# Patent Pacifism

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## Abstract

*Over the last decade, much of the patent law literature has focused on the problem of "patent trolls," or patent owners who don't make products, but sue others that do. The basic complaint against these types of entities is that they impose a tax on innovation without providing offsetting societal benefits. Furthermore, their patent assertions have been on the rise, with a significant percentage of patent suits now attributable to them. In short, the troll phenomenon suggests a problem of excessive patent assertions.*

*But despite the importance of the troll phenomenon, the fact remains that most patents are never asserted, or are asserted less than they could be. Under-assertion of patents thus appears to be more prevalent than over-assertion. Yet, beyond noting a set of generic economic considerations that may lead to this outcome, the literature fails to provide systematic, industry-specific assessments of why patent owners choose to forego asserting their rights in so many cases. And the generic nature of these assessments is particularly problematic given that patents play significantly different roles from one industry to the next, as scholars have noted for some time.*

*This Article addresses these issues by providing an industry-specific, informal model for theorizing why patent owners forego asserting their rights in so many cases (and why they may not in others). It briefly applies this model to four industries: software, pharmaceuticals, biotechnology, and semiconductors. The Article then explores some potential implications of this industry-specific model. In particular, this Article suggests that high barriers to patent assertion in an industry may, ironically, result in increased patent trolling in the industry. Hence, this Article provides guidance to policymakers by helping explain the rise of patent assertions in some industries, such as software, as well as helping to identify other industries, such as biotechnology, that may be increasingly at risk of patent trolling.*

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## Introduction

On July 6, 2010, the United States Patent and Trademark Office ("USPTO") granted Amazon.com, Inc. a patent that, according to multiple sources, appeared to cover Barnes & Noble's Nook e-Reader, Amazon's primary competition in the e-Reader market at the time.[1] If the patent did cover the Nook, it would provide Amazon with

[1] Devin Coldewey, *Amazon's Original Kindle Patent Could Spell Trouble for Competitors*, TechCrunch (July 6, 2010), http://techcrunch.com/2010/07/06/amazons-original-kindle-patent-could-spell-trouble-for-competitors/; Ryan Fleming, *Amazon Wins e-Reader Patent, How Will This Affect the Nook*, Digital Trends (July 7, 2010, 3:04 PM), http://www.digitaltrends.com/cool-tech/amazon-wins-e-reader-patent-how-will-this-affect-the-nook/; Nilay Patel, *Amazon*

significant remedies against Barnes & Noble, including potential injunctive relief, monetary damages, and attorney's fees.[2] All Amazon had to do was assert the patent against Barnes & Noble to find out. Yet Amazon never did formally assert its patent against Barnes & Noble.[3] Given the possible benefits of doing so, the question looms large: why not?

This question becomes even more interesting in context. Over the past decade, scholars have devoted most of their attention to the opposite issue: *excessive* assertion of patent rights. For instance, the "non-practicing entity," "patent-assertion entity," or "patent troll" problem—where patent owners neither make nor provide goods and services to the public, instead asserting patents against others that do—has resulted in a voluminous literature.[4] The basic complaint against patent trolls is that they abuse patent rights for their own monetary benefit, while providing no commensurate benefit to society.[5] This trolling problem has become such a concern that it has attracted the attention of the President of the United States,[6] Congress,[7] the

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*Kindle Dual-Screen e-Reader Patent Granted, Barnes & Noble Nook Potentially in Trouble*, ENGADGET (July 6, 2010), http://www.engadget.com/2010/07/06/amazon-kindle-dual-screen-e-reader-patent-granted-barnes-and-nobl/.

2 *See* 35 U.S.C. §§ 283–285 (2012) (laying out the remedies available for infringement of a patent, including injunctive relief, money damages, and attorney's fees).

3 It remains possible that the two parties entered into a license agreement with respect to the patent, which, if true, represents a form of rights assertion that is simply difficult to account for because of the secret nature of many such transactions.

4 The "troll" literature would be difficult to capture in a single footnote. For some of the more prominent studies, see James Bessen & Michael J. Meurer, *The Direct Costs from NPE Disputes*, 99 CORNELL L. REV. 387 (2014); Robin Feldman, *The Pace of Change: Non-Practicing Entities and the Shifting Legal Landscape*, 18 CHAP. L. REV. 635 (2015); John M. Golden, *"Patent Trolls" and Patent Remedies*, 85 TEX. L. REV. 2111 (2007); Mark A. Lemley & A. Douglas Melamed, *Missing the Forest for the Trolls*, 113 COLUM. L. REV. 2117 (2013); Gerard N. Magliocca, *Blackberries and Barnyards: Patent Trolls and the Perils of Innovation*, 82 NOTRE DAME L. REV. 1809 (2007); Michael Risch, *Patent Troll Myths*, 42 SETON HALL L. REV. 457 (2012); James F. McDonough III, Comment, *The Myth of the Patent Troll: An Alternative View of the Function of Patent Dealers in an Idea Economy*, 56 EMORY L.J. 189 (2006).

5 Lemley & Melamed, *supra* note 4, at 2124 ("There is widespread belief that trolls impose greater costs on technology users and society as a whole than do practicing entities, and that they provide little social benefit to offset those costs.").

6 Edward Wyatt, *Obama Orders Regulators to Root Out 'Patent Trolls,'* N.Y. TIMES (June 4, 2013), http://www.nytimes.com/2013/06/05/business/president-moves-to-curb-patent-suits.html?_r=0.

7 There have been numerous legislative proposals over the years aimed at addressing "troll" behavior. For one recent example, see Caroline Craig, *Congress to Patent Trolls: You Shall Not Pass*, INFOWORLD (Sept. 18, 2015), http://www.infoworld.com/article/2984696/government/can-congress-stop-the-patent-trolls.html.

Federal Trade Commission,[8] numerous state legislatures,[9] the popular press,[10] and frequent academic conferences.[11]

But despite the importance of these topics, the fact remains that the vast majority of patents are likely never asserted, either formally in litigation or informally as part of a demand letter, settlement, or licensing deal.[12] Indeed, the USPTO has issued hundreds of thousands of patents each year for decades, but the number of patent lawsuits per year during the same time period—and the number of patents involved in those lawsuits—ranges in the thousands.[13] And while it is difficult to calculate the number of other types of patent assertions such as demand letters, settlements, and licensing deals because of their non-public nature, there are good reasons to believe that their numbers are few relative to the overall number of issued patents.[14] In other words, while this Article does not (and cannot[15]) define the total number of patents that are asserted, it nonetheless remains true that many—likely most—patents are never asserted in any manner. But if patent trolls have been able to game the patent system for great gain

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8 Grant Gross, *FTC Will Target Patent Trolls, Commissioner Says*, PCWORLD (Dec. 10, 2014, 1:35 PM), http://www.pcworld.com/article/2858392/ftc-will-target-patent-trolls-commissioner-says.html.

9 Jonathan Griffin, *2015 Patent Trolling Legislation*, NAT'L CONF. OF ST. LEGISLATURES (June 15, 2016), http://www.ncsl.org/research/financial-services-and-commerce/2015-patent-trolling-legislation.aspx (indicating that twenty-seven states have enacted anti-patent troll legislation).

10 The number of popular press articles on trolls is too large to list here. For a sampling of such articles from just one popular technology news site, see *Patent Trolls*, WIRED, http://www.wired.com/tag/patent-trolls/ (last visited May 31, 2017).

11 *See, e.g.*, *Patent Trolls and Patent Reform*, STAN. L. SCH., https://law.stanford.edu/event/patent-trolls-and-patent-reform/ (last visited May 31, 2017).

12 Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1497, 1501–08 (2001) ("[T]he overwhelming majority of patents are never litigated or even licensed."); Kimberly A. Moore, *Worthless Patents*, 20 BERKELEY TECH. L.J. 1521, 1521–22 (2005) ("Each year the United States Patent and Trademark Office (PTO) receives 350,000 patent applications and grants approximately 180,000 patents. Despite the large number of patent grants annually, patent holders file only 3,000 patent lawsuits involving approximately 4,500 patents each year to enforce patents against infringers." (footnotes omitted)).

13 PRICEWATERHOUSECOOPERS, 2016 PATENT LITIGATION STUDY: ARE WE AT AN INFLECTION POINT? 1 (2016), http://www.pwc.com/us/en/forensic-services/publications/assets/2016-pwc-patent-litigation-study.pdf.

14 Lemley, *supra* note 12, at 1498, 1503.

15 To address this issue, some have called for a requirement that all license deals be registered as part of a national database. *See id.* at 1503 n.38. This proposal has never been implemented, however. *See* U.S. PATENT & TRADEMARK OFFICE, MANUAL OF PATENT EXAMINING PROCEDURE ch. 313 (2015), https://www.uspto.gov/web/offices/pac/mpep/mpep-0300.pdf (indicating that license agreements "will generally be recorded," even though there is no recording requirement).

by systematically asserting patents, as many claim,[16] it may be surprising to find that so many patents remain on the sidelines. What, then, accounts for this phenomenon of widespread patent non-assertion?

Previous scholarship has often assessed this question generally, noting that the high costs of litigation, coupled with the low expected value of recoverable damages, deters many parties from asserting their rights.[17] Other scholars have zeroed in on patent non-assertion in particular, describing a related set of generic economic reasons for why parties forego asserting their patents.[18] For instance, asserting a patent can be time consuming and costly, and is fraught with uncertainty and risks.[19] Furthermore, most patents may be of little actual commercial value, even losing whatever value they have over time.[20] In sum, in many—perhaps most—cases, the likely costs of asserting a

16 *See* Jennifer H. Wu & Jenny C. Wu, *Giving Teeth to 35 U.S.C. § 285 to Award Attorneys' Fees Against Vexatious Plaintiff Patentees*, FED. LAW., Jan/Feb 2015, at 44, 46–47. *See generally* EXEC. OFFICE OF THE PRESIDENT, PATENT ASSERTION AND U.S. INNOVATION (2013), https://obamawhitehouse.archives.gov/sites/default/files/docs/patent_report.pdf.

17 *See, e.g.*, Louis Kaplow, *Private Versus Social Costs in Bringing Suit*, 15 J. LEGAL STUD. 371, 371 (1986); Peter S. Menell, *A Note on Private Versus Social Incentives to Sue in a Costly Legal System*, 12 J. LEGAL STUD. 41, 41 (1983); Steven Shavell, *The Fundamental Divergence Between the Private and the Social Motive to Use the Legal System*, 26 J. LEGAL STUD. 575, 577–79 (1997) [hereinafter Shavell, *Fundamental Divergence*]; Steven Shavell, *The Social Versus the Private Incentive to Bring Suit in a Costly Legal System*, 11 J. LEGAL STUD. 333, 333–34 (1982); Tim Wu, *Tolerated Use*, 31 COLUM. J.L. & ARTS 617, 619 (2008).

18 *See* Lemley, *supra* note 12, at 1503 (showing that many issued patents are abandoned, presumably because of their weak economic prospects); Robert P. Merges, *As Many as Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform*, 14 BERKELEY TECH. L.J. 577, 603 (1999) (concluding that most patented technologies fail commercially and present few economic advantages).

19 Damon C. Andrews, *Why Patentees Litigate*, 12 COLUM. SCI. & TECH. L. REV. 219, 223–38 (2011) (reviewing a variety of disincentives for patentees to assert their rights, including the high costs of and "unpredictable results" of patent litigation); Jonathan M. Barnett, *Property as Process: How Innovation Markets Select Innovation Regimes*, 119 YALE L.J. 384, 397 (2009) (noting "that median patent discovery and litigation costs are $2.5 million and $4 million respectively"); Christopher R. Leslie, *The Anticompetitive Effects of Unenforced Invalid Patents*, 91 MINN. L. REV. 101, 134–35 (2006) ("Uncertainty increases the deterrent effect of invalid patents . . . because courts routinely make mistakes in patent litigation."); Kimberly A. Moore, *Forum Shopping in Patent Cases: Does Geographic Choice Affect Innovation?*, 79 N.C. L. REV. 889, 908–09 (2001) (noting that the average length of patent litigation often exceeds a year).

20 Andrews, *supra* note 19, at 229–30; Edmund W. Kitch, *Property Rights in Inventions, Writings, and Marks*, 13 HARV. J.L. & PUB. POL'Y 119, 122–23 (1990) (concluding that most patents are so narrow that they are relatively worthless); Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 U. PA. L. REV. 1, 5–6 (2005) ("The true value of patents inheres not in their individual worth, but in their aggregation into a collection of related patents—a patent portfolio.").

patent outweigh the likely benefits, and patentees consequently forego asserting their rights.[21]

Yet while these economic considerations make a great deal of sense,[22] they fail to account for patent non-assertion with the nuance it deserves. Indeed, rational economic behavior in one context may be entirely irrational in another, particularly because different industries are subject to different economic influences.[23] Furthermore, clumping together these disincentives to assert patents fails to account for how these factors may interact and affect one another. Previous scholarship explaining patent non-assertion is thus lacking in these several key respects.

This Article attempts to address these gaps by assessing patent non-assertion using an informal, industry-specific theoretical model. It analyzes patent non-assertion in an industry-specific manner for several reasons. First, though the requirements of patentability are more or less uniform across industries, scholars have long argued that, in reality, patents and patent law are industry specific.[24] In other words, patents play different roles depending on the industry,[25] and courts often apply the requirements of patent law differently depending on the implicated technology and industry.[26] Second, some industries, in particular the pharmaceutical sector, include a regulatory overlay that may significantly affect whether a party chooses to forego asserting its patent rights.[27]

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21 Andrews, *supra* note 19, at 248.

22 Paul Stancil, *Balancing the Pleading Equation*, 61 BAYLOR L. REV. 90, 93 (2009) ("U.S. civil litigation is in many ways an inherently economic enterprise . . . .").

23 *See, e.g.*, Jay Berman & Janet Pfleeger, *Which Industries Are Sensitive to Business Cycles?*, MONTHLY LAB. REV., Feb. 1997, at 19, 19 (discussing how different industries respond differently to swings in business cycles, thereby suggesting that different industries are subject to different economic models).

24 *See* DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 62 (2009) (arguing that courts apply patent law differently depending on the industry and advocating that courts should increase such tailoring to better realize the purposes of patent law); Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155, 1205–06 (2002) (same); Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1581–95 (2003) [hereinafter Burk & Lemley, *Policy Levers*] (arguing that innovation is industry specific and that patent law should more readily adapt to that reality).

25 JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK 181–83 (2008) (arguing that the patent system imposes more costs than benefits in most technology sectors).

26 *See supra* note 24.

27 *See, e.g.*, Rebecca S. Eisenberg, *The Role of the FDA in Innovation Policy*, 13 MICH. TELECOMM. & TECH. L. REV. 345 (2007) (discussing the FDA's regulatory overlay and the role of patents in the development of biomedical research); Richard A. Merrill, *The Architecture of*

As such, explaining patent non-assertion is almost certainly industry specific as well. Different costs and risks arise depending on the industry, and those differences matter in terms of theorizing whether and why a particular patent owner will forego asserting its rights. This Article first charts out some of these different costs and how they may interact, thereby building a model for assessing patent non-assertion across different industries. It then applies this model to four specific industries: software, pharmaceuticals, biotechnology, and semiconductors. Scholars often focus on these industries because of their overall importance to the economy,[28] and this Article uses them as case studies for similar reasons.

Of course, it is important to stress at the outset that industries—and patents and parties within them—are also not monolithic.[29] In the information technology industry, for instance, Facebook likely faces different costs and benefits in asserting its patents than, say, a start-up or patent troll in the same sector. Furthermore, different parties within an industry may possess different types of patents in terms of quality and quantity that may also affect whether they choose to assert their patents.[30]

Nonetheless, though no theory can capture all relevant nuances,[31] an industry-specific theoretical model has several advantages. First, it allows for identification of broader trends within industries that previous studies of patent non-assertion have failed to account for. And second, an industry-specific model provides a useful theoretical basis for further studies of specific industries and the different factors that affect how parties within those industries act, with respect to patents and otherwise.

Overall, this Article's industry-specific theoretical model finds that disincentives to patent assertion are particularly high in the software industry. The semiconductor industry similarly exhibits strong disincentives to patent assertion, though typically not as high as

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*Government Regulation of Medical Products*, 82 VA. L. REV. 1753 (1996) (providing an overview of how the FDA regulates medical products).

28 Benjamin M. Roin, *The Case for Tailoring Patent Awards Based on Time-to-Market*, 61 UCLA L. REV. 672, 687 (2014).

29 *See, e.g.*, W. Nicholson Price II, *Big Data, Patents, and the Future of Medicine*, 37 CARDOZO L. REV. 1401, 1452–53 (2016) (stressing that the pharmaceutical industry is not uniform in terms of the role of patents).

30 *See, e.g.*, Jonathan H. Ashtor, Michael J. Mazzeo & Samantha Zyontz, *Patents at Issue: The Data Behind the Patent Troll Debate*, 21 GEO. MASON L. REV. 957, 969 (2014) (assessing the quality of patents asserted by patent trolls vis-à-vis those of manufacturing companies).

31 *See generally* KENNETH N. WALTZ, THEORY OF INTERNATIONAL POLITICS 7 (1979) (arguing that "[a] full description would be of least explanatory power" in modeling a theory).

in the software industry. In the pharmaceutical industry, conversely, disincentives to patent assertion are relatively low; instead, incentives to assert pharmaceutical patents are typically high. The biotechnology industry similarly demonstrates relatively weak disincentives to patent assertion, though for a variety of reasons explored *infra*, incentives to assert patents in the biotechnology industry may not be as strong as they once were.

Importantly, these findings have implications for recent judicial and legislative patent law changes, many of which aim to curb excessive patent assertions by so-called patent trolls. Ironically, this Article finds that high barriers to patent assertion in an industry may actually increase patent assertions in the industry. This is so because those high barriers can make patent assertion too costly and risky for the patent holder, at which point many patent holders outsource those costs to patent trolls by selling or licensing to them some or all of their patents. Or in other cases, the high costs may help push a company to become a patent assertion entity itself as it seeks economies of scale in patent litigation.[32] And once either of these scenarios plays out, patent assertions are likely to rise, since the adopted business model demands it.

This, in fact, seems to be what has happened in the software industry: while the industry generally exhibits high barriers to patent assertion, it has simultaneously seen an explosion in patent assertions over the last decade. And much of that explosion is attributable to patent trolling.[33] This Article thus contends that high barriers to patent assertion in the software industry help explain, in part, the rise in patent assertions in the industry. This industry-specific analysis, therefore, may also help identify other industries that are increasingly at risk of increased patent trolling should barriers to patent assertion become too high. As this Article will explore, the biotechnology and semiconductor industries may be two such industries.

This Article has four parts. Part I provides a brief overview of the predominant theories behind patent law to highlight how these theories predict how patent holders will act in the face of potential infringements of their rights. These theories suggest that, all else being equal, patent holders will assert their rights in the face of potential infringement. Part II then contrasts these theories with the reality that most patent rights are never asserted, even in cases where they could

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32 *See* Kristen Osenga, *Formerly Manufacturing Entities: Piercing the "Patent Troll" Rhetoric*, 47 CONN. L. REV. 435, 467–68 (2014).

