
ARTICLE

AN EMPIRICAL STUDY OF PATENT LITIGATION TIMING: COULD A PATENT TERM REDUCTION DECIMATE TROLLS WITHOUT HARMING INNOVATORS?

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This Article conducts an empirical analysis of the relative ages of patents litigated by practicing and nonpracticing entities (NPEs). By studying all infringement claims for a sample of recently expired patents, I find considerable differences in litigation practices between these groups. Product-producing companies usually enforce their patents soon after issuance and complete their enforcement activities well before their patent rights expire. NPEs, by contrast, begin asserting their patents relatively late in the patent term and frequently continue to litigate until expiration. This variance in litigation timing is so dramatic that all claims asserting the average product-company patent are resolved before the average NPE patent is asserted for the first time. Further, I find that NPEs are the dominant source of patent enforcement in the final few years of the patent term. NPEs, enforcers of just twenty percent of all studied patents, are responsible for more than two-thirds of all suits and over eighty percent of all infringement claims litigated in the final three years of the patent term. These findings cast serious doubt on the utility of the last few years of the patent term and suggest that Congress should, at a minimum, consider increasing the frequency and magnitude of maintenance fee payments in the latter half of the term.

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INTRODUCTION

The impact nonpracticing entities (NPEs), or “patent trolls,” have on innovation may be the most important empirical question in patent law today. So far, however, scholars have analyzed litigation brought by various types of patent owners in a fragmented and indirect fashion. Some scholars have studied only the most litigious or easily identifiable trolls.¹ Such studies miss as much as 85% of NPE-asserted patents.² Others have focused

¹ See John R. Allison et al., *Patent Quality and Settlement Among Repeat Patent Litigants*, 99 GEO. L.J. 677, 681-83 (2011) [hereinafter Allison, *Patent Quality and Settlement*] (comparing patents asserted eight or more times with patents asserted just once); John R. Allison et al., *Extreme Value or Trolls on Top? The Characteristics of the Most-Litigated Patents*, 158 U. PA. L. REV. 1, 5 (2009) [hereinafter Allison, *Extreme Value*] (same); Michael Risch, *Patent Troll Myths*, 42 SETON HALL L. REV. 457, 460 (2012) (studying only “the ten most litigious NPEs”); see also Sannu K. Shrestha, Note, *Trolls or Market-Makers? An Empirical Analysis of Nonpracticing Entities*, 110 COLUM. L. REV. 114, 143 & n.160 (2010) (studying patent infringement cases filed by fifty-one NPEs identified in the press).

² Throughout this Article I refer to a dataset that I compiled using a random sample of 472 litigated patents that issued in 1993 and 1994. For a detailed discussion of my sample selection and

exclusively on litigation filed during a handful of years in the last decade.³ These studies fail to account for the vast differences among patents that happen to be litigated at the same time. It makes little sense, for example, to compare the first and only litigation of a one-year-old medical-device patent to the twentieth litigation of a nineteen-year-old software patent, even if both proceed contemporaneously.

Perhaps not surprisingly, these narrow studies have produced results at odds with one another. The empirical literature examining NPEs is, to put it mildly, internally inconsistent. Some studies strongly suggest that NPEs are every bit the tail that wags the dog. NPEs, for example, assert the lion's share of "most-litigated" patents⁴ and are especially dominant in high-tech fields, where patents tend to be plentiful, cheap, and broad.⁵ Others report the exact opposite. Trolls really don't exist at all,⁶ exist but are exceedingly

data collection efforts, see *infra* Sections I.B–C. References to the information on patents and cases in my dataset are cited throughout this Article to the *Timing Dataset*. Where the data relates to the litigation of a particular patent, I include the patent number in the citation. The data is on file with the author.

In the sample of cases gathered for this study, about 14% of NPE-asserted patents (twelve of eighty-eight) were litigated in eight or more suits. About 7% (six of eighty-eight) were asserted by the ten NPEs studied by Michael Risch. See *Timing Dataset*.

³ See Allison, *Patent Quality and Settlement*, *supra* note 1, at 682 (studying litigation brought between 2000 and 2009); Allison, *Extreme Value*, *supra* note 1, at 5 (studying litigation brought between 2000 and 2007); Colleen V. Chien, *Of Trolls, Davids, Goliaths, and Kings: Narratives and Evidence in the Litigation of High-Tech Patents*, 87 N.C. L. REV. 1571, 1593 (2009) (studying high-tech cases filed between January 2000 and March 2008); Gwendolyn G. Ball & Jay P. Kesan, *Transaction Costs and Trolls: Strategic Behavior by Individual Inventors, Small Firms and Entrepreneurs in Patent Litigation 2* (Ill. Pub. Law & Legal Theory Papers Series, Research Papers Series No. 08-21, 2009), available at <http://ssrn.com/abstract=1337166> (studying cases filed between 2000 and 2002).

⁴ Allison, *Patent Quality and Settlement*, *supra* note 1, at 692-93 figs.2 & 3 (reporting that NPEs filed 63.5% of the patent cases involving a patent litigated eight or more times, but just 21% of cases involving a patent litigated only once).

⁵ See *id.* at 695-96 & tbl.10 (reporting that over 74% of the most litigated patents cover software-related inventions); Chien, *supra* note 3, at 1600, 1604 (reporting that NPEs filed 17% of patent suits and were a party to 28% of patent claims in high-tech industries); Mark A. Lemley & Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 TEX. L. REV. 1991, 2009 (2007) (estimating that NPEs file 30-40% of patent suits in the computer and electronic industries).

⁶ See Robert P. Merges, *The Trouble with Trolls: Innovation, Rent-Seeking, and Patent Law Reform*, 24 BERKELEY TECH. L.J. 1583, 1586 (2009) ("Some believe the troll label is a meaningless epithet, applied only to a plaintiff in a patent lawsuit with whom one has a legal conflict."); Michael C. Smith, "Patent Pirates" Only Exist in Neverland, TEX. LAW., Oct. 11, 2004, available at http://mcsmith.blogs.com/eastern_district_of_texas/files/patent_pirates_exist_only_in_neverland.pdf ("[P]laintiffs in patent litigation are hardly pirates—they are simply investors who bought an asset and seek a return on their money."); *Innovators Fear the Patent Trolls*, TMCNET (May 7, 2006), <http://www.tmcnet.com/usubmit/2006/05/07/1639931.htm> ("Patent trolls 'don't exist. Trolls are imaginary creatures I think the whole issue is overblown." (quoting Carl Gulbrandsen, Managing Dir., Wis. Alumni Research Found.)).

rare,⁷ or exist in modest numbers but hold few of the traits attributed to them by their detractors.⁸

This Article fills these gaps in the existing literature by studying a broad cross-section of patents over the entire patent term. Rather than studying a subset of patents linked by litigiousness or contemporaneous court filings, I study all patent enforcement for a random sample of recently expired patents.

With this data, I can for the first time account for the relative timing of lawsuits filed by practicing and nonpracticing entities. My findings are dramatic: opposing views of NPEs in the literature ring true but at opposite ends of the patent term. Product-producing companies predominantly enforce their patents soon after they issue and complete their enforcement activities well before their patents expire. NPEs, on the other hand, begin asserting their patents relatively late in the patent term and frequently continue to litigate their patents to expiration. Indeed, I find that the average product-company patent has been shelved by its owner before the average NPE patent has even been asserted.

The degree to which NPEs dominate the final few years of the patent term is especially surprising. Though asserting just over 20% of all studied patents, NPEs account for more than two-thirds of suits and over 80% of infringement claims litigated in the final three years of the patent term. Notably, NPEs' domination of late-term litigation is almost completely attributable to firms that do nothing more than hold patents. NPEs that many do *not* consider trolls—universities⁹ and individual inventors¹⁰ in particular—do not drive the results reported below.

⁷ Ball & Kesan, *supra* note 3, at 25 (concluding that the “number of patent licensing firms—the most obvious candidate for the role of troll—active in cases filed . . . was quite modest”); Nathan Myhrvold, Op-Ed., *Inventors Have Rights, Too!*, WALL ST. J., Mar. 30, 2006, at A14 (“Court records show that only 2% of all patent lawsuits are due to plaintiffs that have no ongoing product business.”).

⁸ See Risch, *supra* note 1, at 474-91 (testing many of the common criticisms of NPEs and concluding that “most of the criticism is based on a few, perhaps anecdotal, cases”); Shrestha, *supra* note 1, at 148-49 (finding that “NPEs may be demanding high royalty fees not because of opportunism, but because their patents are, in fact, more valuable” and that “NPE patents have had considerable influence on subsequent patents and are also not trivial improvements in a particular technology class”).

⁹ See Mark A. Lemley, *Are Universities Patent Trolls?*, 18 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 611, 629 (2008) (arguing that universities are not patent trolls, at least in part because they are “not engaged in hiding the ball, waiting until people have developed an industry and then popping up and demanding a disproportionate share of royalties”); Randall R. Rader, Chief Judge, U.S. Court of Appeals for the Fed. Circuit, Remarks at the Eastern District Bench Bar: The State of Patent Litigation (Irving, Tex. Sept. 27, 2011) (“[T]he NPE designation sweeps in some unintended ‘culprits’ like universities and research clinics and can also extend to almost every corporation and business because they practice only a fraction of their patent portfolio.”). *But see*

I also compare the relative litigiousness of product-producing companies and NPEs, as well as differences in the subject matter and strength of their infringement claims. In addition to my overall findings, I report how these statistics change among patents litigated in the final years of the patent term. I find that NPEs are especially litigious: they overwhelmingly assert high-tech patents and lose at a relatively high rate when their infringement claims are adjudicated on the merits. The same is true for patents litigated late in the patent term: NPEs are more litigious, more high-tech focused, and more likely to lose on the merits of their infringement claims. Interestingly, an outsized percentage of product producing–company patents litigated late in the term are high-tech related. These patents are asserted by a unique group of companies, which sell a product and yet blur the line between practicing entities and trolls.

My findings add to mounting evidence that the costs of NPE litigation outweigh their benefits. In fact, they cast serious doubt on NPEs' chief alleged benefits: that paper patentees help create a market for innovation and contribute to the dissemination of useful technology. Instead, NPEs overwhelmingly wait to assert their rights until the underlying technology is stale and unlikely to be of much use to accused infringers that independently developed the technology themselves years earlier.¹¹ Overall, my findings suggest that Congress should shorten the patent term by three years or even longer.¹² In these final years of patent protection, more than 80% of patent assertions are brought by patent-holding firms that have no intention of commercializing a product. Much of the remaining litigation is brought by product-producing companies asserting high-tech patents, often with far less than ideal motivation. At the very least, Congress or the Patent

Merges, *supra* note 6, at 1611 (“[U]niversities, at least some of them, have crossed the line between innovators and rent-seekers.” (footnote omitted)).

¹⁰ Chien, *supra* note 3, at 1587 (arguing that individual inventors should not be considered NPEs).

¹¹ See Christopher A. Cotropia & Mark A. Lemley, *Copying in Patent Law*, 87 N.C. L. REV. 1421, 1444-46 (2009) (finding that allegations of copying are rare in patent litigation, especially in cases asserting high-tech patents); see also Markus Reitzig et al., *On Sharks, Trolls, and Their Patent Prey—Unrealistic Damage Awards and Firms' Strategies of “Being Infringed,”* 36 RES. POL'Y 134, 150 (2007) (developing a model of NPE behavior suggesting that the NPEs can “act most profitably as sharks” when asserted patents are infringed inadvertently); John L. Turner, Patent Thickets, Trolls and Unproductive Entrepreneurship 23 (Sept. 2012) (unpublished manuscript), available at <http://ssrn.com/abstract=1916798> (“[W]hen the frequency of inadvertent infringement is smaller . . . [.] my model predicts that trolls will cause less of a change in rates of invention and patenting and that their presence will harm welfare less.”).

¹² For a discussion of study limitations that temper this recommendation, including a discussion of NPEs' ability to simply file suit earlier in the event of a term reduction, see *infra* Section III.C.

and Trademark Office (PTO) should consider increasing the frequency and magnitude of maintenance fee payments required in the latter half of the patent term.

