December 2017

Summary

Patent rights in a climate of intellectual property rights skepticism

Hon. Maureen K. Ohlhausen
Haris Tsilikas, Research Associate at Max Planck Institute for Innovation and Competition

Summary of paper by the Hon. Maureen K. Ohlhausen, Acting Chairman of the US Federal Trade Commission which first appeared in the Harvard Journal of Law & Technology, Volume 30, Number 1 in the fall 2016

4iP Council

Summary

PATENT RIGHTS IN A CLIMATE OF INTELLECTUAL PROPERTY RIGHTS SKEPTICISM

Hon. Maureen K. Ohlhausen

I. Introduction

A movement is underway to dilute U.S. patents, which have recently been the object of unprecedented criticism. U.S. policymakers lack clear guideposts for evaluating this criticism. Further, some emerging economies are at a crossroads in deciding how to treat proprietary technology, and they look at this U.S. debate through the prism of their own history and economic pressures.

In order to provide a clearer policy path through this thicket, this Article explores the empirical and theoretical literature on the relationship between patents and innovation. In crafting the most beneficial patent policy, we should not overlook or minimize the strong theoretical and evidentiary justifications for property rights in technology, although this does not mean that granting ever-stronger patent protection will inevitably lead to ever-greater innovation. Limited patent reform may also be appropriate to address identified problems such as insufficient quality control, the broad scope of certain method patents, and inadequate disclosure.

This Article defends robust patent rights based on evidence about the relationship between patents and innovation. It is true that it is not always possible to identify when patents are a but-for cause of innovation, and the patent system has flaws and is subject to some abuse. Nevertheless, there is ample evidence that patents serve a materially valuable role in promoting innovation in at least some settings. Given the rich innovation in markets where claimed patent-related problems are most prevalent, the cautious, informed and correct response is incremental, targeted adjustment. Patents should remain a central feature of U.S. technology policy.

II. The Patent System Under Fire

The cornerstone of American innovation policy, patents allow inventors to prevent others from copying their hard-earned creations, encourage firms to invest in commercializing technologies, prompt technology transfer, disclose cutting-edge insights to those skilled in the art, and reflect the U.S. tradition of honoring property rights. Why, then, are they so controversial today?

Respected economists Michele Boldrin and David Levine find "no evidence that intellectual monopoly achieves the desired purpose of increasing innovation," describe IP rights as an "unnecessary evil," and call for the patent system's abolition.[1] Economist Adam Jaffe and Harvard Business School professor Josh Lerner call the patent system "broken."[2] Law professors Michael Meurer and James Bessen think it "unlikely that patents today are an effective policy instrument to encourage innovation overall."[3] As for encouraging ideas, the Economist wrote that "[t]oday's

---

[1] MICHELE BOLDRIN & DAVID K. LEVINE, AGAINST INTELLECTUAL MONOPOLY (2010), at 7, 11; see also Michele Boldrin & David K. Levine, The Case Against Patents, 27 J. ECON. PERSP. 3, 3–4 (2013).

[2] ADAM B. JAFFE & JOSH LERNER, INNOVATION AND ITS DISCONTENTS: HOW OUR BROKEN PATENT SYSTEM IS ENDANGERING INNOVATION AND PROGRESS, AND WHAT TO DO ABOUT IT (2007).

[3] JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK 216 (2008).

patent systems are a rotten way of rewarding them."[4] The chorus of criticism goes on. The Hon. Richard A. Posner sees "serious problems with our patent system."[5] A leading authority on patent law, Mark Lemley, has proclaimed the existence of a "patent crisis."[6] A renowned economist, Carl Shapiro, believes that the "patent system . . . provides excessive rewards to patent holders . . . reduc[ing] economic efficiency by discouraging innovation."[7] Whether these claims are justified or not, it is remarkable that the stalwart of U.S. innovation policy has become so controversial.

Generally, the patent-policy debate accompanying revolutionary advances over the prior art goes to optimal breadth of the exclusive right — not to whether society should grant any such right at all. Thus, despite occasional controversy, patents have enjoyed an illustrious reputation. The maelstrom of controversy surrounding the U.S. patent system today, however, is unprecedented. One cause is that the patent system emerged in a time when mechanical inventions and manufacturing processes accounted for the lion's share of innovation. Today, the reality is different. Advances in computing, microelectronics, nanotechnology, and beyond have given rise to increasingly sophisticated consumer products that combine a dazzling array of discrete technologies. Yet the fact that many separate IP rights relate to a single device does not in itself mean that patents encumber technical advance. Patents can create incentives necessary to engage in further R&D, and those incentives are no less important because the invention is part of an end product. Still, problems can emerge when the technology search and licensing environment is subject to significant transaction costs.