33 *See infra* Section III.A.

be. In reviewing some of the basic economic rationales that help explain this phenomenon, this Part builds a taxonomy of different disincentives to patent assertion. Part III applies this taxonomy to four specific industries: software, pharmaceuticals, biotechnology, and semiconductors. This application shows that the different disincentives to patent assertion play out differently depending on the industry. This Part also shows that these different categories of disincentives often have a dynamic relationship, meaning that the presence of one type of disincentive may increase or decrease the presence of another. Finally, Part IV assesses some potential implications of these industry-specific disincentives to patent assertion, including the claim that high barriers to patent assertion in an industry may ironically result in increased patent assertions in that industry.

## I. The Theories Behind Patents

The U.S. Constitution authorizes Congress to grant inventors with exclusive rights in their discoveries in order to "promote the Progress of Science and the useful Arts."[34] On the basis of this provision, Congress has enacted patent laws.[35] Patent laws grant exclusive rights to qualifying inventors for their "discoveries."[36] According to the dominant theory behind patent rights, these exclusive rights are necessary because without them, inventors would have insufficient economic incentives to engage in socially beneficial inventive behavior.[37]

This is so, the story goes, because intellectual products such as inventive ideas have the features of public goods: they are non-rivalrous, meaning one party's use of the product does not prevent another from using the same, and they are non-excludable, meaning that it is difficult to prevent others from using such intellectual products.[38] Consequently, absent rights of exclusion under patent law, third parties could replicate the intellectual products of others without incurring the same costs.[39] Inventive parties would thus not create them for fear of this happening. With rights of exclusion in hand, con-

34 U.S. Const. art. I, § 8.

35 *See* Dotan Oliar, *The (Constitutional) Convention on IP: A New Reading*, 57 UCLA L. Rev. 421, 463–64 (2009).

36 *Id.* at 458, 463.

37 Mark A. Lemley, *Ex Ante Versus Ex Post Justifications for Intellectual Property*, 71 U. Chi. L. Rev. 129, 129–30 (2004) (articulating this rationale); Henry E. Smith, *Intellectual Property as Property: Delineating Entitlements in Information*, 116 Yale L.J. 1742, 1744–45 (2007).

38 *See* Robert P. Merges, Peter S. Menell & Mark A. Lemley, Intellectual Property in the New Technological Age 2 (6th ed. 2012).

39 *Id.* at 11–17.

versely, inventive parties have the right economic incentives to invent because those rights allow them to exclude others from free-riding on their inventive ideas.[40]

To illustrate this theory in practice: a pharmaceutical company may not invest the millions of dollars it takes to develop life-saving drugs if it were true that another party could replicate the drug without incurring the same costs as—or any liability to—the pharmaceutical company.[41] And when third parties attempt to use the products of pharmaceutical companies without permission, we have plenty of evidence of pharmaceutical companies protecting their investments by asserting their patent rights in pharmaceutical products.[42]

Hence, an important part of this economic incentives story is that we would expect rights holders to assert their rights in cases where doing so helps protect their investments in creating the intellectual products. And we might expect this to be so in most cases because, all else being equal, third parties would otherwise free-ride on the efforts of the rights holders. That free-riding problem, after all, is precisely the problem patents are meant to solve.[43]

Of course, a variety of other economic considerations may affect whether a party ultimately chooses to assert its rights; Part II will examine those considerations in detail.[44] For now, suffice it to say that the basic economic reasoning of the dominant theory behind patent rights would appear to predict some form of patent assertion when infringement occurs.

Aside from this dominant "utilitarian" model, other important intellectual property law theories also appear to predict that patent owners will assert their rights when third parties infringe those rights. For instance, "prospect" and "commercialization" theories of patent

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40 *Id.*

41 Indeed, the pharmaceutical industry is often pointed to as one of the areas where this theory applies well. *See, e.g.*, Price, *supra* note 29, at 1452 (noting that "[t]he pharmaceutical and biomedical industries are typically characterized as areas where patents work fairly well" because these industries require substantial upfront investment, and patent rights help recoup those investments).

42 Indeed, because pharmaceutical companies "protect the intellectual property (IP) that drugs represent and sue those who try to manufacture and sell patented drugs cheaply," some regard pharmaceutical companies as "vampires who exploit the sick and ignore the sufferings of the poor." *The New Drugs War*, ECONOMIST (Jan. 4, 2014), http://www.economist.com/news/leaders/21592619-patents-drugs-are-interests-sick-well-industry-protection-should-not.

43 *See* Joseph Scott Miller, *Building a Better Bounty: Litigation-Stage Rewards for Defeating Patents*, 19 BERKELEY TECH. L.J. 667, 680–85 (2004) (describing this theory in the patent context).

44 *See infra* Part II.

law argue that we grant patent rights in order to incentivize inventors to further develop and commercialize their inventions.[45] These types of "ex-post" theories thus focus on the post-invention incentives of parties, and theorize that granting parties rights in their inventions, if done correctly, will incentivize those parties to cultivate their inventions for the benefit of society.[46] Another group of theories, what some call "disclosure" or "coordination" theories, similarly focuses on the post-invention incentives of creators, positing that parties will be averse to sharing their technological accomplishments with others without rights of exclusion in hand.[47] This is so because, without exclusive rights, inventors fear they will lose the economic value of their inventions, while others will capture that value.[48]

Hence, if these theories hold true, we would also expect rights holders to assert their patent rights against infringers. Otherwise, such infringements would significantly undermine the incentives of patent owners to further develop their inventions, or to disclose their inventions to third parties or the public in general. For instance, a third party using some patented technology without a license from the relevant patent owner would harm that patent owner's economic prospects in several ways. First, the patent owner loses an economic opportunity vis-à-vis that third party. Second, the patent owner may lose economic opportunities more broadly, either because other par-

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45 *See, e.g.*, Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265 (1977) (articulating "prospect" theory). For "commercialization" theory accounts, see Michael Abramowicz, *The Danger of Underdeveloped Patent Prospects*, 92 CORNELL L. REV. 1065 (2007); Michael Abramowicz & John F. Duffy, *Intellectual Property for Market Experimentation*, 83 N.Y.U. L. REV. 337 (2008); F. Scott Kieff, *Property Rights and Property Rules for Commercializing Inventions*, 85 MINN. L. REV. 697 (2001); Ted Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341 (2010).

46 *See* Lemley, *supra* note 37, at 130; *supra* note 45.

47 *See* WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 326–30 (2003) (elaborating on the coordination function and value of patents); Paul J. Heald, *A Transaction Costs Theory of Patent Law*, 66 OHIO ST. L.J. 473, 488–89, 497 (2005) (arguing that patents help address concerns about information misappropriation and thus encourage information sharing); Roberto Mazzoleni & Richard R. Nelson, *Economic Theories About the Benefits and Costs of Patents*, 32 J. ECON. ISSUES 1031, 1039–40 (1998) (describing different strands of disclosure theory generally); Stephen Yelderman, *Coordination-Focused Patent Policy*, 96 B.U. L. REV. 1565 (2016).

48 *See, e.g.*, Nancy T. Gallini, *The Economics of Patents: Lessons from Recent U.S. Patent Reform*, 16 J. ECON. PERSP. 131, 132 (2002) (suggesting that patents may induce parties to disclose information that they may otherwise withhold); Robert P. Merges, *A Transactional View of Property Rights*, 20 BERKELEY TECH. L.J. 1477, 1487–90 (2005) (describing how property rights, including patent rights, may induce parties to disclose information before, during, and after contract formation that they otherwise may withhold for fear that the value of their property will be lost).

ties choose to obtain the patented technology from the original infringer rather than the patent owner, or these other parties may simply develop the technology themselves. Of course, the patent owner may at that point choose to assert its patent rights against any and all of these parties. But if they did so, that would simply confirm the expectation that, in accordance with these theories, patent owners will assert their rights against infringers in order to vindicate their economic interests in developing or sharing the patented technologies more broadly.

In contrast to these economic-centric theories, "natural rights" theories may, at first glance, seem less straightforward in terms of predicting that rights holders will assert their rights against potential infringers of those rights. Natural rights theories posit that we grant patents for a variety of reasons that are not strictly economic in nature.[49] For instance, we might grant parties rights in what they have created on the basis of their efforts, or the "labor" that they exerted in creating the intellectual product.[50] We might also grant rights to parties in their inventions because those inventions are bound up in the personality or "personhood" of the creator.[51]

Hence, if patent rights arise because of a creator's personhood or labor, the economic incentives to sue infringers may not exist because the intellectual activity was never entirely about economics in the first place. But in reality, these types of theories, when and if they apply, may in some cases actually predict greater rights assertions than their economic counterparts discussed above. This is so because, if rights accrue due to the inventor's effort or "personhood," use of that creation without permission may represent in some sense a personal violation. And in many cases, a personal affront of this nature may be more likely to trigger an attempt by rights holders to vindicate their interests than if the right is simply economic in nature.[52]

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49 Wendy J. Gordon, *A Property Right in Self-Expression: Equality and Individualism in the Natural Law of Intellectual Property*, 102 YALE L.J. 1533, 1535, 1560 (1993).

50 *See, e.g.*, *id.*; Justin Hughes, *The Philosophy of Intellectual Property*, 77 GEO. L.J. 287, 296–330 (1988) (discussing different interpretations of Lockean property theory and how reward schemes interact with labor output).

51 *See, e.g.*, Neil Netanel, *Copyright Alienability Restrictions and the Enhancement of Author Autonomy: A Normative Evaluation*, 24 RUTGERS L.J. 347, 423 (1993); Margaret Jane Radin, *Property and Personhood*, 34 STAN. L. REV. 957, 957 (1982).

52 Christopher Buccafusco & David Fagundes, *The Moral Psychology of Copyright Infringement*, 100 MINN. L. REV. 2433, 2483–84 (2016) (reviewing a number of psychological reasons why parties may assert copyright rights, even when it may not make economic sense to do so).

In sum, the predominant theories behind patent rights appear to suggest that patent holders will typically assert their rights when third parties violate them. And of course, plenty of examples exist where rights holders do exactly that. Indeed, as discussed in the Introduction, there is growing concern that many rights holders actually assert their rights in excess, in ways that harm society and sully intellectual property laws more generally.[53]

Yet the reality is that most patents are never asserted, or at least are asserted less than they could be.[54] In light of the predominant theories behind patent law, this is a curious result, because many of these theories argue that patent rights are necessary incentives to inventive and other socially beneficial behavior. Hence, implicit in such theories is that rights holders will vindicate those interests when parties, such as infringers, act to undermine them. The next Part explores reasons why these theories may often not match reality.

## II. The Reasons Behind Patent Non-Assertion

This Part examines various reasons why patent holders may choose to forego asserting their rights, even in cases where they clearly could assert those rights, and where dominant patent theories suggest that they would. Section II.A argues one reason is that the theories reviewed above may simply be incomplete in many cases. Section II.B momentarily sets aside that possibility and takes the predominant theories at face value, instead exploring a variety of reasons why patent holders don't assert their rights more than they do.

### *A. Theoretical Incompleteness*

One reason why parties may not assert their patents in situations where dominant theories predict that they would is, quite simply, that the theories may not always accurately explain the role of patents. In other words, the widespread phenomenon of patent non-assertion may simply be evidence of the incompleteness, in many cases, of predominant patent law theories.

Indeed, a substantial body of scholarship has grown over the years challenging the traditional premises of many of these theories. One line of critique is that intellectual property rights are not the only,

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53 *See, e.g.*, Jeanne C. Fromer, *Should the Law Care Why Intellectual Property Rights Have Been Asserted?*, 53 Hous. L. Rev. 549, 587–92 (2015) (arguing that assertions of intellectual property rights that do not align with the purposes behind those laws can cause greater societal losses than the laws intended).

54 *See supra* note 12 and accompanying text.

or even the most important, incentives that promote inventive behavior.[55] Tax incentives, government grants and prizes, and other regulatory measures also provide incentives for such behavior.[56] And in some cases, they may be better mechanisms than patent rights for promoting creativity and invention.[57] Hence, non-assertion of rights may result in some cases because these other incentives are the real drivers behind many inventive activities, and vindication of patent rights is, consequently, simply less important than imagined.

Second, in a growing literature often referred to as "IP without IP," scholars point to a number of areas where creativity and innovation have flourished absent any intellectual property protections at all.[58] Other factors, such as social norms, competition, or the love of creativity itself, appear to motivate parties to innovate even absent formal intellectual property protections.[59] Hence, this evidence may suggest that intellectual property rights are less needed than imagined, or in some cases not needed at all, even in areas of intellectual activity where intellectual property rights apply.[60] And if intellectual property rights such as patents sometimes do not act as incentives in the ways that traditional intellectual property law theories posit, then it may be less surprising that violation of those rights does not result in more frequent rights assertions.

Third and relatedly, although patents may have an important role to play, in many cases the roles may be different than those that traditional theories ascribe to them. For instance, some scholarship argues that parties sometimes obtain patents in order to signal information to

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55 *See, e.g.*, Daniel J. Hemel & Lisa Larrimore Ouellette, *Beyond the Patents—Prizes Debate*, 92 TEX. L. REV. 303 (2013) (arguing for a "pluralistic approach" to innovation policy because tax incentives and government grants can stimulate innovative behavior with greater effect than patents in certain areas); Lisa Larrimore Ouellette, *Patentable Subject Matter and Nonpatent Innovation Incentives*, 5 U.C. IRVINE L. REV. 1115 (2015).

56 Ouellette, *supra* note 55, at 1130.

57 *See* Hemel & Ouellette, *supra* note 55, at 303.

58 *See, e.g.*, KAL RAUSTIALA & CHRISTOPHER SPRIGMAN, THE KNOCKOFF ECONOMY: HOW IMITATION SPARKS INNOVATION 5 (2012); Rochelle Cooper Dreyfuss, *Does IP Need IP? Accommodating Intellectual Production Outside the Intellectual Property Paradigm*, 31 CARDOZO L. REV. 1437, 1437, 1446 (2010); Kal Raustiala & Christopher Sprigman, *The Piracy Paradox: Innovation and Intellectual Property in Fashion Design*, 92 VA. L. REV. 1687, 1689–91 (2006); Elizabeth L. Rosenblatt, *A Theory of IP's Negative Space*, 34 COLUM. J.L. & ARTS 317, 319–21 (2011).

59 *See supra* note 58.

60 *See, e.g.*, Anthony J. Casey & Andres Sawicki, *The Problem of Creative Collaboration*, 58 WM. & MARY L. REV. (forthcoming 2017) (manuscript at 3–4), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2772710 (arguing that informal rules are often more effective and important in facilitating creative collaboration than formal copyright law).

capital, product, and labor markets about the patent holder.[61] Hence, rather than using patents as means by which to directly recoup their costs, parties may use patents to attract venture financing, recruit talented employees, and facilitate collaboration more generally.[62] As such, patent holders using patents in these ways may lack good reasons to assert some or all of their patents. In fact, in some cases they may even have very good reasons to formally forego asserting their rights.[63]

These pushbacks to traditional intellectual property law theories are certainly plausible in many cases, and may explain in some settings why parties forego asserting their rights in the face of infringement. In other words, patent rights simply may not be important to many patent holders—at least in the ways that traditional patent law theories posit.[64] Widespread patent non-assertion may thus provide additional evidence that traditional patent law theories are often incomplete explanations of the roles that patents play.

But other economic factors may help explain such non-assertion as well. Indeed, parties may choose to forego asserting their rights against infringers because of such factors, even in cases where the premises of traditional patent law theories accurately explain the role of patents in incentivizing patent holders. The following Sections momentarily take predominant patent law theories at face value and seek to explain, on the basis of certain economic factors, why parties may forego asserting their rights in the face of infringement.

### *B. Economic Disincentives*

Part I painted a fairly basic economic picture in suggesting that, under the predominant economic theories behind patent rights, rights holders would be expected to assert their rights in the face of infringement, all else being equal. But it is clear that in many cases, all else is not equal.

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61 *See* Clark D. Asay, *The Informational Value of Patents*, 31 BERKELEY TECH. L.J. 259, 265 (2016) (arguing that patent holders that pledge their patents to the public do so in many cases in order to credibly signal information about themselves to capital, labor, and product markets); Clarisa Long, *Patent Signals*, 69 U. CHI. L. REV. 625, 636–37 (2002).

62 *See supra* note 61.

63 Asay, *supra* note 61, at 300, 304 (discussing a variety of patent pledges made by patent owners where such parties formally and publicly pledge to forego asserting their rights against third parties).

64 *Cf.* Lisa Larrimore Ouellette, *Patent Experimentalism*, 101 VA. L. REV. 65, 69 (2015) (arguing for policy diversity with respect to innovation policy more generally).

Indeed, scholars have long noted a number of general economic considerations that may lead any given party with a colorable legal claim to forego making that claim.[65] For instance, in many cases the private benefits of bringing a suit are simply too few, particularly since the legal system "is a very costly social institution" and potential litigants may not realize many of the benefits of their suits (e.g., such as deterring future wrongs from others).[66] Indeed, the high costs of litigation, coupled with the low expected value of recoverable damages, may deter many parties from pursuing lawsuits.[67] The result in many cases may be too few incentives for parties to assert claims that may otherwise benefit society.[68] Or as one scholar put it, such factors often lead to "systematic underenforcement of otherwise actionable claims" in legal regimes, such as the patent system, that rely on private enforcement.[69]

Patents may be particularly prone to underenforcement for a number of additional reasons. First, many—perhaps most—patents may simply lack significant commercial worth, even losing whatever value they have over time.[70] Indeed, several scholars suggest that most patents, in isolation, are of extremely limited value.[71] Hence, even if a patentee wins a patent infringement suit or otherwise successfully asserts its patents against a third party, any damages or licensing fees that the party obtains may be relatively small, particularly in light of

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65 *See supra* note 17 and accompanying text.

66 Shavell, *Fundamental Divergence*, *supra* note 17, at 575–78.

67 Menell, *supra* note 17, at 41.

68 Shavell, *Fundamental Divergence*, *supra* note 17, at 578; *see also* Mark A. Lemley, *The Surprising Resilience of the Patent System*, 95 TEX. L. REV. 1, 2 (2016) (discussing the possibility of a "crisis of underprotection" because of patent law reforms that have weakened patent rights).

69 Shyamkrishna Balganesh, *The Uneasy Case Against Copyright Trolls*, 86 S. CAL. L. REV. 723, 729 (2013).

70 Andrews, *supra* note 19, at 229–30; Kitch, *supra* note 20, at 122–23 (concluding that most patents are so narrow that they are relatively worthless); Lemley, *supra* note 12, at 1503–06 (showing that many issued patents are abandoned, presumably because of their weak economic prospects); Merges, *supra* note 18, at 603 (concluding that most patented technologies fail commercially and present few economic advantages).

71 *See* F.M. Scherer, *The Innovation Lottery*, *in* EXPANDING THE BOUNDARIES OF INTELLECTUAL PROPERTY: INNOVATION POLICY FOR THE KNOWLEDGE SOCIETY 3, 3–21 (Rochelle Cooper Dreyfuss et al. eds., 2001) (arguing that the hope of winning a patent "lottery" encourages many parties to obtain patents that do not end up proving valuable, and which are thus never enforced); John R. Allison et al., *Valuable Patents*, 92 GEO. L.J. 435, 436–37 (2004) ("The best explanation for why some patents are used and others are not is simple: Some patents are intrinsically more valuable than others."); Parchomovsky & Wagner, *supra* note 20, at 5–6 ("The true value of patents inheres not in their individual worth, but in their aggregation into a collection of related patents—a patent portfolio."); *see also supra* note 70.

the high costs of making the assertion in the first place.[72] Thus, the lack of significant value associated with any given patent may be enough, on its own, to deter many patent assertions.

