

Unlocking Patents: Costs of Failure, Benefits of Success

Robert Litan and Hal Singer¹



¹ Robert Litan is a non-resident Senior Fellow at the Brookings Institution and a Consulting Economist with Economists, Inc. During his professional career, he has headed economic research at the Brookings Institution, the Kauffman Foundation, and Bloomberg Government. Litan has also served as Deputy Assistant Attorney General in the Antitrust Division of the Justice Department and as Associate Director of the Office of Management and Budget. Hal Singer is a Principal at Economists, Inc., a Senior Fellow at Progressive Policy Institute and an Adjunct Professor at Georgetown University's McDonough School of Business. This study was supported by The U.S. Patent Utility. The authors take sole responsibility for its content. They also want to thank Andrew Card of Economists, Inc. for excellent research assistance.

Abstract: *Patents are critical to incentivizing innovation, which in turn is key to sustaining economic growth and increasing living standards. Public officials, academic scholars and other commentators continue to debate whether and how to improve the legal standards and procedures for granting patents and challenging them. As important as these subjects are, they do not address the central economic problem with the current patent system in the United States.*

The real challenge is that today the legally oriented patent system imposes significant transactions costs on licensing inventions: Most patent owners and users cannot bear the costs or risks associated with enforcing and licensing their patents. As a result, a substantial portion of the two million-plus patents granted, and thus the knowledge and technology they embody, is not commercialized or used to benefit others. The potential cost of this waste to the American economy has been estimated to be as large as \$1 trillion annually, representing a five percent reduction in potential GDP.

Although legal reforms to the patent system might help improve “patent quality” (ensuring that patents are granted only for truly novel inventions) and cut down wasteful patent litigation, the real key to improving the patent system and enhancing economy-wide innovation is to unlock the potential economic value of hundreds of thousands of ostensibly “dead” patents—that is, those having commercial value but not being licensed because of the costs and risks of litigation to owners and users of patents. This outcome can be achieved by several market-based solutions, which are not mutually exclusive, and do not require any legal reform.

This study provides an illustrative calculation suggesting that modestly increasing the number of patents under license, using conservative assumptions of the impact on the economy of increased innovation, could generate social benefits ranging between \$100 and \$200 billion per year. This estimated range easily could be surpassed if the U.S. can achieve enhanced licensing of existing patents, and if any market solutions also enable the dissemination of more knowledge that could increase the numbers of patented innovations themselves.

I. THE INNOVATION CHALLENGE

Americans have long celebrated many things, but one of them has been our incredible ability to continue innovating. Much of what it means to be a modern society is due to innovations made or commercialized most successfully first in this country. The telephone, the automobile, the airplane, computers (mainframe and personal) and software to operate them, air conditioning, and the Internet (with retailing and search) were all commercialized by entrepreneurs in the United States.

Economic research has consistently documented the centrality of innovation, even more so than investments in physical and human capital, to be the most important driver of economic growth and hence rising living standards. Our founding fathers knew this proposition implicitly without the benefit of sophisticated economic research. They imported from Great Britain the notion of patents—a temporary legal right of exclusivity given to inventors meant to encourage innovation in return for disclosure of the knowledge so discovered—and included patent rights in the Constitution.

With the financial crisis of 2008 fresh in their minds, and the subsequent sluggish recovery, many Americans are anxious about their personal economic future and that of our country. A vigorous debate is under way among academics and government economists about the pace of future growth. While some are optimistic that the compounding effects of information technology (driven by Moore's law) will continue, broaden to sectors outside of IT, and conceivably even accelerate, others worry the U.S. economy has run out of good ideas and is condemned to a future of "secular stagnation," or even worse. Official government forecasts of future productivity growth (a good proxy for innovation) lie somewhere in the middle of these extremes, but at roughly 1.5 percent per year, even these

forecasts have a pessimistic tone: During the 1990s, productivity grew at about double this rate.²

The magic of compound interest underscores the huge differences in average living standards implied by different growth rates, and thus different rates of innovation. For example, it takes almost 50 years for an economy growing at 1.5 percent (on a per capita basis) to double in size. At three percent, the doubling time is halved to about 24 years. In dollar terms, this means that average family income, currently about \$45,000, will take almost two generations to hit \$100,000 in the slow-growth scenario. At the more rapid three percent growth rate, average family income would be closer to \$200,000 at the end of same time frame.

Solutions that encourage the commercialization of innovations and the knowledge they embody can help address America's productivity challenge. Unfortunately, these innovations are impeded rather than facilitated by the current patent system. The reason is that the current *patent licensing system does not scale*—that is, the transactions costs associated with consummating the tenth (or hundredth) licensing deal is no less than the transactions costs associated with consummating the first. Licensing is critical because that is an important way, in addition to direct use of patents by their inventors, that patented innovations actually get used and commercialized, to the benefit of consumers. In addition, because patents require disclosure of the new knowledge embodied in the innovations they cover, patents are more valuable to other producers, entrepreneurs and established firms than trade secrets, which by definition, are kept hidden from others.

2. See *Americas Lost Oomph*, THE ECONOMIST, July 16, 2014, available at: <http://www.economist.com/news/leaders/21607809-countrys-potential-growth-rate-barely-half-what-it-was-two-decades-ago-heres-how-raise> (last accessed August 13, 2014).

Yet as explained below, independent of the controversy over patent infringement suits filed by non-practicing patent owners (NPPOs),³ most patent owners and users—including individual inventors, small to medium-sized businesses, and even universities—cannot afford the cost or complexity of licensing patents under current legal arrangements. These costs favor large companies that have the resources to build up large patent portfolios to use offensively or even defensively against infringement claims of other large competitors. As a result, only the patents that companies guess will be most immediately highly profitable, and therefore can hurdle the high risks or costs of infringement lawsuits, will be used and licensed. It is as if the economy were playing a game of baseball in which the only hits that counted were home runs by players on very well-financed teams.

In such an economy, vast numbers of other valuable or “run-producing” innovations—triples, doubles, singles, or even sacrifice flies—generated by many other firms, universities or individual inventors cannot be economically licensed given the potential risks or costs of litigation. Extending the baseball analogy, the current patent system is like a reconfigured Baseball Hall of Fame that accepts only long-ball hitters, and leaves out all those great players—like Ty Cobb, Rob Carew, Tony Gwynn, and Honus Wagner (among many others)—who were great singles and doubles hitters, and who were of great value to their teams.

In addition, the fear of being held as a “willful infringer” (and thus having to pay much larger damages than might otherwise be the case) discourages potential users, including firms and entrepreneurs, from searching for and using the knowledge embodied

3. *See, e.g.*, Timothy B. Lee, “New study shows exactly how patent trolls destroy innovation,” Vox (2014), available at: <http://www.vox.com/2014/8/19/6036975/new-study-shows-exactly-how-patent-trolls-innovation> (last accessed August 19, 2014).

in many patents. As a result, the U.S. economy has a lot of “dead” intellectual capital and knowledge that could come alive if only the transactions costs were surmountable.

These underemployed assets can be too easily overlooked even though it is well recognized that intellectual property already has become hugely important to the U.S. economy. By one recent estimate, intellectual capital in some form, including patents, accounts for 55 percent of gross domestic product (GDP),⁴ and “intangible assets” (such as corporate intellectual property, goodwill, and brand recognition) account for 80 percent of the value of U.S. public companies today.⁵ Yet as hugely significant as the intangible asset figures are, they could be even larger (raising GDP further) under a well-functioning patent-licensing regime. Indeed, given the centrality of IP to our economy, it is essential for firms of all sizes and ages to have an IP strategy, and often specifically a patent strategy—one laying out how firms are going to commercially use or license their innovations, minimizing the likelihood of infringing patents owned by others, or minimizing the financial risks if those owners assert patent rights against them.

This is simply common sense given the \$1.5 trillion dollars that companies and governments spend globally on research and development (R&D) each year.⁶ Leading companies know they have to rely on ideas from others as much, if not more so, than ideas generated within. Much, if not most, of that outside knowledge can be found in patent disclosures, the quid pro quo for granting patent holders a time-limited right to exclude,

4. See Kevin A. Hassett & Robert Shapiro, *What Ideas Are Worth: The Value of Intellectual Capital And Intangible Assets in the American Economy*, Sonecon (Sept. 2011) at 2, available at www.sonecon.com/docs/studies/Value_of_Intellectual_Capital_in_American_Economy.pdf (last accessed September 10, 2014).

5. *Id.*, at 12 and Table 3.

