Ina Ganguli (UMass Amherst)
Jeffrey Lin (Philadelphia Fed)
NBER Innovation Policy Grant Proposal
May 1, 2016

The Long-run Impacts of Patents on Inventors and Firms: Evidence from Patent Interferences

The goals of the proposed research project are to collect new data on historical and modern cases of "patent interferences" to provide evidence on the effect of patent rights on (1) the careers of individual inventors, including future inventive activity and earnings, and (2) the behavior and performance of firms, including innovation, research and development, and growth.

This project leverages the fact that until 2013, the US had a "first to invent" rule. When the U.S. Patent Office received patent applications from multiple, independent parties with identical claims at roughly the same time, it was obliged to investigate the competing claims to determine which party was entitled to patent protection through what was known as an "interference proceeding". Interferences present a unique natural experiment in the assignment of patent rights, since identical invention suggests common inventive inputs, including knowledge inputs, and the timing of who was "first to invent" was effectively random. Our empirical strategy uses this plausibly exogenous variation in the assignment of patent rights and compares the subsequent inventor- and firm-level outcomes of winning and losing parties through a difference-in-differences approach.

Specifically, we compare the outcomes for the winning and losing parties before and after the interference decision. Since our setting provides a quasi-experiment, so that patent rights are not actually randomized to the parties, the DD will allow us to account for unobserved differences between the winning and losing parties. Since unobserved differences between winners and losers that vary over time may persist in this approach, which could bias the estimates of the impact of obtaining patent rights, we will further leverage additional sources of exogenous variation through potential instruments such as the timing between the discoveries of the interfering parties and the likelihood of an examiner declaring an interference.

Under provisions of the Leahy–Smith America Invents Act (AIA) that took effect in 2013, the US patent system moved from a "first to invent" to a "first to file" system, eliminating interference proceedings. However, we believe this project will provide evidence on the impacts of obtaining patent rights that continue to be policy relevant for countries around the world considering how to design a patent system that most effectively encourages innovation. Recent

literature focused on optimal patent policy design has examined how patents can impact follow-on innovation and firm outcomes. Along with historical evidence on these questions, the findings have pointed either to negligible or negative effects of patents on follow-on innovation. While these studies have been able to exploit exogenous variation in obtaining patent rights, a lack of such contexts has hindered the current literature.

Moreover, we still know very little about how obtaining patent rights can impact individual inventors' long-run career outcomes, including future inventive activity and earnings, and how patents can impact firms' long-run behavior, and including innovation activities, research and development investments, and growth. Thus, we envision the project making important contributions to the literature on the long-run impacts of intellectual property rights and optimal patent policy design. This evidence will also contribute to broader discussions in economics and among policymakers regarding the factors leading to increasing wealth inequality, by showing whether intellectual property may be one mechanism through which wealth accrues differentially to individuals at the top of the income distribution.

We have currently hand-collected a rich dataset of identical claims of invention filed at the USPTO from 1981–2013 which led to 1,314 interference decisions. We are seeking funding to support efforts to collect similar information for historical interference cases (beginning in the 1870s) to provide a long-run perspective, and to then link the full interference database to several datasets of inventor and firm outcomes, primarily micro-level data sets available from the US Census Bureau's Federal Statistical Research Data Centers (RDC). The datasets include information from several datasets including the U.S. Census Bureau Business Register, the Longitudinal Business Database and the Longitudinal Employer Household Dynamics (LEHD). For the historical cases (19th century) we also plan to match names of inventors from the historical cases to the 100% U.S. Census Samples, which include information on earnings and employment.

We would plan to use the $20,000 research funding to complete gathering data on the historical interference cases (travel and digitization costs), to fund initial costs to access the NBER RDC, and to support a part-time research assistant.

INA GANGULI

University of Massachusetts Amherst ▪ Department of Economics
200 Hicks Way ▪ Amherst, MA 01003
Telephone: 617-230-2045
Email: iganguli@econs.umass.edu

Appointments

2015 – present	Assistant Professor, Dept. of Economics, University of Massachusetts Amherst
2012 – 2014	Assistant Professor, SITE, Stockholm School of Economics
2011 – 2012	Postdoctoral Fellow, Harvard Business School-Harvard Medical School Innovation Lab

Other Affiliations

2015 – present	Core Faculty, Computational Social Science Institute (CSSI), UMass Amherst
2015 – present	Affiliated Researcher, SITE, Stockholm School of Economics
2011 – present	Fellow, Institute for Quantitative Social Sciences (IQSS), Harvard University