I. STUDY DESIGN

On the issue of patent reform, a civil war of sorts divides the technology community.¹³ Battle lines are drawn largely between industries. Pharmaceutical companies, on one side, argue that strong patent rights are crucial to continued innovation.¹⁴ High-tech firms, on the other, view the patent system as more foe than friend.¹⁵ According to these firms, and many scholars and patent attorneys, the patent system is too often a vehicle for “patent trolls”—entities that assert patents they do not use and frequently did not invent—to extract undeserved royalties from “true” innovators working to build successful new high-tech products.¹⁶

How these opposing views of the patent system should be reconciled turns in large part on questions concerning the utility of NPEs. Are NPEs the pervasive litigation-cost “extortionists” their detractors make them out to be?¹⁷ Or are they, as their defenders contend, small-time players that help

¹³ See, e.g., DAN L. BURK & MARK A. LEMLEY, *THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT* 4 (2009) (“Any doubts that the patent system is perceived by different industries in fundamentally different ways were dispelled during the course of congressional debates over patent reform in the four years beginning in 2005. The reform process ground to a halt because different industries couldn’t agree on a single principle of reform.”); Merges, *supra* note 6, at 1608-09 (“[R]ecent battles over patent reform in Congress show that there is a major divergence between the interests of the biomedical industries . . . and information technology companies . . .”).

¹⁴ See BURK & LEMLEY, *supra* note 13, at 4 (“In the pharmaceutical industry, there seems to be a strong consensus . . . that patents are critical to innovation.”).

¹⁵ See *id.* (“[T]he information technology industries . . . almost invariably see the patent system as a cost rather than a benefit to innovation.”).

¹⁶ Patent “trolls” are so named because their behavior bears resemblance to mythological trolls who emerge without warning from beneath bridges to demand a toll from all who would pass. See Gerard N. Magliocca, *Blackberries and Barnyards: Patent Trolls and the Perils of Innovation*, 82 NOTRE DAME L. REV. 1809, 1814 (2007) (“The ensuing litigation comes as a surprise to a defendant, which is why these suits are analogized to mythical trolls that hid under bridges and leapt out to demand a ransom from travelers.”).

¹⁷ Timothy J. Haller & Sally Wiggins, *The Patent Troll Myth*, INTELL. ASSET MGMT., http://www.buildingipvalue.com/06US_Can/113_116.htm (last visited Mar. 15, 2013); see Magliocca, *supra* note 16, at 1816 (“[Patent trolls] acquire an invention and then refuse to do anything until the technology becomes an industry standard. This behavior is akin to setting a deliberate trap and is not permitted elsewhere in the law.”); Merges, *supra* note 6, at 1600-02 (comparing the patent troll business model to blackmail); Ted Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341, 368 (2010) (noting that NPEs “tend to exploit litigation and licensing market defects to extract unwarranted rents from commercializers”); see also Rader, *supra* note 9, at 8 (“[E]xpenses can force

disseminate useful technology,¹⁸ create markets for inventions,¹⁹ and provide capital for inventors?²⁰

A. Hypotheses

Unfortunately, the existing literature has done little to settle the debate. One reason is that, even after several studies on the topic, commentators cannot agree on the percentage of patent enforcement attributable to NPEs. Results have been all over the map. NPEs, or some “trollish” subset thereof, account for 2%,²¹ 4%,²² 22%,²³ or 27%²⁴ of patent litigation depending on whom you ask. Though diverse, these relatively modest estimates have led at least one scholar to declare that “the uniform findings indicate that NPEs file only a small fraction of all patent infringement suits.”²⁵ Other clues, however, suggest that NPEs have anything but a modest effect on the

accused infringers to acquiesce to non-meritorious claims. This only serves as an unhealthy tax on innovation and open competition.”).

¹⁸ See Brian D. Kacedon et al., *Patent Trolls: A Stereotype Causes a Backlash Against Patents and Licensing*, FINNEGAN (Dec. 2006), <http://www.finnegan.com/resources/articles/articlesdetail.aspx?news=c49b5d62-61bf-4d90-99ad-30d4d6e9da23> (noting that the patent licensing community “performs a central role in helping commercial entities obtain the rights to use valuable technologies that produce new and beneficial products”).

¹⁹ See 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, 211 (2006) (“[Patent trolls] make the patent market more efficient through buying and licensing patents. Patent dealers create a credible threat of litigation, which encourages exchange, makes patents more liquid, and facilitates market clearing through price equalization.”).

²⁰ See, e.g., John E. Dubiansky, *An Analysis for the Valuation of Venture Capital-Funded Startup Firm Patents*, 12 B.U. J. SCI. & TECH. L. 170, 171-72 (2006) (noting that venture capital firms have begun to “assess and remarket the intellectual property of failed startup firms”); Ronald J. Mann, *Do Patents Facilitate Financing in the Software Industry?*, 83 TEX. L. REV. 961, 1024 (2005) (“[T]rolls are serving a function as intermediaries that specialize in litigation to exploit the value of patents that cannot be exploited effectively by those that have originally obtained them.”).

²¹ Myhrvold, *supra* note 7.

²² Ball & Kesan, *supra* note 3, at 15 (finding that “3% of plaintiffs, who were active in 4% of the cases, were licensing firms”).

²³ Compare Patent Cases by United States District Court, LEX MACHINA (Jan. 15, 2013) (on file with author) [hereinafter LEX MACHINA] (reporting that 2541 patent cases were filed in U.S. district courts in 2008, 2521 in 2009, and 2724 in 2010), with *Litigations Over Time*, PATENT FREEDOM, <https://www.patentfreedom.com/about-npes/litigations> (last updated Jan. 18, 2012) (showing that there were 559 NPE-filed suits in 2008, 546 in 2009, and 623 in 2010).

²⁴ See Colleen V. Chien, *Predicting Patent Litigation*, 90 TEX. L. REV. 283, 314 (finding in a sample of litigated patents issued in 1990 that 27% were asserted by either a “patent assertion entity” or an individual); Sara Jeruss et al., *The America Invents Act 500: Effects of Patent Monetization Entities on U.S. Litigation*, 11 DUKE L. & TECH. REV. 357, 375-78 (finding, in a study of 100 patent suits filed each year from 2007 to 2011, that the percentage attributable to NPEs was roughly 22% in 2007, 27% in 2008, 33% in 2009, 30% in 2010, and 40% in 2011).

²⁵ Risch, *supra* note 1, at 466.

patent system. One study found that NPEs owned more than 60% of patents litigated eight times or more,²⁶ and multiple studies have found that NPEs file as much as 40% of suits asserting high-tech patents.²⁷

What accounts for these seemingly inconsistent results? This Article argues that existing studies of NPE litigation are incomplete because they fail to take into account differences in the relative ages of patents asserted by practicing and nonpracticing entities. It further suggests that all previous empirical studies underestimate NPEs' true impact because they fail to compare NPE patents with other patents of the same age.

To date, no empirical studies have accounted for time in examining patent litigation by NPEs.²⁸ This omission is surprising because there is good reason to believe that product-producing companies and NPEs assert their patents on very different timelines. If, as many suggest, product-producing companies value their patents for exclusionary power,²⁹ these companies should file suit (if at all) soon after their patents issue to fend off competitors that are developing or introducing similar products.³⁰ In addition, because products generally have short lifecycles relative to the patent term³¹ and next generation products may be protected by newer patents, practicing patentees should generally cease litigating a patent well

²⁶ See Allison, *Patent Quality and Settlement*, *supra* note 1, at 690, 692.

²⁷ See Chien, *supra* note 3, at 1600, 1604 (reporting that NPEs file 17% of patent suits and are a party to 28% of patent claims in hardware and software industries); Lemley & Shapiro, *supra* note 5, at 2009 (estimating that NPEs file 30-40% of patent suits involving computer and electronic technology).

²⁸ For example, Michael Risch found that highly litigious NPEs asserted their patents an average of 8.3 years after issue, but he did not compare this delay with data on when product-producing companies do the same. Risch, *supra* note 1, at 490.

²⁹ See, e.g., Daniel A. Crane, *Intellectual Liability*, 88 TEX. L. REV. 253, 286 (2009) (noting that NPEs and product-producing companies "have asymmetrical incentives, since trolls are only interested in exacting payments").

³⁰ Product-producing companies are also discouraged from delaying patent enforcement until the patented technology matures by the risk that doing so will give their competitors time to amass their own arsenal of patents, which they could use to file a successful counterclaim. See, e.g., Tom Ewing, *Indirect Exploitation of Intellectual Property Rights by Corporations and Investors: IP Privateering and Modern Letters of Marque and Reprisal*, 4 HASTINGS SCI. & TECH. L.J. 1, 35 (2012) ("Each company views its patent armamentarium as an instrument of mutually assured destruction, e.g., if one company sues another for patent infringement, then retaliation is guaranteed."). Because NPEs do not sell products that could be the subject of a counterclaim, they do not face this risk when filing suit. See, e.g., John R. Allison et al., *Patent Litigation and the Internet*, STAN. TECH. L. REV., no. 3, 2012, at 5, <http://stlr.stanford.edu/pdf/allison-patent-litigation.pdf> ("[NPEs] do not make or sell products and thus are not vulnerable to patent infringement counterclaims, as are product companies that sue for infringement. NPEs consequently may be less reluctant to sue.").

³¹ In the computer industry, for example, products become twice as powerful about every two years. See *infra* note 114 and accompanying text (describing Moore's law).

before it expires and move on to litigating newer patents covering newer products.

By contrast, there is good reason to believe that NPEs overwhelmingly litigate their patents late in the patent term. For one, many NPEs do not file their own patent applications, but instead purchase patents on the secondary market (often from failed companies³²) for the purposes of litigation.³³ Naturally, it takes time for such patents to reach NPEs.³⁴ Further, because NPEs primarily value patents for their usefulness in extracting royalties and damages from product-producing companies,³⁵ these patentees should generally wait to file suit until a lucrative industry has developed and continue to file suits as long as deep-pocketed targets remain.³⁶

If these characterizations are rooted in fact rather than anecdote, it makes little sense to base patent policy on calculations of the bare percentage of NPE suits among those brought during some year or group of years. Product-producing companies are far and away the chief players in the patent system and such studies will always reflect this fact.³⁷ What these studies cannot reflect, however, is whether NPEs begin to have a disproportionate effect at some point during the patent term and how such a finding would color NPEs' (and their defenders') claims that they are beneficial market makers and disseminators of technology.

B. *Compiling a Database*

To test these hypotheses, I set out to collect data on all litigation asserting a sample of recently expired patents. Using Westlaw and PACER,³⁸ I

³² See Risch, *supra* note 1, at 489 (finding in a study of patents acquired by NPEs that more than 14% of the original patent-holder companies were no longer operating and suggesting that another 13% may have been in financial distress).

³³ See, e.g., Crane, *supra* note 29, at 286 ("Patent trolls are firms that aggregate patents for technology that they usually did not themselves create and do not themselves use, but for which they seek to exact royalty payments from commercial users.").

³⁴ See *infra* notes 100-01 and accompanying text.

³⁵ See *supra* note 29.

³⁶ See Mann, *supra* note 20, at 1027 (noting the "especially damaging" strategy of "waiting after a patent has been issued while an industry advances using the covered technology and then suing widely for infringement only after the industry has become locked into the technology through independent innovation and development"); Merges, *supra* note 6, at 1590-91 ("The patent troll strategy is to take advantage of 'lock-in' that occurs as a result of [sunk cost] investments. Typically, the troll waits until a technology is fully entrenched before scouting around for patents to acquire or asserting patents it holds." (footnote omitted)).

³⁷ See *infra* Figure 1.

³⁸ See PACER, <http://www.pacer.gov/> (last visited Mar. 15, 2013) (cataloguing case and docket information from federal litigations).

located every litigated³⁹ patent⁴⁰ that issued with a patent number falling between 5,210,000 and 5,309,999. These patents issued between May 11, 1993, and May 10, 1994 (“the study period”).⁴¹

As shown in Table 1, I identified 1180 patents issued during the study period⁴² that were litigated in a district court (including in U.S. territories) or the Court of Federal Claims, or at the International Trade Commission (ITC).⁴³ In the ninety district courts located in the fifty states and the

³⁹ Here and throughout, by “litigated” I mean asserted in an action raising a claim for infringement (or for a declaration of noninfringement or invalidity) of the studied patent, as opposed to merely involved in litigation concerning ownership, inventorship, antitrust, contract, trademark, copyright, or other patent claims. For an additional discussion of the kinds of cases that were excluded from the study because they were not patent infringement cases, see *infra* Section I.C.