6. See Gautum Naik, *Global R&D Spending Growth is Expected to Slow This Year*, WALL STREET J., Dec. 8, 2013, available at <http://online.wsj.com/news/articles/SB10001424052702303997604579242211359271526> (last accessed September 11, 2014).

although as we discuss later, interpreting the disclosed information is complicated by the legal language in which it is stated. Nonetheless, a 2006 study concluded that 88 percent of U.S., European, and Japanese businesses say they rely upon the technical knowledge disclosed in patents to keep up with industry advances and to direct their own R&D.⁷

All of this matters not just now, but indefinitely into the future. The former head of the United States Patent and Trademark Office (USPTO), David Kappos, has aptly analogized the U.S. patent system to a national 401(k) plan; a generator of income-producing assets whose value will only grow over time, to the benefit of both current and future generations. Yet, as we demonstrate below, America's 401(k) plan is underperforming, delivering far less return than it could. If markets could develop ways to commercialize a substantially greater number of assets now impaired by a cumbersome patent-licensing system, productivity and living standards would advance at a more rapid pace.

II. PATENTS HAVE BEEN A CENTRAL TOOL FOR PROMOTING INVENTION AND LEARNING

Patents have played an important role in spurring the development of new technologies and the dissemination of knowledge throughout modern history, and have been shown by economists to generate necessary incentives for innovation and investment.

7. See Francois Leveque & Yann Menier, *Patents and Innovation: Friends or Foes?* CERNA (December 2006), available at: <http://www.microeconomix.fr/sites/default/files/import2/FL-YM-PatentsInnovationJanuary07.pdf>. (last accessed September 11, 2014). Even with the difficulties of interpreting the disclosures in patents, one estimate suggests that 80 percent of the world's current technical knowledge is contained only in patent documents. See European Community, *Why Researchers Should Care About Patents*, 2007, available at http://ec.europa.eu/invest-in-research/pdf/download_en/patents_for_researchers.pdf (last accessed September 11, 2014).

A. The Origins of Patents

The term “patent” is derived from the Latin “*litterae patentes*,” which referred to “open letters” issued by medieval rulers to serve as proof of conferred rights and privileges.⁸ Over time, patents evolved as a mechanism to spur and safeguard innovation by granting inventors the exclusive right to profit from their creations.⁹ One of the earliest mechanisms for conferring exclusive rights emerged in Renaissance Italy, and was disseminated throughout the rest of Europe by Venetian artists and glassmakers in an effort to guard their techniques from local imitators.¹⁰

The first modern patent system took shape in England in the 1500s, where the government engaged in the practice of granting patents concerning intellectual property to incentivize innovation. The Founding Fathers, seeking to democratize the granting of patents in a way the British system did not, adapted British patent laws in Article 1, Section 8 of the U.S. Constitution, which states that:

The Congress shall have power . . . to promote the progress of science and useful arts by securing for limited times to authors and inventors the exclusive right to their respective writing and discoveries.¹¹

Today, the USPTO is responsible for reviewing patent applications, granting patents, and maintaining records of existing patents.¹² A patent issued by the USPTO authorizes the owner to pursue legal action to exclude “others from making, using, offering for sale, or

8. See Thomson Reuters, “The History of Patents,” available at: <http://ip-science.thomsonreuters.com/support/patents/patinf/patentfaqs/history/> (last accessed July 22, 2014).

9. See Timothy B. Lee, *Everything you need to know about patents*, VOX (2014), available at: <http://www.vox.com/cards/patent-reform/whats-a-patent> (last accessed August 11, 2014).

10. See Thomson Reuters; see also Ted Sichelman & Sean O’Connor, *Patents as Promoters of Competition: The Guild Origins of Patent Law in the Venetian Republic*, 49 SAN DIEGO L. REV. 1267-82 (Fall 2012). To this day, the neighboring island of Murano still attracts tourists with its glassmaking acumen.

11. See Thomson Reuters.

12. See The United States Patent and Trademark Office, available at: <http://www.uspto.gov/> (last accessed July 25, 2014).

selling the invention throughout the United States or importing the invention into the United States.”¹³

B. The Economic Significance of Patents

Economists have long recognized the potential for private and social benefits resulting from modern patent regimes.

1. Patents Incentivize Innovation

Nobel Prize-winning economist Kenneth Arrow observed that where the production of knowledge is concerned, markets (even competitive ones) might fail to incentivize individuals to innovate at socially optimal levels.¹⁴ The logic underlying this potential for market failure is straightforward: The pursuit of new knowledge often imposes high costs on innovators, including R&D expenses and the opportunity costs of time and effort. By comparison, new knowledge is non-rival (one individual’s use does not lessen the amount available to others) and non-excludable (it is not possible to exclude individuals from enjoying it once it is disseminated).¹⁵ Consequently, absent some mechanism for making new discoveries excludable, innovators bear the costs of innovation, while others (or society) reap the benefits. Such a market structure decreases the incentives for any given individual to engage in costly innovation, while increasing incentives for free-riding on the efforts of others, leading to the potential for an overall shortfall in innovation.¹⁶

13. 35 U.S.C. § 157(a)(1).

14. *See, generally*, Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, in *THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS* 609-626 (NBER 1962).

15. *See* Corinne Langinier & GianCarlo Moschini, *The Economics of Patents: An Overview*, in *INTELLECTUAL PROPERTY RIGHTS AND PATENTING IN ANIMAL BREEDING AND GENETICS* (Scott Newman & Max Rothschild eds. CABI Publishing, 2002).

16. *See, e.g.*, Kenneth Arrow, *The Economic Implications of Learning by Doing*, 29(3) *THE REVIEW OF ECONOMIC STUDIES* 155–173 (1962).

Federal government funding of basic scientific R&D is one way by which this market failure is corrected. Patents are another way.¹⁷ By granting temporary exclusive rights to new knowledge and discoveries to their inventors, modern patent systems give incentives to inventors to undertake costly investments in time, effort, and resources to generate innovations, in hopes of realizing potential profits from them.¹⁸ Often, patents are a bargain for society: They facilitate the production and dissemination of knowledge in return for a temporary grant of monopoly earnings for the inventor.

2. Patents Incentivize Investment

Economists have underscored the importance of patents in spurring the investment necessary to shepherd crude innovations from infancy to commercial status.¹⁹ Innovators (or firms) often lack the resources necessary to fully realize the potential of their creations. Patents serve as a mechanism for attracting investment, by acting as an assurance that if a development is commercially successful, its economic fruits can be appropriated.²⁰ As economists Roberto Mazzoleni and Richard Nelson explain, the holding of a patent can be crucial when innovators must look to capital markets to secure financing. This ability can

17. See Economics and Statistics Administration & United States Patent and Trademark Office, *Intellectual Property and the U.S. Economy: Industries in Focus*, (March 2012) at 1 (“Firms and individuals, in order to invest the necessary resources, need some assurance that they will benefit from and recover the costs of the creation of intellectual property. IP rights help protect authors, inventors, and merchants of goods and services from having their creations and innovations quickly and easily exploited by other firms or individuals, diminishing the benefits to the inventor of the IP. This reduction in private benefits to be gained from the underlying innovation could, in turn, reduce the incentives to undertake the investments necessary to develop the IP in the first place.”).

18. See Langinier & Moschini (2002), at 3-4.

19. See Roberto Mazzoleni & Richard R. Nelson, *The benefits and costs of strong patent protection: a contribution to the current debate*, 27 RESEARCH POLICY 273-284 (1998).

20. *Id.* at 277 (“The argument is that the holding of a patent at an early stage provides assurance that, if development is technologically successful, its economic rewards can be appropriated... an important role of patents is to induce the firms to commit resources to the development of inventions.”).

often be vital for “small and/or new firms faced with substantial development costs before they can get their innovations to market.”²¹

3. Patents Promote the Dissemination of Knowledge

Patents also promote the dissemination of knowledge by requiring that new knowledge, inventions, and processes be disclosed (while maintaining the inventor’s exclusive rights).²² Disclosure of patents can result in a variety of private and social benefits. For example, a single individual or firm may be unable to exploit the full potential of an invention without the expertise or assistance of others.²³ In these situations, disclosure can allow for collaboration, which otherwise might not occur if the original inventor were afraid of sharing knowledge without a veil of exclusivity. Moreover, the ability to license patents for direct use by others may (if structured properly) incentivize individuals to make new discoveries available, to their private financial benefit and potentially to the benefit of society.

