RSM 3091: Innovation & Technology

University of Toronto Rotman School of Management PhD Seminar

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Thursdays 9-12 AM in Room 7024
First class Jan 8, Final class Apr 2 | No class on Feb 19

Overview

This course is intended to prepare PhD students to write novel research on topics related to innovation. Innovation is a multidisciplinary field: there is interesting work being done in economics, management, sociology, law and history, among others. We will cover the most important theoretical and empirical questions, discuss fundamental background knowledge from the related social sciences, and discuss the appropriateness of various methodologies for tackling open questions in the field. The only technical prerequisite is knowledge of basic game theory and the mathematics necessary to solve those types of models.

Readings

Required readings are denoted with a * in the syllabus. All required reading is made up of articles, except that you need to purchase Joel Mokyr's "Gifts of Athena" and Bruno Latour's "Laboratory Life". Please purchase these as soon as possible.

Assignments

Each class, I will begin with a 30 minute lecture and occasional forays into data sources of interest, before we discuss the day's reading in earnest.

If you are taking this class for credit, you are obligated to do all of the assigned reading, as well as prepare 10 minute introductions of your share of the papers (to be assigned week-by-week) for your classmates, as well as to write a term paper. For each assigned paper, I will designate a student to prepare a 10 minute discussion about what you see as the important contribution of the paper, your thoughts on why the paper has become influential, and your insight as to flaws or shortcomings which can be modified in follow-up work. This discussion ought help structure the broader discussion of the paper among your classmates. The term paper should essentially contain the germ of a legitimate research paper on an open question in innovation; as you are graduate students, it is not worth your time to work on projects which do not contribute to graduating on time, which is why I assign term papers which might conceivably become part of your disseration rather than assigning exams.

Grading will be based entirely on the term paper and your contribution to a good classroom environment by properly preparing for each class.

1962 K. Arrow, Economic Welfare and the Allocation of Resources for Invention, In NBER volume The Rate and Direction of Inventive Activity
What makes invention an interesting economic problem?

2005 P. Aghion, N. Bloom, R. Blundell, R. Griffith and P. Howitt, Competition and Innovation: An Inverted U Relationship, QJE
Moderate levels of competition maximize innovation, theoretically and empirically

1991 G. Grossman and E. Helpman, Quality Ladders in the Theory of Economic Growth, RESTUD
Expands differentiated products models to allow quality-improving innovation

1991 S. Scotchmer, Standing on the Shoulders of Giants: Cumulative Innovation and the Patent Law, JEP
Qualitative exploration of how cumulativeness interacts with the idea of patent law

1995 J. Green and S. Scotchmer, On the Division of Profit in Sequential Invention, RAND
Basic model of sequential invention

2002 D. Acemoglu, Directed Technical Change, RESTUD
How do changes in factor prices affect the incentive to innovate?

1973 F. Fisher and P. Temin, Returns to Scale in Research and Development: What Does the Schumpeterian Hypothesis Imply?, JPE
How does increasing returns to R&D relate to the size of firm that does R&D

1979 C. Rodriguez, A Comment on Fisher and Temin on the Schumpeterian Hypothesis, JPE
Expanding on Fisher and Temin, testing the Schumpeterian hypothesis is even harder

1992 P. Aghion and P. Howitt, A Model of Growth Through Creative Destruction, Ecta
The classic model of Schumpeterian Growth

WP P. Aghion, U. Akcigit and P. Howitt, What Do We Learn From Schumpeterian Growth Theory?
What have we learned from creative destruction models a la Aghion-Howitt?

1986 P. Romer, Increasing Returns and Long-Run Growth, JPE
Origin of endogenous growth lit where current knowledge begets future growth

Week 2 | Path Dependence, Science and Technology, Modeling Growth

1985 P. David, Clio and the Economics of QWERTY, AER P&P
Path dependence can explain QWERTY, though see Liebowitz and Margolis

1990 R. Cowan, Nuclear Power Reactors: A Study in Technological Lock-in, JEH
Path dependence based on a minor factor led to dominance of light water reactors

1994 S. Liebowitz and S. Margolis, Network Externality: An Uncommon Tragedy JEP
Socially inefficient path dependence is not what happened to the QWERTY keyboard

* 2006 S. Page, Path Dependence, Quarterly Journal of Political Science
Great typology of different ways that "path dependence" can be thought of formally