Education

Ph.D., Public Policy, Harvard University, May 2011
Thesis Title: "Labor Markets in Transition: Science and Migration After the Collapse of the Soviet Union"
Winner of the 2011 W.E. Upjohn Institute for Employment Research Dissertation Award (Honorable Mention) for the best PhD dissertations on employment-related issues
Thesis Committee: Richard B. Freeman (Chair), Alberto Abadie, Pierre Azoulay, George Borjas, Asim Khwaja

M.P.P., Gerald R. Ford School of Public Policy, University of Michigan, 2004
Graduate Certificate in Russian and East European Studies, University of Michigan, 2004
B.A., Mathematical Methods in the Social Sciences, Northwestern University, 2001

Research & Teaching Fields:
Labor Economics, Economics of Science & Innovation, Development Economics, Economic History

Refereed Publications:

"It's Good to Be First: Order Bias in Reading and Citing NBER Working Papers" (with Daniel Feenberg, Patrick Gaulé and Jonathan Gruber), *Review of Economics and Statistics* (Forthcoming)

"Immigration & Ideas: What Did Russian Scientists 'Bring' to the US?" *The Journal of Labor Economics,* Vol. 33, No. S1, pp. S257-S288 (Part 2, July 2015).

"Scientific Brain Drain and Human Capital Formation After the End of the Soviet Union," *International Migration*, 52: 95–110 (2014).

"Closing The Gender Gap In Education: What Is The State of Gaps In Labour Force Participation For Women, Wives And Mothers?" (with Ricardo Hausmann and Martina Viarengo), *International Labour Review* 153: 173–207 (2014).

"Marriage, Education and Assortative Mating in Latin America" (with Ricardo Hausmann and Martina Viarengo), *Applied Economics Letters* 21(12), 806-811 (2014).

"Institutions, Markets and Men's and Women's Wage Inequality: Evidence from Ukraine" (with Katherine Terrell), *Journal of Comparative Economics*, 34(2): 200-227 (2006).

Book Chapters and Other Publications:

"Why and Wherefore of Increased Scientific Collaboration" (with Richard Freeman and Raviv

Murciano-Goroff), in Adam Jaffe and Benjamin Jones (eds), *The Changing Frontier: Rethinking Science and Innovation Policy,* University of Chicago Press (2015).

"Who Leaves and Who Stays? Evidence on Immigrant Selection from the Collapse of Soviet Science", in Aldo Geuna (ed), *Global Mobility of Research Scientists: The Economics of Who Goes Where and Why,* Elsevier (2015).

"Russian-American Scientific Collaboration" in Y.P. Tretyakov (ed), *Russian-American Links: Leaps Forward and Backward in Academic Cooperation.* St. Petersburg, Russia: Nestor-Historia, pp. 120-135 (2012).

"The Dynamics of the Gender Gap: How do Countries Rank in Terms of Making Marriage and Motherhood Compatible with Work?" (with Ricardo Hausmann and Martina Viarengo) in Ricardo Hausmann, Laura D. Tyson, Saadia Zahidi (eds), *The Global Gender Gap Report 2009*. Geneva: The World Economic Forum (2009).

Working Papers:

"Saving Soviet Science: The Impact of Grants When Government R&D Funding Disappears", Revise and Resubmit, *American Economic Journal: Applied Economics*.

"The Mobility of Elite Life Scientists: Professional and Personal Determinants" (with Pierre Azoulay and Joshua Graff Zivin), NBER Working Paper #21995.

"Closing Gender Wage Gaps in Ukraine: Composition, Returns and the Minimum Wage" (with Katherine Terrell), Revise and Resubmit*, Industrial & Labor Relations Review.*

"Location and Scientific Productivity: Evidence from the Soviet Brain Drain"

"Do Scientists Care About Kudos? A Field Experiment on Status Rewards in Academia" (with Patrick Gaule, Eva Guinan and Karim Lakhani)

"A Field Experiment on Search Costs and the Formation of Scientific Collaborations" (with Kevin Boudreau, Tom Brady, Patrick Gaule, Tony Hollenberg, Eva Guinan and Karim Lakhani)

"Gender Differences in Professional Career Dynamics: New Evidence from a Global Law Firm" (with Ricardo Hausmann and Martina Viarengo)

"Did the Soviets Solve the "Productivity Puzzle"? Gender Differences in Science in the Soviet Union"

Research Papers in Progress:

"Gender Gaps in New Business Models for Development: Evidence from the Latin American Microfinance Sector" (with Ricardo Hausmann and Martina Viarengo)
"Curse of the Bambino? The Impact of Star Scientist Mobility on the Productivity of their Peers" (with Pierre Azoulay and Joshua Graff Zivin)
"The Paper Trail of Knowledge Flows: Evidence from Patent Interferences (with Jeffrey Lin and Nicholas Reynolds)
"Skoltech-MIT: Rethinking Innovation Spaces" (with Christian Catalini)
"A Field Experiment on the Motivations of Social Entrepreneurs" (with Chloé Le Coq and Marieke Huysentruyt)
"Immigration Restriction and Literacy: Evidence from Ellis Island Ship Manifests"

Other Writing:

"Does Immigration Help Diffuse Knowledge? Evidence from Russian Scientists" *Forum for Research on Eastern Europe and Emerging Economies (FREE) Policy Brief*, November 24, 2014.
"Putting the "I" Back in Team: The Rise of International Teams in Science" *Forum for Research on Eastern Europe and Emerging Economies (FREE) Policy Brief*, January 20, 2014.
"Fact or Fiction? The Reversal of the Gender Education Gap across the World and the Former Soviet Union" *Forum for Research on Eastern Europe and Emerging Economies Policy Brief*, March 4, 2013.
"New Support for Russian Universities: New Centers of Scientific Research?" *IREX EPS Scholar*

Research Brief, October 2012.
"Migration in Azerbaijan: The Transition to a Destination Country?" *IREX EPS Scholar Research Brief*, May 1, 2010.
"Tajik Labor Migration to Russia: Is Tajikistan at a Crossroads?" *IREX EPS Scholar Research Brief*, September 30, 2009.

Awards, Grants, and Fellowships:

2016-2017	W.E. Upjohn Institute for Employment Research Early Career Research Award
2015-2016	Institute for Social Science Research (ISSR) Scholar, University of Massachusetts
2014-2015	NESTA Innovation Growth Lab innovation, entrepreneurship and growth experiments research grant (£25,000)
2014-2015	SEFORIS Social Entrepreneurship Research Program, European Commission (SITE team, €280,830)
2012-2014	Social Science Research Council (SSRC) Eurasia Program Postdoctoral Fellowship (US State Department, Title VIII) ($19,000)
2012	IREX Embassy Policy Specialist Fellow in Science Policy, Moscow, Russia (US State Department, Title VIII)
2011	W.E. Upjohn Institute for Employment Research Dissertation Award, Honorable Mention
2010-2011	Harvard University Dissertation Completion Fellowship
2009, 2010	IREX Embassy Policy Specialist Fellow in Migration, Tajikistan & Azerbaijan (US State Department, Title VIII)
2009	Allyn A. Young Teaching Prize for excellence in teaching Principles of Economics, Harvard University
2009	Levenson Memorial Teaching Prize Nominee for excellence in Undergraduate Teaching, Harvard University
2009	The Institute for Quantitative Social Science Research Grant, Harvard University
2009	Davis Center for Russian and Eurasian Studies Travel Grant, Harvard University
2009	Center for International Development Research Grant, Harvard University
2008	Women and Public Policy Program Research Grant, Harvard University
2005-2007	John F. Kennedy School of Government Doctoral Fellowship, Harvard University
2004-2005	U.S. Fulbright Scholar, Economics Research & Outreach Center, National University of Kyiv-Mohyla Academy (Ukraine)
2003-2004	Foreign Language and Area Studies Fellowship, University of Michigan (US State Department, Title VIII)
2002-2003	Edward Gramlich Fellowship, University of Michigan
2001-2002	International Parliamentary Fellow, German Bundestag/Humboldt University

Teaching Experience:

2015	Econ 341: Labor Economics, University of Massachusetts Amherst
Fall 2007 - Spring 2009	Ec 10: Principles of Economics, Harvard University, Teaching Fellow (Group Leader and Section Leader) for Professors Gregory Mankiw and Silvia Ardagna
Fall 2006	STM-103: Good Governance and Democratization, Harvard Kennedy School, Course Assistant for Prof. Pippa Norris
Summer 2004	Botswana AIDS Impact Survey Workshop, University of Botswana, Teaching Assistant for Prof. James Levinsohn
Winter 2003	South Africa Distance Learning Project Workshop, University of Michigan/University of Cape Town, TA for Prof. James Levinsohn

Professional Activities:

Presentations:

2015	ASSA-ACES Meetings, Boston; Science of Team Science (SciTS) Conference
2014	Northeastern University; NBER Summer Institute, Innovation Workshop; The