4. Trade Secrets as a Limited Second-Best IP Strategy

The benefits of disclosed knowledge reflected in patents stand in stark contrast to the closed nature of new knowledge when bottled up as a “trade secret,” a legitimate form of intellectual property to be sure, but one that is clearly inferior from a social perspective to patents because no one else except the “owner” of the trade secret can benefit from the knowledge embodied in it. This difference is important to keep in mind when considering the effectiveness of the current patent system. As we explain in more detail below, the high transactions costs and risks of patent licensing are deterring not only the

21. *Id.*

22. *See* Langinier & Moschini (2002), at 5.

23. *See* Mazzoleni & Nelson (1998), at 278.

commercialization of new knowledge, but *discouraging patent applications themselves* in favor of trade-secret protection. This makes society clearly worse off than it could be if institutions or incentives were changed to make patenting more worthwhile.

C. Patents Are Responsible for Significant Social Benefits

Economists have also demonstrated that patents generate significant benefits for society, above and beyond the financial rewards to successful innovators themselves.

1. Benefits to Society from Innovation Tend to Swamp Private Gains

Innovation is one of the primary sources of growth in the American economy.²⁴ Nobel laureate Robert Solow and others have demonstrated that a significant share of U.S. economic growth in the 20th Century was the result of innovation.²⁵ Other estimates concerning more recent periods found that more than 80 percent of gains in U.S. productivity in the early 2000s could be traced to the development and application of new ideas and technologies (in particular IT),²⁶ while a significant share of growth in the U.S. economy at the turn of the century was generated by increases in the stock of “intangible assets”—specifically patents, copyrights, and other intellectual property and the R&D underlying them.²⁷

Economists have also shown that patents have played a direct role in driving this innovation-based growth. For example, survey evidence indicates that up to 60 percent of pharmaceutical-research projects that eventually lead to new discoveries would not have

24. See Hassett & Shapiro, at 1 (“Innovation is widely recognized by economists as the most powerful factor that can drive changes in an economy’s underlying rates of productivity and growth.”).

25. See Robert M. Solow, *A Contribution to the Theory of Economic Growth*, 70 *QUARTERLY JOURNAL OF ECONOMICS* 65-94 (1956); see also Robert M. Solow, *Technological Change and the Aggregate Production Function*, 39 *REV. ECON. & STATISTICS* 312-320 (1957).

26. See Hassett & Shapiro, at 8.

27. *Id.*, at 7-8.

occurred without patent-based incentives.²⁸ Recent data also estimate that a pharmaceutical firm will incur average out-of-pocket costs of at least \$1 billion (and as much as \$11 billion) to develop, test and market a new drug.²⁹ These firms rely on the exclusivity period afforded by patents to recoup these upfront costs. Indeed, economists acknowledge that the U.S. biotechnology industry is reliant on patents for its very existence.³⁰

Moreover, while the patent system helps to ensure that patent holders profit from their efforts, the benefits to society from innovation are often much larger than private gains. In a 2005 study, Yale economist William Nordhaus estimated that only about *four percent* of the total present value of social returns to innovation is captured by innovators.³¹ *This implies that social returns to innovation exceed private returns by a ratio of approximately 25 to 1.* Professor Nordhaus concludes that:

[O]nly a miniscule fraction of the social returns from technological advances over the 1948-2001 period was captured by producers, indicating that most of the benefits of technological change are passed on to consumers rather than captured by producers.³²

There is no doubt that advances in medical science, transportation, telecommunications, software and computing have generated immense profits for the individuals behind them. But these same innovations have also extended average lifespans, eradicated certain

28. *Id.* at 11.

29. See Matthew Herper, *The Truly Staggering Cost of Inventing New Drugs*, FORBES, Feb. 10, 2012, available at: <http://www.forbes.com/sites/matthewherper/2012/02/10/the-truly-staggering-cost-of-inventing-new-drugs/> (last accessed September 3, 2014).

30. See Mazzoleni & Nelson (1998), at 276 (“The collection of small and medium sized firms in the American biotechnology industry is, of course, a striking example of enterprises that would not have come into existence without the prospect of a patent, and which depend on patent protection to make their profits, and to attract capital, through one or another of these strategies.”).

31. See William D. Nordhaus, *Schumpeterian Profits and the Alchemist Fallacy Revised*, Yale Working Papers on Economic Applications and Policy, Discussion Paper No. 6 (April 2005) at 12, 17 (“Using both aggregate and industry data for the United States, I estimate that innovators were able to capture about 4 percent of the total social surplus from innovation.”).

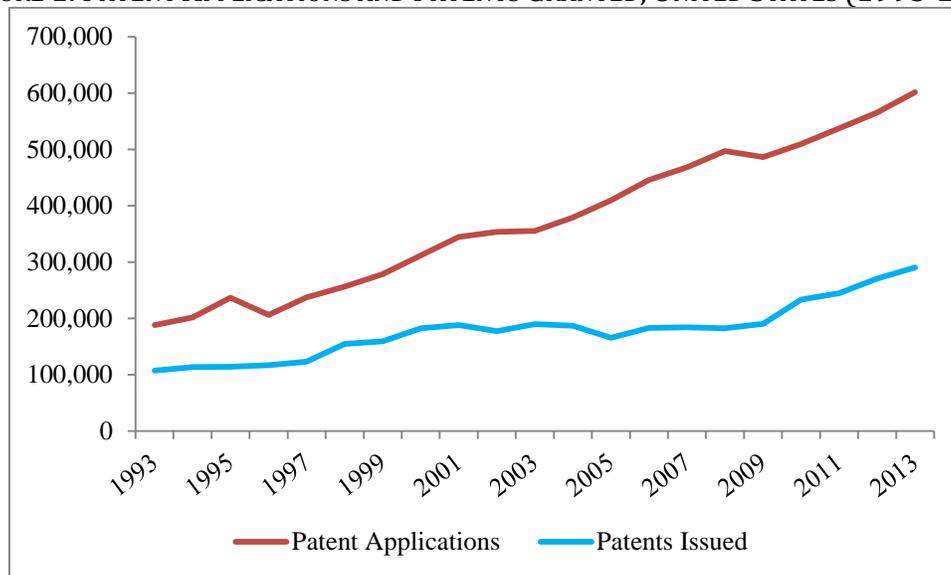
32. *Id.* at 1.

diseases, and allowed for near-instantaneous communication—benefits enjoyed by society as a whole. These tremendous positive spillovers imply that policymakers should be considering how to stimulate additional innovations.

2. Estimates of the Social Value of Patent-Related Activity in the United States

Data from the USPTO confirm that patents have become an increasingly important component of innovation in the U.S. economy. As shown in Figure 1, annual patent applications have grown from 188,099 in 1993 to 601,317 in 2013 (an increase of 220 percent),³³ while the number of patents granted by the USPTO has increased from 107,331 to 290,083 over the same period (an increase of 170 percent).³⁴ The USPTO reports that patent-related fees (including application, maintenance, and renewal fees) totaled approximately \$120 million in 2013.³⁵

FIGURE 1: PATENT APPLICATIONS AND PATENTS GRANTED, UNITED STATES (1993-2013)



Source: USPTO, “Performance and Accountability Report,” (2013), Tables 2 and 6.

33. See United States Patent & Trademark Office, “Performance and Accountability Report,” Fiscal Year 2013, 189 (Table 2); (includes Utility, Design, Plant, and Reissue patent applications).

34. *Id.* at 192 (Table 6).

35. *Id.* at 78.

Although innovation is clearly critical to the growth of the U.S. economy and therefore is highly valuable, the value of *patented innovations* is not readily ascertained. Comprehensive data on patent-licensing activity and revenues is notoriously difficult to obtain (in large measure because many of the financial terms underlying patent licensing agreements are often not disclosed). The United States Census Bureau reports patent license income, presumably earned only by for-profit entities for 2012 (the year of the most recent Economic Census) of approximately \$10 billion.³⁶ To this figure one must add licensing income of \$2.6 billion in 2012 earned by universities, according to the Association of University of Technology Managers (AUTM).³⁷ This yields an estimate of about \$12.6 billion for annual patent licensing income.

But this figure clearly understates the total value of all U.S. patents currently being commercially used in some fashion. For one thing, because these figures represent only *cash* that exchanges hands, the figures exclude the implicit value of patents that are *cross-licensed* between companies. The latter figure must be significant given the frequent pooling arrangements that are developed or are necessary to establish standards.³⁸ For example, two major U.S. firms, Microsoft and IBM, report annual income from the licensing of patents of at least \$2 billion³⁹ and \$1 billion,⁴⁰ respectively. In the first half of its 2014

36. See Data from the 2012 Economic Census, *available at*: http://factfinder2.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ECN_2012_US_5313&prodType=table (last accessed August 11, 2014).