1994 H. Brooks, The Relationship Between Science and Technology, RP
Science affects technology in six ways, and technology also feeds back into science

* 1962 R. Nelson, The Link Between Science and Invention: The Case of the Transistor, in NBER Volume The Rate and Direction of Inventive Activity
Classic case study of the mutual feedback between science and invention

* 1990 P. Romer, Endogenous Technological Change, JPE
Knowledge affects growth like Romer 1986 but also created as an equilibrium choice

* 1999 C. Jones, Growth: With or Without Scale Effects, AER
Endogenous growth involves tricky modeling choices to get realistic growth paths

1997 S. Kortum, Research, Patenting and Technological Change, Ecta
Why is research output not growing even as we have many more scientists?

2011 R. Goettler and B. Gordon, Did AMD Spur Intel to Innovate More?, JPE
Structural examination of how competition spurs innovation along a quality ladder

WP B. Jones, The Knowledge Trap: Human Capital and Development Reconsidered
More diversity in occupations matters so effect of human capital on growth is large

1942 J. Schumpeter, Capitalism Socialism and Democracy
Especially Chapter 7 is the Late Schumpeter on his "creative destruction"

1990 J. Mokyr, The Lever of Riches
Legendary book on technology and growth from BC until the modern era

1981 R. Easterlin, Why Isn't the Whole World Developed?, JEH
Human capital is a precondition for technology adoption

2009 M. Marx, D. Strumsky, and L. Fleming, Mobility, Skills, and the Michigan Non-Compete Experiment, MS
Noncompete agreements limit mobility of technically skilled employees

* 2011 O. Sorenson and S. Samila, Non-compete Covenants?: Incentives to Innovate or Impediments to Growth, MS
Noncompete agreements are bad for entrepreneurship

2011 J. Singh, and A. Agrawal, Recruiting for Ideas: How Firms Exploit the Prior Inventions of New Hires, MS
Not much evidence that you buy another firm's knowledge when you buy a researcher

1994 P. Bolton and M. Dewatripont, The Firm as a Communication Network, QJE
How do you organize a firm to get the right information to the right people?

2004 J. Anton and D. Yao, Little Patents and Big Secrets: Managing Intellectual Property, RAND
The optimal use of secrecy to protect inventions depends on the size of the invention

* 2011 G. Manso, Motivating Innovation, Journal of Finance
Optimal labor schemes for scientists are lenient about failure

1994 J. Lerner and U. Malmendier, Contractibility and the Design of Research Agreements, QJE
How to get the research firm you contract with to actually do the research you want?

* 1994 P. Aghion and J. Tirole, The Management of Innovation, QJE
Incomplete contracts as an explanation for why R&D is sometimes internal

1989 B. Holmstrom, Agency Costs and Innovation, JEBO
Exploration of how mech. design can explain strange-looking R&D contracts

2008 P. Aghion, M. Dewatripont and J. Stein, Academic Freedom, Private Sector Focus, and the Process of Innovation, RAND
Give academics autonomy in basic research because it's cheaper

1990 N. Rosenberg, Why Do Firms Do Basic Research (with their own money?), RP
By accident, because of agency problems, because they are big or like risk

* 1994 B. Holmstrom and P. Milgrom, The Firm as an Incentive System, AER
Performance incentives need bundle with additional organizational features

Week 4 | Recombination, GPTs, Directing Science

2001 L. Fleming, Recombinant Uncertainty in Technological Search Management, MS
Recombinant knowledge across fields is valuable

* 1998 M. Weitzman, Recombinant Growth, QJE
Limit to growth is finding new combinations from huge set of existing knowledge

* 2013 B. Uzzi, S. Mukherjee, M. Stringer and B. Jones, Atypical Combinations and Scientific Impact, Science
Optimally your work should be weird but not too weird

WP A. Galasso and M. Schankerman, Patents and Cumulative Innovation: Causal Evidence from the Courts
Patents limit subsequent use in complex fields where many users are small

2014 S. Kaplan and K. Valiki, The Double Edged Sword of Recombination in Breakthrough Innovation, SMJ
Uses topic modeling to show recombinant inventions are not breakthroughs

1995 T. Bresnahan and M. Trajtenberg, General Purpose Technologies: Engines of Growth?, Journal of Econometrics
Introduces idea of key "general purpose technologies" in history of innovation

2004 N. Rosenberg and M. Trajtenberg, A General Purpose Technology at Work: The Corliss Steam Engine in the Late Nineteenth Century United States, JEH
Empirical case of how a GPT leads to growth-inducing reallocation

* 2005 B. Jovanavic and P. Rousseau, General Purpose Technologies, in The Handbook of Economic Growth
How did the economy react to the introduction of electricity and IT?