Second, even if a given patent has some value, asserting it may be unappealing because the initial costs of making that determination are so high. That is, in order to assert their patents against third parties, patent holders must first do several things. For starters, they must incur the (often significant) costs associated with evaluating their own patent portfolios to identify patents that have more than marginal value and that are likely infringed.[73] Conducting such evaluations may include enlisting both internal resources—such as engineers, in-house counsel, and business personnel—as well as outside counsel and other analytics expertise.[74]

Once a patent holder evaluates its patent portfolio, the patent holder must then identify and assess actual instances of potential infringement.[75] Doing so can be time consuming and difficult as well, since not all instances of patent infringement are readily observable.[76] Furthermore, even once a party has identified a potential target, it may incur additional search costs in evaluating the strength of potential counterclaims.[77] Indeed, this phase will also likely require using

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72 *See infra* Part III.

73 *See, e.g.*, Michael Gulliford, *Sound Patent Portfolio Management Is the Key to Innovation Success*, IPWATCHDOG (Nov. 1, 2015), http://www.ipwatchdog.com/2015/11/01/sound-patent-portfolio-management-key-innovation-success/id=62674/ ("[M]any innovative companies have no idea what is actually in their patent portfolio.").

74 It may seem surprising that parties spend so many resources acquiring patents, only to lose track of them internally. Indeed, the costs of patent acquisition can be significant, and only increase in absolute terms the more patents a party acquires. *See* Gene Quinn, *The Cost of Obtaining a Patent in the US*, IPWATCHDOG (Apr. 4, 2015), http://www.ipwatchdog.com/2015/04/04/the-cost-of-obtaining-a-patent-in-the-us/id=56485/ (detailing ballpark figures for obtaining different types of patents, which in the cumulative typically cost at least $10,000 per patent). Be that as it may, it is common for parties to lack rigorous patent portfolio management. *See* Gulliford, *supra* note 73. Consequently, the costs of assessing one's patents can be high, and those costs may deter many patent assertions that would otherwise make commercial sense.

75 Tun-Jen Chiang, *The Reciprocity of Search*, 66 VAND. L. REV. 1, 2–4, 39–40 (2013) (arguing that patent law currently imposes too few obligations on patentees to search for potential infringers); Jonathan S. Masur, *Patent Liability Rules as Search Rules*, 78 U. CHI. L. REV. 187, 187–88 (2011) (discussing the search costs that patentees may face when seeking out potential infringers).

76 *See, e.g.*, Julia Elvidge, *Using Reverse Engineering to Discover Patent Infringement*, PHOTONICS MEDIA (Sept. 2010), http://www.photonics.com/Article.aspx?AID=44063 (discussing the need in many cases to use reverse engineering to discover patent infringement, since many instances of patent infringement may not be otherwise readily observable).

77 Kayla Fossen, Note, *The Post-Grant Problem: America Invents Falling Short*, 14 MINN. J.L. SCI. & TECH. 573, 593 (2013) ("[T]here is an institutional bias in the United States for counterclaims.").

both internal and external resources to identify and evaluate potential targets, all of which can be costly.[78] In the cumulative, these types of search costs may thus be significant enough to deter many patent assertions, even in cases where the patents otherwise have more than marginal value.

Third, even if a party overcomes these search costs, moving ahead with a patent assertion entails additional, potentially significant negotiation costs. For starters, even if a party does not formally file a patent suit, asserting a patent against a third party involves costs associated with making the assertion, such as initially approaching the party and negotiating with them thereafter. And these negotiation costs can quickly grow, especially if negotiations become protracted and ultimately result in the need to prepare complex legal documents relating to a settlement or licensing deal.[79]

Indeed, these negotiations may become particularly complex, time consuming, and costly in cases where the original asserter wakes a sleeping dragon. In other words, the asserted-against party may own patents of its own that it can bring to bear against the original asserter. Hence, patent owners that practice a variety of inventive ideas in their day-to-day commercial operations may be more loathe to assert patents against others, simply for fear that those parties will strike back with patent claims of their own and thereby increase the costs of negotiating an end to the original assertion.[80]

Fourth, a patent asserter may incur significant litigation costs related to formally asserting a patent in court. A party may ultimately file a patent infringement suit against a third-party infringer for several reasons. First, they may do so to increase their leverage vis-à-vis the other party in licensing and settlement negotiations.[81] Second, they may file a patent infringement suit because licensing and settlement negotiations have broken down, and litigation is their final resort.[82] Finally, the patent owner may file a patent infringement suit

78 *See* Gulliford, *supra* note 73.

79 *See, e.g.*, Gene Quinn, *Drafting a Licensing Agreement, a Patentee Perspective*, IPWATCHDOG (Apr. 30, 2016), http://www.ipwatchdog.com/2016/04/30/drafting-licensing-agreement/id=68723/ (discussing some of the complexities of negotiating a patent license, which leads to many of these negotiation costs).

80 Bessen & Meurer, *supra* note 4, at 413 (noting that non-practicing entities ("NPEs"), also known as patent trolls, "have a bargaining advantage over practicing-entity patent plaintiffs because NPEs are invulnerable to patent counterclaims and have lower litigation costs, especially discovery costs").

81 Andrews, *supra* note 19, at 240.

82 *Id.* at 248–49.

because they prefer patent law remedies, such as potential injunctive relief, to those they are able to privately negotiate.[83]

But patent litigation is notoriously expensive.[84] Indeed, average costs for litigating a patent range in the millions of dollars.[85] These high costs also mean that patent litigation can last a long time, thereby consuming time and resources that the patent owner might otherwise devote to other important interests.[86] Furthermore, many of the negotiation costs discussed above also typically become part of the litigation, as parties often spend significant resources during litigation attempting to settle their dispute, not to mention also responding to counterclaims.[87] Hence, the high costs of litigation, too, can often act as a deterrent to many parties asserting their patents,[88] since a party considering patent assertion must be prepared for the possibility that it may need to ultimately resort to the courts to settle its dispute.

Fifth, asserting a patent can also entail what this Article refers to as invalidity costs. That is, if a patent holder asserts its patents against a third party, the asserted patents may ultimately be invalidated, and the patent holder thereby forfeits patent assets against the world.[89] This can happen on the basis of a number of substantive patent law doctrines, including a failure to satisfy patent law's novelty, non-obviousness, patentable-subject matter, utility, or disclosure requirements.[90]

It can also happen in a number of different settings. For instance, if a patent holder asserts its patents against a party outside of court, the asserted-against party can appeal to a court seeking a declaratory

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83 *See* 35 U.S.C. §§ 283–284 (2012) (providing remedies such as injunctive relief and monetary damages).

84 *See* Andrews, *supra* note 19, at 226–38 (reviewing a variety of disincentives for patentees to assert their rights, including the high costs of such litigation); Barnett, *supra* note 19, at 398.

85 *See* AM. INTELLECTUAL PROP. LAW ASS'N, REPORT OF THE ECONOMIC SURVEY 2005 22 (2005) (indicating that the median expense for a patent litigation with more than $25 million at risk was $4.5 million); Aaron S. Kesselheim & Jonathan J. Darrow, *Hatch-Waxman Turns 30: Do We Need a Re-Designed Approach for the Modern Era?*, 15 YALE J. HEALTH POL'Y L. & ETHICS 293, 324 (2015); Chris Neumeyer, *Managing Costs of Patent Litigation*, IPWATCHDOG (Feb. 5, 2013), http://www.ipwatchdog.com/2013/02/05/managing-costs-of-patent-litigation/id=34808.

86 Moore, *supra* note 19, at 908 (noting that the average length of patent litigation often exceeds a year).

87 *See supra* note 80 and accompanying text.

88 Barnett, *supra* note 19, at 398.

89 *See* Roger Allan Ford, *Patent Invalidity Versus Noninfringement*, 99 CORNELL L. REV. 71, 77–78, 78 n.21 (2013).

90 *Id.*

judgment that the patent is invalid.[91] Furthermore, if a patent holder asserts its patents against a party in court, that party is likely to defend against the assertion, in part, by claiming that the patent is invalid.[92] In either case, if a court finds that the patents are invalid, that invalidity affects not only the instant dispute, but also means that the patent owner loses rights against the rest of the world, including potential licensing opportunities.[93] Moreover, if a court finds that the patent owner engaged in "inequitable conduct" in procuring the patent, such a finding could mean that other, related patents are also no longer enforceable.[94]

In addition to these traditional court options, the 2011 America Invents Act[95] (said to be the most important patent law reform in some sixty years) also instituted a number of patent validity review procedures that third parties can use to invalidate patents, even absent any sort of patent controversy between the parties.[96] Nonetheless, a patent assertion, in or outside of court, may make it more likely that defendants resort to these expedited review mechanisms as well.[97]

In all of these settings, the risk that a patent asserter will incur invalidity costs is relatively high for several reasons. First, it may be true that many, and perhaps most, patents are actually invalid.[98] Indeed, scholars have long complained that the USPTO harms society by flooding the marketplace with significant numbers of invalid patents.[99] If this is true, then there's simply a good chance that the as-

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91 *See, e.g.*, Jennifer R. Saionz, *Declaratory Judgment Actions in Patent Cases: The Federal Circuit's Response to* MedImmune v. Genetech, 23 BERKELEY TECH. L.J. 161, 168–69 (2008) (discussing several cases involving a finding of invalidity based on an action for declaratory judgment).

92 But for reasons why a defendant may rely on non-infringement as a defense over invalidity, see Ford, *supra* note 89, at 85.

93 *See* Andrews, *supra* note 19, at 233.

94 Lee Petherbridge, Jason Rantanen & R. Polk Wagner, *Unenforceability*, 70 WASH. & LEE L. REV. 1751, 1752–54 (2013).

95 Leahy-Smith America Invents Act, Pub. L. No. 112-29, § 19, 125 Stat. 284 (2011) (codified as amended in scattered sections of 35 U.S.C.).

96 *See generally* Eric C. Cohen, *A Primer on Inter Partes Review, Covered Business Method Review, and Post-Grant Review Before the Patent Trial and Appeal Board*, 24 FED. CIR. B.J. 1 (2014) (discussing three "fast-track proceedings for challenging issued patents" under the America Invents Act).

97 *See, e.g.*, Brian J. Love & Shawn Ambwani, *Inter Partes Review: An Early Look at the Numbers*, 81 U. CHI. L. REV. DIALOGUE 93, 94 (2014) (providing statistics relating to inter partes review, a new mechanism within patent law for reviewing the validity of patents).

98 Alan Devlin, *Antitrust Limits on Targeted Patent Aggregation*, 67 FLA. L. REV. 775, 779 (2015).

99 Michael D. Frakes & Melissa F. Wasserman, *Does the U.S. Patent and Trademark Office Grant Too Many Bad Patents?: Evidence from a Quasi-Experiment*, 67 STAN. L. REV. 613, 615

serted patents are actually invalid, and that a court or other tribunal will accordingly reach that conclusion.

Second, even if the asserted patents are valid, the judge or jury may misunderstand both the law and the implicated technologies in a way that results in an invalidity finding. This risk stems in part from the fact that patent law is highly technical, and the implicated technologies are often quite complicated.[100] And there is some evidence that courts misapply patent law with some frequency.[101] Of course, it is also possible that courts may often misunderstand patent law and the implicated technologies in ways that favor the patent holder. But courts and other tribunals that assess the validity of patents routinely find them invalid.[102] This pattern might simply support the widespread belief that most patents are, in fact, invalid. But it could also be evidence that courts are more typically biased against patent holders in misapplying patent law and misunderstanding the implicated technologies. Hence, while high invalidation rates in general do not mean that any given patent owner's patent will face a similar fate, those high invalidation rates nonetheless highlight the very real risks that patent asserters will incur invalidity costs if they decide to assert their patents.

Sixth and finally, patent owners may face significant reputational costs when asserting patents. For instance, a pharmaceutical company that asserts its patents against a nonprofit entity for providing the pharmaceutical company's patented drug in developing countries may draw the public's ire.[103] Furthermore, patent owners that assert their patents against competitors are increasingly labeled derisively in the press and otherwise, for seemingly no other reason than the fact that

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(2015) ("Many believe the root cause of the patent system's dysfunction is that the U.S. Patent and Trademark Office (PTO or Agency) is issuing too many invalid patents that unnecessarily drain consumer welfare, stunt productive research, and unreasonably extract rents from innovators.").

100 *See* Kimberly A. Moore, *Are District Court Judges Equipped to Resolve Patent Cases?*, 15 HARV. J.L. & TECH. 1, 3 (2001).

101 *Id.* (presenting the results of an empirical study showing that district court judges misconstrue what patents cover one-third of the time).

102 *See, e.g.*, John R. Allison & Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 AIPLA Q.J. 185, 205–06 (1998) (finding that nearly half of patents litigated on the issue of validity were found invalid); Love & Ambwani, *supra* note 97, at 93–94 (providing statistics relating to inter partes review, a new mechanism within patent law for reviewing the validity of patents).

103 *See, e.g.*, Marius Meland, *Abbott Labs Sued by Activists over AIDS Drug Patents*, LAW360 (Dec. 2, 2005, 12:00 AM), http://www.law360.com/articles/4659/abbott-labs-sued-by-activists-over-aids-drug-patents (detailing the ire that Abbott Labs' AIDS drug patents have drawn, including attempts to invalidate the patents in Brazil).

they asserted their patents against those competitors.[104] Indeed, parties increasingly use the pejorative "patent troll" term not only to describe parties that assert patents as their primary commercial activity, but to describe parties asserting their patents against competitors as well.[105] And when patent holders take hits to their reputation on the basis of patent assertions, they may lose support in capital, labor, and product markets.[106]

In sum, these different costs cumulatively mean that in many—perhaps most—cases, the likely costs of asserting a patent outweigh the likely benefits. As a result, many patentees are likely to forego asserting their rights in a wide range of situations, even in cases where they could, and where the predominant theories behind patent law seem to predict that they would.[107] Table 1 below summarizes these factors in table format. Following Table 1, Part III turns to applying this taxonomy to different industries to show that these disincentives to patent assertion play out differently from one industry to the next.

TABLE 1. TAXONOMY OF DISINCENTIVES TO PATENT ASSERTION

| **Factor** | **Examples** |
|---|---|
| Value of Patent(s) | Patent(s) may have limited commercial value, resulting in limited license fees and other damages even if successfully asserted |
| Search Costs | Costs associated with evaluating patent portfolios for valuable, infringed patents and seeking out potential infringers |
| Negotiation Costs | Costs associated with preparing and sending demand letters, negotiating and drafting licensing and settlement deals, and responding to counter-assertions |

104 *See, e.g.*, Ethan Baron, *Yahoo Investor Hits Back at 'Patent Troll' Critique of Activist Shareholder Starboard Value*, SILICONBEAT (May 6, 2016, 1:31 PM), http://www.siliconbeat.com/2016/05/06/yahoo-investor-hits-back-at-patent-troll-critique-of-activist-investor-starboard-value/ (reporting on this concern with respect to Yahoo); Sebastian Anthony, *Microsoft, Apple Withdraw from Android Patent Trolling: Is the Patent War Drawing to a Close?*, EXTREMETECH (Dec. 24, 2014, 8:03 AM), http://www.extremetech.com/extreme/196432-microsoft-apple-pull-back-from-android-patent-trolling-is-the-patent-war-drawing-to-a-close (describing how Microsoft, Apple, and others used an independent company endowed with its patent assets to "troll" Android-based hardware makers).

105 *See* Anthony, *supra* note 104.

106 *See* Asay, *supra* note 61, at 265.

107 Andrews, *supra* note 19, at 248.

| | |
|---|---|
| Litigation Costs | Costs of filing suit, discovery, responding to counterclaims, and litigating to trial |
| Invalidity Costs | Asserted patents may be invalidated if successfully challenged, resulting in lost licensing opportunities and forfeited patent rights more broadly |
| Reputational Costs | Assertions may damage company reputation, resulting in less support in capital, labor, and product markets |

## III. INDUSTRY-SPECIFIC PATENT NON-ASSERTION

Part II reviewed a variety of economic disincentives to asserting patents. Taken in the cumulative, these factors may make it seem surprising that patent holders ever assert patents. Yet while helpful, assessing patent non-assertion in this general matter misses important nuance. Indeed, clearly not all of the factors detailed above apply equally in any given situation. In other words, different patent owners have different risk profiles, resource and time constraints, relationships vis-à-vis potential infringers, business models, and, ultimately, different types and quantities of patents. These many differences likely matter in any given situation as to whether a patent holder ultimately asserts their patents.

This Part seeks to capture some of this missing nuance. It does so by theorizing patent non-assertion in a more industry-specific manner. Scholars have long argued that patents play different roles across industries.[108] On this basis, some have argued for more industry-specific tailoring of patent law.[109] This Article does not take a position on these policy proposals. Instead, it uses their collective acknowledgement of the industry-specific role of patent rights as a basis for better theorizing why patent owners forego asserting their patents in so many cases (as well as why they may not in others).

This Part has two basic claims. First, the different disincentives to asserting patents detailed in Part II apply differently depending on the industry. For instance, reputational costs for asserting patents are likely higher in some industries, such as software, than in others, such

108 Roin, *supra* note 28, at 687 ("For at least the past thirty years, patent scholars have recognized that there is substantial heterogeneity both within and across industries in the technological and economic characteristics relevant to optimal patent strength.").

109 *See supra* notes 24–27 and accompanying text.

as in the pharmaceutical industry.[110] Second, these disincentives to asserting patents often have dynamic relationships with one another. For example, if an industry is generally known for patents of low or questionable value and validity, patent assertions in that industry are more likely to result in higher reputational costs, even in cases where the patent is of significant commercial value and high quality. Conversely, in industries generally known for patents of high value and validity, patent assertions in those industries are less likely to result in significant reputational costs (regardless of the patent's actual value or validity). This dynamic interaction among the different factors, I argue, likely affects the decisions of many patent owners as to whether to forego asserting their patents.

Of course, as briefly discussed in the Introduction, it is also true that industries lack uniformity.[111] In other words, even an industry-specific approach will inevitably fail to capture all of the relevant nuances in any given situation, many of which are likely relevant as to whether a party chooses to assert its patents.[112] But an industry-specific approach nonetheless captures important generalizations that help explain industry-specific trends, as well as generates testable hypotheses for future research.[113] It also provides a better basis for assessing patent law theory and reform proposals more generally, a task which this Article takes up in Part IV.

The following Sections assess patent non-assertion in four specific industries: software, pharmaceuticals, biotechnology, and semiconductors. Although there are numerous other possible industries for study, these industries are some of the more significant to the economy and are, consequently, often selected for more intense examination.[114] For similar reasons, this Article selects these industries as case studies for deeper analysis.

Software and pharmaceuticals are often said to be on opposite ends of the spectrum in terms of patents, with patents being unimportant (and even harmful) in software and vital in pharmaceuticals.[115]

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110 *Compare* Section III.A.6, *with* Section III.B.6.

111 *See supra* notes 24–28 and accompanying text.

112 *See* Roin, *supra* note 28, at 687.

113 *See generally* WALTZ, *supra* note 31, at 7 (arguing that the best models represent theory, while also exemplifying reality).

114 *See* Roin, *supra* note 28, at 687.