⁴⁰ Here and throughout, I use “patent” to refer exclusively to “utility” patents. This study does not include design patents or plant patents, both of which are protected by separate statutory schemes. See 35 U.S.C. §§ 171–173 (2006) (covering design patents) (amended 2012); *id.* §§ 161–164 (covering plant patents).

⁴¹ Under the law in effect at the time these patents issued, each would have expired between May 11, 2010, and May 10, 2011. See 35 U.S.C. § 154 (1988) (setting the patent term at seventeen years from the date of issue). Legislation passed in December 1994 modifying the patent term for patents then-in-force to the longer of seventeen years from issue or twenty years from filing. Uruguay Round Agreements Act, Pub. L. No. 103-465, sec. 532, § 154(c)(1), 108 Stat. 4809, 4984–85 (1994) (codified as amended at 35 U.S.C. § 154(c)(1) (2006)). Because an application spends on average close to three years at the PTO, these calculations generally provide a similar term of protection. See John R. Allison & Mark A. Lemley, *The Growing Complexity of the United States Patent System*, 82 B.U. L. REV. 77, 98 (2002) (finding that patents issued between 1996 and 1998 spent an average of 2.8 years in prosecution). Many patents, however, receive a modest extension under the new law. See Mark A. Lemley, *An Empirical Study of the Twenty-Year Patent Term*, 22 AIPLA Q.J. 369, 385 (1994) (finding that, on average, the new rule for patent terms extended patentees’ rights by 253 days).

⁴² The earliest patent issued on May 11, 1993. U.S. Patent No. 5,210,272 (filed Aug. 14, 1991). The latest issued on May 10, 1994. U.S. Patent No. 5,309,861 (filed Aug. 5, 1992). The rate of assertion during the study period (1.2%) is consistent with prior estimates of litigated patents. See Mark A. Lemley, Essay, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1501 (2001) (“[A]t most only about two percent of all patents are ever litigated . . .”).

⁴³ Patent suits fall within the exclusive subject matter jurisdiction of federal courts, 28 U.S.C. § 1338(a), and may generally be brought in any United States district court which has personal jurisdiction over the defendant, see *Int’l Shoe Co. v. Washington*, 326 U.S. 310, 316 (1945) (“[D]ue process requires . . . that in order to subject a defendant to a judgment *in personam*, if he be not present within the territory of the forum, he have certain minimum contacts with it . . .”), and where venue is proper, see 28 U.S.C. § 1400(b) (permitting a suit for patent infringement in any judicial district in which “the defendant resides” or “the defendant has committed acts of infringement and has a regular and established place of business”). However, patent claims against the United States must be brought in the Court of Federal Claims. 28 U.S.C. § 1498(a). Another exception is that the ITC has jurisdiction to investigate and exclude imported goods that infringe a United States patent from entry into the country. 19 U.S.C. § 1337(a)(1)(B)(i), (c), (d). ITC orders barring the entry of infringing goods may be appealed to the Court of International Trade. 19 U.S.C. § 1514(a). The Court of Appeals for the Federal

District of Columbia, court clerks' offices report basic information on patent suits to the PTO, and searchable copies of these reports are available via Westlaw's Derwent LitAlert database.⁴⁴ From these reports I identified 1159 patents.⁴⁵ The LitAlert database, however, does not include records for cases filed in the District Court of Puerto Rico and the three territorial district courts.⁴⁶ To locate all patents asserted solely in these courts, I searched PACER docket reports and pleadings (where available⁴⁷) for all patent cases brought in each court during or after 1993 and cross-referenced these results with all relevant patent numbers cited in opinions or orders issued by these courts over the same period. From these records I found another two unique patent numbers and two duplicates.⁴⁸ Similarly, to locate all patents asserted solely against the United States, I searched PACER docket reports and pleadings for all patent cases brought in the Court of Federal Claims during or after 1993 and cross-referenced these results with opinions or orders issued by the court. This search identified another seven unique patent numbers and one duplicate.⁴⁹ Finally, to locate

Circuit holds appellate jurisdiction over the Court of Federal Claims, the Court of International Trade, and all patent-related cases brought in district courts. 28 U.S.C. § 1295(a)(1), (3), (5).

⁴⁴ Searching the LitAlert database confirms that all ninety districts located in the fifty states and the District of Columbia submitted litigation reports to the PTO throughout the 1990s and 2000s. Thus, any missing patents should be attributable to idiosyncratic oversight rather than systematic failure of any particular district to file reports with the PTO.

⁴⁵ Patents from this timeframe were asserted in seventy-four of the ninety districts. *See Timing Dataset*. Based on patent filing data from Lex Machina, these seventy-four districts account for over 98% of patent suits filed since 2000. *See LEX MACHINA, supra* note 23. And the top forty-six of those districts, ranked by number of patent filings since 2000, are represented in the dataset I analyze. *Compare id., with Timing Dataset*.

⁴⁶ These three territorial courts are the District Court for the Northern Mariana Islands, the District Court of Guam, and the District Court of the Virgin Islands. That these courts are excluded is not surprising given that the District Court of Puerto Rico and the three territorial districts collectively receive about one patent case per year. *See LEX MACHINA, supra* note 23 (reporting just fourteen patent suits filed in these four districts between 2000 and 2010). Virtually all of these cases were filed in the District of Puerto Rico. *See id.*

⁴⁷ Starting around the year 2000 and gradually increasing thereafter on a district-by-district basis, federal courts have published filings and orders online in PDF format. Prior to electronic filing, docket entries were described only briefly on docket reports. Thus, despite personally hand-searching patent dockets in these districts, my dataset is potentially underinclusive for the District Court of Puerto Rico, the territorial district courts, and the Court of Federal Claims. *See Allison, Patent Quality and Settlement, supra* note 1, at 682 n.22 (describing the limitations in data collected from PACER by the Stanford IP Litigation Clearinghouse). Nonetheless, collection in this manner gives "the best, most representative data set available." *Id.*

⁴⁸ I identified a total of four patents issued during the study period that were asserted in a territorial district court, but two were also asserted in a district court.

⁴⁹ I identified a total of eight patents issued during the study period that were asserted in the Court of Federal Claims, but one was also asserted in a district court.

patents asserted only at the ITC,⁵⁰ I searched Westlaw's database of ITC filings and cross-referenced these results with all relevant patent numbers cited in opinions or orders issued by the United States Court of International Trade in or after 1993.⁵¹ Here, I found another twelve unique patent numbers and twenty-two duplicates.

Table 1: Database Composition by Venue⁵²

Venue	Total Patents	Unique	Database Source
U.S. Dist. Cts.	1159	--	Westlaw: LITALERT
U.S. Territorial Cts.	4	2	PACER; Westlaw: DCTGU, DCTMP, DCTPR, DCTVI
Ct. of Fed. Claims	8	7	PACER; Westlaw: FEDCL
ITC/Ct. of Int'l Trade	34	12	Westlaw: USITC-FILINGS, FINT-CIT

C. Sampling and Data Collection

From these 1180 patents, I randomly selected a sample of 472 (exactly two-fifths) to investigate in depth. From this smaller sample, I excluded fifty-one patents because they were never asserted against an alleged patent infringer. Of these fifty-one, fourteen patents were involved solely in litigation brought to resolve a dispute between putative owners or inventors. Thirteen more were involved in patent false-marking cases brought after the patents' expiration.⁵³ Another eighteen were not litigated, but only cited

⁵⁰ Technically, the ITC's jurisdiction is in rem, so the suit is brought against the allegedly infringing goods themselves. *See, e.g., Sealed Air Corp. v. U.S. Int'l Trade Comm'n*, 645 F.2d 976, 985-86 (C.C.P.A. 1981) (noting that an ITC order to exclude products from entry into the United States operates "against goods, not parties").

⁵¹ Westlaw's coverage of ITC filings dates back to December 1994. *See* Scope USITC-FILINGS, WESTLAW CLASSIC, https://web2.westlaw.com/scope/default.aspx?db=USITC-FILINGS&RP=/scope/default.wl&RS=WLW12.10&VR=2.0&SV=Split&FN=_top&MT=208&MST= (last visited Mar. 15, 2013). Thus, this dataset is underinclusive to the extent that patents issued during the study period were asserted at the ITC within twelve to eighteen months of their issue.

⁵² *See supra* notes 38-51 and accompanying text.

⁵³ In the past, it was unlawful to mark a product with an expired patent number. *See* *Pequignot v. Solo Cup Co.*, 608 F.3d 1356, 1358, 1361 (Fed. Cir. 2010) (holding that a "now-expired patent" was "unpatented" under 35 U.S.C. § 292(a), which prohibits marking unpatented products with the word "patent" "for the purpose of deceiving the public"). The Leahy-Smith America Invents Act clarified that an expired patent does not violate § 292. *See* Pub. L. No. 112-

in pleadings.⁵⁴ Five additional patent numbers were excluded because they contained typographical errors,⁵⁵ and one final patent was erroneously asserted long after it had expired for failure to pay maintenance fees.

For each of the remaining 421 patents, I collected a variety of data to determine when the patents were asserted, how many times they were asserted, and against whom they were asserted. In order to compare the relative ages of patents asserted by practicing and nonpracticing entities, I categorized the party enforcing each patent using patentee classes developed by Mark Lemley and Nathan Myhrvold.⁵⁶ Finally, in order to compare the diversity of technology enforced by practicing and nonpracticing entities, I categorized the invention claimed in each patent using technology and industry classes developed by Lemley, John Allison, and Joshua Walker.⁵⁷

1. Prosecution Data

First, to calculate each patent's term, I determined the date on which each patent was filed and issued.⁵⁸ Specifically, I identified the filing date of each patent's application, or of the earliest United States parent application⁵⁹ to which it claims priority.⁶⁰ I also identified whether each patent's owner

29, § 16(b)(3), 125 Stat. 284, 329 (2011) (amending 35 U.S.C. § 292(c) (2006)) ("The marking of a product . . . with matter relating to a patent that covered that product but has expired is not a violation of this section.").

⁵⁴ Seven patents were cited as prior art in an answer or declaratory judgment complaint. Eleven were cited for other extraneous reasons in pleadings bringing claims for trademark infringement, copyright infringement, unfair competition, or breach of contract.

⁵⁵ Westlaw's Derwent LitAlert database was rife with erroneously transcribed patent numbers. In the vast majority of cases, I was able to reverse-engineer the correct patent number. The vast majority of corrected patent numbers issued within the study period, but a small minority did not.

⁵⁶ See Allison, *Patent Quality and Settlement*, *supra* note 1, at 683-84 (describing the typology of entity-status classes developed by Lemley and Myhrvold).

⁵⁷ See *id.* at 685 tbl.2 (defining nine technology areas, including software, optics, and electronics, and thirteen industry areas, including pharmaceuticals, communications, and transportation). This Article does not address my findings with respect to technology and industry in detail. Those results are tentatively reserved for a forthcoming companion piece.

⁵⁸ Both dates are found on the patent document itself.

⁵⁹ Prior foreign filing dates do not start the twenty-year term. 35 U.S.C. § 154(a)(3).

⁶⁰ Many patent applications blossom over time into a "family" of divisional, continuation, and continuation-in-part child applications, each of which may in turn spawn their own children, and so on. See 35 U.S.C. §§ 120-121; 37 C.F.R. § 1.53(b), (d) (2011) (permitting each of these types of applications). It is frequently these subsequent applications, rather than their parents, which ultimately issue patents. See Mark A. Lemley & Kimberly A. Moore, *Ending Abuse of Patent Continuations*, 84 B.U. L. REV. 63, 70 (2004) (noting that over half of all litigated patents issue from continuation applications); Mark A. Lemley & Bhaven Sampat, *Is the Patent Office a Rubber Stamp?*, 58 EMORY L.J. 181, 190-93 (2008) (finding that, taking continuation applications into account, the PTO grants patents to more than 70% of applicants).

made all three maintenance fee payments and, if not, on which date the patent prematurely fell into the public domain.⁶¹

2. Litigation Data

Next, I collected enforcement data for each patent.⁶² Specifically, I identified:

(a) *the date each patent was first enforced*: the filing date of the earliest complaint alleging infringement of the patent or seeking a declaration that the patent was not infringed or was invalid;⁶³

(b) *the date enforcement of each patent ceased*: the date on which the very last claim asserting infringement of the patent, or seeking a contrary declaration, was resolved;⁶⁴

⁶¹ Generally, patent owners are given a six-month grace period to pay their maintenance fees, and failure to pay beyond that period results in the patent's expiration. 35 U.S.C. § 41(b). But, a payment made within twenty-four months after the grace period may be accepted if the delay was "unintentional" or "unavoidable." *Id.* § 41(c).