Transaction costs can rise steeply in an environment where myriad patents relate to a single device, especially if ownership of the relevant patents is atomized. The result today is that, in industries such as information technology and consumer electronics, there is a disconnect between invention and commercialization. Fearing inadvertent or willful infringement, and perhaps due to an inability to secure at reasonable cost a guaranteed clearing position ex ante, many technology implementers instruct their engineers simply to ignore patents and to develop technical solutions to problems afflicting next-generation products independently.[8]

Two contemporary developments have added urgency to claims of a "patent crisis." First, competition in the lucrative smartphone industry produced aggressive litigation on an international scale. Second, the emergence of patent-assertion entities ("PAEs") as a new business model. Such companies neither sell products incorporating technology nor build their patent holdings via prosecution. Rather, they buy patents reading on goods that already exist in the marketplace and then seek to monetize them. There is dispute as to whether PAEs efficiently compensate inventors who could not otherwise afford to enforce their rights or whether PAEs suppress innovation by taxing independent innovation. The upshot of these developments is widespread and entrenched skepticism of the patent system.

III. The Economic Effects of Patent Rights

The essential question is whether patents enhance innovation. Theory suggests that patents may variously boost and hinder R&D depending on a host of factors. Econometric and survey evidence hint at an answer but do not establish it irrefutably. The uncertainty is unfortunate and feeds

---

[4] Time to Fix Patents, THE ECONOMIST (Aug. 8, 2015), http://www.economist.com/ news/leaders/21660522-ideas-fuel-economy-todays-patent-systems-are-rotten-way- rewarding-them-time-fix [https://perma.cc/QRE7-RWSE].

[5] Richard A. Posner, Why There Are Too Many Patents in America, ATLANTIC (July 12, 2012), http://www.theatlantic.com/business/archive/2012/07/why-there-are-too-many- patents-in-america/259725/ [https://perma.cc/A4T9-C3MH].

[6] See DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 167–70 (2009).

[7] Carl Shapiro, Patent Reform: Aligning Reward and Contribution, 8 INNOV. POL'Y & ECON. 111, 112 (2007).

[8] See Mark A. Lemley, Ignoring Patents, 2008 MICH. ST. L. REV. 19, 19–21 (2008).

debate. Combined with economic theory and common sense, existing empirical evidence can support at least partially informed decision-making.

i. The Economic Relationship Between Patents, Innovation, and Welfare

A basic economic premise underlies the patent system: technologies are expensive to invent but easy to copy. Thus, absent a Pigovian subsidy or a property right,[9] positive externalities will cause suboptimal investment in innovation.[10] This is the classic "public goods" narrative, which warns that easily appropriated information will be under-produced in a free market. In some important industries, public-goods theory accurately captures the nature of invention. The standout example is pharmaceuticals, in which private firms pour billions of dollars into R&D. It is widely understood that, absent an alternative reward structure like regulatory exclusivity or suitably tailored prizes, innovation in the life sciences industry would suffer catastrophic decline without patent protection.

Unfortunately, the classic narrative fails to reflect real-world complications that often arise outside of the life sciences. The workings of some technologies are not discernible at a low cost relative to the expense of initial invention. In some such cases, inventions are not public goods at all, meaning that trade-secret protection allows inventors to appropriate the value of their discoveries. Elsewhere, copying is feasible, but its impact on incentives to invent may still be modest. Competition itself can drive firms to devote R&D to improving their product offerings. Darwinian survival may be among the most powerful incentives to invent.[11] Thus, patents form part of a larger universe of incentives — competition, first-mover advantage, trade-secret protection, and beyond — that collectively bestow the net incentive to invent. Sometimes, the absence of patent protection would not lead inventors to abandon R&D investment, such as where the expected value of R&D without patents exceeds the innovator's reservation return.[12] Nevertheless, we would expect that introducing patents would increase the net incentive to invent a first-generation technology.