37. See Association of University Technology Managers, "U.S. Licensing Activity Survey Highlights," (FY2012) at 4.

38. See, e.g., Justus Baron & Tim Pohlmann, *Patent Pools and Patent Inflation: An empirical analysis of contemporary patent pools*, (August 2012), *available at*: <http://www.oecd.org/site/stipatents/3-1-Baron-Pohlmann.pdf> (last accessed August 11, 2014).

39. Includes patent license revenues from Android technology only. See Jay Yarow, "Microsoft Is Making An Astonishing \$2 Billion Per Year From Android Patent Royalties," BUSINESS INSIDER (Nov. 6, 2013), *available at*: <http://www.businessinsider.com/microsoft-earns-2-billion-per-year-from-android-patent-royalties-2013-11> (last accessed August 1, 2014).

fiscal year, licensing comprised 70 percent of Microsoft's revenue and 94 percent of the company's gross margin.⁴¹ At a third company, Qualcomm, one-third of its revenue comes from licensing, and licensing revenues represented 80 percent of its profits in 2013.⁴²

Furthermore, cash-licensing figures do not count the profits earned from the commercial use of patented innovations by *their inventors*. For example, if an inventor were compensated in a lump-sum payment, the future stream of cash flows would not reflect this lump sum. Aggregate payments to inventors has to be especially significant—and very likely exceeds the aggregate licensing income figures reported above—in industries such as chemicals, pharmaceuticals, and medical devices, where patents have been found to be critical for incentivizing large research and development expenditures.⁴³

For all these reasons, it seems clear that the \$12.6 billion estimate for the *private gains* from patented innovations is excessively conservative. This figure, therefore, serves as an absolute *lower bound* for private earnings from patented innovations. Indeed, other studies have estimated significantly greater annual revenues from U.S. patent licensing or its equivalent. For example, patent law professor Samson Vermont, in a 2002 book chapter, reported that “In 2000, annual patent revenues reached about \$130 billion.”⁴⁴ Another

40. See Steve Lohr, *The 2012 Patent Rankings: IBM on Top (Again), Google and Apple Surging*, NEW YORK TIMES, Jan. 10, 2013, available at: http://bits.blogs.nytimes.com/2013/01/10/the-2012-patent-rankings-ibm-on-top-again-google-and-apple-surging/?_php=true&_type=blogs&_r=0 (last accessed July 30, 2013).

41. Calculations based on financial information reported in Microsoft's Earnings Release FY14 Q2, available at: <http://www.microsoft.com/Investor/EarningsAndFinancials/Earnings/SegmentResults/S1/FY14/Q2/Performance.aspx> (last accessed October 14, 2014). For 2014Q1 to 2014Q2, licensing revenue represented approximately 70 percent of total revenue (licensing revenues of \$30 billion along with total revenues of \$43 billion). For the same period, licensing represented approximately 93 percent of gross margin (\$27 billion in licensing along with \$29.6 billion in total gross margin).

42. Tom Habert, “Qualcomm Takes on the World,” *Electronics* 360, February 11, 2013.

43. See Bronwyn Hall, Christian Helmers, Mark Rogers, & Vania Sena, *The Choice Between Formal and Informal Intellectual Property: A Review*, 52 J. ECON. LIT. 375-423 (2014) (surveying the empirical evidence on values of patents to different industries).

44. See Samson Vermont, *The Economics of Patent Litigation*, in FROM IDEAS TO ASSETS: INVESTING WISELY IN INTELLECTUAL PROPERTY 331 (Wiley & Sons, Inc., 2002, B. Berman, ed.).

study places the annual value of patent licensing in the United States at \$150 billion.⁴⁵ We found no other sources for patent licensing and thus believe that these latter two estimates represent an *upper bound* for the private value of annual earnings from patent licensing activities.

For the remainder of this paper, we will use \$80 billion—the approximate midpoint between \$12.6 billion and \$150 billion—as our estimate for the annual private value of patent licensing in the United States. This figure is consistent with the \$89 billion that American companies received in 2009 in royalty and licensing income from foreign sources, a major source of export revenue for the United States.⁴⁶ Admittedly, the \$89 billion figure covers more than just patent licensing income, as it also includes royalty and licensee fees for trademarks and copyrights (and unfortunately is not broken down by type of intellectual property). Nonetheless, its magnitude indicates that patent licensing income from all sources received by U.S. companies annually is surely substantially higher than the lower bound figure of \$12.6 billion, and quite clearly closer to or just above the \$80 billion average we use here.

As demonstrated by Professor Nordhaus, the private gains to individuals and firms from innovation are dwarfed by its social benefits. Using the Nordhaus estimate that producers capture only four percent of overall gains from patents, our licensing revenue estimate implies that the annual social value of patents for U.S. consumers is approximately \$2 trillion (equal to the product of \$80 billion in annual patent licensing revenues and

45. See Yuichi Watanabe, *Patent Licensing and the Emergence of a New Patent Market*, 9 HOUSTON BUS. & TAX L.J. 449, 445-479 (2009).

46. See Economics and Statistics Administration & United States Patent and Trademark Office, “Intellectual Property and the U.S. Economy,” 54 (March 2012), *available at*: http://www.uspto.gov/news/publications/IP_Report_March_2012.pdf (last accessed September 3, 2014).

Nordhaus's multiplier of 25). This is a hugely important figure in a \$17.5 trillion economy.⁴⁷ And, as detailed later in this paper, growth in this annual \$80 billion aggregate figure of patent licensing will yield a proportionately larger contribution to overall annual GDP.

3. Patents Are Cumulative

While it may be tempting to focus on the contribution of single breakthrough patents, it is not just these “home runs” that generate (private and social) value. Patents that could more appropriately be analogized to singles, doubles or even sacrifice flies also have the potential to produce social value. As knowledge advances and as technology becomes more complex, multiple innovations (and often patents) must be combined (and licensed) to generate major breakthroughs. For example, the iPhone is comprised of thousands of individually patented parts and processes. As Corinne Langinier of the University of Alberta notes, much present-day innovation takes place using past (often minor) discoveries as building blocks:

In some areas of research (e.g., biotechnology), follow-up innovations may be built on several basic innovations, and might not be developed without them. Inventions such as methods to isolate and locate gene sequences have no value by themselves, but they permit the development of subsequent valuable applications. Furthermore, basic innovations and applications are usually developed by different companies.⁴⁸

New innovations and patents, even if they are not “home runs” by themselves, are the knowledge-equivalent of building roads and infrastructure for use in expediting future breakthroughs.

47. See *World's largest economies*, CNN MONEY (2014), available at: http://money.cnn.com/news/economy/world_economies_gdp/ (last accessed August 13, 2014).

48. See Corinne Langinier, *Patent Pool Formation and the Scope of Patents*, 49 ECONOMIC INQUIRY 1070-1082 (2011).

III. THE U.S. PATENT SYSTEM IS PERFORMING SUB-OPTIMALLY

Despite the significant private and social benefits accruing from patent-based innovation, at present the U.S. patent system is only generating a fraction of its potential value. The mainstream patent debate has focused on whether and to what extent NPPOs are deterring useful commercialization while imposing largely needless litigation costs on inventors and society. Almost no focus has been directed at an equal, if not greater problem—the excessively high transactions costs for licensing inventions (of which the fear of litigation initiated by NPPOs is only a part). For a variety of reasons discussed below, the current patent ecosystem actually *discourages* patent holders and potential licensees from transacting in the marketplace, resulting in the remarkable outcome that over 95 percent of currently existing patents are unlicensed (and fail to generate royalties). These “dead” patents represent a huge potential loss for private entities and society, not solely in terms of unrealized revenue, but also in wasted learning for entrepreneurs and established businesses. Furthermore, to the extent that high transactions costs and risks of patent licensing are deterring innovators from even filing patents in the first place, or in the case of many businesses choosing to keep their innovations as trade secrets rather than public knowledge via patent disclosures, society loses from the failure to disseminate new knowledge that could be used by others to develop other innovations.