⁶² To locate the docket number of each case asserting a given patent, I cross-referenced results from three databases: (i) each case in which the patent was reported as asserted in Westlaw's Derwent LitAlert database, (ii) each additional case, if any, from which a document was listed on Westlaw's "citing references" for each studied patent, and (iii) each additional case, if any, returned by a search for the patent's number on the Stanford IP Litigation Clearinghouse. To exclude false positives and gather litigation statistics from true assertions, I relied on PACER docket reports for cases filed prior to 2000 and Stanford IP Litigation Clearinghouse docket reports for cases filed in 2000 or later. The dockets for three cases filed pre-2000 were, for unknown reasons, not available via PACER. *See* Nos. 97-CV-285 (D. Nev.); 96-CV-1040 (D. Nev.); 95-CV-782 (W.D. Tex.). Because I could not determine when these three cases were resolved, I excluded the patents at issue in these cases from the analyses related to litigation end dates.

⁶³ Patents can, of course, be enforced without filing litigation. For a detailed discussion, see *infra* Section III.C.

⁶⁴ In suits resolved by settlement (the vast majority of cases), I identified the date on which the court granted the parties' stipulated motion for dismissal or for a consent judgment. In suits resolved in the accused infringers' favor, I identified the date of the jury's verdict; the date on which the court granted the accused infringer's dispositive motion to dismiss (e.g., following a ruling that the patentee is not the true owner of the patent-in-suit), motion for summary judgment, or motion for judgment as a matter of law. In the event of an appeal, I identified the date of the affirmance of any of the aforementioned motions. In suits resolved in the patentee's favor, I identified the date on which the court awarded damages or an injunction, or, in the event of an appeal, the date of affirmance of these remedies. Finally, for three suits in which an unsuccessful petition for certiorari to the Supreme Court was filed, I identified the date certiorari was denied.

I did not identify the date on which the case was "terminated"—i.e., the date on which the court administratively closed the case. Doing so would have counted days, months, or years spent litigating nonsubstantive post-trial or post-judgment issues, like motions for attorneys' fees and motions for sanctions. Also, in many cases, other claims (including claims for infringement of other patents) continued after claims asserting the studied patent had been resolved. In these multiclaim cases, I identified the date specific to the claim for infringement of (or declaratory judgment claim against) the studied patent.

(c) *the total number of suits in which each patent was asserted*: the total number of unique docketed cases in which the patentee asserted the patent or alleged infringers sought declaratory relief from an imminent assertion, excluding parallel case pairs and consolidated cases other than multi-district litigation;⁶⁵

(d) *the total number of accused infringers against which each patent was asserted*: the total number of unique parties against which an infringement claim has been filed or which filed a claim seeking a declaration of relief;⁶⁶

(e) *litigation outcomes*: whether each patent was ever adjudicated on the merits and, if so, whether the outcome was a finding of infringement, noninfringement, or invalidity;⁶⁷ and

⁶⁵ Accused infringers will often file suit preemptively, seeking a declaration of non-infringement or invalidity. The vast majority of these suits are filed close in time to a mirror-image patent infringement complaint brought by the patent owner. In fact, until recently, courts would only exercise jurisdiction over declaratory judgment actions in which the plaintiff held “a reasonable apprehension of imminent suit.” *Teva Pharm. USA, Inc. v. Pfizer, Inc.*, 395 F.3d 1324, 1333 (Fed. Cir. 2005), *abrogated by* *MedImmune, Inc. v. Genentech, Inc.*, 549 U.S. 118 (2007). Patentees and accused infringers often race to the courthouse (albeit in different districts) in hopes of ultimately consolidating both suits in their forum of choice. See Kimberly A. Moore, *Judges, Juries, and Patent Cases—An Empirical Peek Inside the Black Box*, 99 MICH. L. REV. 365, 404 (2000) (stating that infringers file declaratory judgment suits before patentees file infringement suits in order to choose the forum they think will be most favorable). As declaratory judgment plaintiffs, accused infringers may also hold a psychological advantage with juries. See *id.* at 406 fig.12 (showing that patentees win 68% of jury trials in patentee-filed infringement actions, but only 38% of jury trials in accused infringer-filed declaratory judgment actions). These case pairs typically involve the same parties and proceed in tandem. I counted these case pairs as one suit since, for all intents and purposes, they are. In a similar fashion, ITC investigations often coincide with a patent infringement suit filed contemporaneously in district court. Again, because an ITC investigation brought in parallel with a patent infringement action is in essence one suit, I counted them as such.

Finally, I merged data for individual suits that were so similar and contemporaneous that they were consolidated into a single action. The sole exception I made to this rule was for multi-district litigations (MDLs), which pull together a large number of cases filed over a long period of time. My sample included three MDLs: *In re Rembrandt Techs., LP, Patent Litig.*, 493 F. Supp. 2d 1367, 1369 (J.P.M.L. 2007) (consolidating fifteen suits in three different federal districts); *In re Accia Media Techs. Corp. Patent Litig.*, 360 F. Supp. 2d 1377, 1378-79 (J.P.M.L. 2005) (consolidating twenty suits in five districts); and *In re Pabst Licensing, GmbH Patent Litig.*, No. 99-1298, 2001 WL 797315, at *1 (E.D. La. July 12, 2001) (addressing seven motions filed in response to the consolidation of four civil actions by the Panel on Multi-District Litigation).

⁶⁶ I excluded “John Doe” parties from this number.

⁶⁷ I did not count default judgments as “adjudications.” To make the most of extremely limited data, the litigation outcomes reported below are restricted to those at the district court level. The data is not adjusted to account for appellate outcomes. Analysis of district court outcomes alone is not uncommon in the patent litigation literature. Cf. Michael J. Mazzeo et al., *Excessive or Unpredictable? An Empirical Analysis of Patent Infringement Awards 27-28* (June 17, 2011) (unpublished manuscript), available at <http://ssrn.com/abstract=1765891> (examining district court damages awards without examining subsequent changes to damages award after appeal). The litigation outcome data also reflects the fact that a small number of patents (four product-

(f) *suit-specific and assertion-specific statistics for litigation ongoing six years prior to patent expiration*: the start date, date of resolution, and number of accused infringers for each suit ongoing within at least six years of the patent-in-suit's expiration, and the start date and date of resolution of each individual infringement claim in those suits.

3. Assignment History and NPE Status

In order to compare enforcement timing among practicing and non-practicing patentees, I also collected information concerning each patent's owner, including:

(a) *each patent's chain of ownership*: the number of times each patent changed hands between the time it was issued and the time it was first asserted in court, including the dates of the first assignment after issue and the last assignment prior to litigation;⁶⁸ and

(b) *the NPE status of each party asserting a patent*: whether the entity asserting each patent sold a product and, if not, what kind of NPE it was.

For the purpose of comparing enforcement timing, I adopted the patentee classification system developed by Mark Lemley and Nathan Myhrvold, which is outlined below in Table 2. Only Class 8 patentees—those that produce a product—are “practicing” entities. Patentees whose status I could not determine fall under Class 10 and were excluded from my sample.⁶⁹

company patents and one NPE patent) were adjudicated multiple times with varying results. See *Timing Dataset*.

⁶⁸ I obtained this data from the PTO's Assignment on the Web for Patents (AOTW-P). See *Assignments on the Web > Patent Query*, U.S. PATENT & TRADEMARK OFFICE, <http://assignments.uspto.gov/assignments/?db=pat> (last visited Mar. 15, 2013). Patent owners generally do, but are not required to, record assignments with the PTO. See Carlos J. Serrano, *The Dynamics of the Transfer and Renewal of Patents*, 41 RAND J. ECON. 686, 690 & n.14 (2010) (noting anecdotal evidence that patent transfers and related transactions are often recorded at the PTO even though recordation is not mandatory). Assignments recorded with the PTO within three months protect against ownership claims of subsequent purchasers. 35 U.S.C. § 261 (2006). However, there are no other benefits or penalties associated with recording. To ensure that my data reflects only true transfers of ownership, I excluded any assignments that occurred merely as a result of an owner's name change or minor corporate reorganization. In a number of instances, the party asserting a patent in litigation did not match the last-recorded owner on file with the PTO. In the vast majority of such cases, I was able to determine from pleadings or other litigation documents whether the party was an owner by unrecorded assignment or simply the last-recorded owner's exclusive licensee. I excluded the few instances in which I was unable to determine the party's status as unrecorded owner or exclusive licensee.

⁶⁹ Following Allison, Lemley, and Walker, I excluded Class 10 patents from my study. However, as they note, “[t]hat a diligent search could not identify what an entity did suggests that it is likely some form of NPE.” Allison, *Patent Quality and Settlement*, *supra* note 1, at 684 n.28. I excluded three patents because I was unable to determine their owners' NPE statuses and also

Strictly speaking, all other classes are “nonpracticing” entities. Though NPEs are by no means homogeneous, for simplicity’s sake many of the results detailed below are reported for NPEs as a whole. Where practicable, however, results are broken down by entity class so that the reader may determine for herself where to draw the line between NPEs and “trolls.”

Table 2: Entity-Status Classes⁷⁰

Entity Class	Description
1	Acquired patents ⁷¹
2	University heritage or tie
3	Failed startup
4	Failed product company
5	Individual inventor–started company ⁷²
6	University, Government, or NGO ⁷³
7	Start-up, pre-product
8	Product company
9	Individual inventor(s)
10	Undetermined
11	Industry Consortium
12	IP subsidiary of a product company

excluded four individually owned patents that were exclusively licensed to patentees of indeterminate NPE status.

⁷⁰ See Allison, *Patent Quality and Settlement*, *supra* note 1, at 683-84 & tbl.1 (describing the typology of entity status classes developed by Lemley and Myhrvold).

⁷¹ There is a fine line between Class 1 and Classes 3 and 4 because many acquired patents come from failed product-producing companies and start-ups. In this study, I categorized a patentee as Class 3 or Class 4 when the entity filing suit was the failed company itself, and Class 1 when the entity filing suit was a distinct IP-holding firm that acquired the patent, even if that firm’s entire portfolio appeared to be salvaged from one failed company. For example, I categorized T.M. Patents, LP—a firm created to hold patent assets from the failed Thinking Machines Corporation—as Class 1, not Class 4. Because there is only a minor distinction between a failed company that began to assert its patents in its own name and a failed company that first reorganized into an LLC or LP before doing the same, I report below combined results for Classes 1, 3, and 4.

⁷² In this class and in Class 9, I included patents owned by licensing companies started by deceased inventors’ heirs and patents owned by such heirs, respectively. A number of patents were litigated by family members of the named inventor after the inventor’s death. See, e.g., First Amended Complaint for Declaratory Judgment and Other Relief and Demand for Jury Trial at 2, 4, 6-7, *Black & Decker, Inc. v. Billy Star Holdings, Ltd.*, No. 08-1261 (D. Minn. May 12, 2008) (asserting a lawsuit against a licensee for failing to pay royalties to plaintiff who inherited patent from his deceased father, the original inventor).

⁷³ In my sample, it turned out that all Class 6 patents were owned by universities. See *Timing Dataset*.

Because many patents were owned at the time of suit by an entity of one class but were asserted by an exclusive licensee of another, I identified the patent owner and the party asserting the patent in each litigation—i.e., the “patentee.” Unless stated otherwise, the results reported in this Article identify the NPE status of the party *acting as patentee in court*, even if that party is the patent’s exclusive licensee and thus, strictly speaking, is not its owner.⁷⁴ Figure 1 below shows the disparity between patent ownership and responsibility for enforcement. Notably, a significant number of NPE-owned patents were exclusively licensed to product-producing patentees. All university-owned patents in my sample, and more than half of the individually-owned patents, were at the time of assertion exclusively licensed to product-producing companies that acted as plaintiffs or declaratory-judgment defendants.⁷⁵ Firms organized for the purposes of exploiting unused patents—patent acquisition firms, firms holding the IP assets of failed companies, and inventor-affiliated licensing firms—therefore account for nearly two-thirds of all NPE-asserted patents.⁷⁶ More controversial NPEs account for a small minority of NPE patents and do not drive the results reported below.⁷⁷

Finally, it is worth noting that by happenstance my random sample did not select any patents owned by class 5 patentees Ronald Katz (i.e., Ronald A. Katz Technology Licensing, LP) or Jerome Lemelson (i.e., Lemelson

⁷⁴ This convention is used consistently in the literature. See Allison, *Extreme Value*, *supra* note 1, at 10 (categorizing “the patent plaintiff”).