Other things being equal, strengthening the patent grant will enhance the incentive to invest in R&D to create a pioneer good or method. By giving an inventor a broader right to exclude, patent law increases the expected value of innovating. One tradeoff is that broadening the exclusive right increases the deadweight loss generated by any market power that flows from the patent.[13] When more competition in a product market increases social welfare then it is possible to enhance efficiency by narrowing the patent grant, but only if the welfare benefits of greater competition exceed the diminished incentive to invent.[14]

There is, however, another complicating factor. Innovation is generally cumulative, meaning that it builds on the prior art. A single act of invention can have spillover effects on subsequent inventions. Hence, expanding patent scope not only diminishes competition in the downstream product market but might also affect how sequential innovation may unfold. Innovation sometimes entails sporadic, transformative leaps over the status quo, and, in those instances, the optimal

---

[9] See Lily L. Batchelder et al., Efficiency and Tax Incentives: The Case for Refundable Tax Credits, 59 STAN. L. REV. 23, 44 (2006)

[10] See Kenneth J. Arrow, Economic Welfare and the Allocation of Resources for Invention, in THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS 609, 609 (1962).

[11] See, e.g., J. Jonas Anderson, Secret Inventions, 26 BERKELEY TECH. L.J. 917, 950 (2011).

[12] See, e.g., Lori B. Andrews, The 'Progress Clause': An Empirical Analysis Based on the Constitutional Foundation of Patent Law, 15 N.C. J.L. & TECH. 537, 566–67 (2014).

[13] It bears emphasizing that a patent grants market power only if there is consumer demand for the claimed product or method and, after the patent issues, there are no good substitutes for the claimed invention.

[14] See, e.g., Vincenzo Denicolo, Patent Races and Optimal Patent Breadth and Length, 44 J. INDUS. ECON. 249, 263 (1996).

scope of pioneer patents depends on the reward/deadweight-loss tradeoff just discussed. More often, though, an invention entails a modest step beyond the prior art, with innovation flowing through a steady stream of incremental improvements that build on prior work. The question then becomes how best to direct the path of technological development.

Law professor Edmund Kitch famously argued that a pioneer inventor, bestowed with broad patent rights, can best coordinate his technology's development.[15] There is reason to think that this avenue works well when transaction costs are surmountable, so that it is feasible for the pioneer both to identify suitable improvers and to negotiate licenses with them. In industries where patent rights are relatively clear and discrete in number relative to a sold product, and where innovation tends not to advance rapidly, broad patents likely provide the breakthrough inventor an appropriate reward and direct follow-on improvements.

Matters become more complicated, however, when innovation is continuous, widespread, and rapid. In such cases, transaction costs rise and make it more difficult for a pioneer to identify and negotiate with the full universe of suitable improvers. Some economic literature predicts that, in such contexts, a broad pioneer patent may inhibit innovation by suppressing follow-on innovation.[16] An obvious "solution" would be to narrow pioneer patents, yet doing so may inefficiently compromise incentives to invent first-generation technologies.[17]

Problems also arise when the number of discrete, patent-eligible technologies residing within a single product increases. If ownership rights in those technologies are dispersed, the result is a Cournot complements problem. As complementary assets under divided ownership, such patents hinder technology firms that want to manufacture and sell new-generation products to consumers. Related to that issue is the anticommons problem, which arises when property rights become narrow and numerous to the point that transaction costs inhibit valuable exchange. Although royalty-stacking and anticommons phenomena hinder the efficacy of the patent system, they do not mean that patents inhibit innovation overall. To navigate high-transaction-cost licensing environments, technology companies use private-ordering solutions such as patent pools, portfolio cross licenses, and standard-setting organizations.[18] New business models have emerged to bridge the gap between infringed IP rights and technology users. Other companies, like defensive patent-buying funds, focus on achieving clearing positions rather than asserting patents and may facilitate the commercialization of technology.[19] The result of such collaborative efforts and new businesses may be a desirable flow of value to upstream inventors as well as active downstream commercialization of technology.

This brief overview of the economics of patents and innovation reveals a complex, interconnected web of incentives that collectively spur or deter R&D investment. Economic models predict that, for a given invention, expanding patent scope increases the incentive to invent. Weak patent protection may therefore lead to suboptimal investment in technological development. As to the royalty-stacking and anticommons effects, economics suggests that vertical integration and suitable, inter-competitor collaboration may ameliorate those conditions and increase output.