* 1979 N. Rosenberg, Technological Interdependence in the American Economy, Technology and Culture
Why is it so hard to find evidence that certain technologies matter for growth?

1997 D. Stokes, Pasteur's Quadrant
Science that is both basic and applied is widespread

2014 D. Acemoglu, U. Akcigit, D. Hanley and W. Kerr, Transition to Clean Technology
How can directed technical change theories guide policies to limit climate change?

* 1996 W. Baumol, Entrepreneurship: Productive, Unproductive, and Destructive, JBV
Innovators can be socially useful or rent-seekers, and have been both historically

1989 D. Evans and B. Jovanovic, An estimated model of entrepreneurial choice under liquidity constraints, JPE
The classic structural model of entrepreneurship

1979 R. Kihlstrom and J.J. Laffont, A General Equilibrium Entrepreneurial Theory of Firm Formation Based on Risk Aversion, JPE
GE model of risk differences as a driver of entrepreneurship

* 1995 J. Anton and D. Yao, Startups, Spinoffs and Internal Projects, Journal of Law, Economics and Organization
What keeps researchers at a firm who have a good idea from leaving?

2005 P. Gompers, J. Lerner, and D. Scharfstein, Entrepreneurial Spawning, Journal of Finance
Entrepreneurs learn from well-suited "spawning" firms

2001 B. Hamilton, Does Entrepreneurship Pay: An Empirical Analysis of the Returns to Self-Employment, JPE
Entrepreneurs make much less money even without adjusting for the additional risk

2013 J. Haltiwanger, R. Jarmin and J. Miranda, Who Creates Jobs? Small vs. Large vs. Young, RESTAT
Young firms, not small firms, are engines of job growth

2011 E. Hurst and B. Pugsley, What do Small Businesses Do?, Brookings Papers on Economic Activity
Most small firms don't hire or grow, are run by people who want to be their own boss

* 2014 T. Astebro, H. Hurz, R. Nanda and R. Weber, Seeking the Roots of Entrepreneurship: Insights from Behavioral Economics, JEP
Risk aversion and overconfidence do not drive entrepreneurship

* 2000 S. Shane and S. Venkataraman, The Promise of Entrepreneurship as a Field of Research, AMR
How do entrepreneurs recognize and create opportunities?

Week 6 | Geography of Invention, Spillovers, Diffusion

WP A. Matray, The Local Spillovers of Listed Firms
Is agglomeration causally linked to the geographic clustering of innovative activity?

1996 D. Audretsch and Feldman, M, R&D Spillovers and the Geography of Innovation and Production, AER
Innovation is much more concentrated geographically than production

* 2013 N. Bloom, M. Schankerman, and J. Van Reenen, Identifying Technology Spillovers and Product Market Rivalry, Ecta
Technology spillovers dominate socially-inefficient market stealing

2010 G. Ellison, E. Glaeser, and W. Kerr, What Causes Industry Agglomeration? Evidence from Coagglomeration Patterns, AER
Input-output analysis can help identify why industries agglomerate

1992 Z. Griliches, The Search for R&D Spillovers, Scandinavian Journal of Economics
Identifying R&D Spillovers has traditionally been incredibly difficult

1993 A. Jaffe, M. Trajtenberg, and R. Henderson, Geographic Localization of Knowledge Spillovers as Evidenced by Patent Citations, QJE
Backward patent citations provide evidence for spillovers

2014 S. Kantor and A. Whalley, Knowledge Spillovers from Research Universities: Evidence from Endowment Value Shocks, RESTAT
University research instrumented using endowment shocks spills over to industry

* 2010 T. Conley and C. Udry, Learning about a New Technology: Pineapple in Ghana, AER
Social network data to examine how a new pineapple technology spreads in Ghana

1957 J. Coleman, E. Katz and H. Menzel, The Diffusion of an Innovation Among Physicians, Sociometry
The classic diffusion paper, among doctors in Chicagoland

2010 P. Azoulay, J. Graff Zivin and J. Wang, Superstar Extinction, QJE
The premature death of scientific superstars can help measure the effect of local spillovers

2010 D. Comin and B. Hobijn, An Exploration of Technology Diffusion, AER
Why does technology take so long to diffuse across countries?