	Graduate Institute, Geneva; CIRCLE, Lund University; Universidad Carlos III de Madrid
2013	NBER "The Changing Frontier: Rethinking Science and Innovation Policy" Conference; 2nd Lisbon Workshop on Economics, Statistics and Econometrics of Education
2012	CERGE-EI, Prague; NBER "The Changing Frontier: Rethinking Science and Innovation Policy" Pre-Conference; NBER High-Skill Immigration Conference; 5th BRICK Workshop "The Organization, Economics and Policy of Scientific Research"; Federal Reserve Bank of Philadelphia; Indian Nat'l Institute of Science, Technology & Development Studies; Indian Institute of Mgt, Bangalore
2011	NBER Summer Institute, Innovation Policy and the Economy; Harvard University-AFD-World Bank "Migration and Development" Conference; Harvard Law School, "The Rise of Nanotechnology" Conference; Northwestern University, Kellogg; Stockholm School of Economics, SITE; Georgia Tech, School of Management
2010	HBS Science-Based Business Initiative Seminar; Russian Academy of Sciences "Russian-American Links" Conference; Academy of Management Meeting; Consortium for Competitiveness and Cooperation (CCC) Doctoral Colloquium
2005-2009	HBS Science-Based Business Initiative Seminar; European Association of Labour Economists (EALE) Annual Conference; UCLA "Migration, Trafficking and Regional Integration" Workshop; Harvard-Manchester Summer Immigration Workshop; EALE Annual Conference; IZA-EBRD Conference, "Labor Market Dynamics, the Role of Institutions and Internal Labor Markets in Transition and Emerging Market Economies"
Ad Hoc Referee:	*Journal of Comparative Economics, Journal of Labor Economics, Journal of the European Economic Association, Management Science, Review of Economics & Statistics, Research Policy, Journal of Economics & Management Strategy, Economics of Transition, NSF*

Languages:

English (native), Bengali (fluent), German (fluent), Russian (proficient), Ukrainian (proficient), Swedish (basic)

JEFFREY LIN

Curriculum Vitae, January 26, 2016

Research Department
Federal Reserve Bank of Philadelphia
Ten Independence Mall
Philadelphia, PA 19106-1574

phone: 215-574-3441
fax: 215-574-4303
email: jeff.lin@phil.frb.org
web: http://jlin.org

EDUCATION

2007 Ph.D. Economics, University of California, San Diego
2001 B.A. Economics and mathematical methods in the social sciences, Northwestern University

EMPLOYMENT

2014 – Economic advisor and economist, Federal Reserve Bank of Philadelphia
2011 – 2013 Senior economist, Federal Reserve Bank of Philadelphia
2007 – 2010 Economist, Federal Reserve Bank of Philadelphia

PUBLICATIONS

Refereed Journal Articles

2012 "Thick-market effects and churning in the labor market: Evidence from U.S. cities," with Hoyt Bleakley, *Journal of Urban Economics* 72 (2–3): 87-103.

"Portage and path dependence," with Hoyt Bleakley, *Quarterly Journal of Economics* 127 (2): 587–644.

2011 "Technological adaptation, cities, and new work," *Review of Economics and Statistics* 93 (2): 554–574.

2007 "Precision, bias, and uncertainty for state population forecasts: an exploratory analysis of time series models," with Jeff Tayman and Stanley K. Smith, *Population Research and Policy Review* 26 (3): 347–369.

2002 "Gentrification and transit in northwest Chicago," *Journal of the Transportation Research Forum* 56 (4): 175–191.

Conference Proceedings

2015 "History and the sizes of cities," with Hoyt Bleakley, *American Economic Review, Papers and Proceedings* 105 (5): 558–563.

Other Publications

2015 "The puzzling persistence of place," *Federal Reserve Bank of Philadelphia Business Review* Q2: 1–8.

2014 "The paper trail of knowledge transfers," *Federal Reserve Bank of Philadelphia Business Review* Q2: 1–6.

2012 "Geography, history, economies of density, and the location of cities," *Federal Reserve Bank of Philadelphia Business Review* Q3: 18–24.

2011 "Urban productivity advantages from job search and matching," *Federal Reserve Bank of Philadelphia Business Review* Q1: 9–215.

Manuscripts in Submission

2015 "Natural amenities, neighborhood dynamics, and persistence in the spatial distribution of income," FRB Philadelphia working paper 15–46, with Sanghoon Lee. Resubmitted to *Review of Economic Studies*. (Previous version: FRB Philadelphia working paper 13–48.)

2012 "Regional resilience," FRB Philadelphia working paper 13–1. Revise and resubmit at *Journal of Regional Science*.

Work in Progress

Freeway revolts, with Jeff Brinkman.