Ultimately it is useful for policymakers to employ theory as a predictive tool in the absence of clear data. But it is not sufficient to stop at theory to achieve the best policy outcome. One must

---

- Edmund W. Kitch, The Nature and Function of the Patent System, 20 J.L. & ECON. 265, 276 (1977).
- Robert P. Merges & Richard R. Nelson, On the Complex Economics of Patent Scope, 90 COLUM. L. REV. 839, 870 (1990).
- See Suzanne Scotchmer, Standing on the Shoulders of Giants: Cumulative Research and Patent Law, 5 J. ECON. PERSP. 29, 39 (1991).
- See Carl Shapiro, Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting, 1 INNOVATION POL'Y & ECON. 119, 122 (2000).
- See FED. TRADE COMM'N, supra note 10, at 65–66.

also examine the empirical question that theory alone cannot answer: do patents actually enhance R&D, and is today's U.S. patent system optimally tailored to maximize innovation?

ii. Difficulties that Afflict Empirical Measurement of How Patents Affect Innovation

Before recounting the evidentiary literature on patents and innovation, it is worth explaining some of the econometric challenges. As a threshold issue, it is difficult to measure innovation. Technological advance takes myriad forms, from subtle tweaks to manufacturing processes to pioneer inventions that give birth to previously unimagined products. Such eclectic improvements over the status quo are often not easily quantifiable. Unable to find data on innovation, econometricians must use proxies. Many studies use R&D expenditures, which are an input to the process that results in innovation. While useful, looking at inputs give researchers an imperfect view on the ultimate output of innovation. Another common proxy is productivity gains, which are difficult to measure accurately and to isolate. Other proxies include R&D flows and innovation surveys. Finally, studies also use the number of patent grants, which are a measurable output of innovation. That proxy is also imperfect.[20] First, patent counts omit potentially important innovation that occurs outside the IP system. Second, more patents do not necessarily mean more innovation.

A further problem is a lack of heterogeneity in patent policies between countries. Common approaches deny empiricists natural experiments to test how a change in the patent system of an otherwise comparable economy alters innovation vis-à-vis similar economies that did not make such a change. If otherwise similarly placed states adopted patent laws with differing approaches to scope, duration, eligibility, or remedies, then that situation would create useful natural experiments. Gauging the effects of different patent policies is more difficult under relative uniformity, which has accelerated under the Agreement on Trade-Related Aspects of Intellectual Property Rights ("TRIPS").

Most importantly, correlation does not imply causation. Even if studies consistently revealed a statistically significant correlation between patents and innovation, that observation would not necessarily mean that patents and innovation have any causal relationship. The outcome could be a zero-sum game, in which patents neither add to nor detract from scientific progress. Such limitations stem from the messy reality of studying variously incomplete, interconnected, fluid, and relatively homogeneous phenomena. Yet that does not mean we are unable to derive meaningful insights from the data.

iii. Econometric Studies Have Linked Patents to Innovation

In some commentators' views, there is no empirical support for the proposition that patents spur innovation. That argument ignores abundant empirical work finding that patent strength and R&D expenditures are correlated. So, too, research shows that strong IP rights are associated with economic growth in developed economies. Firms with stronger patent holdings tend to perform better. Surveys reveal that patents contribute to incentives to invest, most acutely in the biopharmaceutical and medical device fields but elsewhere to varying degrees as well. There is also historical evidence connecting strong patent rights to technological advancement.[21]

- See, e.g., Zvi Griliches, Patent Statistics as Economic Indicators: A Survey, 28 J. ECON. LITERATURE 1661, 1666 (1990).
- B. ZORINA KHAN, THE DEMOCRATIZATION OF INVENTION: PATENTS AND COPYRIGHTS IN AMERICAN ECONOMIC DEVELOPMENT, 1790–1920 (2005); Naomi R. Lamoreaux & Kenneth L. Sokoloff, Inventors, Firms, and

For ardent skeptics of the IP system, the admittedly imperfect empirical literature likely will not change their minds. It is possible to explain statistically significant correlations between patent strength and R&D as reflecting something other than a causal relationship between patents and innovation. But claims that the incentive-to-invent rationale underlying the patent system lacks empirical support are simply incorrect. Those who find the economic justification for a patent system convincing encounter much support in the relevant empirical research. As the following review shows, the evidence is consistent with the proposition that patents lead to greater investment in R&D.

a. Statistically Significant Correlation Between Patent Strength and R&D Investment or Economic Growth

IP rights strength positively correlates with R&D investment, at least in developed countries.[22] Two leading studies particularly warrant attention. Using cross-country data from thirty-two nations on R&D investment and patent protection from 1981 to 1995, Kanwar and Evenson in 2003 concluded, "[t]he evidence unambiguously indicates the significance of intellectual property rights as incentives for spurring innovation."[23] They found that "[t]he strength of intellectual property protection is positively and significantly associated with R&D . . . . Thus, countries which provided stronger protection tended to have larger proportions of their GDP devoted to R&D activities."[24]