* 1957 Z. Griliches, Hybrid Corn: An Exploration in the Economics of Technical Change, Ecta
Examines the rationality of the lagged diffusion of hybrid corn in a classic study

1995 E. Rogers, Diffusion of Innovations
Legendary psuedotextbook covering diffusion literature from many different fields

1995 G. Saloner and A. Shephard, Adoption of Technologies with Network Effects, RAND
Empirical investigation of the diffusion of a network good

* 2010 J. Evans, Industry Induces Academic Science to Know Less about More, AJS
Industry collaboration causes academics to work less deeply and more broadly

Week 7 | Patents and their alternatives

* 1979 G. Loury, Market Structure and Innovation, QJE
The classic "patent race" model and why firms might innovate too much

1980 T. Lee and L. Wilde, Market Structure and Innovation: A Reformulation, QJE
A minor but important caveat to Loury's patent race

1982 J. Reinganum, A Dynamic Game of R and D: Patent Protection and Competitive Behavior, Ecta
How do patent races change when we allow non-static strategies?

* 2005 M. Lemley and C. Shapiro, Probablistic Patents, JEP
Patents are not that strong in practice

2009 J. Bessen and E. Maskin, Sequential Innovation, Patents, and Imitation, RAND
Patents can discourage innovation in cumulative industries like software

1988 E. von Hippel, The Sources of Innovation
Many cases of industries where users were the dominant source of new inventions

2011 C. Ponce and E. Henry, Waiting to Imitate: On the Dynamic Pricing of Knowledge, JPE
Inventors earn rents by threatening to give away their tech to rivals if no one pays

2012 L. Brunt, J. Lerner and T. Nicholas, Inducement Prizes and Innovation, Journal of Industrial Economics
Examines a series of royal society prizes for innovation in the 18oos

2012 G. Weyl and J. Tirole, Market Power Screens Willingness-to-Pay, QJE
Benefit of patents versus prizes depends on slope of demand curve

* 1998 M. Kremer, Patent Buyouts: A Mechanism for Encouraging Innovation, QJE
Governments should buy patents to reduce deadweight loss, use auction to do it

2002 N. Gallini and S. Scotchmer, Intellectual Property: What is the Best Incentive System, Innovation Policy and the Economy
Summarizes literature on alternatives to patents

2008 M. Lemley, The Surprising Virtues of Treating Trade Secrets as IP Rights, Stanford Law Review
Trade Secrets actually are a tool for disclosure if policy is optimal

2003 M. Baye and H. Hoppe, The Strategic Equivalence of Rent-Seeking, Innovation and Patent-Race Games, Games and Economic Behavior
Rent-seeking games and patent races are simple to analyze

1994 J. Anton and D. Yao, Expropriation and Inventions: Appropriable Rents in the Absence of Property Rights, AER
Inventors without patents can earn rents by threatening to make invention public

1986 M. Katz and C. Shapiro, How to License Intangible Property, QJE
What goes wrong when firms try to sell to product market competitors?

* 2006 H. Hopenhayn, H. Llobet and M. Mitchell, Rewarding Sequential Innovators: Prizes, Patents and Buyouts, JPE
Forcing innovators to set a buyout price optimally rewards sequential innovators

WP K. Bryan and J. Lemus, The Direction of Innovation
When do firms work on the wrong types of projects?

Week 8 | Empirical Effects of Patents and other IP

WP B. Sampat and H. Williams, How do patents affect follow-on innovation?: Evidence from the human genome
Formal IP less harmful if easy to license and IP holders have incentive to do so

* 2014 H. Williams, Intellectual Property Rights and Innovation: Evidence from the Human Genome, JPE
Formal IP causes innovations to be used less frequently by downstream users

* 1990 A. Trajtenberg, A Penny for your Quotes: Patent Citations and the Value of Innovation, RAND
Patent citations are a useful proxy for the (otherwise highly skew) value of patents

2014 T. Nicholas, Are Patents Creative or Destructive, Antitrust Law Journal
Accessible introduction to where patents are particularly appropriate

WP T. Nicholas, Scale and Innovation During Two U.S. Breakthrough Eras
In 20th century, big firms innovate more, but don't do more creative work

2001 B. Hall and R. Ziedonis, The Patent Paradox Revisited: An Empirical Study of Patenting in the US Semiconductor Industry, 1979-95, RAND
Why do firms in some industries say patents don't matter but then use them a ton?

