that takes place, and who benefits from these innovations? The rising level of nominal income inequality in the United States over the past thirty years has been a key topic of interest for academics and policymakers. Much less attention has been paid to how price changes in the product market, due to the dynamics of innovation, may differentially affect households at different points of the income distribution.

Depending on their income level, households consume very different goods and services. Due to price changes in the product market over time, trends in real inequality may therefore differ from trends in nominal inequality. Product innovations may play a central role in this process by increasing the variety and quality of goods available in specific consumer segments, as well as by driving down the price of existing products in these segments due to increased competitive pressure. My project investigates the relevance of this hypothesis in the US retail sector (accounting for over 25% of GDP) during the past fifteen years.

Using detailed product-level data, I have documented in preliminary analysis that there are indeed large differences in the rates of inflation and in the benefits from product innovations experienced by individuals in different income groups. Specifically, I have found that from 2004 to 2013 annualized quality-adjusted inflation was 0.65 percentage point lower for households earning more than $100,000 a year, relative to households with an annual income below $30,000. Furthermore, product innovations disproportionately targeted higher-income households during this period.

In the rest of the project, I investigate whether endogenous innovation dynamics can explain these results. In particular, I examine whether the equilibrium response of entrepreneurs to higher income growth at the top of the income distribution can explain the new facts on differential inflation and increase in product variety across the income distribution. It is well known that nominal income growth has been faster at the top of the income distribution in recent decades, in particular during the period considered in my project. In my sample, product groups catering to higher-income households indeed grow faster and have a higher rate of product introduction, as well as lower inflation on existing products. I investigate the hypothesis that entrepreneurs respond to changes in relative market size by skewing product introductions toward market segments that are growing faster. This process may lead to a decrease in the price of existing products in the fast-growing market segments as increased competitive pressure from new products pushes markups down.

To test this hypothesis, identification requires finding a shifter in demand that is plausibly exogenous to supply. I use shifts in the national age and income distributions in the US over time (in the spirit of Acemoglu and Linn, 2004), as well as changes in food stamps policy across US states over time. I found preliminary evidence that the rate of introduction of new products endogenously increases in response to growing market size. For existing products, I found that prices go down when demand goes up, i.e. the observed supply curve is downward sloping. In other words, these preliminary results suggest that absent the endogenous response of supply to market size effects, there would not have been a substantial difference in inflation nor in the rate of increase in product variety across the income distribution. Therefore, economic inequality does seem to substantially influence the kind of innovation that takes place.

2. Detailed Methodological Approach

Data: My project is based on the Nielsen Homescan Consumer Panel and Nielsen Retail Scanner datasets, which have been widely used in the literature (Einav, Leibtag and Nevo, 2008). With this data, I can track consumption from 2004 to 2013 at the product level in department stores, grocery stores, drug stores, convenience stores and other similar retail outlets across the US. The data are representative of about 40% of household expenditures on goods (Broad and Weinstein, 2010).

Measuring quality-adjusted inflation and increasing product variety across the income distribution: One important goal of the project is to compute the cost of achieving a certain level of utility in one year relative the previous year in the retail sector for various income groups. This exercise requires taking a stance on a utility function. The role of the utility function is twofold: quantifying the impact on utility of price changes for the goods that exist across periods, but also translating into a welfare metric the patterns of product creation and destruction. In order to understand what parts. Preference parameters in my estimation framework are a flexible function of the income level, which allows for nonhomotheticities. My preliminary results

suggest that the patterns of differential inflation across the income distribution are very robust and are not driven by particular structural assumptions on the utility function.

Characterizing the equilibrium response of supply to market size effects: A major difficulty in any investigation of the impact of market size on innovation is the endogeneity of market size: better products will have larger markets. A strategy to overcome this problem is to exploit variations in market size driven by US demographic changes, which should be exogenous to other, for example scientific, determinants of innovation and entry of new products. To estimate potential market size, I construct age profiles of users for each product module, and then compute the implied market size from aggregate demographic changes given these (time invariant) age profiles. As an additional identification strategy, I use state-level policy changes in food stamp policy in the 2000s, which creates variation in market size across US states.

3. Potential Policy Implications

This project directly speaks to how income inequality affects the direction of product innovations, and in turn price dynamics and real inequality. It has potentially important policy implications. First, documenting that inflation rates differ across the income distribution, and explaining why, is key because many government transfers are indexed on inflation.

Second, characterizing the equilibrium response of entrepreneurs to changes in relative market size is a crucial input for any cost-benefit analysis of government transfers. Intuitively, if the direction of product innovations shifts and if the equilibrium price falls when relative demand increases, then government transfers are "more effective" in general equilibrium than in partial equilibrium because the endogenous response of entrepreneurs magnifies the effect of redistribution.