A study by Park and Ginarte six years earlier created an index of patent strength using data from sixty countries from 1960–1990 "to determine the role of IP rights in economic growth."[25] The authors concluded that "IP [rights] affect economic growth by stimulating the accumulation of factor inputs like research and development capital and physical capital" and that IP rights' "benefits to growth are from encouraging the research sector to invest and take risk," except in developing countries.[26]

A host of other empirical work similarly finds a statistically significant relationship between patent strength and R&D investment. A 2013 Brookings report observed, "[r]esearch has established that patents are correlated with economic growth across and within the same country over time" and "R&D spending since 1953 is highly correlated with patenting and the patent rate."[27] In a 2012 study, Duguet and LeLarge examined the relationship between patents and innovation performance between 1997 and 1999 for the French manufacturing sector. They concluded that "patents significantly promote product innovations but not process innovations." In short, "patents do increase the private incentives to innovate, but through a specific, unbalanced, channel."[28]

---

the Market for Technology in the Late Nineteenth and Early Twentieth Centuries, in LEARNING BY DOING IN MARKETS, FIRMS AND COUNTRIES 19, 19–25 (1999). See generally Kenneth L. Sokoloff, Inventive Activity in Early Industrial America: Evidence from Patent Records, 1790–1846, 48 J. ECON. HIST. 813 (1988).

[22] See, e.g., JONATHAN ROTHWELL ET AL., BROOKINGS, PATENTING PROSPERITY: INVENTION AND ECONOMIC PERFORMANCE IN THE UNITED STATES AND ITS METROPOLITAN AREAS 8 (2013); John Bound et al., Who Does R&D and Who Patents?, in R&D, PATENTS, AND PRODUCTIVITY 21, 51 (1984); Georg Licht & Konrad Zoz, Patents and R&D: An Econometric Investigation Using Applications for German, European and US Patents by German Companies, 49 ÉCONOMIE ET ÉCONOMÉTRIE DE L'INNOVATION 329, 350 (1998); Ariel Pakes & Zvi Griliches, Patents and R&D at the Firm Level: A First Report 5 ECON. LETTERS 377 (1980).

[23] Sunil Kanwar & Robert Evenson, Does Intellectual Property Protection Spur Technological Change?, 55 OXFORD ECON. PAPERS 235, 235 (2003).

[24] Id. at 249–50.

[25] Walter G. Park & Juan Carlos Ginarte, Intellectual Property Rights and Economic Growth, 15 CONTEMP. ECON. POL'Y 51, 51 (1997).

[26] Id.

[27] ROTHWELL, supra note 23, at 4, 8.

[28] Emmanuel Duguet & Claire Lelarge, Does Patenting Increase the Private Incentives to Innovate? A Microeconometric Analysis, 107 ANNALS ECON. & STATS. 201, 221 (2012).

Unsurprisingly, empirical evidence that patents drive innovation in pharmaceuticals is especially strong.[29] More generally, there is evidentiary support for the core proposition underlying the economic case for patents: investment in R&D will be suboptimal if the investing firm has limited ability to internalize the ensuing value.[30] Absent patent rights, firms redirect their R&D efforts toward technologies that they can protect as trade secrets.[31]

b. Some Studies Find a Statistically Insignificant Correlation Between Patent Strength and R&D Investment or Economic Growth

The following Section explores leading work that has found no or statistically insignificant evidence of a relationship between patents and technological advance.

Sakakibara and Branstetter undertook an interesting study in 2001 on the reform of the Japanese patent system, which took place under U.S. pressure.[32] In 1988, Japan passed a law allowing one patent to include many claims, thus expanding the scope of a given patent. The authors interviewed key Japanese stakeholders and determined that the 1988 reform was indeed a boon to inventors seeking patents. If the theoretical causal relationship running from patent strength to R&D and innovation were true, then one would expect to see an increase in R&D or innovation post-1988 reform in Japan after controlling for other explanatory factors. While the 1980s were a time of generally rising R&D in Japan, Sakakibara and Branstetter nevertheless found no statistically significant evidence that patent reform plausibly contributed to greater R&D or innovation on the part of the 307 public Japanese companies on which they collected data.[33]

Another illuminative study is Hall and Ziedonis's empirical examination of patenting in the U.S. semiconductor industry between 1979 and 1995.[34] Unlike the study of Japan's 1988 patent reforms, the semiconductor study finds mixed evidence on the incentive effects of stronger patents rights. First, it determined that "large-scale [semiconductor] manufacturers have invested far more aggressively in patents during the period associated with strong U.S. patent rights, even controlling for other known determinants of patenting."[35] The evidence thus shows that U.S. semiconductor firms respond to changes in patent strength. Nevertheless, the evidence implies that the firms used patent holdings strategically, undertaking an arms war to secure market position vis-à-vis one another.[36]