2005 B. Hall, A. Jaffe and M. Trajtenberg, Market Value and Patent Citations
Uses Tobin's Q to value patent citations

2012 P. Moser, Innovation Without Patents: Evidence from World's Fairs, Journal of Law and Economics
Almost all important innovations in 1800s Britain were not patented

* 2013 A. Hagiu and D. B. Yoffie, The New Patent Intermediaries: Platforms, Defensive Aggregators and Super-Aggregators, JEP
The patent market involves many third parties with empirically interesting stories

1997 J. Lerner, An Empirical Exploration of a Technology Race, RAND
Reinganum-style patent races do seem to occur in the disk drive industry

* 2005 P. Moser, How Do Patent Laws Influence Innovation? Evidence from Nineteenth-Century World Fairs, AER
Uses World's Fair records to show how patent systems affect innovation style

1996 S. Schaeffer, Making up Discovery, in Dimensions of Creativity
Credit for discoveries, or idea of how the discovery came about, are made up expost

* 1979 B. Latour and P. Woolgar, Laboratory Life: The Construction of Scientific Facts (required pp 105-183)
Science involves choices by scientists about how evidence is interpreted

2013 M. Bikard, Is Knowledge Trapped Inside the Ivory Tower, Working Paper
Uses text scraping to find simultaneous inventions

2010 F. Murray, The Oncomouse that Roared, AJS
How do academics react to formal IP restrictions that arrived with the Oncomouse?

* 2011 J. Furman and S. Stern, Climbing Atop the Shoulders of Giants, AER
Openness to reuse increases the use of previous knowledge

2010 U. Shwed and P. Bearman, The Temporal Structure of Scientific Consensus Formation, ASR
Can we used automated methods to figure out when scientific consensus exists?

2014 R. Funk, Making the Most of Where You Are: Geography, Networks, and Innovation in Organizations, AMJ
Optimal organization structure may be cohesiveness-inducing or not

* WP R. Funk and J. Owen-Smith, A Dynamic Network Approach to Breakthrough Innovation
How can we identify "breakthrough innovations" in the data?

1957 R. K. Merton, Priorities in Scientific Discovery: A Chapter in the Sociology of Science, AJS
Priority disputes are widespread

2001 J. Owen-Smith, Managing Laboratory Work through Skepticism: Processes of Evaluation and Control, ASR
Skepticism is used for control and not simply evaluation

* 2001 A. Hargadon and Y. Douglas, When Innovations Meet Institutions: Edison and the Design of the Electric Light, ASQ
Design helps the acceptance of radical innovations

2004 R. Burt, Structural Holes and Good Ideas, AJS
Knowledge "brokers" in organizational structural holes find it easier to move new ideas

* 1990 W. Cohen and D. Levinthal, Absorptive capacity: a new perspective on innovation and learning, ASQ
Scientists within the firm help you find opportunities outside the firm

* 2014 J. Gans, D. Hsu and M. Marx, Dynamic Commercialization Strategies for Disruptive Technologies: Evidence from the Speech Recognition Industry, MS
When should you wait for potential disruptors to try things out and then buy them?

2002 J. Gans, D. Hsu and M. Marx, When Does Start-Up Innovation Spur the Gale of Creative Destruction?, RAND
Why don't disruptors just sell out to incumbents and thus maximize joint profits?

2003 J. Bessen, Technology and Learning by Factory Workers: The Stretch-Out at Lowell, 1842, JEH
Worker tenure is important when learning curves are important

WP A. Agrawal, A. Goldfarb and F. Teodoris, Does Knowledge Accumulation Increase the Returns to Collaboration? Evidence from the Collapse of the Soviet Union
Evidence that science is done in teams more often now because science is simply harder

WP C. Catalini, How Does Co-Location Affect the Rate and Direction of Innovative Activity?
Being physically proximate, at the level of an office, matters for productivity

WP D. Acemoglu, U. Akcigit and M. A. Celik, Young, Restless and Creative: Openness to Disruption and Creative Innovations
Places that allow young managers to rise quickly also do more radical innovation

* 1986 D. Teece, Profiting from Technological Innovation, RP
You need "complementary assets" if you want to make money from inventions

2009 B. Jones, The Burden of Knowledge and the Death of the Renaissance Man, RESTUD
Science is getting harder and people rationally are specializing more

2004 S. Stern, Do Scientists Pay to Be Scientists?, MS
Scientists turn down higher salaries if they cannot publish their work

2002 J. Anton and D. Yao, The Sale of Ideas: Strategic Disclosure, Property Rights and Contracting, RESTUD
Partially disclose your idea to make it easier to sell

* 1993 R. Henderson, Underinvestment and Incompetence as Responses to Radical Innovation, RAND
Existing firms fail to exploit radical innovations for neoclassical and org. reasons

* 1997 P. Temin, Two Views of the British Industrial Revolution, JEH
Was the IR broad or simply driven by a few small industries?