⁷⁵ See *Timing Dataset*. In addition, one individually owned patent was asserted by a patent acquisition firm. Only one patent originally owned by a university found its way into the hands of another NPE. See *id.*, U.S. Patent No. 5,260,093. Additionally, four patents were transferred in between suits to entities of a different class. One patent, initially asserted by a product company, was later assigned to an intellectual property–holding subsidiary. See *id.*, U.S. Patent No. 5,289,183. Another was asserted by a product company that subsequently failed and was reborn as a litigation-oriented enterprise. See *id.*, U.S. Patent No. 5,213,670. A third was asserted by an individual inventor who later assigned the patent to an acquisition firm. See *id.*, U.S. Patent No. 5,279,051. And a final patent was initially asserted by a start-up company that subsequently failed and assigned the patent to a patent acquisition firm. See *id.*, U.S. Patent No. 5,291,302. In order to compare litigation timing strictly across entity type, I divided these patents into multiple data points, one for each period of litigation supervised by a new entity type.

⁷⁶ See Allison, *Extreme Value*, *supra* note 1, at 24 (referring to “licensing companies in the business of buying up and enforcing patents” as “trolls” by virtually anyone’s definition); Ball & Kesan, *supra* note 3, at 14–15 (noting that licensing firms “are among the parties most frequently cited as the most prominent form of patent ‘troll’”). Collectively, these patentee types account for 57 of 88 NPE-asserted patents, or 65%. See *infra* Table 7. Acquired patents account for 38 of 88, or 43%. Patents asserted by inventor-affiliated licensing companies account for the remaining 19 of 88, or 22%. *Id.*

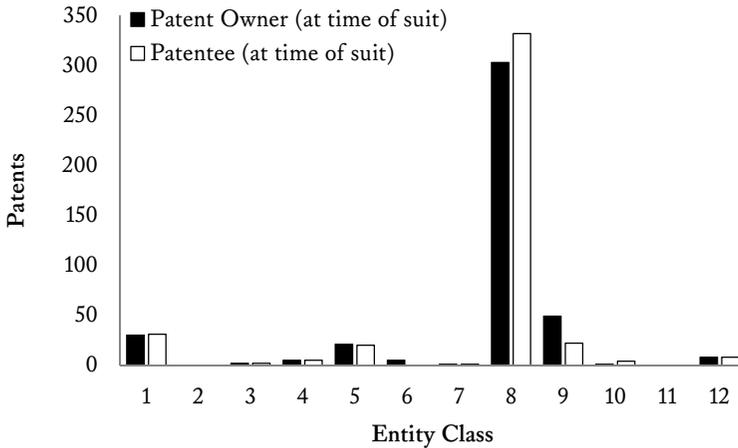
⁷⁷ See *supra* notes 9–10. As discussed later, see *infra* paragraph accompanying note 99, virtually all individually owned patents were asserted relatively early in the patent term and, therefore, also do not drive the results reported below.

Medical Education & Research Foundation), although several litigated patents owned by both were issued within the study period.⁷⁸ Katz and Lemelson are perhaps the two most famous and most prolific patent plaintiffs of all time, and they have what can conservatively be described as an outsized impact on patent litigation statistics. Both, and especially Katz, have a history of filing extremely large numbers of suits against extremely large numbers of accused infringers, and authors of previous studies have grappled with whether to exclude their statistics.⁷⁹ The addition of even one Katz patent to my sample—e.g., U.S. Patent No. 5,255,309 or U.S. Patent No. 5,251,252,⁸⁰ both of which have been asserted in about eighty suits—would have *significantly* increased the per-suit and per-assertion results reported below.

⁷⁸ Katz and Lemelson asserted at least eight patents issued during the study period. For Katz's asserted patents, see U.S. Patent No. 5,297,197 (filed June 8, 1992); U.S. Patent No. 5,259,023 (filed Dec. 3, 1991); U.S. Patent No. 5,255,309 (filed Dec. 3, 1991); U.S. Patent No. 5,251,252 (filed Oct. 21, 1991); U.S. Patent No. 5,224,153 (filed Apr. 5, 1991); and U.S. Patent No. 5,218,631 (filed June 8, 1990). For Lemelson's asserted patents, see U.S. Patent No. 5,283,641 (filed June 16, 1993) and U.S. Patent No. 5,231,259 (filed Aug. 14, 1992). *See generally* *Timing Dataset*.

⁷⁹ In a study of patents litigated eight or more times between 2000 and 2007, Katz alone accounted for 60% of all studied lawsuits. *See* Allison, *Extreme Value*, *supra* note 1, at 26 (noting the enormity of the "Katz effect," but ultimately deciding to retain Katz-related patents in the empirical analysis).

⁸⁰ *See supra* note 78.

Figure 1: Patent Owner–Patentee Histogram⁸¹

4. Technology and Industry Categories

Lastly, I categorized each patent by technology and industry. Rather than using the PTO classification system, I followed Allison, Lemley, and Walker’s taxonomy, which includes nine nonexclusive technology categories and thirteen nonexclusive industry categories listed below in Table 3.⁸²

⁸¹ See *Timing Dataset*. These statistics are generally consistent with Colleen Chien’s findings in a study of litigated patents issued in 1990, though I find a higher percentage of product company–asserted patents. See Chien, *supra* note 24, at 309, 314 (finding, in a study of 659 litigated patents issued in 1990, that 73% were litigated by product-producing companies, 9% by “patent assertion entities,” and 18% by individual inventors). For the precise breakdown of NPE–asserted patents among the various classes, see *infra* Table 7.

⁸² See Allison, *Patent Quality and Settlement*, *supra* note 1, at 684–85 (describing the taxonomy I apply here). In prior work, Allison and Lemley have criticized the PTO’s rather byzantine classification system. See John R. Allison & Mark A. Lemley, *Who’s Patenting What? An Empirical Exploration of Patent Prosecution*, 53 VAND. L. REV. 2099, 2114 (2000) (criticizing the PTO’s classification system as unreliable and imprecise when grouping technologies together).

Table 3: Technology and Industry Areas⁸³

Technology Categories	Industry Categories
1. Software	1. Computer
2. Pure software	2. Semiconductor
3. Software business method	3. Electronics
4. Mechanical	4. Medical
5. Electronics	5. Pharmaceutical
6. Optics	6. Biotechnology
7. Imaging	7. Chemical
8. Biotechnology	8. Communications
9. Chemistry	9. Transportation
	10. Energy and utility services
	11. Financial
	12. Consumer goods and services
	13. Construction

Much of this data I have reserved for future research. I do, however, report results below that distinguish among “software,” “high-tech,” “medical device,” “pharmaceutical,” and “biotechnology” patents. Software patents, as used in this study, are those that fall within technology categories 1, 2, or 3, regardless of the industry in which they are employed.⁸⁴ I label “high-tech” all patents covering computer, electronics, and/or telecommunications technology, including all software patents. These patents generally fall within one or more of technology categories 1-3 and 5-7, and one or more of industry categories 1-4 and 8-9. Finally, medical device, pharmaceutical, and biotech patents are classified as industry categories 4, 5, and 6, respectively. Medical device patents touch on almost every technology category, though most are strictly or primarily mechanical in nature. Some medical device patents—for example those covering computer- or electronically-assisted medical procedures—overlap with technology categories 1-3 and 5-7.

II. RESULTS

A. *Two Patent Terms*

I begin my analysis by investigating the relative ages of patents asserted by practicing and nonpracticing entities. To make this comparison, however,

⁸³ See *supra* note 82.

⁸⁴ Categories 2 and 3 are both subsets of category 1. Allison, *Extreme Value*, *supra* note 1, at 6-7.

I must adjust for the fact that patents in my sample may have one of two different patent terms. All patents in this study issued just before a major event in the history of patent law: the United States' 1994 ratification of the Agreement on Trade-Related Aspects of Intellectual Property Rights.⁸⁵ To comply with the new international obligations, Congress changed the way United States patent law calculates the patent term for the first time since 1952. The legislation, effective June 8, 1995, altered the patent term from seventeen years from issue to twenty years from filing.⁸⁶ Importantly, the legislation created a hybrid calculation for unexpired patents issued before or pending on June 8, 1995.⁸⁷ Every patent issued during the study period is included in this group. These patents receive a term of either seventeen years from issue or twenty years from filing, *whichever is longer*.⁸⁸

Thus, barring invalidation or a missed maintenance fee payment, every patent in this study received a term of *at least* seventeen years from issuance and *at least* twenty years from filing.⁸⁹ The percentage of patents falling in each category is shown below in Table 4. For product-producing companies and NPEs alike, the average duration of prosecution among studied patents was nearly three years.⁹⁰ Nonetheless, to account for these slight variations in the patent terms, I primarily report patent age measured in *years prior to expiration*, whether the term is calculated as seventeen years from issue or twenty years from filing.⁹¹

⁸⁵ The United States adopted the Uruguay Round Agreement of the General Agreement on Tariffs and Trade. *See supra* note 41. The Uruguay Round Agreement included the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS). Uruguay Round Agreements Act, Pub. L. No. 103-465, § 101(d)(15), 108 Stat. 4809, 4814-15 (1994) (codified at 19 U.S.C. § 3511(d)(15) (2006)); Agreement on Trade-Related Aspects of Intellectual Property Rights [hereinafter TRIPS agreement], *adopted by United States* Dec. 8, 1994, 18 U.N.T.S. 299; *see also* Evelyn Su, Comment, *The Winners and the Losers: The Agreement on Trade-Related Aspects of Intellectual Property Rights and Its Effects on Developing Countries*, 23 HOUS. J. INT'L L. 169, 185 (2000) (describing the history of the TRIPS agreement).

⁸⁶ Compare 35 U.S.C. § 154(a)(2) (providing that the term of a patent currently lasts twenty years from filing), with 35 U.S.C. § 154 (1988) (providing that the term of a patent lasted seventeen years from issue).

⁸⁷ 35 U.S.C. § 154(c)(1) (2006).

⁸⁸ *Id.*

⁸⁹ Patents that issued from applications less than three years old received a longer term under the twenty-years-from-filing formulation. Patents that issued from applications spending longer than three years at the PTO received a longer term under the seventeen-years-from-issue formulation.

⁹⁰ NPE patents spent an average of 1094 days at the PTO (almost exactly three years). Product-company patents spent an average of 1089 days, just five fewer days. *See Timing Dataset*.

⁹¹ When measuring backwards from expiration, I use the date the term expired or *would have* expired for patents that fell into the public domain prematurely.

Table 4: Patent Term⁹²

Event	Percentage of Patents	
	Possible Term	Actual Expiration
20 Years from Filing	68.7%	56.3%
17 Years from Issue	31.3%	25.4%
Failure to Pay Maintenance Fee	--	14.3%
Invalidated	--	4.0%

B. Timing Per Patent

Figures 2 and 3 below show the relative timing of patent enforcement across NPE status on a per-patent basis. Figure 2 is a histogram of the dates on which patents were litigated for the first time, measured backward from the date each patent's term ended. Figure 3 is a histogram of the dates on which litigation asserting patents ended once and for all, again measured backward from the date of expiration. The results are dramatic. As shown below in Table 5, on average, product-producing companies finish enforcing their patents before NPEs even begin.

Product producing-company litigation and NPE litigation follow opposing trends. On average, product-producing companies overwhelmingly begin litigating their patents early in the patent term, more than twelve years before expiration,⁹³ and overwhelmingly finish with many years of patent life remaining, more than nine years from expiration.⁹⁴ NPEs, on the other hand, begin litigating their patents much later in the term, less than nine years from expiration on average,⁹⁵ and overwhelmingly finish in the final few years of the patent term, with an average of 4.4 years (and a median of under three years) remaining.⁹⁶

These opposing trends intersect one another about three to five years prior to expiration. With five years of patent life remaining, product-producing companies have started (and in most cases finished) litigating over 93% of their (asserted) patents, while over 31% of NPE patents have

⁹² See *Timing Dataset*.