---

[29] See, e.g., Edwin Mansfield, R&D and Innovation: Some Empirical Findings, in R&D, PATENTS, AND PRODUCTIVITY 127, 142–43 (1984); Bronwyn H. Hall, Patents and Patent Policy, 23 OXFORD REV. ECON. POL'Y 568, 574–75 (2007); Jean O. Lanjouw & Iain M. Cockburn, New Pills for Poor People? Empirical Evidence After GATT, 29 WORLD DEV. 265, 265, 287 (2001); Yi Qian, Do National Patent Laws Stimulate Domestic Innovation in a Global Patenting Environment? A Cross-Country Analysis of Pharmaceutical Patent Protection, 1978–2002, 89 REV. ECON. & STAT. 436, 436 (2007).

[30] See, e.g., Emmanuel Dechenaux et al. Appropriability and the Timing of Innovation: Evidence from MIT Inventions, 1–2 (May 2003) (Working Paper), www.nber.org/papers/w9735.pdf; see also Emmanuel Dechenaux et al.,Appropriability and the Timing of Innovation: Evidence from MIT Inventions at 24 (Apr. 2003) https://smartech.gatech.edu/bitstream/handle/1853/10720/gt_tiger_appropriability.pdf.

[31] Petra Moser, How Do Patent Laws Influence Innovation? Evidence from Nineteenth-Century World's Fairs, 95 AM. ECON. REV. 1214, 1214 (2005).

[32] Mariko Sakakibara & Lee Branstetter, Do Stronger Patents Induce More Innovation? Evidence from the 1988 Japanese Patent Law Reforms, 32 RAND J. ECON. 77 (2001).

[33] Id. at 86, 98–99.

[34] Bronwyn H. Hall & Rosemarie Ham Ziedonis, The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979–1995, 32 RAND J. ECON. 101 (2001).

[35] Id. at 104.

[36] Id. at 125.

In an extensive 2002 study, Josh Lerner engaged in a cross-sectional analysis of 177 changes in patent strength across sixty countries between 1850 and 2000.[37] He found that a country's increase in patent protection substantially affected patent filings in that country by foreign entities, but reduced patent filings by domestic residents and in Great Britain, to which he devoted individual attention.[38] Consistent with economic theory predicting an inverse-U-shaped relationship between patent strength and innovation, he found that "patent protection-enhancing shifts have a lesser impact on innovation when the nation already has strong patent protection and when its per capita gross domestic product lags behind other nations."[39]

c. Surveys Reveal that Patents Are Critical to Innovation in the Life Sciences Sector and Relevant in Other Industries, Albeit Less so than Other Factors

Given the ambiguous nature of empirical studies of patent strength and innovation, there is reason to survey innovators in an effort to determine which factors drive them to invest in R&D. Researchers have undertaken numerous surveys, but two in particular stand out: the 1994 Carnegie Mellon survey and the 1983 Yale survey.[40] The most important takeaway is that patents are the principal means of protecting innovations in certain industries, especially in pharmaceuticals but elsewhere too, and of ancillary effectiveness compared to other appropriation mechanisms in other industries. These surveys support the U.S. patent system, which plays a material appropriation function worth protecting for innovations across industries.

The Yale study surveyed 634 American R&D executives in over 100 manufacturing industries.[41] The goal was to determine patents' effectiveness as an appropriability mechanism. The study found that, for new methods, "patents were generally rated the least effective of the mechanisms of appropriation."[42] Product patents were different. For them, "[p]atents . . . were typically considered more effective than for processes."[43] The study observed that "[i]n only one industry, drugs, were product patents regarded by a majority of respondents as strictly more effective than other means of appropriation."[44]

Eleven years later, the Carnegie Mellon study surveyed 1,478 R&D labs in the U.S. manufacturing sector in 1994.[45] The researchers asked firms to rate the effectiveness of different appropriability mechanisms for their product and method innovations, including patents, secrecy, lead time, and know-how. The study found that "among large firms, patents have the highest effectiveness scores in a number of industries, including drugs, toilet preparations, gum and wood chemicals, pipes/valves, oil field machinery, switchgear, and autoparts."[46] Compared to the earlier Yale study, "patents are still not the dominant mechanism in most industries for protecting product