A. The Vast Majority of Existing U.S. Patents Go Unlicensed

Data indicates that unused patents represent a significant share of existing patents and a non-trivial share of research and development spending in the U.S. in recent decades. An estimated 95 percent of patented U.S. inventions fail to be licensed or commercialized,

and 97 percent generate no royalties.⁴⁹ These unlicensed patents include many patented inventions developed by American universities. While many unlicensed patents have no commercial value, there are surely many that do, but have not made it into the marketplace because of the costs and risks. According to estimates by Forrester, a market researcher, by failing to extract the full value of unused but commercially valuable patents and other IP, U.S. firms waste \$1 trillion annually.⁵⁰

Estimates from academic economists support the assertion that the present patent ecosystem is performing well below optimal levels. A 2005 study by Carlos J. Serrano found that between 1983 and 2001, only 18 percent of patents issued to small inventors were ever traded.⁵¹ These data have led researchers to conclude that small inventors and established firms are sitting on “Rembrandts in the Attic”⁵²—that is, dormant technologies that could be integrated into society’s wider knowledge base. Below, we provide our own estimated range of potential future social benefits that could be realized by market solutions to the patent-license scaling problem.

B. Non-Practicing Patent Owners and the Phenomenon of “Litigation or Bust”

The current patent debate puts much of blame for the failures of the current patent regime at the feet of NPPOs.⁵³ While some NPPOs might be acting opportunistically, this

49. See Vermont (2002) at 332 (“[A]t any given time, over about 95 percent of patents are unlicensed and over about 97 percent of patents are generating no royalties.”). See also Mark Lemley & Carl Shapiro, *Probabilistic Patents*, 19 J. ECON. PERSP. 75-98 (Spring 2005).

50. See IBM presentation, “An Overview of the Critical Importance of IP and IP Analysis,” based on research by Navi Radjou of Forrester Research, at slide 2, *available at*: http://www.tiec.gov.eg/backend/Presentation%20Files/01122010_IPCD_IBM%20Presentation%20Excerpt.pdf (last accessed October 15, 2014).

51. See JAMES BESSEN & MICHAEL L. MEURER, *PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK*, (Princeton Univ. Press 2008), at 180 (citing Carlos J. Serrano, *The Market for Intellectual Property: Evidence from the Transfer of Patents*, (2005)).

52. See BESSEN & MEURER, 180.

53. See, e.g., Timothy B. Lee, *Everything you need to know about patents: What’s a patent troll?*, Vox (2014), *available at*: <http://www.vox.com/cards/patent-reform/whats-a-patent-troll> (last accessed October

blanket critique fails to distinguish between the validity of the *business model* of owning patents until they can be commercialized in some fashion at a later date and *abuses* by certain NPPOs that engage in excessive litigation, driving up the costs and risks of enforcing all patents.

A benefit of the U.S. patent system is that it does not require inventors and thus patent owners to “practice” or “work” their inventions.⁵⁴ Many inventors do not have the capital, business experience, relationships and access to markets immediately, or sometimes ever, to commercialize their inventions, and thus licensing is the only way they can profit from them. This business choice and circumstance should not be tarred with the abuses of some NPPOs that use their patent portfolios as a kind of legalized blackmail to collect fees from firms that would rather settle than litigate.

Excessive litigation by NPPOs clearly can harm innovation both directly and indirectly. The direct harms to innovation come in the form of the costs incurred by litigating patent disputes and the loss of wealth associated with the uncertainty such suits generate (some estimates put these costs in the tens of billions of dollars per year).⁵⁵ In

15, 2014) (“A patent troll, more formally known as a “non-practicing entity,” is a company that makes no useful products of its own but makes money by threatening lawsuits against other companies. Some trolls are startups who turn to patent litigation as a business strategy after their products fail. Others are companies that buy patents from third parties with the explicit goal of making money by threatening patent lawsuits.”). It is important to recognize, however, that not all NPPOs are so-called “patent trolls.” Some NPPOs seek to make markets for patent licensing by acquiring patents and attempting to license them.

54. See B. Zorina Khan, *Trolls and Other Patent Inventions: Economic History and the Patent Controversy in the Twenty First Century*, GEORGE MASON L. REV. (forthcoming, 2014), available at: [file:///C:/Users/Owner/Downloads/Khan-Zorina-Trolls-and-Other-Patent-Inventions%20\(1\).pdf](file:///C:/Users/Owner/Downloads/Khan-Zorina-Trolls-and-Other-Patent-Inventions%20(1).pdf) (last accessed at September 15, 2014).

55. See James Bessen & Michael L. Meurer, *The Direct Costs from NPE Disputes*, 99 Cornell L.R. (forthcoming 2014), at 387 (“Using a survey of defendants and a database of litigation, this paper estimates the direct costs to defendants arising from NPE patent assertions. We estimate that firms accrued \$29 billion of direct costs in 2011. Although large firms accrued over half of direct costs, most of the defendants were small or medium-sized firms.”). See James Bessen, Jennifer Ford, & Michael L. Meurer, *The Private and Social Costs of Patent Trolls*, 34 REGULATION 31, 26-35 (2011) (“Aggregating over the sample (column 6) shows that NPE lawsuits from 1990 through October 2010 are responsible for over half a trillion dollars in lost wealth

their 2008 book *Patent Failure*, economists James Bessen and Michael J. Meurer engaged in an in-depth study of the costs to U.S. firms of patent litigation and concluded that:

By the late 1990s the risk of patent litigation for public firms outside of the chemical and pharmaceutical industries exceeded the profits derived from patents. This means that patents likely provided a net *disincentive* for innovation for the firms who fund the lion's share of industrial R&D; that is, patents tax R&D.⁵⁶

In a separate study, Bessen and Meurer (along with Jennifer Ford) reported that the incidence of lawsuits initiated by NPPOs in the United States increased five-fold between 2004 and 2010, totaling 2,600 in 2010.⁵⁷ According to their estimates, the probability that a given patent will be involved in at least one lawsuit within four years of its issue date increased by 100 percent between 1984 and 2000.⁵⁸

The studies of NPPO-driven litigation so far, however, do not generally distinguish between suits that have merit and those that do not. Nonetheless, it should be clear that *unwarranted* patent litigation provides obvious disincentives for innovation and investment in patent-related R&D. Few patent owners can afford to litigate patent disputes. Even those who can afford initial litigation face the prospect of losing in a trial court, and may have to spend even more to prevail on appeal, a result that also is not guaranteed. *These costs and risks prevent many potentially valuable patents ever from being licensed and thus used.*

Knowing this to be the case can even deter creators of new knowledge from filing patents in the first place, preferring to privately retain that knowledge as a trade secret (and taking appropriate physical and legal precautions to ensure that secrets remain that

(in 2010 dollars). From 2007 through October 2010, the losses average over \$83 billion per year in 2010 dollars, which equals over a quarter of U.S. industrial R&D spending per annum.”).

56. See BESSEN & MEURER (2008) at 144 (emphasis in original).

57. See Bessen, Ford, & Meurer (2011) at 26.

58. See BESSEN & MEURER (2008) at 129.

way—think of the “coke” formula held by Coca-Cola, which has remained a trade secret for over a century). Yet for society as a whole, trade secrets are a poor substitute for patents because the knowledge embodied in secrets cannot be used by others to develop *their* innovations. If all new knowledge were bottled up as trade secrets, then scientists and entrepreneurs would not be “standing on the shoulders of giants” before them, but instead would have to reinvent the wheel, which is wasteful and time-consuming. An economy in which it is excessively costly or risky to patent, in other words, can make patenting a “dumb choice.” Even though patent applications have increased in recent years, the United States may be *under-patenting* because of the high costs and risks associated with enforcing patents, whether against legitimate or excessively litigious third parties.

An equal, if not potentially greater, problem grows out of the disincentives for individuals and firms to *read* existing patents for fear of providing grounds for willful infringement: Penalties for willful infringement are greater than those for accidental or unknowing infringement. An optimal patent regime should encourage the sharing of knowledge and the exchange of innovative platforms, not discourage them. The disincentives to innovators to examine and incorporate existing patent-related knowledge into future projects represents a potentially huge loss in learning for society and the economy.

C. Other Disincentives to Licensing

While excessively litigious NPPOs play a role in the ineffectiveness of the existing patent ecosystem, there are other barriers to the licensing and commercial use of patents. For one thing, the claims that are the essential features of patents are typically written in dense legalese that can be hard for even some technically trained people to understand, let

alone for many business people or entrepreneurs.⁵⁹ This complexity means that the property rights embodied in patents are not well defined, resulting in disagreements—often played out in court—between patent owners and potential users (licensees).