⁹³ 12.1 years, with a standard deviation of 4.4 years and a median of 12.7 years. See *id.*

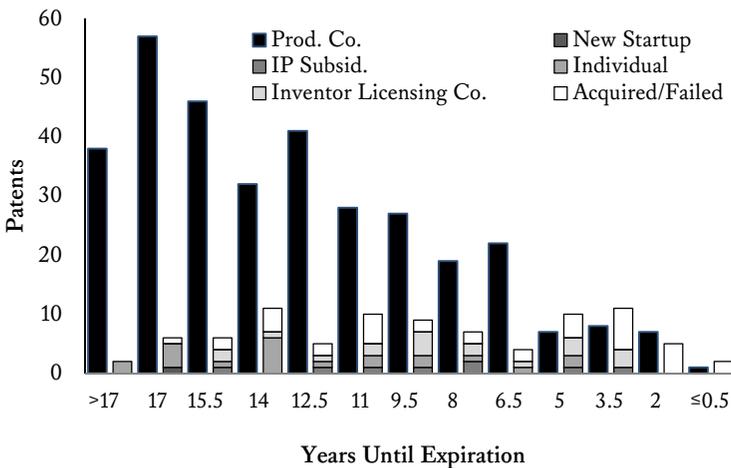
⁹⁴ 9.2 years, with a standard deviation of 4.9 years and a median of 9.9 years. See *id.*

⁹⁵ 8.8 years, with a standard deviation of 5.2 years and a median of 8.5 years. See *id.*

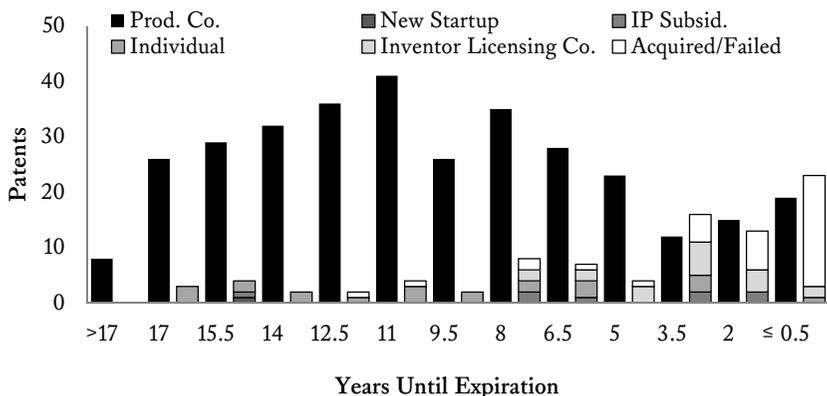
⁹⁶ 4.4 years, with a standard deviation of 5.0 years and a median of 2.8 years. See *id.* These statistics are comparable to prior estimates. See John R. Allison & Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 AIPLA Q.J. 185, 237 (1998) (finding that patent suits, on average, are resolved 12.3 years from the application date of the patent-in-suit); Risch, *supra* note 1, at 490 (finding, among the most litigious NPEs, an average delay of 8.3 years between issue and filing a first complaint).

not yet been asserted. With three-and-a-half years of term remaining, product-producing companies have finished asserting more than 86% of their patents, while more than 59% of NPE patents remain in, or will soon enter, the court system. Though they constitute just one-fifth of all patentees, NPEs asserted almost 55% of patents litigated for the first time within five years of expiration and over 53% of patents in litigation resolved within three-and-a-half years of expiration.

Figure 2: Years from First Suit to Expiration⁹⁷



⁹⁷ See *Timing Dataset*. For a breakdown of specific findings across patentee classes and the patent term, see *infra* Table 7.

Figure 3: Years from Cessation of All Litigation to Expiration⁹⁸

Data on the chain of ownership of these litigated patents in Table 5 sheds additional light on NPEs' relatively long delay in filing suit. NPE-asserted patents, particularly those acquired from other firms (failed or otherwise), change hands more frequently over a longer period of time than their counterparts litigated by product-producing companies. Moreover, once NPE-asserted patents reach the patentee who will ultimately assert them in court, they sit on average for another three years before they are litigated.

As a whole, NPE-asserted patents are three times more likely to have changed hands between issue and enforcement than product company-asserted patents.⁹⁹ Litigant classes 1, 3, and 4, collectively, are more than four times as likely to be asserting a patent that has been transferred between owners post-issue. And assigned patents asserted by these classes have changed hands roughly 50% more often per patent. Patents do not reach acquisition firms until about 9.5 years after issue, and these firms wait 2.4 additional years on average before filing suit. Other NPEs fare little better. Inventor-affiliated licensing companies generally do not form until about six years after issue and, on average, wait more than five additional years before filing suit. And, on average, patents reach product-producing companies' licensing subsidiaries about eight years after issue and sit for an

⁹⁸ See *Timing Dataset*.

⁹⁹ See *id.* These statistics likely understate the disparity in the rate at which product-company and NPE patents are *sold* because many product-company assignments are the result of mergers, acquisitions, and spin-offs involving all of the patent owner's assets, not just its patent rights. See generally Chien, *supra* note 24, at 310-11 (discussing the various ways in which patents can be conveyed).

additional four years before assertion. Individual inventors, by contrast, file suit quickly on almost the exact same timeline as product-producing companies.

Thus, with the notable exception of those claims litigated by individuals, NPE-asserted patents take a long, circuitous path from the PTO to the courthouse that often spans more than a decade and includes multiple prior owners. This finding strongly suggests that it makes little sense to discuss the percentage of NPE litigation among all suits filed. NPEs do not obtain patents until the patent term is half-spent and hold their patents for several years more before filing suit, perhaps while waiting for emerging industries to mature.¹⁰⁰ Thus, the bare statistic that NPEs account for only about one-fifth of all patents litigated obscures the fact that NPEs account for the majority of patents litigated in the final few years of the term—the only portion of the term when NPEs are actively asserting their patent rights.

¹⁰⁰ Again, my findings are consistent with prior estimates in the literature. *See* Risch, *supra* note 1, at 490 (finding that, among patents asserted by the ten most litigious NPEs, the average time span between issuance and last assignment was seven years).

Table 5: Litigation Timing and Assignment History¹⁰¹

	Prod. Co. (Class 8)	All NPEs	p-value	Acquired/Failed (Classes 1, 3-4)	Inventor Licensing Co. (Class 5)	Individual (Class 9)	IP Subsid. (Class 12)
Avg. litig. start							
Until exp'n	12.1 yrs	8.8	< 0.001	6.7	7.9	12.1	8.3
From issue	5.7 yrs	9.0	< 0.001	10.8	9.95	5.7	9.7
From filing	8.7 yrs	11.9	< 0.001	14.2	12.4	8.6	12.1
Avg. litig. end							
Until exp'n	9.2 yrs	4.4	< 0.001	1.5	3.1	9.3	5.4
From issue	8.6 yrs	13.2	< 0.001	16.1	14.7	8.5	12.5
From filing	11.6 yrs	16.1	< 0.001	19.4	17.2	11.4	14.9
Percent assigned	21%	62%	< 0.001	87%	71%	14%	67%
Assignment data							
Total assigns.	1.4	1.9	0.0014	2.1	1.67	1	2.25
Time from issue to first assign.	4.2 yrs	6.0	0.0163	6.6	4.1	7.2	5.4
Time from first to last assign.	1.3 yrs	2.3	0.0085	2.9	1.7	0	1.4
Time from last assign. to assertion	2.9 yrs	3.1	0.3931	2.4	5.2	2.3	3.0

¹⁰¹ See *Timing Dataset*. All statistical analysis reported in this paper was conducted using the Stata v.10.0 *t*-test, Pearson's chi-squared, and Fisher's exact functions, as appropriate. As explained above, the "percent assigned" statistics attempt to count only "true" transfers of ownership, not mere name changes or minor corporate reorganizations (both of which appear in PTO assignment records). See *supra* note 68. The percentage of patents assigned in the "Acquired/Failed" classes is not 100% because five patents remained in the name of their failed owner. The percentage of patents assigned in the "Individual" class is not zero because there were three assignments between joint inventors—for example, one co-owning joint inventor assigned his rights to the other in order to consolidate ownership of the patent in one inventor's name.

C. *Per Suit and Per Assertion*

The results above actually understate the true magnitude of late-term NPE enforcement. As shown below in Table 6, NPEs are far more litigious on average than product-producing companies. Overall, NPEs file more than twice as many suits per patent and assert each patent against more than four times as many alleged infringers.¹⁰² Moreover, NPEs are even more litigious late in the patent term. Per patent litigated in the last three years of its term, NPEs file two-and-a-half additional suits against thirteen additional infringers.¹⁰³

Table 6: Relative Litigiousness¹⁰⁴

	Prod. Co.	NPE	<i>p</i> -value
Overall			
Suits/Patent ¹⁰⁵	1.5	3.6	< 0.001
Assertions/Patent	2.9	12.3	< 0.001
Litig. complete, more than 3 yrs. from exp'n			
Suits/Patent	1.4	1.7	
Assertions/Patent	2.6	5.0	
Litig. ongoing, less than 3 yrs. from exp'n			
Suits/Patent	2.6	5.2	
Assertions/Patent	5.1	18.1	
<i>p</i> -value	< 0.001	< 0.001	
	< 0.001	< 0.001	

Taking into account NPEs' relative litigiousness, NPEs' dominance of late-term patent litigation grows considerably, as does their share of overall enforcement. Figure 4 below is a histogram of lawsuit filing dates for all suits filed within six years of the patent-in-suit's expiration. Figure 5 is a histogram of lawsuit resolution dates for all suits resolved within six years of the patent-in-suit's expiration. Both show a significant increase in NPEs' late-term domination viewed on a per-suit basis. NPEs account for the

¹⁰² See *Timing Dataset*. James Bessen et al. found a mean of 15.3 (and a median of 5) accused infringers per suit in a study of patent infringement cases filed by NPEs between 1990 and 2010. James Bessen et al., *The Private and Social Costs of Patent Trolls* 4, 31 tbl.2 (Bos. Univ. Sch. of Law Working Paper No. 11-45, 2011), available at <http://ssrn.com/abstract=1930272>.

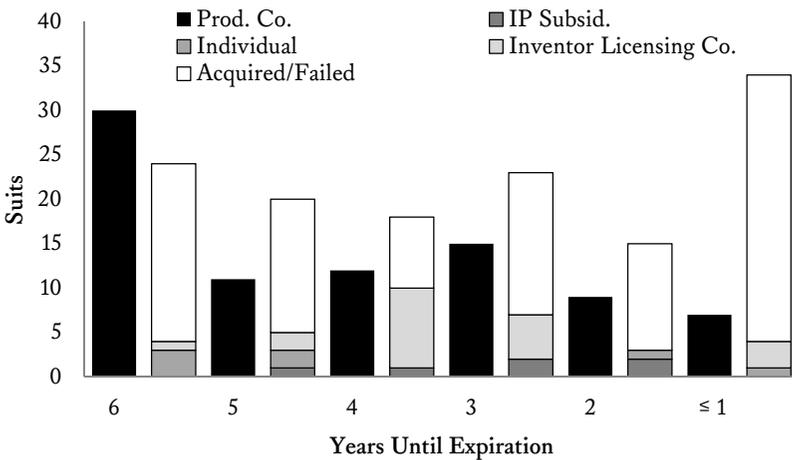
¹⁰³ See *Timing Dataset*. Naturally, both product-producing companies and NPEs assert their oldest patents still in litigation more times than average.

¹⁰⁴ See *Timing Dataset*.

¹⁰⁵ Some studied patents were asserted together in the same suit, and all "per suit" data accounts for this fact. The rates reported in this Table, however, report the average number of suits in which *each patent* was asserted, whether or not another studied patent was asserted in the same suit.