115 Richard Posner, *Do Patent and Copyright Law Restrict Competition and Creativity Excessively?*, BECKER-POSNER BLOG (Sept. 30, 2012), http://www.becker-posner-blog.com/2012/09/do-patent-and-copyright-law-restrict-competition-and-creativity-excessively-posner.html ("Pharmaceutical drugs are the poster child for patent protection . . . . But the conditions that make

Perhaps unsurprisingly, the following Sections find that these two ends of the spectrum show the most divergence in terms of how disincentives to assert patents are likely to play out. In the middle of the spectrum, the semiconductor industry shows many similarities to the software industry in terms of patent non-assertion (but with important differences), while the biotechnology industry is more similar to the pharmaceutical industry (but also with important differences). The following Sections explore these claims in greater detail.

### *A. The Special Case of Software*

This Section claims that asserting an average software patent will typically result in high search, negotiation, litigation, validity, and reputational costs, and that an average software patent is likely to be of low value. Furthermore, in many cases these factors likely exacerbate one another, thereby increasing the costs of asserting an average software patent. Overall, these high barriers to patent assertion would thus seem to predict that patent non-assertion will be the norm in the software world, and that rates of patent assertion in the software industry will be lower than in other industries with more modest barriers to patent assertion.

Yet recent rises in patent assertion rates are largely attributable to software patents.[116] Can this reality be reconciled with this Article's claim that barriers to asserting software patents are generally high? This Section argues that reconciling the two actually leads to important insights. For instance, because of the high costs associated with asserting software patents, software patent holders often undertake efforts to minimize those costs while realizing some benefit from their patents; the primary means of doing so is to shift many of these costs to so-called patent trolls, which results in higher levels of software patent assertion than would otherwise be expected.[117] Furthermore, some software companies have sought to mitigate these costs by specializing in patent assertion themselves, thereby effectively becoming patent assertion entities.[118] This all suggests that high barriers to patent assertion may, ironically, result in increased rates of patent assertion in a given industry as parties outsource or otherwise attempt to mitigate

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patent protection essential in the pharmaceutical industry are absent [in the software industry].").

116 James Bessen, *A Generation of Software Patents*, 18 B.U. J. Sci. & Tech. L. 241, 257 (2012).

117 *See infra* notes 196–98 and accompanying text.

118 *See infra* notes 199–201 and accompanying text.

the high costs of patent assertion. The following Sections explore these points in greater detail.

### *1. The Low Value of Software Patents*

The value of an average software patent is likely to be low, and that low value may deter patent assertion in many cases. Software patents may generally exhibit low value for several reasons. For starters, many software patents may be of poor quality, which decreases their overall value.[119] Indeed, this has been a common complaint of software patents for some time.[120] And while it is a disputed point, it seems to hold true in many cases.[121] Hence, in cases where it does, that low value may deter the patent owner from asserting the patent.

But even in cases where a software patent's quality is high, the software patent may still have low value for other reasons, and that low value may also deter many patent assertions. For instance, modern software innovation is typically incremental and cumulative.[122] This means that any given software patent may only cover a modest innovation, thereby decreasing the overall value of such a patent. In some cases, parties may still assert such patents by engaging in strategic behavior, such as "patent holdup" or "royalty stacking"—tactics that can artificially inflate the value of otherwise low-value patents.[123] But there is at least some evidence that these types of holdup problems are not as significant as often imagined.[124] Hence, the low value of many software patents stemming from the incremental and cumulative nature of software innovation may also deter many patent holders from asserting them.

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119 *See* BESSEN & MEURER, *supra* note 25, at 187–214; James Bessen & Michael J. Meurer, *Lessons for Patent Policy from Empirical Research on Patent Litigation*, 9 LEWIS & CLARK L. REV. 1, 16 (2005); Arti K. Rai, *Improving (Software) Patent Quality Through the Administrative Process*, 51 HOUS. L. REV. 503, 509–11 (2013) (reviewing the literature on software patent litigation and its implications for software patent quality). *But see generally* John R. Allison & Ronald J. Mann, *The Disputed Quality of Software Patents*, 85 WASH. U. L. REV. 297 (2007) (reviewing and then refuting the claim that software patents are generally of low quality on the basis of an empirical analysis).

120 *See supra* note 119.

121 *See* Allison & Mann, *supra* note 119, at 324.

122 Pamela Samuelson et al., *A Manifesto Concerning the Legal Protection of Computer Programs*, 94 COLUM. L. REV. 2308, 2331 (1994).

123 *See* Mark A. Lemley & Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 TEX. L. REV. 1991, 1992–94 (2007) (describing the problems of patent holdup and royalty stacking when complicated products with multiple patentable features are subject to patent assertions).

124 *See, e.g.*, Ronald J. Mann, *Do Patents Facilitate Financing in the Software Industry?*, 83 TEX. L. REV. 961, 1004–05 (2005) (providing evidence suggesting that claims of patent "thicket" problems are largely unfounded).

Another reason software patents are increasingly losing value lies in recent Supreme Court jurisprudence. For instance, in *Alice Corp. Pty. Ltd. v. CLS Bank International*,[125] the Court effectively decreased the value of many software patents by making them more likely to be found invalid.[126] It did so by reformulating the test for determining whether a patent covers an "abstract idea," a category traditionally ineligible for patent protection.[127] The Court did not explicitly refer to software in its decision.[128] But the test it articulated meant that most granted software patents are likely ineligible for patent protection, in large part because earlier generations of patent prosecutors drafted software patents in ways that fail to satisfy the *Alice* test.[129] As evidence in support of this point, courts applying *Alice* have found the vast majority of software patents invalid for failure to claim patentable subject matter.[130] These outcomes may change for future software patents as parties adjust their patent drafting methods to better account for the *Alice* test.[131] But for now, *Alice* decreases the value of many software patents by making them more likely to be invalidated, which in turn may make it less likely that they will be asserted.

Of course, many software patents may be said to exhibit high value in part because of software's ubiquity. For instance, that ubiquity may increase a software patent's value by increasing the number of potential targets. Hence, even if a given software patent only covers a modest software innovation, software's ubiquity may increase the patent's value by increasing the chances that many parties practice the patented software. This greater array of targets may be particularly likely because the boundaries of software patents are often difficult to determine,[132] which may mean that software patent holders have greater ability to legitimately assert their patents against more parties. And if all of this is true, many software patents may actually have high value because of the greater number of potential infringers and, thus, revenue streams.

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125 134 S. Ct. 2347 (2014).

126 *See id.* at 2360.

127 *See id.*

128 *Id.*

129 *See* Gene Quinn, *The Ramifications of* Alice*: A Conversation with Mark Lemley*, IPWatchdog (Sept. 4, 2014), http://www.ipwatchdog.com/2014/09/04/the-ramifications-of-alice-a-conversation-with-mark-lemley/id=51023/.

130 *See, e.g.*, Yasser M. El-Gamal et al., *Down the Rabbit Hole: Trends in Software Patent Court Decisions Post-*Alice, Lexology (Dec. 22, 2015), http://www.lexology.com/library/detail.aspx?g=AB50e680-2ee4-451c-a2d7-720aa75fa914.

131 Asay, *supra* note 61, at 311–12.

132 *See* Bessen & Meurer, *supra* note 25, at 152.

Yet while these factors in isolation may increase the potential value of many software patents, other factors, discussed above and more fully below, can offset any such increase in value. For instance, while the fuzziness of software patents' boundaries may increase the number of potential targets, that same fuzziness may increase the costs of analyzing one's patents, identifying infringers, and negotiating with them.[133] It may also increase litigation costs and the possibility of the asserted patents being invalidated, including on the basis of the *Alice* decision or their low quality. Hence, while software's ubiquity may increase the value of many software patents by providing for more potential infringers, taking into account the frequently dynamic relationships between the different costs and risks of asserting software patents may frequently offset any potential increase in value.

In sum, there are a number of reasons why software patents may often exhibit low value. That low value, in turn, is likely to deter many patent owners from asserting them. Furthermore, the value of many software patents appears to have a dynamic relationship with the other costs associated with asserting software patents, as briefly discussed above and more fully examined below.

### *2. Search Costs*

On average, the search costs associated with asserting a software patent are likely to be high for several reasons. First, the last several decades have seen a significant increase in the overall number of software patents.[134] As such, any given software patent owner is likely to own a good number of patents to sift through in assessing whether they have patents worth asserting. Of course, this general trend of growing numbers of software patents does not affect all patent owners equally; some parties own significant numbers of patents, some have moderate numbers, and some only a few.[135] But the overall growth in software patents does mean that it is more likely a software patent owner will own some, and perhaps even many, software patents, par-

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133 *See id.* at 152–55.

134 *See, e.g.*, Brian Kahin, *Software Patents: Separating Rhetoric from Facts*, SCI. PROGRESS (May 15, 2013), http://scienceprogress.org/2013/05/software-patents-separating-rhetoric-from-facts/ (showing the significant increase in overall numbers of software patents granted over the last several decades in graph form).

135 For instance, IBM has acquired the most patents of any company for twenty-three straight years. Jing Cao & Susan Decker, *IBM Has Most U.S. Patents for 23rd Year in Cloud, Watson Push*, BLOOMBERG TECH. (Jan. 13, 2016, 5:00 AM), http://www.bloomberg.com/news/articles/2016-01-13/ibm-has-most-u-s-patents-for-23rd-year-in-cloud-watson-push.

ticularly since effective defensive patent portfolios—a growing trend in the software industry—require significant numbers of patents.[136]

A second reason that search costs are likely to be high stems from the difficulty in ascertaining the meaning and scope of any given software patent. Indeed, the meaning and scope of software patents is notoriously difficult to determine without multiple layers of litigation.[137] Unlike other fields such as chemistry and biotechnology, where "a clear scientific language [exists] for delineating what a patent claim does and doesn't cover," software patents have no such standard language.[138] This is exacerbated by the fact that those drafting software patents often purposefully inject ambiguity into the patents in hopes of broadening their scope.[139] Hence, the fuzzy boundaries of software patents will often increase search costs as parties encounter greater uncertainty in assessing their own patents and potential instances of infringement.

Third, the fuzzy boundaries of software patents, as well as the sheer number of software patents, also increase search costs by making it more difficult to assess potential counterclaims. As discussed above, even once a party has evaluated its own patents and identified potential infringers, that party may wish to assess the target's patent portfolio and other prior art, all in order to evaluate potential counterclaims.[140] But the high volume of software patents and their often indeterminate scope mean that such evaluations will often prove difficult and, thus, costly.

In the aggregate, these factors thus mean that software patent holders will often experience significant search costs in evaluating their own patent portfolios, the identity of potential infringers, and the strength of potential counterclaims. These search costs, even on their own, are likely high enough to deter many patent assertions. Furthermore, these search costs are likely to increase—and thus act as an even greater deterrent to patent assertion—because of their dynamic

136 *See, e.g.*, Bessen, *supra* note 116, at 257 (highlighting that while more software companies increasingly obtain patents, still relatively few software companies obtain patents at all); Mann, *supra* note 124, at 990–91 (providing survey results that indicate a major reason for software companies to obtain patents is for defensive purposes).

137 Mark A. Lemley, *Software Patents and the Return of Functional Claiming*, 2013 WIS. L. REV. 905, 930–31.

138 *Id.*

139 *See id.*

140 *See supra* Section II.B.

relationships with other categories of disincentives to patent assertion, as discussed more fully below.[141]

*3. Negotiation Costs*

Software patent assertions are likely to result in high negotiation costs for several reasons. Perhaps most importantly, it will often be the case, at least for parties that produce products, that an assertion results in some type of counter-assertion.[142] Indeed, some scholarship suggests that this is a significant reason why many parties do not assert their software patents in cases where they could.[143] Furthermore, as previously discussed, the growing numbers of issued software patents and the buildup of defensive patent portfolios mean that the likelihood of a counter-assertion is, on average, much higher today than it was previously.[144]

To illustrate: a patent owner may own a patent that is likely infringed, while the potential infringer owns a significant number of patents. Asserting the patent against the infringer is thus likely to result in significant costs, such as evaluating the counter-asserted patents and negotiating the terms of a license and settlement. And the terms may not be favorable given the disparity in patent leverage between the parties.

Moreover, even in cases where a party has significant patent leverage over the other party, negotiation costs may still be high. For instance, the party will still need to divert resources to negotiating a license and settlement agreement. And such diversions can undermine firm culture, morale, and focus.[145] In other words, the transaction costs resulting from a patent assertion may not be worth the assertion given tangible and intangible losses that the assertion leads to.

Furthermore, these negotiation costs may be higher in the software context simply because, as discussed above, ascertaining the scope and meaning of software patents is often quite difficult.[146] In other words, negotiations may become more protracted than they otherwise would be in part because the parties have a difficult time determining (and agreeing on) the scope of the respective patents, their value, and how to structure a licensing and settlement deal accord-

141 *See infra* Section III.A.7.

142 *See* Bessen & Meurer, *supra* note 4, at 413.

143 *See* Mann, *supra* note 124, at 980–82.

144 *See supra* Section III.A.2.

145 Mann, *supra* note 124, at 981–84.

146 *See supra* Section III.A.2.

ingly.[147] Overall, then, high negotiation costs, either separately or in combination with some of the other types of costs discussed herein, may dissuade many software patent owners from asserting their patents.

One point of clarity: the negotiation costs associated with assessing and responding to counterclaims, while related to the search costs associated with assessing potential counterclaims discussed above, are nonetheless different, additional costs. In the pre-assertion context, for instance, parties often incur search costs in speculating what counterclaims may be likely, all in order to assess whether the overall benefits of asserting patents against a party outweigh the costs.[148] But once a party has asserted patents against another party, some of the actual counter-assertions materialize, at which point the party may incur additional costs in negotiating with the other party, as described above. And those additional negotiation costs, for the reasons also detailed above, are likely to be high in the software context.

*4. Litigation Costs*

Litigation costs associated with software patent assertions are likely to be high, in part because patent litigation in general is simply expensive.[149] But there are additional reasons why software patent litigation costs may be high relative to other types of patent litigation.

First, the difficulty of ascertaining the meaning and scope of software patents makes it more plausible that software patent litigation will need to undergo several rounds of litigation, including appeals and remands to district courts, before a final outcome is reached.[150] In other words, the uncertain scope and meaning of software patents may dissuade many parties from asserting them, simply because the high costs associated with multiple rounds of litigation are entirely possible, and, perhaps, even likely.

Interestingly, a recent study by Jonas Anderson and Peter Menell shows that parties involved in computer-related and other software-related patent litigations appeal their cases at a lower rate, in absolute terms, than certain other types of patent cases.[151] But this may simply be evidence confirming that the uncertainty associated with software-

147 Lemley, *supra* note 137, at 930–31.

148 *See* Bessen & Meurer, *supra* note 4, at 413.

149 *See supra* Section II.B.

150 *See* Moore, *supra* note 100, at 3.

151 J. Jonas Anderson & Peter S. Menell, *Informal Deference: A Historical, Empirical, and Normative Analysis of Patent Claim Construction*, 108 Nw. U. L. Rev. 1, 51–53 (2014). Note that the many patent appeals were included in multiple categories, simply because the patents in-

related patents—and the likely high litigation costs that such uncertainty entails—pushes many parties to settle their disputes early, rather than fully litigating them. Of course, it is an open question as to why parties initiate software-patent litigations in the first place, given that this uncertainty, and the high litigation costs associated with it, also existed prior to the litigation. But in many cases, parties may simply miscalculate the costs of asserting their patents, only realizing the extent of the costs later in the process.

Indeed, such miscalculations may be particularly likely in part because it is often difficult for the original patent asserter to anticipate ex ante the exact counterclaims they will face (even if they can anticipate that some counterclaims are likely). Accurately anticipating counterclaims (and the costs associated with them) may be particularly difficult in the software context because the uncertain scope and meaning of software patents means that counterclaims may materialize from unexpected sources.

Counterclaims thus represent a second reason why litigation costs may be particularly high in software patent litigation. And this is so for at least two reasons. First, as previously discussed, the likelihood of counterclaims is growing on average, particularly as more parties in the software industry acquire increasing numbers of patents.[152] Second, because of the uncertain scope and meaning of software patents, counterclaims may result in higher than expected costs as parties are forced to muddle through multiple rounds of litigation to resolve their disputes.

In sum, litigation costs are likely to be high in the software industry. This is so in part simply because patent litigation is extremely expensive. But the uncertainty associated with software patents, and the likelihood of counterclaims, increases these costs in ways that may deter many parties from ever asserting their software patents in the first place. And for those that do, these costs may eventually push parties to settle rather than fully litigate the dispute.

### *5. Invalidity Costs*

Software patent holders that assert their patents are likely to incur invalidity costs for several reasons. For instance, courts and other tribunals, such as the Patent Trial and Appeals Board ("PTAB"), find

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volve more than one category. *Id.* at 52. Hence, computer-related patent appeals may include many software patent appeals, and vice-versa.

152 *See* Bessen & Meurer, *supra* note 4, at 413.

challenged patents invalid at relatively high rates.[153] Furthermore, some (albeit limited) evidence suggests that these reviewing tribunals are even more likely to find software patents invalid than other types of patents.[154]

There are good reasons why this may be true. First, much of the prior art in software is not patented for various reasons, but patent examiners typically mostly search issued patents when assessing new patent applications.[155] This means that when this non-patent prior art does surface, such as when a party finds and presents it in court or at the PTAB, many issued software patents are invalid because they do not cover new material or are obvious in light of this prior art. These risks and the associated costs may thus deter many parties from asserting their software patents, let alone daring to fully litigate them.

Second, even setting aside this unpatented prior art, the sheer number of software patents may also increase the risks of invalidity. For instance, in processing patent applications, patent examiners may often find it difficult to assess all relevant patented software prior art, since there is so much of it and examiners spend so little overall time examining any given patent application.[156] But once patent holders assert their rights against third parties, those third parties have every motivation to seek out all relevant patented prior art as evidence that the asserted patent is invalid.[157]

Third, these risks of invalidity have increased in the wake of the Supreme Court's *Alice* decision. As previously discussed, this decision has significantly increased the likelihood that challenged software patents will be found invalid for failing to claim patentable subject matter.[158] In fact, post-*Alice* decisions have so overwhelmingly invalidated contested software patents that invalidation may be a near certainty, rather than a mere risk. Part IV discusses the implications of this result in greater detail.

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153 *See* Love & Ambwani, *supra* note 97, at 94–95.

154 John R. Allison et al., *Patent Quality and Settlement Among Repeat Patent Litigants*, 99 GEO. L.J. 677, 707–09 (2011).

155 Julie E. Cohen, *Reverse Engineering and the Rise of Electronic Vigilantism: Intellectual Property Implications of "Lock-Out" Programs*, 68 S. CAL. L. REV. 1091, 1177–79 (1995); Dennis M. de Guzman, In Re Epstein*: A Case of Patent Hearsay*, 70 WASH. L. REV. 805, 809–11 (1995).

156 Lemley, *supra* note 12, at 1500 (indicating that patent examiners spend on average eighteen hours total per patent application).

157 *See* Greg Reilly, *Decoupling Patent Law*, 97 B.U. L. REV. (forthcoming 2017) (manuscript at 15), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2854375 (indicating that accused infringers are "strongly incentivized to identify, develop, and exploit any problem, ambiguity, or uncertainty in the patent").

158 *See supra* notes 125–31 and accompanying text.

In sum, for at least the three reasons identified above, software patent asserters face high risks that they will incur invalidity costs. These costs may on their own may be sufficient to deter many software patent assertions, let alone when combined with the other high costs described herein.