---

[37] Josh Lerner, Patent Protection and Innovation Over 150 Years (Nat'l Bureau of Econ. Research, Working Paper No. 8977, 2002), http://www.nber.org/papers/w8977 [https://perma.cc/2U9C-N8PY].
[38] Id. at 19–20, 27.
[39] Id. at 2.
[40] See generally Wesley M. Cohen et al., Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not), (Nat'l Bureau of Econ. Research, Working Paper No. 7552, 2000); Richard C. Levin et al., Appropriating the Returns from Industrial Research and Development, 3 BROOKINGS PAPERS ON ECON. ACTIVITY 783 (1987).
[41] Levin, supra note 41.
[42] Id. at 795.
[43] Id.
[44] Id. at 796.
[45] Cohen, supra note 41.
[46] Id. at 12.

innovations, [but] it now appears that they can be counted among the major mechanisms of appropriation in a more sizeable minority of industries."[47]

d. Does Patent Strength Have an Inverse-U-Shaped Relationship with Innovation?

Theory suggests that expanding patent scope will not always enhance innovation. That result is intuitive. Strengthening patent protection should enhance the incentive to invent a new product or process, but it may reduce the propensity to improve upon existing proprietary technologies. Where broad patents encumber follow-on R&D, it would be no surprise that expanding them further would not enhance net innovation. Yet there is to date limited evidence that reflects that theory.

At least one study finds empirical support for the proposition that strengthening IP rights beyond a critical point may discourage innovation.[48] To the extent that finding reflects a causal relationship, it may mirror evidence of an inverted-U-shaped relationship between product-market competition and innovation. Nevertheless, evidence to date that greater patent strength eventually weakens incentives to invent is thin.

e. Patents May Help Startups Secure Capital Funding and Compete

There is evidence that patents serve a material role in the startup process. A 2008 survey found that 76% of venture-backed startup managers reported that venture-capital investors consider patents important to funding decisions.[49] However, that figure masked significant differences among industries. Ultimately, the evidence on the role of patents in allowing firms to attract venture capital is akin to that contained in the broader econometric literature exploring the relationship between patents, R&D investment, and innovation. The evidence is strong in industries where innovation has public-good characteristics making suboptimal investment in R&D likely absent property protection. Outside of those settings, patents continue to play a material part of the larger innovation-incentive environment, but they do not dominate it. It is thus not surprising that the importance of patents to venture capital, compared to incentives to invent in the first place, is less pronounced in such markets.

f. There Is Some Evidence that Some PAE Behavior Harms Innovation

This Section's exploration of the empirical literature closes with a brief word on how PAEs affect innovation. A prominent example of strongly held views that lack a robust evidentiary foundation is PAEs, which are non-technology-practicing companies that aggregate and license patents under threat of suit. Many voices have argued that PAEs are harming inventive activity.

To understand how reality can depart from conjecture, consider the Section 6(b) report on PAE conduct that the FTC released in October 2016.[50] Although it does not address the efficiency of PAEs, the case study contributes significantly to the empirical literature, revealing in particular two different business models — Litigation PAEs and Portfolio PAEs. The study unearthed evidence that Litigation PAEs, which own relatively small patent holdings, generally sue without first

---

[47] Id. at 13.
[48] Yi Qian, Do National Patent Laws Stimulate Domestic Innovation in a Global Patenting Environment? A Cross-Country Analysis of Pharmaceutical Patent Protection, 1978–2002, 89 REV. ECON. & STAT. 436, 436, 447, 449 (2007).
[49] Stuart J.H. Graham et al., High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey, 24 BERKELEY TECH. L.J. 1255, 1307 (2009).
[50] FED. TRADE COMM'N, PATENT ASSERTION ENTITY ACTIVITY: AN FTC STUDY (2016).

negotiating a license and then settle quickly, usually at a sum that is below early-stage litigation costs.[51] The report observed that such conduct is consistent with nuisance lawsuits. Based on that evidence, I supported modest reform proposals that would not affect the rights of larger patent holders.

IV. Fashioning Responsible Policy From Imperfect Information

Consider what we know about patents and innovation, beginning with the relevant theory. First, when inventors invent, they discover new information. Some technologies resist copying and are thus prime candidates for trade-secret protection. Many other forms of information, however, are expensive to develop and have the public-good characteristic of non-excludability, making them vulnerable to third-party appropriation. As with all activities generating positive externalities, suboptimal investment in the creation of technology is likely to result. Patent rights to exclude free-riders alleviate the public-goods issue, thus spurring more innovation.