A further problem confronting patent holders is that because the boundaries of a patent are not clearly defined until a judge definitively rules on what they are, users cannot really know whether or not they are violating a patent, which creates an incentive not to pay patent owners what they are rightfully due.⁶⁰

Moreover, as discussed above, data on patent licensing is often unreliable and hard to find. The unavailability of data is due in part to the fact that many licensing deals between firms are not made public. That many of the licensing deals that do actually take place occur behind a veil means that there is little true “price discovery” in the patent licensing market. Absent price discovery, it can be difficult for would-be licensors to discern the value of their patents (would-be licensees have similar trouble determining what to pay for potential licenses).

For all these reasons, the *patent market* is undeveloped. Because patents are difficult to interpret, patent boundaries are often opaque, and price discovery is difficult, a lawsuit is often the only way to value a patent, or determine the extent of a patent’s rightful claims. Given the high transactions costs associated with licensing patents (in combination with the threat of litigation from NPPOs), it is easy to understand why the vast majority of existing patents fail to be licensed by potential users.

59. *Id.*, 56-57.

60. *Id.*, 8-11.

D. The Need to “Unlock” the Patent System Could Not Be Greater

The gridlock currently afflicting the U.S. patent ecosystem is imposing large and unnecessary costs on the economy, while depriving society at large of potential advances built on the backs of accumulated knowledge and inventions.

In addition to foregone revenues, the high transactions costs associated with patent licensing harm the economy in other ways. In addition to the litigation costs incurred in prosecuting and defending lawsuits, some firms presently spend billions of dollars to acquire patent portfolios for “defensive” reasons—essentially as a means of insurance against potential infringement. For example, in 2011 Google spent \$12.5 billion to acquire Motorola Mobility.⁶¹ It then agreed to sell Motorola Mobility to Lenovo, but retained rights to many of Motorola’s patents.⁶²

Moreover, while firms and small inventors continue to innovate and accelerate the pace of technological progress, absent licensing, too many potentially important products will fail to become commercialized. U.S. firms across a gamut of industries face mounting competition in the global marketplace, and domestic enterprises (startups and existing entities) cannot afford to be hamstrung by a lack of efficient access to patents. The United States simply cannot expect to remain an innovation pioneer unless it does a better job of deploying innovation and other forms of intangible assets.

If the transactions costs of licensing patents were lowered, a large fraction of currently “dead” patents could come alive, singly or in combination. Or put differently, the patent system at present has only a few “highways,” while the vast proportion of the

61. See Matthew Panzarino, *Google Keeps “Vast Majority” Of Motorola Mobility Patents In Sale to Lenovo*, TECHCRUNCH (Jan. 29, 2014), available at: <http://techcrunch.com/2014/01/29/google-keeps-vast-majority-of-motorola-mobility-patents-in-sale-to-lenovo/> (last accessed August 7, 2014).

62. *Id.*

“cars”—a good portion of the 95 percent of currently issued patents that are unlicensed—are still stuck in garages.

IV. BEYOND THE LEGAL ARENA: ACHIEVING SCALE IN INNOVATION

Most of the problems with the current patent system reviewed above have been widely recognized. It is commonly assumed that the solutions must be legal in nature, through yet more changes in patent law (legislative or judicial) or patent administration by the USPTO. We briefly review below some of the more widely discussed legal system reform proposals.

But no legal changes in the patent system can alter the fundamental economic fact that *the U.S. patent system does not scale*. With 316 million people, the United States has many inventors, working on their own or for existing firms. The USPTO can ultimately process and grant a mounting number of patents on these inventions each year—almost 300,000 in 2013 alone⁶³—but it and no other governmental body controls the *licensing* or *use* of patents and the knowledge they embody. The commercial diffusion of patents and their knowledge depends on the marketplace; more specifically, whether the private benefits they promise for those undertaking commercialization (which as we have already discussed pale in comparison to their broader social impacts) exceed the costs and risks of bringing innovations to market (or as economists prefer to say, the *transactions costs* of doing so).

There are three critical questions for any patent system reform proposal, public or private: (1) Is it likely to promote inventions?; (2) Is it likely to reduce the transactions costs of commercializing new or existing knowledge, which is often but not necessarily

63. See Figure 1, *infra*.

patented?; and (3) If answers to the first two questions are affirmative, then how large is the positive social impact likely to be? With these questions in mind, we review some of the more recent ideas for enhancing the effectiveness of the U.S patent system.

A. Legislative Reform Proposals

Over the past several decades, Congress has been a battleground for “patent reform,” where very different and often conflicting proposals for “fixing” the patent system have been debated. In each case, advocates claim that their proposals will promote innovation, the central purpose of patents after all. Because of the highly contentious nature of these issues, however, it is difficult to gain consensus in Congress for any meaningful patent reform, the last being the American Invents Act of 2011.

Even when rare reforms are adopted, measuring their efficacy is frustrated by two problems common to any patent legislation. Given the time lags involved, it is likely to take decades before researchers can disentangle all of the possible impacts on future innovation to isolate the impact of any specific piece of legislation, and this assumes researchers and policy makers actually will reach consensus. In addition, any legislation in this technical area, perhaps more than most, is likely to have unintended consequences. Two future legislative reform ideas, in different stages of discussion, are likely to suffer from the same problems.

The first idea—ending the exclusive jurisdiction of the U.S. Court of Appeals for the Federal Circuit—is not yet ripe, but may eventually gather steam in the wake of several rejections by the Supreme Court of recent decisions by the specialized patent appellate court, which Congress created in 1982 to hear all patent appellate challenges. Prior to that time, all federal appeals in cases involving patents were decided by the twelve appellate

courts. In creating this special court, Congress hoped it would develop and ensure a level of expertise in often very technical patent issues, thereby bringing more clarity and consistency to patent law across all the circuits.

This actually happened, but at a price. To some, the Supreme Court's reversals imply that the Federal Circuit appellate court has been too accommodating of patent rights, especially for software and so-called "business methods" patents.⁶⁴ In addition, despite the concentration of appellate authority in a single court, the specialized court has ten judges, not all of whom always agree with each other. The result, again in the software area in particular, has not been the model of clarity that the Congressional architects of the Federal Circuit court had in mind.

For all these reasons, a number of critics of the exclusive jurisdiction of the Federal Circuit court have suggested that Congress ought to reverse itself and either abolish the court or at least give it concurrent jurisdiction over patent disputes along with the regular appellate courts.⁶⁵ At this point nothing like this is being considered seriously in the Congress, but the idea is a sleeper issue that could gain support over time.

If and when that happens, can anyone say with confidence what the impact will be on the pace of innovation? For that matter, can anyone say with confidence what impact the specialized court so far has had on *innovation*? We can reasonably conclude that the creation of the court has probably increased the number of patents approved, but it is not clear that *innovation* has increased on net. Whatever the effects may be, they may and

64. See Julie Samuels, *Patent Trolls are Mortally Wounded*, FUTURE TENSE, June 20, 2014, available at: http://www.slate.com/articles/technology/future_tense/2014/06/alice_v_cls_bank_supreme_court_gets_software_patent_ruling_right.html (last accessed September 10, 2014).

65. Among the most prominent critiques is that of Judge Diane Wood, Chief Judge of the U.S. Court of Appeals, 7th Circuit; see <http://www.ipo.org/wp-content/uploads/2013/10/Wood-Keynote-Address.pdf> (last accessed October 15, 2014).

probably do vary by industry.⁶⁶ In short, it is impossible to really know whether keeping or changing the current system for hearing patent appeals will provide desirable answers to any of the questions posed at the outset of this section.

The same can be said of the second patent reform initiative, which is much further along than the first, which is designed to reduce the number of patent infringement suits, primarily those launched by NPPOs. A version of this legislation, H.R. 3309, overwhelmingly passed the House in December 2013 (one of the few bills to have received such broad across-the-aisle support this Congress), and is supported by the Obama Administration. At this writing, the bill is stalled in the Senate and most likely will die this year unless revived during a post-election lame-duck session of Congress.

That the number of infringement suits brought by NPPOs has increased sharply is beyond dispute, up from several hundred a year in the middle of the last decade, to more than 2,200 or even 2,900 in 2012, depending on how they are counted.⁶⁷ Total patent infringement suits in 2012 neared 5,000, although some of the increase in the numbers has been due to the requirement in the America Invents Act that suits against multiple parties be filed separately against individual defendants.⁶⁸ In recent months, a significant drop in

66. One recent study found that patents blocked innovation in computer, electronics, and medical devices, but not in pharmaceuticals, chemicals, and mechanical devices—more or less the traditional industry dividing line between those not needing strong protection and those that do. See Alberto Galasso & Mark Schankerman, *Patents and Cumulative Innovation: Causal Evidence from the Courts*, Centre for Economic Performance Discussion Paper No. 1205 (2014), available at <http://cep.lse.ac.uk/pubs/download/dp1205.pdf> (last accessed September 10, 2014).