### *6. Reputational Costs*

Software patent holders are likely to incur significant reputational costs when they assert their patents. This is so, in part, because asserting software patents violates growing norms of collaboration and openness that permeate the software industry.[159] And as other scholars have recognized, norms in an industry can often be more important than actual legal rules.[160]

The software industry's growing norms of openness and collaboration largely derive from the free and open source software movement. For the last several decades, this movement has championed sharing software externally and collaborating with other software developers to build software resources collectively.[161] This model of software innovation powers some of the most important software technologies and services in the world—including Linux, Android, Apache, Mozilla, Facebook, Netflix, Airbnb, and countless others.[162] Indeed, this movement has proved so successful that its tenets are increasingly a part of everyday life in corporate America.[163]

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159 *See* Clark D. Asay, *A Case for the Public Domain*, 74 OHIO ST. L.J. 753, 765–66 (2013) (reviewing some of these changes).

160 *See* Lisa Bernstein, *Merchant Law in a Merchant Court: Rethinking the Code's Search for Immanent Business Norms*, 144 U. PA. L. REV. 1765, 1771 (1996) (discussing the role of norms in interactions between members of the National Grain and Feed Association); Lisa Bernstein, *Opting Out of the Legal System: Extralegal Contractual Relations in the Diamond Industry*, 21 J. LEGAL STUD. 115, 115 (1992) (describing the trade codes and private arbitration tribunals used to resolve disputes in the New York diamond industry); Lisa Bernstein, *Private Commercial Law in the Cotton Industry: Creating Cooperation Through Rules, Norms, and Institutions*, 99 MICH. L. REV. 1724, 1724 (2001) (discussing how the "cotton industry has almost entirely opted out of the public legal system" and instead relies on private legal system of its own creation).

161 *See* Asay, *supra* note 159, at 765–77.

162 *Id.* at 761, 766–67; Jake Flomenberg, *The Rise of OPEN Innovation: The 3P's for Building a Durable Open Software Company*, ACCEL INSIGHTS (Feb. 26, 2016), https://medium.com/accel-insights/the-rise-of-open-innovation-the-3p-s-for-building-a-durable-open-software-company-3bc6e0ec6fa7#.c9a60ztwv.

163 *See The Tenth Annual Future of Open Source Survey*, BLACK DUCK (2016), https://www.blackducksoftware.com/2016-future-of-open-source (noting high percentages of companies that contribute to and use free and open source software technologies).

Yet importantly, the movement's norms conflict with some of patent law's core tenets.[164] For instance, a patent centralizes rights in whoever owns the patent, whereas open innovation movements thrive in part because authority is decentralized.[165] In other words, the open innovation model works in part because no single party controls participants in any given software project; participants are free to use and contribute to the software project as they please, subject to satisfying a variety of possible license conditions.[166]

Hence, in part because of this conflict, the role of patents has drawn increased (and often negative) attention in the software industry.[167] Parties have tried and proposed a variety of potential solutions to reconciling this conflict,[168] many of which focus on using patents as defensive tools against patent assertion.[169] Patent holders in the software industry also increasingly "pledge" some or all of their patents to the public.[170] In such scenarios, software patent owners voluntarily commit to forego enforcing the pledged patents.[171] There are a variety of possible reasons behind these pledges.[172] But most of these reasons often focus, in one form or another, on facilitating some type of collaborative innovation,[173] including generating "network effects."[174] And while the free and open source software movement may not be solely responsible for this trend, its important role in pushing

164 *See generally* Clark D. Asay, *Enabling Patentless Innovation*, 74 MD. L. REV. 431 (2015) (exploring some of these conflicts).

165 *See id.* at 432; Yochai Benkler, *Coase's Penguin, or, Linux and* The Nature of the Firm, 112 YALE L.J. 369, 375 (2002) ("Commons-based peer production, the emerging third model . . . relies on decentralized information gathering and exchange to reduce the uncertainty of participants.").

166 *See* David McGowan, *The Tory Anarchism of F/OSS Licensing*, 78 U. CHI. L. REV. 207, 207 (2011) (arguing in favor of the importance of these licensing conditions in making the model work).

167 *See, e.g.*, Kristen Osenga, *Debugging Software's Schemas*, 82 GEO. WASH. L. REV. 1832, 1844–47 (2014) (describing some of this controversy).

168 *See* Asay, *supra* note 164, at 472–80 (reviewing the main categories of such proposals).

169 *See, e.g.*, Jason Schultz & Jennifer M. Urban, *Protecting Open Innovation: The Defensive Patent License as a New Approach to Patent Threats, Transaction Costs, and Tactical Disarmament*, 26 HARV. J.L. & TECH. 1, 37 (2012) (proposing the "Defensive Patent License" as a remedy to patent risks in the free and open source software world).

170 *See, e.g.*, Jorge L. Contreras, *Patent Pledges*, 47 ARIZ. ST. L.J. 543, 545 (2015).

171 *See id.* at 543.

172 *See id.* at 573–93 (describing the various motivations behind patent pledges).

173 *See id.* at 588–90.

174 For a discussion of network effects in the world of software, see generally Max Schanzenbach, *Network Effects and Antitrust Law: Predation, Affirmative Defenses, and the Case of* U.S. v. Microsoft, 2002 STAN. TECH. L. REV. 4, 8 (discussing operating systems and complementary software products as exhibiting network effects).

innovators toward more collaborative innovation in general cannot be denied.[175]

Given these growing norms, software patent holders that violate them by asserting patents are likely to incur significant reputational costs. One such cost may be that many third-party software developers—so many of which have embraced these norms—will be less likely to adopt (and support) the asserter's goods and services.[176] And in today's software world, that is a significant cost, because companies often depend on third-party developers to make their own more attractive.[177] For instance, Apple's app store without third-party apps is hardly alluring,[178] nor is a game console with limited numbers of third-party games.[179] This means that alienating those third parties via patent assertions can significantly affect a company's bottom line. And if much of the industry is focused on using patents only defensively and finding other ways to limit patent aggression,[180] then patent assertions are, in fact, likely to alienate much of the industry.

A related cost of asserting patents in the software industry is greater difficulty in hiring and retaining talented employees in an in-

175 *See* Elon Musk, *All Our Patent Are Belong to You*, TESLA BLOG (June 12, 2014), https://www.tesla.com/blog/all-our-patent-are-belong-you (describing Tesla's patent pledge as being in the "spirit" of the open source software movement).

176 *See, e.g.*, Ryan Paul, *Oracle's Java Lawsuit Undermines Its Open Source Credibility*, ARSTECHNICA (Aug. 14, 2010, 4:08 PM), http://arstechnica.com/information-technology/2010/08/oracles-java-lawsuit-undermines-its-open-source-credibility/ (describing a possible fallout of customers and users because of an Oracle patent lawsuit against Google).

177 *See* Michael Vakulenko, *5 Ways Developers Can Extend Your Business Model*, VISIONMOBILE (Jan. 11, 2016), http://www.visionmobile.com/blog/2016/01/5-ways-developers-can-extend-your-business-model/ (discussing five specific ways that third-party developers are important to creating value for companies).

178 Apple Inc., Annual Report (Form 10-K) 18 (Oct. 27, 2009), http://files.shareholder.com/downloads/AAPL/4244750170x0xS1193125%2D09%2D214859/320193/filing.pdf ("The Company's future performance depends on support from third-party software developers. If third-party software applications and services cease to be developed and maintained for the Company's products, customers may choose not to buy the Company's products.").

179 Paul Tassi, *An Inside Explanation of Why Third Parties Have Left the Wii U*, FORBES (Jan. 11, 2014, 11:20 AM), http://www.forbes.com/sites/insertcoin/2014/01/11/an-inside-explanation-of-why-third-parties-have-left-the-wii-u/#3aa5235357b1 (discussing reasons why third-party game developers have ceased developing games for the Wii U).

180 For a discussion of another recent and important effort to limit patent aggression in the software industry, see Matt Levy, *The License on Transfer Network Is a LOT of Good*, PAT. PROGRESS (July 18, 2014), http://www.patentprogress.org/2014/07/18/license-transfer-network-lot-good/ (discussing the "License on Transfer Network" of patents, whereby any patent included in the network is automatically licensed to all other members if that patent is ever sold to a third party).

creasingly competitive labor market.[181] This cost can be particularly significant since software engineers in today's world are, in some respects, the most important assets of many technology companies.[182] Indeed, "acqhires," where companies purchase other companies solely for their talented engineers, are increasingly common.[183] Hence, remaining competitive for talented software engineers requires at least some acceptance of the norms of open innovation, since the current generation of software engineers in particular has largely embraced them.[184] Aggressive patent enforcement can thus harm a patent holder's ability to attract and retain talented engineers, since such enforcement conflicts with the norms that many of these engineers adhere to.

In fact, some patent pledges seem squarely aimed at currying favor with engineers by disavowing patent aggression, such as Twitter's pledge not to assert any of its patents unless it receives permission from the employee(s) responsible for the patented invention.[185] While less overt, Microsoft's recent spate of patent pledging also seems to be motivated, at least in part, by a desire to rehabilitate a somewhat tarnished reputation in developer communities.[186]

In sum, patent assertions in the software industry can entail high reputational costs that may undermine commercial success in important respects. Of course, patent holders may still find patent assertions worthwhile, despite these costs, in a variety of cases.[187] But the reputa-

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181 *See* Sean Gallagher, *Software Is Eating the Job Market*, TECHCRUNCH (June 9, 2015), https://techcrunch.com/2015/06/09/software-is-eating-the-job-market/.

182 Venkatesh Rao, *The Rise of Developeronomics*, FORBES (Dec. 5, 2011, 6:32 PM), http://www.forbes.com/sites/venkateshrao/2011/12/05/the-rise-of-developeronomics/#3f4abdeb1548 (discussing how software engineers have become the most important asset of many companies).

183 Miguel Helft, *For Buyers of Web Start-Ups, Quest to Corral Young Talent*, N.Y. TIMES (May 17, 2011), http://www.nytimes.com/2011/05/18/technology/18talent.html?_r=0 (discussing the growing phenomenon of "acqhire[s]").

184 Simon Phipps, *The Rise and Rise of Open Source*, INFOWORLD (May 8, 2015), http://www.infoworld.com/article/2914643/open-source-software/rise-and-rise-of-open-source.html; Erin Richey, *5 Things to Know About the Rise of Open Source*, FORBES (Apr. 9, 2015, 4:53 PM), http://www.forbes.com/sites/centurylink/2015/04/09/5-things-to-know-about-the-rise-of-open-source/#6d8ab0ec780f.

185 Adam Messinger, *Introducing the Innovator's Patent Agreement*, TWITTER (Apr. 17, 2012, 5:00 PM), https://blog.twitter.com/2012/introducing-the-innovator-s-patent-agreement.

186 Asay, *supra* note 61, at 294–95.

187 *See* Kevin McLaughlin, *Microsoft Exec: Linux Patent Licensing Becoming 'Less Relevant' as We Embrace Open Source Partnerships*, CRN (Apr. 26, 2016, 6:43 PM), http://www.crn.com/news/applications-os/300080479/microsoft-exec-linux-patent-licensing-becoming-less-relevant-as-we-embrace-open-source-partnerships.htm (discussing how Microsoft asserts its patents against users of Android, but also noting that these assertions may diminish as Microsoft increasingly adopts the norms of open innovation).

tional costs associated with asserting patents in the software industry are nonetheless increasingly significant and likely to affect whether a given software patent holder decides to assert its rights.

### *7. Dynamic Costs*

Importantly, the six categories of costs reviewed above are likely to have dynamic relationships in many cases. Some of this dynamism was discussed or alluded to in the preceding Sections. For instance, as briefly touched upon, the high risks of invalidity lower the value of many software patents.[188] Furthermore, a widespread perception of low-value, invalid software patents may increase the reputational costs associated with asserting a patent.[189] And this may be true even in cases where the patent is actually valid and of relatively high value. In addition, the norms behind open software innovation that lead to reputational costs for asserting patents may also increase the risks that software patents will be invalidated and considered of low value. This may be so, for instance, if those norms are so entrenched that biases against software patents affect judicial assessments of validity and value.

Search, negotiation, and litigation costs will also often affect each other. For instance, as discussed above, search costs may include assessing not only one's own patent portfolio, but also the patent portfolios of likely infringers (and others), all in order to assess the likelihood of counterclaims and what negotiation and litigation costs may follow. Furthermore, once counterclaims in fact materialize, search costs exacerbate negotiation and litigation costs as parties incur additional costs sifting through the patents and other prior art used in those counterclaims. And in the software industry, these added costs may be quite high, since the difficulties of assessing one's own patents[190] also apply in examining the patents (and other prior art) of third parties. Furthermore, invalidity costs may also affect search, negotiation, and litigation costs, since the high risks of incurring them may force parties to spend more time assessing their own patents, potential infringers, and engaging in negotiation and litigation.

In the software industry, therefore, many of the categories of high costs reviewed above are likely to exacerbate each other in ways that make software patent assertions even less likely than when these cate-

188 *See supra* notes 125–31 and accompanying text.

189 *See supra* Section III.A.6.

190 *See* BESSEN & MEURER, *supra* note 25, at 152.

gories are considered in isolation. Table 2 below summarizes the above analysis relating to the software industry.

TABLE 2. DISINCENTIVES TO PATENT ASSERTION IN THE SOFTWARE INDUSTRY

| **Factor** | **Analysis** |
|---|---|
| Value of Patent(s) | Low, including by way of perception. May be further decreased by invalidity and reputational costs |
| Search Costs | High. May be exacerbated by negotiation, litigation, and invalidity costs |
| Negotiation Costs | High. May be exacerbated by litigation and invalidity costs |
| Litigation Costs | High. May be exacerbated by negotiation and invalidity costs |
| Invalidity Costs | High. May be exacerbated by reputational factors |
| Reputational Costs | High. May be exacerbated by perceptions that software patents have low value or are invalid |

### *8. Mitigating the Costs*

It is worth reiterating that the above analysis is a general one and may not fully explain any given instance of patent non-assertion in the software industry. But that is how theories work—they seek to explain events in general, while acknowledging that details relevant to any given situation are necessarily left out.[191]

More problematic for a theoretical model, however, is if it does not track reality at all. At first glance, this may seem to be a problem for the software industry model described above. For instance, these factors would seem to predict low rates of patent assertion in the software industry. Yet recent rises in patent litigation rates are largely attributable to software patent assertions.[192] Indeed, some recent evidence shows that software patents are much more likely to be enforced in litigation than some other types of patents,[193] though it is still the case that the vast majority of software patents are never asserted.[194] But the rise in software patent assertions relative to other

191 *See* WALTZ, *supra* note 31, at 7.

192 Bessen, *supra* note 116, at 249.

193 *See* John R. Allison et al., *Patent Litigation and the Internet*, 2012 STAN. TECH. L. REV. 3, 4 (discussing litigation rates of internet patents).

194 *See, e.g.*, James Bessen, *The Case Against Software Patents, in 9 Charts*, VOX (Sept. 15,

types of patent assertions is nonetheless troubling given the analysis above. What explains this potential discrepancy?

While the growth of the software industry in general provides one possible answer, the more persuasive response is patent trolling.[195] As others have documented, the recent uptick in software patent assertions (and patent assertions in general) is largely attributable to patent trolling.[196] This reality points to an important claim of this Article: high barriers to patent assertion in a given industry may, ironically, result in higher rates of patent assertion by fostering patent trolling.

How would high barriers to patent assertion in an industry result in increasing rates of patent assertion? They may do so principally in one of two ways. First, the high costs of patent assertion may push some software patent owners to attempt to mitigate these costs (while still realizing some economic benefit from their patents) by outsourcing those costs to a specialized patent assertion entity, i.e., a patent troll.[197] For instance, a company may be able to avoid many of the otherwise debilitating costs described above by licensing or selling its software patents to a patent troll.[198] A patent troll then does the dirty work: the troll assesses the patents and likely infringers, begins an assertion campaign, collects licensing fees, and ultimately may pass some of these fees back to the original patent owner. The patent troll thus assumes many of the search, negotiation, litigation, and invalidity costs described above. Furthermore, patent trolls' immunity to counter-assertions eliminates some of the costs that a software patent owner would otherwise incur.[199] Nor are trolls dissuaded from patent assertions because of potential reputational repercussions. And the original patent owner, behind the veil of the patent troll, may also be able to escape many of the reputational costs as well.

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2014, 11:08 AM), http://www.vox.com/2014/7/7/5862284/9-charts-that-show-patents-are-bad-for-the-software-industry (showing that only about 5% of software patents become involved in litigation).

195 *See* John R. Allison et al., *Extreme Value or Trolls on Top? The Characteristics of the Most-Litigated Patents*, 158 U. PA. L. REV. 1, 32 (2009); Joe Mullin, *Patent Troll Lawsuits Head Toward All-Time High*, ARSTECHNICA (July 10, 2015, 3:00 PM), http://arstechnica.com/tech-policy/2015/07/patent-troll-lawsuits-head-towards-all-time-high/ (showing that patent trolls are responsible for 68% of all patent suits, with that number rising to 90% in the high-tech sector).

196 Lemley, *supra* note 137, at 933 & n.113; James Bessen, *The Patent Troll Crisis Is Really a Software Patent Crisis*, WASH. POST: THE SWITCH (Sept. 3, 2013), https://www.washingtonpost.com/news/the-switch/wp/2013/09/03/the-patent-troll-crisis-is-really-a-software-patent-crisis/.

197 *See* Lemley & Melamed, *supra* note 4, at 2122, 2124–25 ("Patent trolls typically, but not always, acquire their patents from others.").

198 *See* Tom Ewing, *Indirect Exploitation of Intellectual Property Rights by Corporations and Investors*, 4 HASTINGS SCI. & TECH. L.J. 1, 5 (2012).

199 Bessen & Meurer, *supra* note 4, at 413.

Second, software patent owners may seek to reduce the costs of patent assertion by specializing in patent assertion themselves.[200] Specialization may reduce many of these costs in a number of ways. For instance, by focusing on patent assertion, a software patent owner obtains efficiencies in searching, negotiating, and litigating its patents, thereby reducing many of the more significant costs described above.[201] Furthermore, the patent owner is likely able to mitigate invalidity risks, because its specialization in patent assertion may provide it with a more grounded sense as to which of its patents are likely valid and otherwise valuable. Finally, in some cases the software patent owner may not face significant reputational costs because they are no longer providing goods and services to the public.[202]

Hence, rather than undermining this Article's theoretical model, the rise in software patent assertions due to patent troll activity instead suggests that high barriers to patent assertion in an industry may unintentionally increase patent assertion rates as parties shift those high costs to third parties or specialize in patent assertion themselves. Accordingly, if lower rates of patent assertion are normatively a good thing, then the key to reducing assertion rates (in the software industry and elsewhere) may be to ensure moderate costs relating to patent assertion, or at least to ensure that the high barriers to patent assertion deter patent trolling rather than patent assertion in general. Part IV will further explore these issues.

### *B. The Special Case of Pharmaceuticals*

As briefly mentioned in the Introduction, the pharmaceutical industry differs in important respects from the software industry.[203] The following Sections explore some of these differences to help explain how patent assertion in the pharmaceutical industry differs from that in the software world and elsewhere.

#### *1. The High Value of Pharmaceutical Patents*

Commentators often point to the pharmaceutical industry as the best example of where patents work well.[204] This claim has much to do

200 *See* Osenga, *supra* note 32, at 444–45.

201 *Id.* at 466 (describing these types of entities as achieving efficiencies "through the division of labor").