1999 J. Mokyr, Editor's Introduction: The New Economic History and the Industrial Revolution
A lengthy summary of how science and technology drove the IR in Mokyr's View

* 2002 J. Mokyr, The Gifts of Athena (required pp 1-77)
Diffusion of useful knowledge, not its creation, was essential in modern growth

2009 R. Allen, The Industrial Revolution in Miniature: The Spinning Jenny in Britain, France, and India, JEH
The IR did not happen in Britain simply because Britain had better inventions

* 2000 O. Galor and D. Weil, Population, Technology and Growth: From Malthusian Stagnation to the Demographic Transition and Beyond, AER
Famous Unified Growth Model of Malthusian and Post-Malthusian eras

1993 M. Kremer, Population Growth and Technological Change: One Million B. C. to 1990, QJE
Can Romer-style endogenous growth explain the long long long run of history?

* 1960 A. E. Musson and E. Robinson, Science and Industry in the Late Eighteenth Century, EHR
What did the technological world look like at the dawn of the IR?

1994 J. De Vries, The Industrial Revolution and the Industrious Revolution, JEH
Increase in labor supply and market production preceded Industrial Revolution

2005 G. Clark, The Condition of the Working-Class in England, 1209-2004, JPE
Changes in fertility and economy-wide income preceded the Industrial Revolution

1978 G. N. Von Tunzelmann, Steam Power and British Industrialization to 1860
Steam was not critical to the British IR

2004 N. Crafts, Steam as a General Purpose Technology: A Growth Accounting Perspective, EJ
Empirics show steam power can only explain tiny portion of TFP growth during IR

1962 A. Gerschenkron, Economic Backwardness in Historical Perspective
Series of essays on European growth which suggest growth paths were not identical

Week 12 | The Second IR, Using History as an Applied Economist

* 1990 P. David, The Dynamo and the Computer, AER P&P
Electricity took long time from invention to impact; similar story for the computer?

* WP J. Mokyr, C. Vickers and N. Ziebarth, Technological Anxiety and the Future of Economic Growth: Is This Time Different?
Is the rise of robotics and AI a different phenomenon from Industrial Revolutions?

1987 G. Clark, Why Isn't the Whole World Developed? Lessons from the Cotton Mills, JEH
Is culture important for the early modern income differences?

1990 G. Wright, The Origins of American Industrial Success, 1879-1940, AER
Exploitation of natural resources helps explain the rise of America

1993 B. Z. Kahn and K. Sokoloff, 'Schemes of Practical Utility': Entrepreneurship and Innovation Among 'Great Inventors' in the United States, 1790-1865, JEH
Great inventors in early modern era actively pursued market opportunities

2015 W. W. Hanlon, Necessity is the Mother of Invention: Input Supplies and Directed Technical Change, Ecta
Civil War cotton price changes affect types of cotton-using inventions

* 2012 A. Nuvolari and J. Sumner, Inventors, Patents and Inventive Activities in the English Brewing Industry, 1634-1850, BHR
Invention of Porter is a great example of collective invention

* 2013 N. Lamoreaux, K. Sokoloff and D. Sutthiphisal, Patent Alchemy: The Market for Technology in US History, BHR
Active sales markets for patents are not a new phenomenon

1983 R. Allen, Collective Invention, JEBO
In new industries collective sharing of knowledge has long been common

2011 R. Richter and J. Streb, Catching Up and Falling Behind: Knowledge Spillover from American to German Toolmakers, JEH
How does "stealing machines" in a country today affect innovation tomorrow?

2006 N. Lamoreaux, M. Levenstein and K. Sokoloff, Mobilizing Venture Capital During the Second Industrial Revolution: Cleveland, Ohio 1870-1920, Capitalism and Society
Something looking very much like venture capital existed in the late 18oos