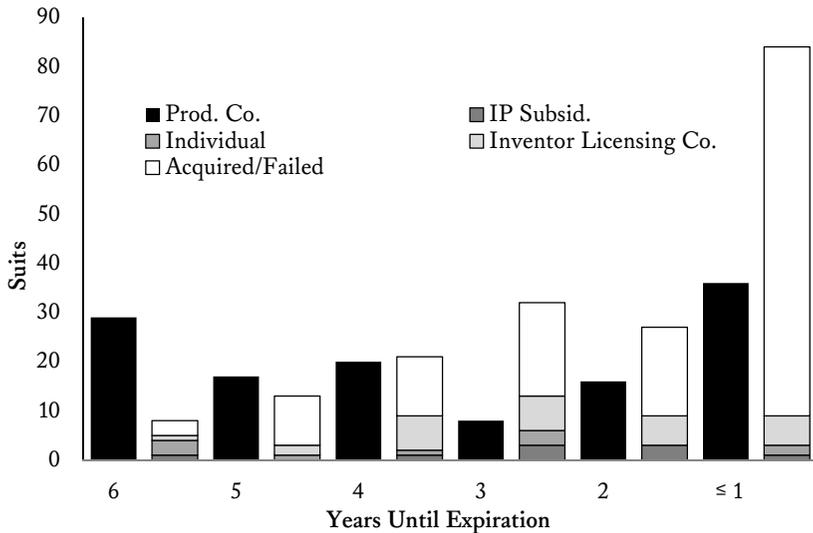
majority of all new patent filings in each of the last five years of the patent term and account for more than 67% of all patent suits filed within five years of the patent-in-suit's expiration. NPEs similarly account for the majority of patent suits resolved within each of the last four years of the patent term and account for more than 70% of all patent suits resolved within three years of the patent-in-suit's expiration.

Figure 4: Years from Each Suit's Filing to Patent-in-Suit's Expiration¹⁰⁶



¹⁰⁶ See *Timing Dataset*.

Figure 5: Years from Each Suit's Resolution to Patent-in-Suit's Expiration¹⁰⁷



Finally, viewed per accused infringer—or per “assertion”—NPEs’ domination of late-term patent litigation becomes even more overwhelming. Figure 6 below is a histogram of filing dates for all assertions filed within six years of the asserted patent’s expiration. Figure 7 is a histogram of resolution dates for all assertions resolved within six years of the patent-in-suit’s expiration. The results in both figures are dramatic. NPEs account for the majority of all new patent assertions in each of the last six years of the patent term and, in particular, account for more than 83% of all patent assertions filed within five years of the patent-in-suit’s expiration. NPEs similarly account for the majority of patent assertions resolved within each of the last five years of the patent term and, particularly, for more than 83% of all patent assertions resolved within three years of expiration.

¹⁰⁷ See *id.*

Figure 6: Years from Each Assertion's Filing to Patent-in-Suit's Expiration¹⁰⁸

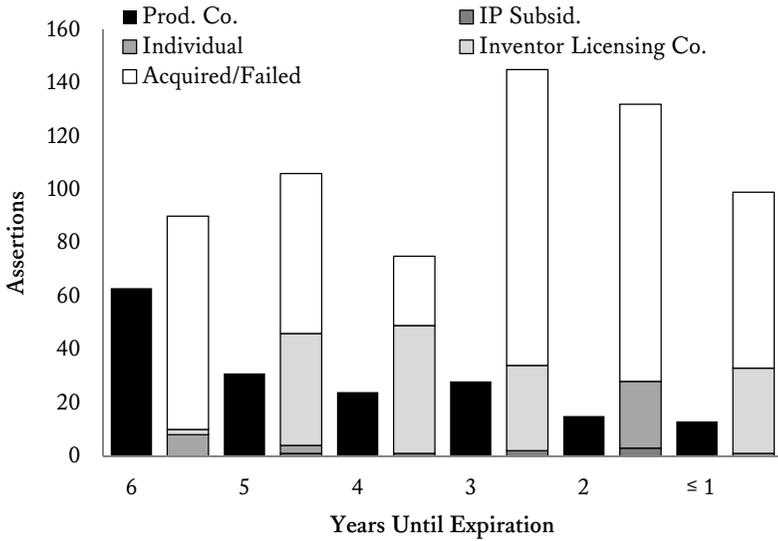
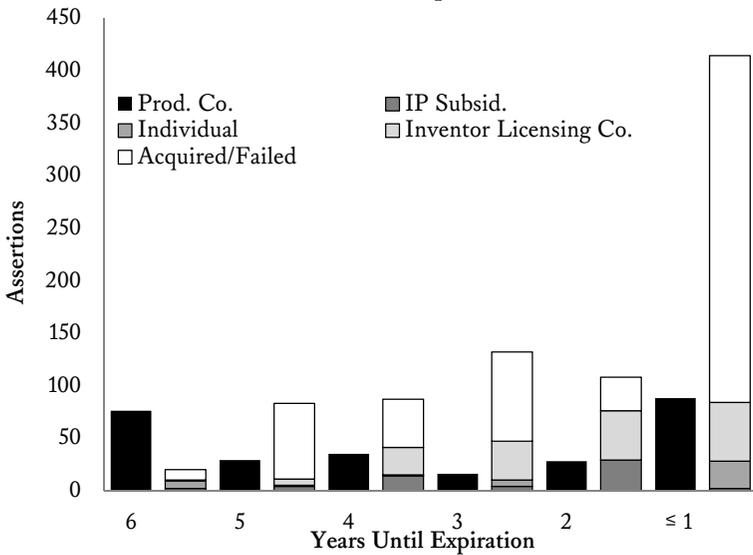


Figure 7: Years from Each Assertion's Resolution to Patent-in-Suit's Expiration¹⁰⁹



¹⁰⁸ See *id.*

¹⁰⁹ See *id.*

As summarized below in Table 7, by comparing patents litigated at a similar age (rather than all litigated patents), it is clear that NPE-asserted patents are the overwhelmingly dominant source of patent litigation in the final years of the patent term. NPEs assert the majority of new patents, file roughly two-thirds of new suits and file over four-fifths of new assertions in the final five years of the patent term. They are also responsible for almost identical percentages of patents enforced, and suits and assertions resolved, within three years of expiration. Moreover, the lion's share of late-term NPE litigation is brought by patent acquisition firms, firms holding the IP remnants of failed companies, and inventor-affiliated licensing firms. Collectively, these classes account for about 92% of NPE suits active within three years of the patent expiration. Thus, while prior studies may have shown that "NPEs file only a small fraction of all patent infringement suits,"¹¹⁰ my results indicate that NPEs—specifically those NPEs most associated with litigation abuse¹¹¹—are responsible for an enormous fraction of infringement claims brought late in the patent term, precisely when litigation seems most abusive.¹¹²

¹¹⁰ Risch, *supra* note 1, at 466.

¹¹¹ See *supra* note 76.

¹¹² See Risch, *supra* note 1, at 490 ("The longer [NPEs] waited, the more like mythical trolls their behavior might appear . . .").

Table 7: Late-Term Litigation Summary¹¹³

	Prod. Co. (Class 8)	All NPEs	<i>p</i> -value	Acquired/ Failed (Classes 1, 3-4)	Inventor Licensing Co. (Class 5)	New Startup (Class 7)	Individual (Class 9)	IP Subsid. (Class 12)
Total Patents	333	88		38	19	1	22	8
Enforcement ceased w/in 3 yrs. of exp'n	38 (11.4%)	48 (54.5%)	< 0.001	31	12	0	2	3
Enforcement initiated w/in 5 yrs. of exp'n	23 (6.9%)	28 (31.8%)	< 0.001	18	6	0	2	2
Total Suits	456	288		189	45	1	37	16
Suits resolved w/in 3 yrs. of exp'n	60 (13.2%)	143 (49.6%)	< 0.001	112	19	0	5	7
Suits filed w/in 5 yrs. of exp'n	53 (11.6%)	110 (38.2%)	< 0.001	81	19	0	4	6
Total Assertions	964	1069		709	211	3	82	64
Assertions resolved w/in 3 yrs. of exp'n	132 (13.7%)	654 (61.2%)	< 0.001	447	140	0	32	35
Assertions filed w/in 5 yrs. of exp'n	111 (11.5%)	557 (52.1%)	< 0.001	367	154	0	29	7

¹¹³ See *Timing Dataset*. The “total suits” data was adjusted to account for the fact that some studied patents were asserted together in one suit.

D. *Technology Areas and Litigation Outcomes*

The results reported above suggest that the final few years of the patent term primarily benefit NPEs. Compared to product-producing companies, NPEs as a whole—and especially firms that hold patents purely for enforcement—assert more patents, in more suits, and against more accused infringers late in the patent term. In fact, as Table 6 shows, NPEs become more aggressive as their patents age. NPE status and litigiousness, however, are not the only traits commonly associated with patent trolls. In this Section, I investigate the prevalence of two other stereotypical characteristics of patent trolls: a propensity for asserting high-tech patents and a tendency to lose when forced to adjudicate their infringement claims on the merits.

In essence, this analysis further measures the extent to which NPEs take advantage of the tail end of the patent term. Product lifecycles in the high-tech industry are notoriously short. Computing power, after all, doubles roughly every two years.¹¹⁴ Thus, high-tech patents are the most likely to be grossly out of date—technologically speaking—when asserted nearly two decades after their filing dates. Additionally, the success rate of NPEs in infringement allegations suggests that they are relying on strained claim interpretations to stretch aging patents to cover more advanced technology.¹¹⁵

Table 8 below provides a technology-by-technology breakdown of patent litigation filed by product-producing companies and NPEs; the Table also measures changes in the division of patented technology over time. This data reveals that high-tech patents play a disproportionate role in NPE litigation and in late-term litigation generally. Overall, about 65% of NPE-asserted patents cover computer- or electronics-related inventions, and almost 40% cover the narrower category of software-related inventions.¹¹⁶ By contrast, just over 40% of product company-asserted patents cover high-tech inventions and just 25% cover software-related subject matter.¹¹⁷ The

¹¹⁴ This observation, which has held true for decades, is known as “Moore’s law.” See Gordon E. Moore, *Progress in Digital Integrated Electronics*, Int’l Electron Devices Meeting, IEEE (1975) (predicting that computing power will double approximately every two years), reprinted in SCS: IEEE SOLID-STATE CIRCUITS SOC’Y NEWS, Sept. 2006, at 36, 37.

¹¹⁵ See *infra* Table 9.

¹¹⁶ Michael Risch, who used PTO classification numbers to define high-tech subject matter, found that 40% of patents asserted by the ten most litigious NPEs were high-tech inventions. Risch, *supra* note 1, at 477; see also *id.* (finding that the majority of high-tech patents in his study were software patents (84 of 138 total)). Bessen et al. found that 62% of patents litigated by NPEs between 1990 and 2010 were “software patents” and 75% covered “computer and communications technology.” Bessen et al., *supra* note 102, at 12.

¹¹⁷ The difference between product-producing companies’ and NPEs’ enforcement of software patents is statistically significant per patent ($p = 0.008$), per suit ($p < 0.001$), and per assertion ($p < 0.001$). The difference between product-producing companies’ and NPEs’ rates of

share of high-tech litigation by product companies is roughly the same whether measured by patent, by suit, or by assertion. However, for NPEs, high-tech litigation accounts for a substantially higher 82% of suits and 80% of assertions.¹¹⁸

Among patents asserted in the final three years of their terms, the proportion of high tech–subject matter patents increases, surprisingly, for all patentees. That is, high-tech patents account for an outsized percentage of patent claims filed in that period by both product-producing companies and NPEs.¹¹⁹ In fact, in the final three years of the patent term, the high-tech gap between NPEs and product-producing companies narrows considerably. This pattern exists not because the high-tech share of NPE litigation shrinks (it grows to 88% of assertions¹²⁰), but rather because the high-tech share of product-company litigation skyrockets to over 71% of assertions.¹²¹

enforcement of other high-tech patents is statistically significant at a 90% level per patent ($p = 0.057$), not significant per suit, and significant at a 95% level per assertion ($p = 0.029$).

¹¹⁸ As shown in Table 8, the difference between product-producing companies' and NPEs' share of *all four* technology categories is only statistically significant on a per-assertion basis (software $p < 0.001$; other high-tech $p = 0.029$; medical device $p < 0.001$; biotech-pharmaceutical $p < 0.001$).