202 *But see id.* (demonstrating that many such entities do, in fact, still produce goods and services for public consumption).

203 *See supra* text accompanying notes 31–32.

204 *See, e.g.*, Price, *supra* note 29, at 1452 (noting that "[t]he pharmaceutical and biomedical industries are typically characterized as areas where patents work fairly well" in part because

with the fact that the industry is capital intensive.[205] In other words, "pioneering" or brand-name pharmaceutical companies must often invest billions of dollars in research and development activities before they are able to bring a pharmaceutical product to market.[206] These costs include those associated with satisfying the Food and Drug Administration's ("FDA") requirements, such as extensive clinical testing aimed at verifying the product's "safety, efficacy, pharmacology, and toxicology."[207] These costs also include high failure rates, since the vast majority of drugs never actually make it out of a company's research and development pipeline.[208] Consequently, the ability to exclude competitors from copying successful products—and thereby recoup some of these costs—is vital to a pharmaceutical company's willingness to make such large investments.[209] Hence, patents in the pharmaceutical industry are said to work as intended, i.e., as ex ante incentives for parties to pursue innovative activity they would otherwise be too risk-averse to undertake.[210]

This leads to a patent acquisition strategy in the pharmaceutical sector that some have identified as patent "portfolio optimization."[211] In other words, because the ability to exclude competitors from practicing their inventions is so vital to pharmaceutical companies, they tend to focus on obtaining "strong legal protection" in the form of multiple patents relating to "discrete" technologies, such as the active molecule in a single pharmaceutical drug.[212] Patents in the pharmaceutical industry thus tend to "correspond to high value innovations," or at least innovations that threaten the commercial footing of their com-

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these industries require substantial upfront investment, and patent rights help recoup those investments).

205 *See id.*

206 *See* Matthew Avery, *Continuing Abuse of the Hatch-Waxman Act by Pharmaceutical Patent Holders and the Failure of the 2003 Amendments*, 60 HASTINGS L.J. 171, 174 (2008); Joseph A. DiMasi & Henry G. Grabowski, *The Cost of Biopharmaceutical R&D: Is Biotech Different?*, 28 MANAGERIAL & DECISION ECON. 469, 477 (2007) (indicating that average time-adjusted research and development costs are $1.32 billion per new molecule approved by the Food and Drug Administration ("FDA")).

207 Avery, *supra* note 206, at 174.

208 Robin Feldman & W. Nicholson Price II, *Patent Trolling: Why Bio & Pharmaceuticals Are at Risk*, 17 STAN. TECH. L. REV. 773, 786 (2014).

209 *See* Avery, *supra* note 206, at 172.

210 *See* DAVID SCHWARTZMAN, INNOVATION IN THE PHARMACEUTICAL INDUSTRY 4 (1976).

211 DIETMAR HARHOFF ET AL., THE STRATEGIC USE OF PATENTS AND ITS IMPLICATIONS FOR ENTERPRISE AND COMPETITION POLICIES 10 (2007).

212 *Id.*

petitors.[213] This high value, in turn, is likely to correspond with high rates of patent assertion in the face of patent infringement.

The pharmaceutical industry also includes an important regulatory overlay—in particular, the Hatch-Waxman Act[214]—that bolsters the value of pharmaceutical patents and makes patent assertion in the face of infringement more likely. To show how, some brief background on Hatch-Waxman is necessary.

The parts of Hatch-Waxman most critical to this Section's analysis relate to generic drug manufacturers. A key part of Hatch-Waxman's purpose was to make it easier for generic drug companies to introduce lower-cost generic versions of popular drugs to the market.[215] One way Hatch-Waxman does this is by allowing generic drug makers to piggyback on a pioneering firm's clinical results by filing an Abbreviated New Drug Application ("ANDA") and otherwise showing bioequivalence to the FDA-approved product.[216] In other words, the generic manufacturer need not undertake all the expensive clinical trials itself.

Furthermore, if the generic manufacturer certifies as part of its ANDA that its product does not infringe any relevant patents of the brand-name firm or that the patents are invalid (called a Paragraph IV certification), the generic company receives a 180-day market exclusivity period.[217] This exclusivity period means that the FDA will not approve other generic companies to market a similar generic product during that period, which starts once the generic company actually starts marketing its own generic product.[218]

When a generic company makes a Paragraph IV certification, the brand-name company receives notice of it and has forty-five days to bring an infringement suit against the generic company, since Hatch-Waxman defines making a Paragraph IV certification as an act of infringement.[219] If the brand-name company initiates a patent infringement suit, the FDA automatically grants a thirty-month stay to

213 Bronwyn H. Hall, The Use and Value of Patent Rights 11 (2009), https://www.uspto.gov/sites/default/files/aia_implementation/ipp-2011nov08-ukipo-2.pdf.

214 Drug Price Competition and Patent Term Restoration Act of 1984, Pub. L. No. 98-417, 98 Stat. 1585.

215 Avery, *supra* note 206, at 175.

216 *Id.* at 175–77 (reviewing key provisions of the Hatch-Waxman Act, including the exclusivity period for the first generic drug maker to challenge the patents of a brand-name drug maker).

217 *Id.* at 177–78.

218 *Id.* at 178.

219 *Id.* at 177.

approving the ANDA application.[220] This has the effect of expanding the brand-name company's patent rights, since if the ANDA were otherwise approved, the generic company could take its chances and simply begin to market the generic product.[221]

This regulatory structure thus increases the value of pharmaceutical patents in several key ways, which in turn makes it more likely that a patent owner will assert its rights against infringers. First, the reality that generic companies often challenge a brand-name company's patents in pursuit of market exclusivity is likely to enhance the patent optimization approach to pharmaceutical patenting mentioned above. In other words, these regulatory interventions should also lead pharmaceutical companies to carefully vet and obtain high-value patents that are highly likely to be found valid and infringed.

Second, these provisions increase the value of pharmaceutical patents by providing them with regulatory enhancements. The automatic thirty-month stay, for instance, provides patentees with a form of injunctive relief without the need to make the typical showing.[222] Indeed, the ability of brand-name companies to sue generic entrants for infringement before actual market entry allows them to avoid any lost revenues.[223] These regulatory enhancements thus simultaneously boost the value of pharmaceutical patents and the likelihood that the owner thereof will assert them.

Of course, patent activity within the pharmaceutical industry also occurs outside of the ANDA context.[224] For instance, pharmaceutical companies are increasingly turning to biologic drugs, often sourcing them from biotechnology companies, and generic versions of biologic drugs are regulated differently than those of traditional pharmaceutical products.[225] Nonetheless, the ANDA context is an important setting for many patent assertions in the pharmaceutical industry.[226]

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220 *Id.*

221 *See* Rebecca S. Eisenberg & Daniel A. Crane, *Patent Punting: How FDA and Antitrust Courts Undermine the Hatch-Waxman Act to Avoid Dealing with Patents*, 21 MICH. TELECOMM. & TECH. L. REV. 197, 208–09 (2015).

222 *Id.* at 209.

223 *Id.*

224 John R. Allison & Lisa Larrimore Ouellette, *How Courts Adjudicate Patent Definiteness and Disclosure*, 65 DUKE L.J. 609, 640 n.80 (2016).

225 *See* Ryan Timmis, *The Biologics Price Competition and Innovation Act: Potential Problems in the Biologic-Drug Regulatory Scheme*, 13 NW. J. TECH. & INTELL. PROP. 215, 222–23 (2015).

226 *See* Jacob S. Sherkow, *Describing Drugs: A Response to Professors Allison and Ouellette*, 65 DUKE L.J. ONLINE 127, 129–30 (2016) (discussing the different types of pharmaceutical industry litigation, with ANDA litigation being a prominent form thereof).

Furthermore, the high value of pharmaceutical patents even outside the ANDA context means that, in the face of infringement, patent assertions in the pharmaceutical industry are still likely.

In sum, pharmaceutical patents on average exhibit high value, both because of the heavy costs associated with pharmaceutical research and development, and because of the FDA regulatory structure that governs pharmaceutical products. This high value, in turn, makes it likely that pharmaceutical patent owners will assert their patents against potential infringers.

*2. Search Costs*

Search costs are likely to be lower in the pharmaceutical industry than in other industries. And Hatch-Waxman has a great deal to do with this. For instance, Hatch-Waxman requires brand-name companies to list in their New Drug Application ("NDA") any of their patents that they believe apply to the new drug.[227] Once the FDA approves the NDA, it is published with information about the applicable patents, in what is informally called the "Orange Book."[228]

When a generic company files an ANDA in hopes of producing a generic version of an FDA-approved drug, they are required to address any patents listed in the Orange Book for the drug, including a potential Paragraph IV certification, as discussed above.[229] Hence, in many cases, owners of pharmaceutical patents need only list their patents relevant to a new drug in the Orange Book and then wait for notifications of infringement.[230] They need not incur costs in monitoring the market for infringers—Hatch-Waxman requires generic companies that file ANDAs to notify them of infringement, including in Paragraph IV certifications, with "a detailed statement of the factual and legal basis of the opinion of the applicant that the patent is invalid or will not be infringed."[231]

Of course, pharmaceutical patent owners do incur costs in determining which of their patents belong in the Orange Book in the first place. But even these costs are likely to be relatively low, in large part because the scope and meaning of pharmaceutical patents is often much easier to decipher than, say, software patents.[232] As a result, de-

227 Natalie M. Derzko, *The Impact of Recent Reforms of the Hatch-Waxman Scheme on Orange Book Strategic Behavior and Pharmaceutical Innovation*, 45 IDEA 165, 169 (2005).

228 *Id.*

229 *Id.* at 173.

230 Eisenberg & Crane, *supra* note 221, at 209.

231 21 U.S.C. § 355(j)(2)(B)(iv)(II) (2012).

232 Lemley, *supra* note 137, at 930.

termining which patents apply to which drugs is likely to be relatively straightforward in many cases. And once pharmaceutical patent owners have made these determinations, many of their search costs are at an end.

Even outside of the Hatch-Waxman context, search costs associated with pharmaceutical patents are low for other reasons. For instance, there are simply fewer participants in the pharmaceutical industry than, say, the software industry.[233] Consequently, it is much easier for the limited number of industry players to monitor each other. Furthermore, even though pharmaceutical companies are increasingly sourcing biologic drugs,[234] the regulatory structure governing generics of most biologic drugs still requires generic companies to consult with the pioneering firm about relevant patents.[235] While these consultations may increase other types of costs, they nonetheless reduce search costs that may otherwise deter patent assertion.

In sum, search costs in the pharmaceutical industry are likely to be relatively low for at least two reasons. First, the regulatory overlays applicable to the industry often force infringers to self-identify. And second, the industry simply has fewer parties to monitor. As a result, search costs in the pharmaceutical industry are unlikely to dissuade parties from asserting their patents against infringers, instead increasing the likelihood that such assertions will occur.

### *3. Negotiation Costs*

Several factors are likely to lead to moderate negotiation costs in the pharmaceutical industry, at least pre-litigation. First, in the ANDA context, a generic company that makes a Paragraph IV certification must include in that certification "a detailed statement of the factual and legal basis of the opinion of the applicant that the patent is invalid or will not be infringed."[236] With respect to generic versions of biologic products (called "biosimilars"), the generic company is typically required to provide similar information as part of a series of patent consultations that the regulations call for.[237] Hence, because of these

233 *See, e.g.*, Mike Benson, *Understanding the Pharmaceutical Industry: An Easier Way to Understand the Pharma Industry*, MARKET REALIST (Jan. 22, 2015, 2:06 PM), http://marketrealist.com/2015/01/easier-way-understand-pharma-industry/ (listing six publicly traded drug manufacturers).

234 W. Nicholson Price II & Arti K. Rai, *Manufacturing Barriers to Biologics Competition and Innovation*, 101 IOWA L. REV. 1023, 1026 (2016).

235 Timmis, *supra* note 225, at 224–26 (reviewing these procedures).

236 21 U.S.C. § 355(j)(2)(B)(iv)(II).

237 Timmis, *supra* note 225, at 224.

requirements, brand-name patent owners will already have a significant amount of information relating to the generic company's factual and legal positions. And that information will save negotiation time that would otherwise be needed to make these assessments.

Second, some recent evidence indicates that ANDA litigation is much more likely to go to trial than non-ANDA litigation, in part because maintaining market exclusivity is so important to brand-name companies.[238] This means that for a host of important patent assertions in the pharmaceutical industry, negotiation costs pre-litigation may be lower simply because the parties are set on fully litigating the matter.[239] Of course, this same reality may also increase litigation costs in the cases that go to trial. But that is a different (though related) category of costs, discussed more fully below.

The prevalence of "reverse payment" patent settlement agreements in the pharmaceutical industry may increase negotiation costs in some cases.[240] These "pay-for-delay" settlements typically involve the patent owner agreeing to drop its infringement lawsuit while also paying the generic company to refrain from producing or selling the allegedly infringing product for a period up until the patent expires.[241] But these types of settlements typically occur subsequent to the patent holder initiating litigation,[242] and thus will also be discussed more fully below.

Patent assertions relating to biologic drugs may include higher negotiation costs than in the ANDA context. This is so, in part, because the Hatch-Waxman regulatory equivalent for most generic biologic drugs is simply less straightforward. For instance, no Orange Book exists for biologic drugs.[243] Instead, biologic drug patent owners and would-be generic manufacturers are directed to engage in several patent consultations before any litigation commences.[244] The regulatory structure for follow-on biologic drugs thus seems to impose heavier negotiation costs on biologic drug patent holders than in the ANDA context.

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238 Tammy Facey, *The Rise of Anti-ANDA Litigation*, IPPRO LIFE SCI., Nov. 27, 2014, at 10, http://www.ipprolifesciences.com/ipprolifesciences/IPPro%20Life%20Sciences_issue_33.pdf.

239 *See id.*

240 Henry N. Butler & Jeffrey Paul Jarosch, *Policy Reversal on Reverse Payments: Why Courts Should Not Follow the New DOJ Position on Reverse-Payment Settlements of Pharmaceutical Patent Litigation*, 96 IOWA L. REV. 57, 60 (2010) (discussing this phenomenon).

241 *See id.*

242 *See id.* at 63–65.

243 *See* Timmis, *supra* note 225, at 224–25.

244 *See id.*

Despite these potentially significant negotiation costs relating to biologic drugs, several factors may still often temper negotiation costs in the pharmaceutical industry overall. First, traditional pharmaceutical products are still subject to Hatch-Waxman, and its structure is likely to frequently reduce negotiation costs relating to patent assertions, as discussed above.[245]

Second, the limited number of participants in the pharmaceutical industry is also likely to reduce negotiation costs, in part because parties to a patent dispute will often be repeat players and thus have some familiarity with each other.[246] Such relationships can, therefore, help reduce negotiation costs that may otherwise arise when parties lack such familiarity.

Third, the (often) relatively clear boundaries of pharmaceutical patents may also help keep in check negotiation costs in the pharmaceutical industry.[247] For instance, the parties to a patent dispute in the pharmaceutical industry need not spend as much time on deciphering the meaning and boundaries of relevant patents as they would, say, in the software industry. This is true in part because pharmaceutical patents often have a 1:1 relationship to a particular drug, whereas in software (and other industries), a single product may be covered by thousands of patents.[248] In many pharmaceutical cases, these realities are, therefore, likely to help reduce some of the complexity of negotiations, thereby also reducing the costs thereof.

In sum, negotiation costs are unlikely to act as much of a deterrent to patent assertions in the pharmaceutical industry. While negotiation costs relating to biologic drugs in particular may be significant, other factors suggest pre-litigation negotiation costs are likely to be moderate in many other cases. Perhaps even more importantly, the high value of pharmaceutical patents is likely to dictate assertion, even if negotiation costs are relatively high.

#### *4. Litigation Costs*

As in other industries, litigation costs in the pharmaceutical industry are likely to be high in part because patent litigation is expensive. Yet, several factors unique to the pharmaceutical industry may increase litigation costs. First, as mentioned above, in many cases ANDA litigation proceeds all the way to trial, thereby increasing liti-

245 *See supra* notes 221–23 and accompanying text.

246 *See* Facey, *supra* note 238, at 10.

247 *See* Lemley, *supra* note 137, at 930.

248 *See id.* at 931.

gation costs.[249] Second, for those cases that do not proceed to trial, the prevalence of reverse-payment settlements means that costs rise because of the extensive (and typically complicated) negotiations relating to such settlements.[250]

There are, however, some potentially mitigating factors. First, the clearer meaning and scope of many pharmaceutical patents relative to other patent types may reduce the complexity of some phases of a typical pharmaceutical patent litigation (such as claim construction, where the court determines the patent's meaning), thereby reducing litigation costs overall. Second, some recent scholarship suggests that high litigation costs are largely attributable to fact discovery relating to remedial issues.[251] Yet ANDA litigation in particular would seem to avoid such costs since damages and willfulness are not at stake.[252] Third, most ANDA litigation (and pharmaceutical patent litigation in general) occurs in several district courts, resulting in a certain amount of judicial efficiency.[253] And finally, given the limited number of participants in the industry overall, many of the litigants are repeat players with some familiarity with each other, the courts, and the relevant judges.[254] This, too, can contribute to judicial efficiencies and reduce litigation costs.[255]

Nonetheless, in most cases these factors seem unlikely to significantly cabin litigation costs in the face of ANDA trials, complicated reverse-payment settlements, and the high costs of patent litigation in general. Indeed, while they may result in some cost savings, those savings are likely to be only modest and in many cases offset by other expensive particularities of pharmaceutical patent litigation.[256] In fact, some recent evidence suggests that ANDA litigation in particular is similar in its costs relative to other forms of patent litigation.[257]

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249 *See supra* note 238 and accompanying text.

250 *See supra* notes 240–41 and accompanying text.

251 *See* Greg Reilly, *Linking Patent Reform and Civil Litigation Reform*, 47 Loy. U. Chi. L.J. 179, 181–82 (2015).

252 *Id.* at 217.

253 *See* Katherine Rhoades, *Do Not Pass Go, Do Not Stop for Summary Judgment: The U.S. District Court for the District of Delaware's Seemingly Disjunctive Yet Efficient Procedures in Hatch-Waxman Litigation*, 14 Nw. J. Tech. & Intell. Prop. 81, 83 (2016).

254 Facey, *supra* note 238, at 10.

255 *See generally* Rhoades, *supra* note 253, at 99 (arguing that local patent rules can increase efficiency in litigation).

256 *See, e.g.*, Am. Intellectual Prop. Law Ass'n, 2015 Report of the Economic Survey 37–38 (2015), http://files.ctctcdn.com/e79ee274201/b6ced6c3-d1ee-4ee7-9873-352dbe08d8fd.pdf (showing that the costs of ANDA litigation are similar or in some cases higher than the costs of patent litigation in general).

257 *Id.*

In sum, litigation costs are likely to be high in the pharmaceutical industry in large part because patent litigation is expensive. And while certain judicial efficiencies may help rein in some of these costs, the growing prevalence of trials in ANDA litigation and complicated reverse-payment settlements may often eliminate whatever tempering otherwise occurs. Nevertheless, the importance of maintaining market exclusivity in most cases likely offsets these high costs in terms of whether patent owners choose to assert their patents.