Second, the simple act of invention itself carries limited social value until it results in an applied technology. Commercialization often requires significant capital investment beyond what was necessary to obtain a patent. Yet making a technology into a working consumable product (or part of a product), obtaining regulatory approval, and bringing the good to market also create positive externalities. Third-party competitors can often free ride off an innovator's efforts in marketing a new product.

Of course, the public-goods and commercialization-incentive narratives will not always hold true. Nor will patents always be the driver of invention. First-mover advantage, Darwinian survival against advancing rivals, network effects, an ability independent of IP rights to protect a developed technology against copying, a desire to foster name recognition or reputation, and a host of other factors can spur innovation. In some settings, one would expect them to be a more powerful impetus toward innovation than patents. Yet, there is no reason to think that non-patent factors spurring innovation are so ubiquitous and powerful as to render patents superfluous always and everywhere.

It is important to evaluate that theory in the context of a long-running U.S. innovation platform in which private industry has invested vast sums in reliance on the patent system and produced a stunning array of innovative technologies. Given this history, in my view, the economic rationale for patents is convincing and the notion that patents cripple innovation is strongly counterintuitive.

With those considerations in mind, to justify a significant departure from the status quo, I would require evidence that patents suppress U.S. innovation. To justify a move from the current framework, which underpins the illustrious track record of U.S. innovation, a reasonable question is whether the evidence suggests that it is more likely than not that the net effect of patents is to suppress current levels of innovation. Such evidence is lacking. To the contrary, the empirical literature yields insights that should give patent skeptics pause in making their case.

Patents exhibit consistent and statistically significant correlation with private R&D investment and with economic growth, at least in developed countries. Although it is precarious to ascribe causal significance to such a statistical relationship, it is certainly important that there is an evident association between robust patent protection, R&D expenditures, and growth. Policymakers should thus be very cautious before concluding that the government could safely disregard, abolish, or dilute patents in that setting.

Those inclined to restrict or even remove patent rights face an important consideration independent of the question of whether the patent system's net effect is to advance or inhibit

---

[51] Id. at 3–4.

technological advance. Specifically, there is ample evidence that firms respond to adjustments to the patent system. Even industries that enjoy anti-appropriation mechanisms more effective than patents invest heavily in patents. Abolishing or seriously weakening the patent system would be extremely disruptive, imposing stranded costs that would almost certainly yield a net negative effect on R&D investment in the short run. Such a sweeping transformation of the new economy would change the kinds of inventions and technologies that markets would produce. Certainly, firms would direct their R&D away from easily appropriable technologies and toward those susceptible to trade-secret protection.

In short, I find that the U.S. innovation experience, theory, and econometric work combined are a powerful argument against abandoning or compromising the patent system. The focus instead should be on recalibration. Lawmakers should enhance quality, boost the clarity of patent disclosure, ratchet up obviousness and novelty conditions in industries subject to anticommons and royalty-stacking effects, encourage breakthrough technologies through suitable rights over pioneer inventions, and narrow patent scope in heavily cumulative fields of innovation that are subject to high transaction costs.

V. Conclusion

The patent system has been part of the fabric of this country since its founding. Enjoying constitutional recognition, patents reflect American ideals of entrepreneurship, creative genius, moral desert, and private ownership rights. That exalted role coincides today with an era of unprecedented technological advance. The last thirty years alone have seen explosive innovation in high-speed computing, the Internet, information technology, consumer electronics, medical technology, hybrid fuels, aviation and car design, and more besides. By any metric, the U.S. economy has been the foremost contributor to this scientific progress.

What makes the U.S. economy such a compelling incubator of future technology? The answer lies in an exceptional innovation policy, which combines myriad factors to create an environment conducive to effective R&D. Political stability, property rights, competitive markets, a culture that rewards and celebrates ingenuity, bankruptcy laws tailored to spur calculated risk-taking, a disproportionate share of the world's best universities, a strong economy with venture capital to fund promising ideas, employment laws that promote the free movement of labor, and respect for the rule of law make the U.S. economy a bastion of invention without equal. A pillar of that innovation platform is the patent regime, which is operating at a busier clip today than in the past.

Patents are not always the principal spurring force for all inventions all the time. But there is ample evidence supporting the basic but powerful intuition underlying the patent system. Thus, some critics' claim that contemporary patent policy lacks an evidentiary foundation does not hold up upon deeper examination. As is true in many areas of life, the real picture is variously messy, complex, qualified, and ambiguous. Yet the stakes are immense, meaning that we must grapple with the facts as we can best discern them in effecting policy.