4. Intended Use of Funds, Timeline and Broader Research Agenda

I would like to use the NBER PIE grant for four purposes. First, I would like to purchase data from GS1[1], the company in charge of allocating barcodes to manufacturers in the US, in order to identify the manufacturer of each product. This will allow me to study possible channels related to manufacturer dynamics that can explain the new empirical facts about product innovations across the income distribution – in particular, does the level of competition between manufacturers increase more in product groups catering to high-income households?

Second, I would like to hire a research assistant to carry out a number of qualitative analyses related to product innovations in the retail sector. The research assistant would check that the barcodes identified as "new" in the Nielsen indeed capture meaningful differences relative to existing UPCs. Moreover, they would carry out case studies in specific product cateogries catering primarily to high- or low-income households (e.g. scotch vs. frozen fruit drinks) to help me gain a better understanding of the dynamics of product innovations. I could then zoom in on these categories and carry out additional empirical work in a new section of the paper (in the spirit of Bronnenberg et al., 2016).

Third, I would like to use the grant to fund research trips to the Bureau of Labor Statistics. I have gained access to the confidential CPI microdata and want to compare the price dynamics observed in the Nielsen data and at the BLS. Specifically, my preliminary results may appear inconsistent with the existing literature using BLS data, which has found a small inflation difference between high- and low-income consumers. My hypothesis is that the discrepancy is explained by the level of aggregation used in the studies based on the BLS data - I will be able to check this directly. This extension has the potential to deliver a broader methodological lesson for the measurement of inflation by statistical agencies.

Fourth, I plan on using the funds to travel to conferences to present the paper.

The timeline for this project is as follows: during the summer 2016, I plan on circulating a preliminary draft of the paper and present at conferences. I will also expand the database and finalize the section of the paper documenting the new facts on inflation and the rate of introduction of new products across the income distribution. By the winter 2016-2017, I will circulate a polished draft of the paper and finalize the section documenting the main channels explaining the new facts, including the equilibrium response of supply to changes in market size. In the spring 2017, I will finalize the model and submit the paper to a peer-reviewed academic journal.

This work is part of a broader research agenda on innovation policy – I have submitted a detailed resume describing these other research projects.

[1] The data is available for purchase at http://www.gs1us.org/resources/tools/gs1-us-data-hub/fees

XAVIER JARAVEL
xjaravel@hbs.edu

HARVARD UNIVERSITY

Office Contact Information
420 Baker Library, Harvard Business School
Boston, MA 02163
Mobile: 857-919-9732

Employment:
Stanford Institute for Economic Policy Research (SIEPR), Postdoctoral Fellow, June 2016 to present

Graduate Studies:
Harvard University, 2012 to present
Ph.D. Candidate in Business Economics
Thesis Title: "Essays in the Economics of Innovation"
Expected Completion Date: May 2016

References:

Professor Raj Chetty	Professor Josh Lerner
chetty@fas.harvard.edu	jlerner@hbs.edu
Professor Philippe Aghion	Professor Ed Glaeser
paghion@fas.harvard.edu	eglaeser@harvard.edu
Professor Larry Katz	Professor Marc Melitz
lkatz@harvard.edu	mmelitz@harvard.edu

Undergraduate Studies:
B.A., Economics and Political Science, Sciences-Po Paris, *summa cum laude*, 2011

Teaching and Research Fields:
Primary fields: Economics of Innovation, Labor Economics, Public Economics
Secondary fields: Applied Econometrics, Macroeconomics

Teaching Experience:

Fall 2014	Graduate Public Finance, Harvard, Teaching Fellow for Professor Raj Chetty
Spring 2014	Graduate Macroeconomics, Harvard, Guest Lecturer for Professor Robert Barro
Summer 2011	Undergraduate Micro- and Macroeconomics, Harvard, Teaching Fellow for Professor David Laibson

Research Experience:

2011-2012	Harvard, Research Assistant for Professors Philippe Aghion, Diego Comin, David Laibson, Marc Melitz, Michael Kremer and Rick Hornbeck
2011-2012	MIT, Research Assistant for Professor Daron Acemoglu

Professional Activities:
Referee: *American Economic Journal: Economic Policy*, *Econometrica*, *Journal of Public Economics*, *Journal of Urban Economics*, *Quarterly Journal of Economics*, *Review of Economics and Statistics*.
Presentations: NBER Summer Institute (2015), United States Patent Office (2015), NBER Productivity Seminar (2014, 2015), Kauffman Emerging Scholar Conference (2016).