*5. Invalidity Costs*

As discussed above, parties that assert their patents always face risks that a court or other reviewing tribunal will find their patents invalid. Some evidence, for instance, indicates that courts find a relatively high percentage of litigated patents invalid.[258] Nonetheless, there is also evidence that pharmaceutical patentees face lesser risks in this regard. For instance, some (albeit limited) evidence indicates that pharmaceutical patents are much more likely to be found valid than patents in other fields.[259]

This may be true for several reasons. For instance, as discussed above, pharmaceutical patents in general have clearer boundaries and meaning than software and other types of patents.[260] This is often so because "the structure of a molecule or the composition of a mixture can be defined with precision," resulting in more definite notice of what the patent covers and what, therefore, the relevant prior art is.[261] Indeed, the nature of pharmaceutical inventions dictates precision in patent drafting in order to clearly claim the invented pharmaceutical product while distinguishing it from previous chemical inventions.[262] And that reality likely leads to many more valid pharmaceutical patents than in other industries. Assertions relating to biologic drugs, on the other hand, present greater risks of invalidity costs, a topic that this Article examines in greater detail below.[263]

In sum, on average the risk of incurring invalidity costs may be lower in the pharmaceutical industry than in other areas, even if the

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258 Allison & Lemley, *supra* note 102, at 205.

259 *Id.* at 216–17.

260 Bessen & Meurer, *supra* note 25, at 152–53.

261 *Id.*

262 *See, e.g.*, Ronald G. Embry, Jr., *How to Improve Drafting Language in Chemical Arts Patents*, Law360 (July 9, 2015, 10:28 AM), http://www.law360.com/articles/674381/how-to-improve-drafting-language-in-chemical-arts-patents (stressing the importance of avoiding ambiguity and vagueness in chemical-based patents).

263 *See infra* Section III.C.1.

risks remain more than trivial. And these lower risks, combined with the importance of patent protection in the industry in general, are likely to lead to higher rates of patent assertion in the industry.

### *6. Reputational Costs*

The reputational costs of asserting patents in the pharmaceutical industry are likely to be low for a number of reasons. First, the importance of patents in the industry means that patent assertion, in the face of infringement, is typically the expectation; each party must protect its own turf in order to recoup the billions of dollars in research and development,[264] and other participants in the industry understand that reality. Second, pharmaceutical patents' generally clearer boundaries mean that asserting such patents is less likely to lead to the type of ire—and thus reputational costs—that assertion of purportedly vague and ambiguous patents in the software industry causes. And third, as discussed above, the pharmaceutical industry's regulatory overlays incentivize parties to assert their patents, thereby diminishing, to some extent, any culpability that parties may otherwise ascribe to patent asserters.[265]

Of course, patent asserters may still suffer some reputational costs for engaging in patent disputes, particularly if their behavior is egregious in some way[266] or the assertion relates to biologic drugs, as discussed in more detail below.[267] Furthermore, some evidence indicates that consumers in general hold negative views of the pharmaceutical industry, and patent assertions may exacerbate those trends.[268] Nonetheless, an average, run-of-the-mill patent assertion in the pharmaceutical industry is unlikely to lead to significant reputational costs that affect a pharmaceutical company's bottom line. Indeed, for most pharmaceutical companies, failure to assert patents in the face of infringement is more likely to have such effects.

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264 *See* DiMasi & Grabowski, *supra* note 206, at 477.

265 *See supra* Section III.B.1.

266 *See, e.g.*, Kartikay Mehrotra & Pamela MacLean, *Merck's Patent Win over Gilead Reversed over False Testimony*, BLOOMBERG (June 6, 2016, 8:44 PM), http://www.bloomberg.com/news/articles/2016-06-06/gilead-judge-throws-out-merck-s-200-million-patent-verdict.

267 *See infra* Section III.C.1.

268 Mark Kessel, *Restoring the Pharmaceutical Industry's Reputation*, 32 NATURE BIOTECHNOLOGY 983, 983 (2014), http://www.nature.com/nbt/journal/v32/n10/pdf/nbt.3036.pdf ("[T]he industry's reputation is not much better than that of the financial sector or tobacco companies.").

### 7. *Dynamic Costs*

Implicit throughout much of the analysis above is a strong dynamism between and among many of the categories of disincentives to patent assertion. The high value of patents in the pharmaceutical industry, for instance, may help temper reputational costs that may otherwise result from patent assertions. The lower risks of incurring invalidity costs, based on the clearer scope and meaning of pharmaceutical patents, may also help bolster the value of pharmaceutical patents while simultaneously reducing reputational costs stemming from asserting such patents. In many cases, the clearer scope and meaning of pharmaceutical patents also likely helps reduce search and negotiation costs.

The overall effect of such dynamism is to remove impediments to asserting patents in the pharmaceutical industry. The expected result, therefore, is high rates of pharmaceutical patent assertion. This result, in turn, may help explain why pharmaceutical companies have not sought or needed to outsource patent assertion to other entities in the same way that many software patent holders have. Put simply, in the pharmaceutical industry the likely benefits of patent assertion, on average, outweigh the likely costs. As a result, there is no need to shift those costs in an attempt to realize some benefits from a party's patents.

Table 3 below summarizes the analysis described above relating to the pharmaceutical industry.

TABLE 3. DISINCENTIVES TO PATENT ASSERTION IN THE PHARMACEUTICAL INDUSTRY

| **Factor** | **Analysis** |
|---|---|
| Value of Patent(s) | High. May be increased by lower risks of invalidity |
| Search Costs | Low. May be indirectly decreased by lower risk of invalidity costs |
| Negotiation Costs | Low to Moderate. May be indirectly decreased by lower risk of invalidity costs |
| Litigation Costs | High. May be exacerbated by negotiation costs |
| Invalidity Costs | Moderate. May be decreased by the high value of pharmaceutical patents |
| Reputational Costs | Low. May be decreased by high value of pharmaceutical patents and lower risk of invalidity costs |

### C. The Biotechnology and Semiconductor Industries

The last two Sections applied the framework developed in Section II.B to the software and pharmaceutical industries. They did so in order to highlight how the different cost categories likely affect patent holders in each industry differently in terms of whether they decide to assert their patents. This Section briefly applies the same framework to two additional cases: the biotechnology and semiconductor industries.

The biotechnology industry exhibits many similarities to the pharmaceutical industry—in fact, the distinction between them has blurred over time, particularly as traditional pharmaceutical companies increasingly turn to biologic drugs as a new source of revenue.[269] As such, much of this Article's analysis for the pharmaceutical industry also applies to the biotechnology industry. Yet despite the similarities, there are also key differences, and Section 1 below discusses those differences.

The semiconductor, on the other hand, exhibits many similarities to the software industry in terms of how disincentives to patent assertion are likely to play out. But again, there are key differences between the two industries that affect these disincentives. Consequently, Section 2 below focuses on those differences in assessing patent nonassertion in the semiconductor industry.

#### 1. Biotechnology

Both the biotechnology and pharmaceutical industries are capital intensive.[270] This means that, as in the pharmaceutical industry, patents in the biotechnology industry are also an important means to recoup the substantial investments necessary to develop biologic drugs and diagnostics.[271] Indeed, biologic products are often more expensive to develop than traditional pharmaceutical products.[272] On

269 Deborah Hopewell, *Biotech vs. Pharma: Once Different, Now Collaborative Entities*, SILICON VALLEY BUS. J. (June 22, 2003, 9:00 PM), http://www.bizjournals.com/sanjose/stories/2003/06/23/focus3.html.

270 Alan Devlin, *Systematic Bias in Patent Law*, 61 DEPAUL L. REV. 57, 74 (2011) ("Like pharmaceutical research, innovation in biotechnology is both capital intensive and risky.").

271 *See* Michael S. Mireles, *An Examination of Patents, Licensing, Research Tools, and the Tragedy of the Anticommons in Biotechnology Innovation*, 38 U. MICH. J.L. REFORM 141, 143 (2004).

272 *See Biologics, Biosimilars, and the Biologics Price Competition and Innovation Act ("BPCIA"): A Short Primer*, BIG MOLECULE WATCH (May 29, 2015), http://www.bigmoleculewatch.com/2015/05/29/2-biologics-biosimilars-and-the-biologics-price-competition-and-innovation-act-bpcia-a-short-primer/.

this basis alone, high patent assertion rates would be expected in the biotechnology industry.

Yet one key difference between the biotechnology and pharmaceutical industries is that the products of biotechnology companies typically have a biological (or natural) basis, rather than a chemically synthesized one.[273] For instance, biotechnology companies often focus on manipulating the genetic information of living organisms in order to produce some positive result, like helping to treat a disease.[274] The products of traditional pharmaceutical companies, on the other hand, typically consist of chemically synthesized medicines.[275]

This difference is crucial in several respects. First, the biological basis of biotechnological products means that they may be more susceptible to invalidation because of recent Supreme Court cases that have expanded exceptions to what is patentable subject matter. For instance, in 2013 the Court invalidated Myriad Genetics's patents on isolated DNA sequences used for testing for ovarian and breast cancer.[276] The Court held that the patents claimed something found in nature (i.e., isolated DNA sequences), a category generally outside of patentable subject matter.[277] In another recent case, the Court expanded the "law of nature" exception to patentable subject matter, finding that a diagnostic test for determining correct drug dosage levels was merely a law of nature ineligible for patent protection.[278] Hence, because the biological basis for biotechnological products means that many of them can be readily characterized as natural phenomena or laws of nature, patents claiming them are more at risk of being invalidated for failing to claim patentable subject matter.[279]

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273 Michelle Ahern, *What's the Difference Between Pharmaceutical and Biotechnology?*, MORGAN MCKINLEY (Dec. 9, 2016), https://www.morganmckinley.ie/article/difference-between-pharmaceutical-and-biotechnology.

274 *Id.*

275 *Id.*

276 Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 133 S. Ct. 2107, 2110–11 (2013).

277 *Id.*

278 Mayo Collaborative Servs. v. Prometheus Labs., Inc., 132 S. Ct. 1289, 1294 (2012).

279 *See* Kate Gaudry, Leslie Grab & Tina Williams McKeon, *Trends in Subject Matter Eligibility for Biotechnology Inventions*, IPWATCHDOG (July 12, 2015), http://www.ipwatchdog.com/2015/07/12/trends-in-subject-matter-eligibility-for-biotechnology-inventions/id=59738/ (showing that since these decisions, rejection rates for biotechnology patents applications have increased). Of course, this may also mean that for the patents that do make it through the process, they are less likely to be invalidated. However, many important biotechnology patents were issued before the Court's rulings, meaning they are still susceptible to invalidation. Furthermore, even the ones that make it through under the new regime may find different treatment in courts versus the USPTO.

This reality thus suggests that biotechnology patent asserters may be more likely to incur invalidity costs than pharmaceutical patent asserters. And these heightened risks, on their own, may dampen biotechnology patent holders' incentives to assert their patents. Yet these heightened invalidity costs may often dynamically affect other categories of costs in ways that further diminish incentives to assert biotechnology patents.

For instance, these higher invalidity risks may decrease the value of biotechnology patents in general, thereby making them less likely to be asserted. Furthermore, they are likely to increase search and negotiation costs by injecting greater uncertainty into those activities. Finally, as biotechnology patent owners appeal more frequent findings of invalidity, negotiation and litigation costs are also likely to rise. Overall, these greater risks and costs associated with biotechnology patents may thus make it less likely that biotechnology patent holders assert their patents.

The Hatch-Waxman equivalent for biologic drugs further complicates matters. Similar to Hatch-Waxman, part of the purpose for the Biologics Price Competition and Innovation Act ("BPCIA")[280] was to make it easier for generic biologic drug manufacturers to introduce low-cost generic biologic drugs (called "biosimilars") to the market.[281] For instance, it allows generic manufacturers of biosimilars to rely on a pioneering firm's clinical trial data for obtaining FDA approval for the biosimilar.[282] As part of that process, the Act calls for a series of patent consultations, which means generic firms are supposed to notify and consult with pioneering firms over relevant patents.[283] In general, these provisions have the potential to help reduce search, negotiation, and litigation costs relating to biotechnology patent assertions.

Yet the BPCIA lacks the equivalent of an Orange Book requirement,[284] which is likely to translate into greater uncertainty about rele-

280 Biologics Price Competition and Innovation Act of 2009, 42 U.S.C. § 262 (2012).

281 *See* Janet Freilich, *Patent Infringement in the Context of Follow-On Biologics*, 16 STAN. TECH. L. REV. 9, 10–11 (2012).

282 *See* Price & Rai, *supra* note 234, at 1027–28. Yet such reliance has been rare, in part because the BPCIA grants the pioneering firm a twelve-year exclusivity period to that clinical data, meaning that generic companies are barred from using it for a much longer duration than under Hatch-Waxman with respect to traditional pharmaceutical products. *See id.*

283 *See* Timmis, *supra* note 225, at 224–25.

284 *See* Terry G. Mahn & Gauri M. Dhavan, *Biosimilars vs. Generics—Major Differences in the Regulatory Model*, PHARMACEUTICAL COMPLIANCE MONITOR (Mar. 13, 2012), http://www.pharmacompliancemonitor.com/biosimilars-vs-generics-major-differences-in-the-regulatory-model/1861/.

vant patents for biologic products. Indeed, the BPCIA is hardly a model of clarity, and a judge on the nation's preeminent patent court recently lamented that parts of it are worthy of "the Pulitzer Prize for complexity or uncertainty."[285] This uncertainty, in turn, is likely to boost search, negotiation, and litigation costs by forcing parties to evaluate a wider array of patents as they engage in negotiations and litigation. Hence, as courts, patent holders, and generic companies continue to sort out exactly what the BPCIA's provisions mean,[286] biotechnology patent owners are more likely to incur relatively high search, negotiation, and litigation costs for asserting such patents. And in many cases, as discussed above, these categories of costs are likely to exacerbate each other.[287]

In general, biotechnology companies may also be more likely to suffer reputational costs when asserting biotechnology patents than pharmaceutical companies that assert pharmaceutical patents. This may be so, in part, because the public has often reacted negatively to patents on living organisms (or parts thereof, such as genetic material).[288] In *Ass'n for Molecular Pathology v. Myriad Genetics*,[289] for instance, significant public outcry arose because the patents at issue dealt with DNA material.[290] And Myriad, as owner of those (now invalidated) patents, often absorbed the brunt of that criticism.[291] These reputational costs may lead to greater difficulty in recruiting talented scientists and less optimism in capital markets. They may also, therefore, dissuade companies from taking an aggressive stance with respect to their biotechnology patents.[292]

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285 Dennis Crouch, *Biologics Price Competition and Innovation Act: Refusal to Dance*, PATENTLYO (July 21, 2015), http://patentlyo.com/patent/2015/07/biologics-competition-innovation.html (quoting Judge Lourie of the U.S. Court of Appeals for the Federal Circuit).

286 *See* Jeff Overley, *Biosimilar Notice Always Mandatory, Fed. Cir. Rules*, LAW360 (July 5, 2016, 1:05 PM), http://www.law360.com/ip/articles/792580?nl_pk=cab4cac9-5c01-4b78-9f6f-41f04f29a984&utm_source=newsletter&utm_medium=email&utm_campaign=ip (providing one recent example).

287 *See supra* Sections III.A.7, III.B.7.

288 *See* Jonathan King & Doreen Stabinsky, *Patents on Cells, Genes, and Organisms Undermine the Exchange of Scientific Ideas*, CHRON. HIGHER EDUC. (Feb. 5, 1999), http://www.councilforresponsiblegenetics.org/ViewPage.aspx?pageId=171.

289 133 S. Ct. 2107 (2013).

290 *See* Kelly Servick, *End of the Road for Myriad Gene Patent Fight*, SCI. (Jan. 28, 2015, 3:00 PM), http://www.sciencemag.org/news/2015/01/end-road-myriad-gene-patent-fight (describing Myriad's patents as "controversial").

291 *See id.*

292 *See id.* (describing how Myriad eventually settled many of its patent assertions following the Supreme Court decision, despite the fact that arguably some of its patents remained intact).

In sum, the high value of biotechnology patents in maintaining market exclusivity would seem to predict high rates of patent assertion. Yet those assertions are more likely than their traditional pharmaceutical counterparts to result in significant search, negotiation, litigation, invalidity, and reputational costs, all of which may exacerbate each other. While these costs may not dissuade many biotechnology patent owners from asserting their patents simply because the value of market exclusivity in the biotechnology space is so high, in some cases they may. And where they do so, parties may instead turn to other forms of intellectual property, such as trade secrecy, to protect their innovations.[293]

But another possibility is that growing barriers to patent assertion in the biotechnology industry will push more biotechnology patent owners to adopt the software world's patent troll outsourcing model.[294] That is, increasingly more biotechnology patents may come into the hands of patent assertion entities as biotechnology patent owners seek to mitigate the increasingly high costs of patent assertion while still realizing economic returns on their patents. Alternatively, these high barriers may ultimately lead many biotechnology patent owners to specialize in patent assertion themselves. And if either of these two possibilities becomes an industry trend, the biotechnology industry may experience higher patent assertion rates than would be expected, since the business models would demand it. The implications of this possibility will be further explored in Part IV *infra*.

Table 4 below summarizes the analysis described above relating to the biotechnology industry.

TABLE 4. DISINCENTIVES TO PATENT ASSERTION IN THE BIOTECHNOLOGY INDUSTRY

| **Factor** | **Analysis** |
|---|---|
| Value of Patent(s) | High. But may be decreased by invalidity costs |
| Search Costs | Moderate. May be exacerbated by invalidity costs |
| Negotiation Costs | Moderate to High. May be exacerbated by litigation and invalidity costs |
| Litigation Costs | High. May be exacerbated by negotiation and invalidity costs |

293 *See* Price & Rai, *supra* note 234, at 1028, 1044–45.

294 *Cf.* Feldman & Price, *supra* note 208, at 776 (arguing that the pharmaceutical and biotechnology industries are increasingly at risk of patent trolls).

| | |
|---|---|
| Invalidity Costs | Moderate to High |
| Reputational Costs | Moderate to High. May be indirectly exacerbated by invalidity costs |

### 2. *The Semiconductor Industry*

The semiconductor industry focuses on producing "chips" that help power all types of computing devices, ranging from smartphones to cars.[295] The industry has witnessed significant growth over the past fifty plus years.[296] That growth, particularly in Northern California, ultimately gave rise to the now famous "Silicon Valley" moniker for the region (i.e., silicon material is used to produce semiconductors chips).[297]

Semiconductor innovation is said to be "rapid," "cumulative," and to include high fixed costs.[298] Hence, chip innovation often occurs in a matter of a year or two, rather than decades, as in the pharmaceutical industry.[299] Furthermore, because of semiconductor innovation's cumulative nature, any given chip innovation is likely to include numerous independently patentable inventions, much like many software innovations.[300]

Interestingly, growth in semiconductor innovation has been accompanied by a surge in semiconductor industry patenting.[301] Previous scholarship has assessed this phenomenon, concluding that semiconductor companies obtain patents largely as trading chips in a defensive patenting scheme.[302] In other words, semiconductor companies increasingly obtain large portfolios of patents in order to protect their

295 Paige Tanner, *An Overview of the Semiconductor Industry*, MKT. REALIST (Sept. 10, 2015, 4:07 PM), http://marketrealist.com/2015/09/overview-semiconductor-industry/.

296 *Id.*

297 David Laws, *"Who Named Silicon Valley?,"* COMPUTER HIST. MUSEUM (Jan. 7, 2015), http://www.computerhistory.org/atchm/who-named-silicon-valley/.