History and the sizes of cities: A structural, partial-identification approach to path dependence, with Hoyt Bleakley.

The paper trail of knowledge spillovers: Evidence from patent interferences, with Ina Ganguli and Nick Reynolds.

Bunching at borders, with David Agrawal and David Albuoy.

Product life-cycles and the geographic diffusion of industries, with Joel Elvery.

HONORS AND AWARDS

2012 Co-winner, IPUMS-USA Research Award for Best Published Work
2002 Honorable mention, National Science Foundation Graduate Research Fellowship
2001 RB Cleaver Scholarship & Katz Graduate Social Science Fellowship, UCSD
Phi Beta Kappa
Best student paper, Transportation Research Forum
Best student paper, Metropolitan Conference on Public Transportation Research
1997 Weinberg College Scholar, Northwestern University

PRESENTATIONS

Invited Seminars

*—*Anticipated*

2015 University of Michigan.
2014 University of California, Los Angeles.
2013 University of British Columbia, Sauder; University of Southern California, Lusk.
2012 Institut d'Economia de Barcelona.
2011 Wharton; University of California, Irvine; FRB Chicago.
2010 Lincoln Institute; Wharton; University of Hong Kong.
2009 University of California, Santa Cruz; FRB San Francisco; University of Missouri.
2007 FRB Kansas City; FRB Philadelphia; Bureau of Labor Statistics; USDA Economic Research Service; Trinity College; Cal State–Fullerton; University of Nevada, Las Vegas; Cal State–Long Beach.

Invited Conference Presentations

2015 FR System Policy Summit; FR System Committee on Regional Analysis; Urban Economics Association.
2014 NBER Summer Institute, IPE (poster); NBER Summer Institute, RE; Urban Economics Association.
2013 American Real Estate and Urban Economics Association.
2012 Urban Economics Association.
2010 Institut d'Economia de Barcelona Workshop on Urban Economics; Conference on Urban and Regional Economics; Urban Economics Association; FR System Committee on Regional Analysis.
2009 University of British Columbia Summer Symposium.
2008 FR System Committee on Applied Microeconomics; Institut Barcelona d'Estudis Internacionals International Workshop in Economic Geography; Stanford Institute for Theoretical Economics Summer Workshop, Theory and History; Urban Economics Association; FR System Committee on Regional Analysis.
2007 Kiel Institute Workshop on Agglomeration and Growth, FR System Committee on Regional Analysis; NBER Summer Institute, IPE; NBER Universities' Research Conference;
2001 Transportation Research Forum; Metropolitan Conference on Public Transportation Research.

Conference Discussions

2016 ASSA, FR Research Symposium on Gentrification*.
2015 Urban Economics Association.
2014 ASSA; Handbook of Regional and Urban Economics vol. 5, Wharton; Urban Economics Association.
2013 ASSA; American Real Estate and Urban Economics Association; Conference on Urban and Regional Economics, LSE.
2012 Urban Economics Association.
2011 Federal Reserve System Committee on Applied Microeconomics.

2010 Federal Reserve System Committee on Applied Microeconomics; Urban Economics Association.
2009 Federal Reserve System Committee on Applied Microeconomics.
2008 Institut Barcelona d'Estudis Internacionals International Workshop in Economic Geography; Urban Economics Association.
2007 Kiel Institute Workshop on Agglomeration and Growth.

TEACHING EXPERIENCE

Courses taught

2006 Urban economics

PROFESSIONAL SERVICE

Editorial positions

2001 – 2002 Assistant editor, *Journal of Environment and Development*

Journal Referee

American Economic Journal: Macroeconomics, American Economic Review, Annals of Regional Science, Canadian Journal of Economics, Econometrica, Economic Journal, Economics Letters, International Economic Review, Journal of Economic Geography, Journal of Housing Economics, Journal of Labor Economics, Journal of Political Economy, Journal of Public Economics, Journal of Urban Economics, Journal of Regional Science, Quarterly Journal of Economics, Regional Science and Urban Economics, Regional Studies, Review of Economic Studies, Review of Economics and Statistics.

Departmental Service

2013 – Organizer, FRB Philadelphia lunch seminar series

Conference Organization

2017 Organizer, FR System Committee on Applied Microeconomics.
2016 Co-organizer, Conference on Regional and Urban Economics, with Gilles Duranton and Jerry Carlino.
2014 Co-organizer, Conference on Regional and Urban Economics, with Nate Baum-Snow and Jerry Carlino.

Professional Membership

American Economics Association, American Real Estate and Urban Economics Association, Urban Economics Association.