Honors and Scholarship:

2016	NBER Value of Medical Research Fellowship
Winter 2016	Visiting Researcher, Stanford Institute for Economic Policy Research
2015-2016	Ewing Marion Kauffman Dissertation Fellowship
2015-2018	Fellow, Collège de France
June 2015	Visiting Researcher, United States Patent Office
2012-present	Doctoral Fellowship, Harvard Business School

Research Papers:

The Unequal Gains from Product Innovations
This paper shows that product innovations disproportionately benefit rich households due to increasing inequality and the endogenous response of supply to market size. Using detailed product-level data in the Nielsen Homescan and Retail Scanner datasets (covering 40% of total expenditures on goods), the paper presents two new stylized facts: (1) from 2004 to 2013, rich households have consistently spent a higher share of their income on new products; (2) quality-adjusted inflation has been lower for these households, relative to more modest households. Using changes in market size driven by demographic trends exogenous to innovation patterns, the paper provides causal evidence that a shock to the relative demand for goods can (1) affect the direction of product innovations, and (2) lead to a decrease in the relative price of the good for which demand became relatively larger (the strong equilibrium bias hypothesis). Finally, the paper examines which theories of directed innovation are consistent with the evidence

Team-specific Capital and Innovation, Revise & Resubmit at the American Economic Review (with Neviana Petkova and Alex Bell)
We show that the team-specific capital is important for the typical patent inventor's lifecycle earnings and productivity. Using administrative tax and patent data for the population of US patent inventors from 1996 to 2012 and employing a difference-in-differences research design based on the premature deaths of 4,714 inventors, we establish that an inventor's premature death causes a large and long-lasting decline in their co-inventor's earnings and citation-weighted patents (-4% and - 15% after 8 years, respectively). We rule out firm disruption, network effects and top-down spillovers as primary drivers of this result. Consistent with the team-specific capital interpretation, the effect is larger for more closely-knit teams and primarily applies to co-invention activities with the deceased.

The Lifecycle of Inventors (with Alex Bell, Raj Chetty, Neviana Petkova and John Van Reenen)
We use administrative records on the population of individuals granted patents between 1996 and 2012 to characterize the lives of more than 780,000 inventors in the United States. We show that children of low-income parents are much less likely to become inventors than their higher-income counterparts. Decompositions indicate that income-innovation gaps can largely be accounted for by differences in human capital acquisition while children are growing up rather than innate ability or differences in preferences between children from different backgrounds. Consistent with the importance of environment, we find that growing up in a high-innovation area (of a particular technology class) is associated with an increased probability of becoming an inventor (in that technology class). While our analysis does not directly identify the causal mechanisms that drive innovation, our descriptive findings shed light on which types of policy tools are likely to be most effective in sparking innovation.

Patent Trolls and the Patent Examination Process (with Josh Feng)
We show that the patent examination process at the United States Patent Office plays an important role in the activity of non-practicing entities (NPEs). Using the random allocation of patent applications to examiners within art units and an estimation framework inspired by the teacher value-added literature, we identify the causal effect of patent examiners on the probability that the patents they grant become part of an NPE's portfolio. We find very large effects: one standard deviation in the estimated distribution of examiner effects accounts for over 50 percent of the baseline rate of NPE-held patents. Heterogeneity analysis shows that examiners with a high NPE effect tend to be more "lenient": they have higher allowance rates, narrow the claims less during prosecution, and are less likely to require the applicant to clarify the claims. Our analysis suggests that NPEs strategically purchase and assert patents with vague claims, and that investing in the quality of the patent examination process may have large social returns. These findings contribute to the continuing debate on patent reform and the nature of NPEs.

Knowledge Spillovers, Innovation and Growth, The Economic Journal, March 2015
(with Philippe Aghion)
Cohen and Levinthal (1989) introduced the notion of absorptive capacity and demonstrated that knowledge spillovers can induce complementarities in R&D efforts. We show that this idea has rich implications when analyzing important aspects of the growth process such as cross-country convergence and divergence, the international co-ordination of climate change policies, and the role of openness in the production of ideas. We also show that the notion of absorptive capacity sets an agenda for new empirical and theoretical analyses of the role of R&D spillovers in innovation and growth.

Education and Military Rivalry, Revise & Resubmit at the Journal of the European Economic Association (with Philippe Aghion, Torsten Persson and Dorothee Rouzet)
Motivated by historical evidence on the relation between military threats and expansions of primary education, we assemble a novel panel dataset from the last 150 years in European countries and from the postwar period in a large set of countries. We find empirically that (i) investments in education increase in response to military threats, (ii) democracy has a negative direct effect on education investments, and, (iii) education investments in better democracies respond more to military threats. These empirical results continue to hold when we instead exploit rivalries in a certain country's immediate neighborhood as an alternative source of variation. To help us interpret these patterns in the data, we develop a theoretical model which is consistent with the three empirical findings. The model has an additional prediction about investments in physical infrastructures, which we also take to the data.

Research Papers in Progress:

Directed Technical Change and Optimal Taxation

Financing Constraints on Innovation: Evidence from NIST Competitions (with Stephen Campbell and Andrew Wang)