67. The differences in the count stem from differences in definitions. See Ashby Jones, *Tech Firms Back Obama Patent Move*, WALL STREET J., June 4, 2013, (citing data compiled by LotNet, at www.lotnet.com and by RPX), available at <http://online.wsj.com/news/articles/SB10001424127887323469804578525103995026598?mg=reno64-wsj> (last accessed September 10, 2014).

68. 35 U.S.C. Chapter 25 §299(b) (as amended by the Leahy-Smith America Invents Act) (“For purposes of this subsection, accused infringers may not be joined in one action as defendants or counterclaim defendants, or have their actions consolidated for trial, based solely on allegations that they each have infringed the patent or patents in suit.”).

the number of patent lawsuits has occurred, according to the legal analytics company, Lex Machina.⁶⁹ Whether this becomes a sustained trend remains to be seen.

All of this aside, the House legislation aims to bring lawsuit numbers down by, among other things, (1) requiring losing parties in these cases to pay the winners' attorneys' fees (a practice followed in other countries, but not in all patent cases), (2) more specific pleading requirements in patent lawsuits, and (3) delaying expensive discovery until certain threshold legal issues have been decided. While many in the tech community and Main Street businesses support the bill as a way to reduce what they believe are too many frivolous infringement actions, the pharmaceutical industry, the medical device industry, universities, and the trade association representing venture capital firms (the National Venture Capital Association) all oppose the bill.⁷⁰

Opponents have claimed that its provisions are crafted too broadly and would apply more generally to all patent owners seeking to enforce their patents, thereby discouraging innovation more broadly. In theory, the bill's provisions could be limited to NPPOs filing meritless claims, or "bad behavior," but any attempt to define an excessively litigious NPPO would invite extensive litigation over its meaning case-by-case, thereby raising the risk of hurting the legitimate business practice of holding a patent for its license revenue rather than directly putting it to use in some process or product.

Even if some version of the House-passed patent infringement legislation is enacted and it accomplishes its objective—which is to reduce unwarranted infringement suits,

69. Lex Machina, *September 2014 New Patent Case Filings Down 40% From September 2013*, available at: <https://lexmachina.com/2014/10/september-2014-new-patent-case-filings-40-september-2013/> (last accessed October 14, 2014).

70. For a summary of the opposition, see <http://democrats.judiciary.house.gov/sites/democrats.judiciary.house.gov/files/documents/Conyers-WattConcerns131202.pdf>. (last accessed September 10, 2014).

primarily by litigious NPPOs filing meritless lawsuits for intimidation or legalized blackmail—the net impact on innovation of the bill will not be clear for some time.

In the end, while the legislative debate over patent reform surely will continue, and while it correctly will focus, at least in part, on reducing the transactions costs associated with patent litigation, it also likely will have winners and losers, so that *a priori* it will be difficult to determine its net impact on innovation and its diffusion. More broadly, legislative reforms, if adopted, will continue to tinker with the *legal system* through which patents are licensed and enforced, but will not address a fundamental flaw in that system which this paper has identified—namely, its inability to “scale” beyond the small portion of overall patents, the so-called “home runs,” owned by large companies with resources to participate in that system. We discuss below how market-based innovations may help solve that problem, which we believe to be the *central* problem confronting the patent system today. Before doing so, we quickly review the proposals to reform the USPTO.

B. Potential USPTO Reforms

The USPTO faces a very different problem from companies, large and small, that are worried about the threat of patent-infringement suits; how to handle the explosive rise in patent applications with limited resources. One recent study finds that because of the pressure to act promptly, patent examiners are granting patents with insufficient study of prior art, resulting in too many “bad patents” that do not embody novel innovation. This problem, in turn, may be fueling demand letters and potentially more lawsuits by NPPOs.⁷¹

71. See Michael D. Frakes & Melissa F. Wasserman, *Is the Time Allocated to Review Patent Applications Inducing Examiners to Grant Invalid Patents?: Evidence from Micro-Level Application Data*, National Bureau of Economic Research, Working Paper No. 20337 (2014), available at <http://www.nber.org/papers/w20337> (last accessed September 10, 2014).

Whether or not the latter claim is true, complaints about processing times on patent applications at the USPTO have been longstanding. A variety of solutions have been proposed or implemented, including: allowing the Patent Office to retain its “profits” (revenues minus expenses) to invest in its own activities rather than returning these funds to the general government accounts; the recently enacted switch to a “first-to-file” system as part of the America Invents Act of 2011 (which at least eliminates the need for patent examiners to determine whether applicants were “first to invent,” the previous standard); and various administrative actions that the current Administration has taken on its own.⁷²

Even if the USPTO is able to process more efficiently, quickly, and correctly the mounting number of patent applications, these improvements will not change the fundamental problem that will continue to plague the vast majority of patent holders; that the legally-based patent system does not scale, given the high transactions costs and risks confronting the vast majority of patent holders.

C. Market Solutions

The sub-optimal performance of the U.S. patent system has not gone unnoticed by the private sector. Various new for-profit initiatives are in their early stages, addressing different aspects of the system. Rather than catalogue and evaluate all of them here, we focus on several to illustrate the kinds of initiatives and firms that have been launched, and the types of problems each is attempting to solve.

There are two things the various solutions share in common. *First*, in different ways, the solutions aggregate packages of patents, and offer participants licenses to the entire

72. See American Bar Association, *USPTO deputy director speaks on patent reform at ABA IP law conference*, (April 2014), available at: http://www.americanbar.org/news/abanews/aba-news-archives/2014/04/uspto_deputy_directo.html (last accessed August 28, 2014).

package, not to just a single or even a small number of patents. *Second*, each of the solutions benefit from “network effects,” or the notion that a service is more valuable to each member the more members participate or belong (think of telephone service, or applications and operating system software). As is the case for many two-sided platforms with network effects, one side (licensees) benefits by more participants on the other side (licensors), and vice versa.

It bears noting that *the solutions are not necessarily mutually exclusive*. Firms worried about exposure to infringement suits may find it in their interest to buy protection or to participate as members in one or more of the “defensive” networks, while at the same time, subscribing to other services designed to maximize revenue from their patent portfolios. Both types of services fill different niches.

We distinguish below between two broad classes of market solutions, which address different market segments and thus intend to provide very different sorts of benefits. One class includes business models primarily aimed at large companies wanting financial protection from NPPOs and possibly other plaintiffs. The other solution, while offering an insurance feature for patent owners, has as its principal objective the significant expansion of the licensing and commercial use of many valuable patents held by individuals, small to medium-sized firms, and universities that are not currently licensed. This is because the law-centered patent system does not effectively scale and discourages the commercial use of patents (although the package license and insurance features of this second solution also should appeal to many larger companies as well).

1. Large Company Solutions

The solutions in this category are “defensive” in nature, designed to protect companies, principally large companies, from lawsuits by NPPOs or other parties.

For example, the License on Transfer Network (LOTNET) is a consortium of technology companies that obtain licenses to any patents owned by these companies that may also be transferred to those outside the consortium, including NPPOs.⁷³ By receiving a license upon transfer to any party outside the LOTNET network (or upon the sale of a LOTNET member to an NPPO or a decision by a member to become an NPPO), members belonging to LOTNET are protected against infringement suits from those parties. According to the organization’s website (www.lotnet.com), the LOT network had 300,000 patent assets covered by its arrangement as of July 2014, at the time of the organization’s launch. In effect, LOTNET members have joined together to protect themselves *from one another* should any one of them sell its patents to a third party. The business model is also clearly defensive in nature, is analogous to a “poison pill” from the corporate governance arena, and is a kind of insurance aimed at reducing the risk of any company doing business with an abusive third party in the first place (like reducing the incidence of an insurance claim), or reducing the financial risks arising from such licensing activity should it occur.

RPX is another market solution aimed at a similar market as LOTNET (primarily large companies wanting protection from infringement lawsuits).⁷⁴ Yet RPX’s business model is different: It buys patents the companies believe to be “high-risk”—those

73. There are two exceptions to the automatic licensing provisions of the network; if a patent is transferred by one LOTNET member to another member, or if the transfer is part of a “legitimate M&A or spin-out activity.” In addition, a license granted to a network member is subject to “defensive termination” if a LOTNET member licensee files “offensive” litigation against the transferee.