298 WERNER BALLHAUS ET AL., FASTER, GREENER, SMARTER–REACHING BEYOND THE HORIZON IN THE WORLD OF SEMICONDUCTORS 12 (2012), https://www.pwc.com/gx/en/technology/publications/assets/pwc-faster-greener-smarter.pdf; Burk & Lemley, *Policy Levers*, *supra* note 24, at 1627–28; 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, 102 (2001).

299 Don Clark, *Intel Rechisels the Tablet on Moore's Law*, WALL ST. J.: DIGITS (July 16, 2015, 10:52 AM), http://blogs.wsj.com/digits/2015/07/16/intel-rechisels-the-tablet-on-moores-law/ (discussing "Moore's Law," a famous prediction in the semiconductor industry that significant chip innovation would occur on roughly a two-year cycle).

300 Burk & Lemley, *Policy Levers*, *supra* note 24, at 1623, 1628.

301 Hall & Ziedonis, *supra* note 298, at 102.

302 *See id.* at 104.

ability to produce semiconductor chips that may infringe upon any number of third-party patents.[303] Patent portfolios protect their ability to do so because a third party may be more loathe to sue the company, or more likely to enter into a cross-license with them, if the company has patents it can counter-assert against that third party.[304]

Thus, the semiconductor industry exhibits some similarities to the software industry that are relevant to predicting patent non-assertion in the industry. For starters, the industry's rapid, cumulative innovation cycles mean that any given semiconductor patent is likely to be of low to moderate value (at least in isolation). This is so for at least two reasons. First, the industry's fast pace of innovation means that companies are often rapidly iterating on their preexisting technology, thereby making it more likely that any given patent covers only an incremental improvement upon what came before.[305] Second, the cumulative nature of semiconductor innovation means that any given patent typically only covers a "minor part of the whole chip."[306] Hence, the value of any single patent will correspond to the value of whatever small part of the chip it covers.

This relatively low value of any given semiconductor patent is thus likely to deter assertion of many such patents, particularly since the search, negotiation, and litigation costs associated with asserting the patents may dwarf the expected return. Indeed, search, negotiation, and litigation costs in the semiconductor industry may often be high, since detecting and ultimately proving infringement often requires costly and time-consuming reverse-engineering of competitive semiconductor products.[307] Furthermore, the "miniature" nature of semiconductor chips presents unique challenges in drafting and enforcing such patents,[308] which may increase these same costs, as well as the risks of incurring invalidity costs more broadly.

Other industry factors may make these costs even more daunting. For instance, search, negotiation, and litigation costs may be especially

303 Burk & Lemley, *Policy Levers*, *supra* note 24, at 1628.

304 *Id.*

305 Eric Brown, *Rediscovering Fundamental Innovation*, MIT NEWS (Dec. 3, 2015), http://news.mit.edu/2015/rediscovering-fundamental-innovation-eugene-fitzgerald-1203; Bruce Upbin, *Silicon Valley Isn't Innovative, It's Iterative: Four Proof Points*, FORBES (Apr. 8, 2014, 10:52 AM), http://www.forbes.com/sites/ciocentral/2014/04/08/silicon-valley-isnt-innovative-its-iterative-four-proof-points/#79f34a5f75f3.

306 Burk & Lemley, *Policy Levers*, *supra* note 24, at 1628.

307 *See* Doris Johnson Hines & Howard Herr, *Drafting and Enforcing Semiconductor Patents*, ECN MAG. (Dec. 2, 2015, 3:31 PM), https://www.ecnmag.com/blog/2015/12/drafting-and-enforcing-semiconductor-patents.

308 *Id.*

cumbersome because, as discussed above, producing innovative chips is capital intensive and expected to occur in a relatively short time frame.[309] Diverting significant resources into an aggressive patent assertion campaign, therefore, may often distract semiconductor companies from their commercial goals. This may be particularly true if semiconductor companies are able to protect their investments through other means, such as lead-time advantages, trade secrecy, and manufacturing and design capabilities.[310]

The reputational costs of asserting semiconductor patents are likely less significant than those associated with asserting software patents. This is so, in part, because the semiconductor industry has not directly experienced an "open innovation" movement like that in the software industry.[311] Nonetheless, because chip innovation involves, and even often depends on, software innovation, the norms of software's open innovation movement have affected the semiconductor industry as well. Indeed, some of the top semiconductor companies in the world, including Intel and Samsung, tout their open innovation credentials on the companies' websites.[312] In fact, Intel claims that it "has been at the heart of the open source [movement]" since its beginnings,[313] pointing out that the company employs "thousands of software developers" devoted to working on open source software projects.[314]

Hence, reputational costs for asserting semiconductor patents are likely to be at least moderate for many semiconductor patent holders. And they may grow the more aggressively a semiconductor company asserts its patents. As such, these potential reputational costs, combined with moderate to high search, negotiation, and litigation costs, are likely to dissuade numerous semiconductor patent holders from

309 *See supra* note 299 and accompanying text.

310 *See* Hall & Ziedonis, *supra* note 298, at 102.

311 Nicole Hemsoth, *Can Open Source Hardware Crack Semiconductor Industry Economics?*, THE NEXT PLATFORM (May 16, 2016), http://www.nextplatform.com/2016/05/16/can-open-source-hardware-crack-semiconductor-industry-economics/ (discussing how an open innovation model may help spur the semiconductor industry forward).

312 *See Open Source in Action*, INTEL: DEVELOPER ZONE, https://software.intel.com/en-us/open-source [https://perma.cc/YP28-6F82] (last visited May 31, 2017); *Open Innovation, Assemblies for a New Future*, SAMSUNG, http://www.samsung.com/semiconductor/about-us/open-innovation/ [https://perma.cc/J6C6-HVMD] (last visited May 31, 2017).

313 *How Intel Drives the Open Source Spirit Forward*, INTEL: BIT FEED, https://connect.intel.com/B08160108_how_intel_drives_the_open_source_spirit_forward [https://perma.cc/DFX2-7DBL] (last visited May 31, 2017).

314 *Helping Establish Linux* Globally*, INTEL: DEVELOPER ZONE, https://software.intel.com/en-us/open-source/linux-kernel [https://perma.cc/5CUP-PUTL] (last visited May 31, 2017).

actively asserting many of their patents. This may be particularly true if the average value of a semiconductor patent is relatively low, as discussed above.

Of course, none of this is to say that patents play an insignificant role in the industry. As mentioned above, patenting in the semiconductor industry has increased as parties race to build large patent portfolios in order to better ensure their freedom to operate.[315] In this setting, in fact, early-stage patent assertions frequently occur as parties approach each other and ultimately negotiate cross-licenses to their respective patent portfolios.[316] But this activity largely centers on trading patent portfolios in whole, thereby minimizing many of the search, negotiation, litigation, invalidity, and reputational costs that would otherwise result if the parties were assessing and asserting individual patents.[317] Hence, while the semiconductor industry appears to utilize a predominantly portfolio-oriented form of patent assertion, that approach seems intended to avoid many of the costs that would otherwise deter patent assertion.[318]

Table 5 below summarizes the analysis described above relating to the semiconductor industry. Note that many of the dynamic relationships between categories of disincentives in the semiconductor industry are likely similar to those found in the software industry. Hence, the analysis from Section III.A is simply reflected in the table below.

TABLE 5. DISINCENTIVES TO PATENT ASSERTION IN THE SEMICONDUCTOR INDUSTRY

| **Factor** | **Analysis** |
|---|---|
| Value of Patent(s) | Low to Moderate. May be decreased by invalidity and reputational costs |
| Search Costs | High. May be exacerbated by negotiation, litigation, and invalidity costs |
| Negotiation Costs | High. May be exacerbated by litigation and invalidity costs |
| Litigation Costs | High. May be exacerbated by negotiation and invalidity costs |

315 *See supra* note 303 and accompanying text.

316 *See* Burk & Lemley, *Policy Levers*, *supra* note 24, at 1624, 1628.

317 *See* Parchomovsky & Wagner, *supra* note 20, at 64.

318 *See id.* at 32–36 (arguing that the true value of patents for many parties lies in aggregation).

| | |
|---|---|
| Invalidity Costs | Moderate to High. May be exacerbated by reputational factors |
| Reputational Costs | Moderate to High. May be exacerbated by perceptions that semiconductor patents have low value or are invalid |

Overall, these relatively high barriers to patent assertion may portend greater risks of patent trolling in the semiconductor industry. In fact, the industry has already witnessed a good amount of patent troll activity, both from patent trolls and formerly manufacturing semiconductor companies.[319] Furthermore, the industry's high and growing fixed costs[320] may presage increasingly more formerly manufacturing semiconductor companies focusing on patent assertion. Indeed, specialization is a necessity for many semiconductor patent holders,[321] and one particularly lucrative specialty may be patent assertion.[322] The next Part now turns to assessing some possible implications of this Article's industry-specific analysis of disincentives to patent assertion.

## IV. IMPLICATIONS

Parts I through III of this Article laid out a more systematic, industry-specific approach to explaining why patent holders may choose to forego asserting their patents. This Part assesses in greater depth some of the normative, theoretical, and practical implications of that approach.

From a normative perspective, when patent holders forego asserting their rights, society may be better off. This normative claim has a clear theoretical basis. Predominant patent law theories, after all, recognize that patents impose deadweight losses on society by artificially increasing the costs of using the patented invention.[323] But at least some of that deadweight loss, according to these theories, is the necessary price for incentivizing parties to engage in inventive behavior,

319 Osenga, *supra* note 32, at 455–57; *Caught in the Patent Currents*, WORLD INTELL. PROP. REV., March/April 2015, at 38, 40; Todd R. Miller, *Patent Litigation and Prosecution Trends in the Semiconductor Industry*, JONESDAY IP PERSP., Fall/Winter 2007, at 10, 11.

320 Stefan Tamme et al., *Trends and Opportunities in Semiconductor Licensing*, 48 LES NOUVELLES 216, 218 (2013).

321 *Id.*

322 *Caught in the Patent Currents*, *supra* note 319, at 39.

323 *See, e.g.*, Tom Nicholas, *What Drives Innovation?*, 77 ANTITRUST L.J. 787, 787 (2011) ("Some theoretical work on intellectual property rights assumes a positive correlation between the strength of patent protection and the rate of innovation, but in the short run, patents also impose a deadweight loss arising from monopoly pricing." (footnote omitted)).

share their inventions with the public, and further develop them.[324] Hence, in industries where parties acquire ever-increasing numbers of patents but forego asserting them because of high costs, the best of both worlds may be possible. And this may be especially true if we think that greater disincentives to assertion on the backend will not affect incentives to engage in inventive behavior on the frontend, as some recent scholarship suggests.[325]

Yet the software industry's experience over the last several decades is instructive on this score. As discussed, high barriers to patent assertion in the software industry seem to have actually helped increase patent assertion rates in the industry.[326] This came about in part as more and more software patent holders outsourced the high costs and risks of patent assertion to patent trolls, or engaged in patent trolling themselves in order to realize economies of scale. And once such outsourcing or specialization occurs, patent assertion is likely to increase, since these business models demand ever-increasing patent assertions to survive. Too high of barriers to patent assertion may thus distort disincentives to patent assertion in ways that actually increase patent assertions. Moderate barriers to patent assertion, therefore, may actually result in lower rates of assertion with, in all likelihood, similar levels of patenting.[327] And such an outcome may be ideal, since high levels of patenting combined with relatively moderate assertion rates may mean society is benefitting from high levels of innovation, but with fewer deadweight losses.[328]

Yet this analysis, while perhaps persuasive in some respects, leaves several open questions that current patent law reform efforts must grapple with. First, it is likely to be extremely difficult in many cases to reliably distinguish ex ante between "good" moderate barriers and "bad" high barriers to patent assertion. In other words, the

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324 *See* Gideon Parchomovsky & Peter Siegelman, *Towards an Integrated Theory of Intellectual Property*, 88 VA. L. REV. 1455, 1458–59 (2002).

325 *See* Lemley, *supra* note 68, at 50–52.

326 *See supra* Section III.A.8.

327 *See* Lemley, *supra* note 68, at 14.

328 Too low of barriers to patent assertion may also be problematic. For instance, as discussed above, the pharmaceutical industry includes a regulatory overlay that in some sense forces patent assertion, or at least makes it much more likely by pushing patent holders and infringers to self-identify. *See supra* Section III.B. Hence, without such regulatory interventions, it seems likely that fewer patent holders would assert their patents, thereby reducing deadweight losses on society that such assertions otherwise impose. Of course, it may be true that these types of regulatory interventions are necessary to spur pharmaceutical innovation in the first place, notwithstanding the deadweight losses that they may cause. But that is a project, or a set of projects, beyond the scope of the present Article.

line between barriers that lead to moderate-to-low patent assertion rates and barriers that contribute to patent assertion outsourcing or specialization is often likely to be blurry. As a result, policymakers seeking to strike the right balance face inherent difficulties in accurately anticipating the effects of their reforms. Indeed, recent reforms such as the Biologics Price Competition and Innovation Act, though meant to facilitate biotechnology innovation, may actually harm it by raising the costs of patent assertion and thereby increasing patent assertion outsourcing or specialization.[329] Hence, though moderate barriers to patent assertion may be the ideal outcome in the abstract, it remains difficult in practice to reliably distinguish between moderate and high barriers to patent assertion.

Second, it is also the case that not all high barriers to patent assertion will result in increased patent assertions. For instance, some barriers to patent assertion may be so high that even patent trolls find them too great to justify their business model. The software world may have experienced such a shock recently with the Supreme Court's *Alice* decision briefly discussed above.[330] Indeed, since the decision, most current software patents may be invalid.[331] And that near certainty is deterring at least some former patent trolls from continuing their line of business.[332] Thus, such high barriers may deter, rather than increase, patent assertions. And if that is true, then it may also be true that high barriers to patent assertion are preferable to moderate ones, so long as they are the right kind of high barriers.

But this conclusion is dubious because these types of high barriers seem more likely than others to simultaneously deter patent assertions *and* innovation. That is, barriers to patent assertion that are so high that they effectively undermine patent protection in an industry may certainly lead to lower rates of assertion in that industry, simply because there is no point in trying to obtain or enforce patents in the industry given these barriers. But the same inability to enforce patents in an industry also means that those barriers are more likely to undermine innovation in that industry. This may be so, for instance, if patents are important incentives to innovative behavior, as predominant

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329 *See supra* Section III.C.1.

330 *See supra* notes 125–31 and accompanying text.

331 *See* Quinn, *supra* note 129 (quoting Professor Mark Lemley as saying that after *Alice*, most current software patents are invalid).

332 *See* Claire Bushey, *Why This Lawyer Is Rethinking Patent Lawsuits*, CRAIN'S CHI. BUS. (June 6, 2015), http://www.chicagobusiness.com/article/20150606/ISSUE01/306069991/why-this-lawyer-is-rethinking-patent-lawsuits (discussing how patent law changes, including the *Alice* decision, have reduced the incentives of some patent trolls to pursue their typical business model).

patent law theories teach.[333] Per those theories, many parties will forego inventive behavior without at least some ability to prevent others from duplicating their inventive efforts (or otherwise economically benefit from them).[334] And if specific high barriers in an industry or field mean that enforcing patent rights is largely implausible, then many such parties may decline to engage in socially beneficial inventive behavior. Some recent scholarship puts this general theoretical premise into question.[335] But it nonetheless remains important to thoroughly assess the societal impacts of specific high barriers that decrease rather than increase patent assertions, because the perverse impact may be less innovative behavior as well. Current reform efforts, many of which aim to erect higher barriers to patent assertion to curb patent trolling,[336] must thus take into account a dual reality: some high barriers to patent assertion may actually increase patent assertions, while those that decrease patent assertions may simultaneously deter socially beneficial innovation.

Yet there may be a subset of high barriers to patent assertion that decreases patent assertions overall while also preserving patents as important incentives to innovative behavior. For instance, this subset may thread the needle by specifically targeting patent assertion outsourcing and specialization.[337] In other words, these types of barriers may impose moderate costs on *most* patent holders, while inflicting higher costs on those that engage in patent assertion specialization or outsourcing. Recent reform proposals aimed at increasing visibility into the parties behind patent assertions may be one example of generally moderate barriers that transform into high barriers for a particular subset of patent assertion types,[338] since such reforms would force these types of parties to more fully internalize the costs, including in particular reputational ones, of outsourcing or otherwise obscuring abusive patterns of patent assertion.

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333 *See, e.g.*, Lemley, *supra* note 37, at 129–131.

334 *See supra* Part I.

335 *See* Lemley, *supra* note 68, at 52 (noting the lack of evidence proving that the patent system drives innovation).

336 *See Patent Progress's Guide to Federal Patent Reform Legislation*, PAT. PROGRESS, http://www.patentprogress.org/patent-progress-legislation-guides/patent-progresss-guide-patent-reform-legislation/ [https://perma.cc/47LS-US8K] (last visited May 31, 2017).

337 *Cf.* Lemley & Melamed, *supra* note 4, at 2172 (arguing against patent law reforms targeting specific types of entities, instead suggesting that reforms should focus on patterns of abusive behavior).

338 Simon Rockman, *New US Bill Aims to Zap Patent Trolls with Transparency Demands*, REGISTER (Jun. 5, 2015, 3:56 PM), http://www.theregister.co.uk/2015/06/05/us_bill_aims_to_reduce_patent_trolling/.

Accordingly, while moderate barriers to patent assertion may represent an ideal outcome from a normative and theoretical perspective, in practice striking that balance is difficult. This difficulty has at least two important causes. First, it is simply difficult to know in advance how patent law changes will affect patent assertion costs in a given industry. For instance, some well-intentioned reforms may raise barriers to patent assertion above optimal levels such that they actually increase patent assertion outsourcing or specialization, thereby arguably undermining innovation. Second, it would appear that the best kind of moderate barriers to patent assertion are those that are moderate for most patent holders, while imposing higher costs on specific patterns of patent assertion such as outsourcing or specialization. Yet striking that balance is difficult, and if done improperly, may in some cases harm innovation in an industry by rendering patent enforcement impractical for a larger subset of patent holders than is warranted. The devil, as always, is in the details.

## Conclusion

Scholars have long puzzled over why parties amass large numbers of patents, only to forego asserting them in the vast majority of cases. In response, they have offered a variety of general economic reasons to explain this phenomenon. Yet these explanations typically lack any sort of industry specificity, despite the reality that patents play vastly different roles across industries, as others have recognized for some time.

This Article provides a more industry-specific approach to explaining patent non-assertion, charting out a taxonomy of different costs that are likely to affect a patent holder's assertion versus non-assertion decision. And crucially, this Article claims, this taxonomy is likely to play out differently depending on which industry is under the microscope.

Some industries that exhibit high barriers to patent assertion ironically also exhibit higher rates of patent assertion. The software industry demonstrates this trend clearly. This reality leads to the important insight that high barriers to patent assertion may result in higher than expected rates of patent assertion as patent holders shift the high costs of patent assertion to patent assertion entities or specialize in patent assertion themselves. Hence, current reform proposals should take such factors into account so that well-intentioned patent reforms aimed at curbing abusive patent assertions do not un-

intentionally increase patent assertion in other industries by erecting similar barriers.

Yet properly demarcating the line between acceptable and too high of barriers in a given industry is difficult for a variety of reasons, in part because it is difficult to know how patent law changes will play out. But the most promising changes would appear to be those that erect moderate barriers to patent assertion in general, while increasing costs for certain patterns of patent assertion, such as outsourcing or specialization. Threading that needle, of course, presents significant challenges. Yet it remains a challenge worth tackling.