74. See <http://www.rpxcorp.com/> (last accessed September 8, 2014).

potentially subject to an NPP0 infringement suit—and then licenses those patents to its subscribers.

A niche version of the RPX solution is the Open Invention Network, which owns hundreds of software patents and licenses them for free to companies promising never to assert their patents against Linux technology in particular.⁷⁵

2. Patent Licensing for the Masses

The U.S. Patent Utility (“Patent Utility”) has developed a very different patent-related business model from the others described above, which are largely defensive in nature and designed primarily to insulate firms from the risks of unwarranted patent litigation. Its primary objective is to expand significantly the number of patents that are licensed and thus commercially used, which goes to the heart of why countries have a patent system in the first place. The company intends to accomplish its objectives by offering an entirely novel packaged patent license, one that benefits patent holders and licensees, and would-be inventors as well. These services help empower all firms with intellectual property to have a sound patent strategy, as they must if they are to maximize their profits.

The Patent Utility will work as follows: Subscribers who want patent licenses, either for defensive reasons or because they want to commercialize or learn from the inventions for which the patents were granted, can obtain from the Patent Utility non-exclusive licenses to a customized package of patents that are most relevant to the subscriber’s business or own patent-licensing activities (such as universities).

75. For a description of OIN and other emerging market solutions in the patent area, see Marta Belcher & John Casey, *Hacking the Patent System: A Guide to Alternative Licensing for Innovators*, Juelsgaard Intellectual Property & Innovation Clinic, Stanford Law School (2014), available at <http://engine.is/wp-content/uploads/Alternative-Patent-Licensing-Paper.pdf> (last accessed September 10, 2014).

The key to scaling the assembly of these customized patent packages is the Patent Utility's reliance on a statistical analysis, rather than through labor and time-intensive human study, *of the two million-plus patents granted* to determine those most likely to be relevant to (and thus the highest potential to be infringed by) the subscriber's products, services or method of production for which patent licensing is desired.

Both licensees and patent holders, small and large, should benefit from the Patent Utility's subscriptions for patent packages, participation in which is entirely voluntary for both parties (and also not mutually exclusive). Licensees benefit, as they could not before, from being able to commercially use previously unlicensed patents and from the financial protection they gain against infringement lawsuits. In addition, this model should help subscribers improve their risk management with regular risk checkups, while strengthening their competitive positions through competitive reports and access to useful third-party R&D. Although small to medium-sized patent holders, as well as universities, are likely to be the main patent beneficiaries—as these are the owners for whom the costs and risks of the current patent system loom most important—even larger companies may earn additional revenues on some of their patents that are not currently being licensed or used to any significant degree.

The U.S. Patent Utility turns on the notion of *probability* rather than *certainty* of a user's relevance to existing patents and hence potential infringement, and uses this insight to benefit both licensees and patent holders alike. In effect, the U.S. Patent Utility should do for small to mid-size companies what ASCAP and BMI have been doing for song writers and recording artists for decades—efficiently pooling funds received for the playing of songs on

the radio and television and distributing the proceeds to the individuals who deserve the credit.

Finally, would-be inventors and society as a whole benefit from the additional knowledge that subscribers gain from now being able to study other patents they would not otherwise dare to browse for fear of adding to their liability in any possible future patent-infringement lawsuit. This is especially true to the extent that the model of statistical relevance induces more inventors to use patents as their preferred form of IP protection, which automatically entails disclosure, rather than trade secret law, which does not. Thus, in a very real sense, this model has the potential to contribute to the dissemination of on-the-shelf knowledge, which in new hands, may yield additional inventions, and thus added benefits for the economy as a whole. How significant those social benefits can be if licensing increases marginally is highlighted in our next section.

V. ESTIMATED IMPACT OF INCREASED PATENT LICENSING

While there are clear benefits to patent owners and users from market-based innovations designed to vastly increase patent licensing, what about gains to the economy and society as a whole?

Earlier we discussed the Nordhaus multiplier for social to private gains from inventions of 25:1. We assume that ratio applies most directly to the most valuable patents, or using our baseball analogy, to the “home runs.” To be conservative, we assume here that the *additional* patents licensed by market solutions such as the U.S Patent Utility and other models will be the equivalents of singles and doubles, and thus on average have a somewhat lower social-gains-to-private-gains ratio. Our numerical assumption is 12:1, or a

little less than half the Nordhaus ratio. We underscore this is a conservative approach because cumulatively the body of singles and doubles may have social-to-private ratios very similar to the home runs: One never knows at the outset which innovations today spark the inventors of tomorrow to build on existing insights to generate other innovations. But out of caution, we take the conservative approach, which very likely understates the net social benefits of the incremental patent licenses induced by models like the Patent Utility, and assume that home-run patents probably generate the larger ratio of social-to-private gains.

The problem is that without some significant experience with these new market models—the Patent Utility approach in particular—it is impossible to know with any precision how *many* singles and doubles would be unleashed by an improved, market-based institutional environment. All we know is that a high transaction cost (\$2 to 4 million per litigation) and risk threshold exists that clearly holds back some of the 95 percent of unlicensed patented innovations from being licensed and thus commercialized.

For illustrative purposes only, we estimate here the broader social benefits to the United States that would accrue *if* patent licensing were increased, say, by 20 to 40 percent. We further assume the average revenue from these additional patent licenses would only be half the average of those already under license, implying that licensing revenue would rise by 10 to 20 percent in our illustration.

Given our midpoint estimate for annual U.S. patent licensing revenue of \$80 billion, this means that a 10 to 20 percent increase in patent licensing *revenue* (from a 20 to 40 percent increase in patent licensing) would translate into \$8 to \$16 billion of additional *privately earned* patent license revenue, annually. With the 12:1 multiplier, this estimate

implies annual social gains for the U.S. economy from the illustrative additional licensing of somewhere between \$100 billion and \$200 billion.

If individual patent business models or some combination of the new market solutions generate a positive disruptive change, not only in licensing of existing patents, but also in encouraging more innovations, some of which are patented, then our conservative range of additional social benefits could considerably understate the true social impact of market-based patent licensing solutions. But in using highly conservative economic assumptions across-the-board, as this study does, even modest increases in patent licensing are shown to have economic impacts of a worthy dimension.

In addition, because most of the incremental license income resulting from greater licensing in particular would benefit small to medium-sized companies, this “democratic” approach to patent licensing is likely to have a favorable distributional consequence in addition to enhancing overall growth. Not only will business owners enjoy additional income, but their increased financial strength will improve their ability to retain or hire workers, or pay higher wages, or both.

This benefit is especially important in light of recently documented trends in falling startup rates (ratios of young firms to total firms), declining shares of even moderately aged firms (those 1-15 years old), and declining success rates for new firms.⁷⁶ Some of these firms surely have patents that are not being commercially used to their fullest. If this were possible, younger firms with more disruptive business models that could potentially

76. See Ian Hathaway & Robert E. Litan, “America’s Firms are Getting Old and Fat, and Why That’s a Problem,” The Brookings Institution, July 31, 2014, *available at*: <http://www.brookings.edu/blogs/brookings-now/posts/2014/07/american-businesses-are-getting-old-and-fat> (last accessed September 3, 2014).

increase the economy's rate of productivity growth would have better chances at surviving and competing with their more established competitors.

Finally, any business model that enables more inventors to license their patents should significantly improve transparency of the value of these patents. Currently, because of the high costs and risks of litigation, the hundreds of thousands of currently unlicensed patents that may and almost certainly do have a positive *gross* value, if licensed, cannot now fetch any price in the marketplace. Enabling these "dead" patents to come "alive" will put a positive price on these patents because each will have licensing income, and the amounts received will be transparent. Greater transparency for these patents, in turn, may also spill over and improve transparency for the "home run" patents that are now under license or being used by larger companies, since some of these patents may be part of the core patent portfolios assembled by the Patent Utility and any other companies like it.

VI. CONCLUSION

Innovation is key to economic growth, and patents in turn are crucial for innovation. The current U.S. patent system is flawed, however, precisely because of its legalized nature, which imposes high transactions costs and risks on all patent owners, whether or not the value of their patents are worth a legal fight. Market solutions can solve this problem for patent owners who cannot afford the legal system but still have economic value in their property, while also generating potentially large gains to society as a whole. Perhaps most important, these benefits can be realized *without any change in current law*.