¹¹⁹ The prevalence of high-tech litigation in the final few years of the patent term, together with the large share of NPE litigation involving high-tech products, could suggest that my findings on litigation timing merely reflect the fact that high-tech patents tend to be litigated late in the patent term. Further analysis of my data directly contradicts this hypothesis, however. Product-producing companies asserting high-tech patents litigate those patents far earlier than their NPE counterparts. Among all high-tech patents, I find that product-producing companies begin enforcement with an average of 11.5 years of patent term remaining, while NPEs begin with just 8.3 years remaining. This difference is statistically significant ($p < 0.001$). Among the same group of patents, product-producing companies finish enforcement with an average of 9.0 years of term remaining, while NPEs conclude their enforcement efforts with just 3.4 years of term left. Again, this difference is highly statistically significant ($p < 0.001$). I find similar results looking at software patents only. On average, product-producing companies begin enforcement with 11.8 years of term remaining and finish with 8.9 years of term left. On average, NPEs begin with 8.6 years of term remaining and conclude just 2.9 years before expiration. These differences are both statistically significant ($p < 0.001$ for both).

¹²⁰ This growth is statistically significant among software claims ($p < 0.001$) and among other high-tech claims ($p = 0.009$).

¹²¹ While growth in the number of product-company software claims is not statistically significant, growth in the number of other high-tech claims is highly significant ($p < 0.001$). Growth in the number of product-company high-tech suits is also significant ($p < 0.001$). Growth in the number of high-tech patents enforced by product companies is, however, not significant.

Table 8: Technology Areas¹²²

	Prod. Co.			NPE		
	Patent	Suit	Assertion	Patent	Suit	Assertion
Overall¹²³						
% software	25.5	21.7	22.2	39.8*	65.6*	60.6*
% other high-tech	16.2	15.5	16.2	25.0**	16.3	20.0*
% medical device	8.4 ¹²⁴	7.0	10.6	12.5 ¹²⁵	4.5	5.5*
% bio-pharma	5.4	6.8	6.0	0*	0*	0*
Litig. complete, more than 3 yrs. from exp'n¹²⁶						
% software	24.4	21.0	21.6	32.5	62.1	52.3
% other high-tech	15.2	12.9	11.5	22.5	15.9	15.9
% medical device	8.1	7.1	11.7	10.0	5.5	4.8
% bio-pharma	4.4	5.0	4.6	0	0	0
Litig. ongoing, less than 3 yrs. from exp'n						
% software	34.2	26.7	25.8	45.8	69.2	65.3*
% other high-tech	23.7	33.3*	45.4*	27.1	16.8	22.5*
% medical device	10.5	6.7	3.8*	14.6 ¹²⁷	3.5	5.8
% bio-pharma	13.2*	18.3*	15.2*	0	0	0

* $p < 0.05$; ** $p < 0.10$

Finally, Table 9 displays litigation outcomes for product companies and NPEs, including how these outcomes change with patent age.¹²⁸ The results suggest that NPEs lose at a higher rate than product-producing companies when their infringement claims are adjudicated and, again, that this disparity is even larger among patents litigated late in the term. The small number of

¹²² See *Timing Dataset*.

¹²³ p -values compare product company versus NPE patents, suits, and assertions.

¹²⁴ Of the 28 product-company patents that cover medical devices, 10 (which collectively account for 11 suits and 15 assertions out of 35 and 102 total, respectively, involving medical devices), are also high-tech-related. Five of those 10, which account for 5 suits and 6 assertions, are software-related. See *Timing Dataset*.

¹²⁵ Of 11 total NPE patents that cover medical devices, 4 (which collectively account for 7 suits and 24 assertions out of 15 and 58 total, respectively, involving medical devices), are also high-tech-related. One of those 4, which accounts for 3 suits and 6 assertions, is software related. See *Timing Dataset*.

¹²⁶ p -values comparing patents, suits, and assertions resolved more than and less than three years before expiration.

¹²⁷ Two medical device patents, which collectively account for three suits and ten assertions, are also high-tech related. See *Timing Dataset*.

¹²⁸ The data in Table 9 reports whether each patent has ever been found infringed, not infringed, or invalid at the district court level before appeal. Data on appeals is not considered in this study. See *supra* note 67.

patents adjudicated, however, renders the detection of a statistically significant difference difficult. Overall, more than 55% of adjudicated NPE patents were found by a judge or jury not to be infringed, compared with just under 30% of adjudicated product company patents.¹²⁹ Similarly, product-producing companies proved infringement of almost half their adjudicated patents, while NPEs proved infringement of less than a quarter.¹³⁰ Moreover, the difference between product-producing companies' and NPEs' success at proving infringement grows with time, though not because NPEs become worse (to a statistically significant degree, anyway). Rather, product-producing companies become *more* successful. Among adjudicated patents litigated in the final three years of the patent term, product-producing companies proved infringement nearly 67% of the time,¹³¹ while NPEs fail to prove infringement or establish validity over 80% of the time.¹³²

¹²⁹ The difference is significant at the 95% level ($p = 0.038$).

¹³⁰ This difference is significant at a 90% level ($p = 0.053$). Also, note that I do not count default judgments as "adjudications."

¹³¹ This increase is not statistically significant ($p = 0.145$).

¹³² One NPE-asserted patent was found both invalid and not infringed. One possible confounding factor here is that, over time, it has become easier for accused infringers to locate prior art that restricts patentees' ability to advance broad claim interpretations. See, e.g., F. Russell Denton, *Plumb Lines Instead of a Wrecking Ball: A Model for Recalibrating Patent Scope*, 16 J. INTELL. PROP. L. 1, 24 (2008) (noting that prior art searching "has become easier because of advances in search technology, online bandwidth, a growth industry in database searches . . . , and the appearance of free searchable PTO online databases, not to mention other public online databases"); see also Allison & Lemley, *supra* note 41, at 138 (discussing how computer searching may have improved patent examiners' ability to locate prior art). Note, however, that the invalidity rates reported in Table 9 do not appear to support this hypothesis.

Table 9: Litigation Outcomes¹³³

	Prod. Co.	NPE	<i>p</i> -value*
Overall			
Adjudicated	19.5%	21.6%	--
Infringed	47.7% ¹³⁴	22.2%	0.053
Noninfringed	29.2%	55.5%	0.038
Invalid	30.8% ¹³⁵	27.8% ¹³⁶	--
* <i>p</i> -values > 0.10 omitted			
Litig. complete, more than 3 yrs. from exp'n ¹³⁷			
Adjudicated	18.0%	17.5%	
Infringed	43.4%	28.6%	
Noninfringed	32.1%	57.1%	
Invalid	28.3%	28.6%	
Litig. ongoing, less than 3 yrs. from exp'n			
Adjudicated	31.6%	22.9%	
Infringed	66.7%	18.2%	
Noninfringed	16.7%	54.5%	
Invalid	41.7%	27.3%	

III. IMPLICATIONS

The results presented above demonstrate that NPEs play a more important role in the patent system than previously recognized, a role that becomes fully apparent only when accounting for the age of the patents they litigate. In short, while NPEs do not assert the majority of litigated patents or even file the majority of patent suits, they play a dominant role in patent litigation in the waning years of the patent term.

¹³³ See *Timing Dataset*.

¹³⁴ One product company-asserted patent was found both infringed and not infringed in different cases. See *id.*

¹³⁵ Four product company-asserted patents were adjudicated before being invalidated. Two were found infringed, and two were found not infringed. See *id.*

¹³⁶ One NPE-asserted patent was found both not infringed and invalid. See *id.*

¹³⁷ The only change that is statistically significant at a confidence level of 90% or greater is the increase in the percentage of product company patents adjudicated, which is statistically significant at the 95% level ($p = 0.046$).

A. *NPEs Are Mostly Not Technology Disseminators;
Product-Producing Companies Are Not Entirely Blameless*

What does this fact mean for our opinion of NPEs? For one, it serves as one more nail in the coffin containing NPEs' claims that they play a "central role in helping commercial entities obtain the rights to use valuable technologies that produce new and beneficial products."¹³⁸ NPEs asserting patents filed by others roughly two decades ago cannot credibly claim that they are championing the rights of their accused infringers' contemporaneous competitors. Similarly, with the notable exception of individual inventors, NPEs asserting their own patents are by no means rushing to the courthouse to vindicate their own rights soon after their patents issue. Instead, NPEs appear to be engaged in classic troll-like behavior: suing the better part of a well-established industry for infringement of an aging patent, generally one covering software or high-tech subject matter, and consistently losing those claims when pushed to prove their infringement allegations.¹³⁹

According to the data discussed above, NPEs' claims that they are vindicators of hard-fought patent rights become even less plausible after considering the breakdown of NPE-asserted patents by technology and industry. Almost 65% of NPE patents cover high-tech subject matter in general, and about 40% are software related. Worse still, more than 80% of NPE-filed *suits* assert high-tech patents generally, and more than 65% have software-related claims. None cover pharmaceutical or biotech inventions, and less than 13% cover medical devices.¹⁴⁰ Among NPE patents asserted in suits ongoing within three years of their expiration, almost 46% are software patents and more than 72% are high-tech related. And, on a per-assertion basis, almost 88% of NPE patent enforcement in the final three years of the

¹³⁸ Kacedon et al., *supra* note 18.

¹³⁹ The breadth and age of NPE patents could alternatively (and more generously) suggest that these patents are far from stale and, instead, cover inventions so ahead of their time that it is not until years later that commercial applications (and thus products) emerge. A growing body of scholarship, however, strongly suggests that "pioneering inventions" of this sort are quite rare. See Mark A. Lemley, *The Myth of the Sole Inventor*, 110 MICH. L. REV. 709, 713, 715-33 (2012) (offering historical evidence to show that the vast majority of the so-called "pioneering inventions" of the past two centuries, including the steam engine, the telephone, and the lightbulb, were independently and contemporaneously invented by multiple inventors); Brian J. Love, *Interring the Pioneer Invention Doctrine*, 90 N.C. L. REV. 379, 429-35 (2012) (listing a large number of pioneering inventions that were independently and contemporaneously invented); Samson Vermont, *Independent Invention as a Defense to Patent Infringement*, 105 MICH. L. REV. 475, 478-79 (2006) (listing a large number of inventions invented contemporaneously, and noting that "[s]ome historians and philosophers of science believe convergence is the rule rather than the exception").

¹⁴⁰ Many of these medical device patents, in turn, have a significant high-tech or software component. See *supra* notes 124-25 & 127 (describing the overlap in these categories).

patent term is high-tech focused. In essence, where innovation is rapid and cheap, NPEs dominate; where innovation is slow and expensive, NPEs are nowhere to be found.

Interestingly, a significant portion of product-company litigation ongoing in the waning years of the patent term fares little better. Among product-company patents in litigation within three years of expiration, a large percentage (about 58%) cover high-tech inventions. On a per-assertion basis, this rate jumps to over 71%. Perhaps not surprisingly, upon closer examination, many of the suits responsible for this jump bear the hallmarks of troll litigation even though they are brought by product-producing patentees. Several are suits filed by failing companies hoping to use patent litigation to keep their doors open just a little while longer. Now-bankrupt film and camera maker Kodak,¹⁴¹ for example, sued virtually every smartphone manufacturer, seeking \$1 billion in damages for infringement of old software patents covering image capture, compression, and preview technology.¹⁴² A struggling Encyclopaedia Britannica¹⁴³ launched a similar patent offensive against the GPS-mapping industry for infringement of its

¹⁴¹ Kodak filed for bankruptcy in January 2012. Michael J. De La Merced, *Eastman Kodak Files for Bankruptcy*, N.Y. TIMES DEALBOOK (Jan. 19, 2012, 1:12 AM), <http://dealbook.nytimes.com/2012/01/19/eastman-kodak-files-for-bankruptcy>.

¹⁴² See Rich Duprey, *The Worst Stocks of 2010: Eastman Kodak*, MOTLEY FOOL (Jan. 21, 2010), <http://www.fool.com/investing/general/2010/01/21/the-worst-stocks-for-2010-eastman-kodak.aspx> (noting that Kodak “sees its future as being little more than a patent troll” because “[a]s its film business collapsed, Kodak was left with few options other than to turn to its patent portfolio to eke out a living”); Jason Mick, *Kodak Demands Over \$1B USD from Apple, RIM for Alleged Infringement*, DAILY TECH (Mar. 25, 2011, 2:17 PM), <http://www.dailytech.com/Kodak+Demands+Over+1B+USD+From+Apple+RIM+for+Alleged+Infringement/article21228.htm> (noting that between 1993 and 2007 Kodak “went on a patent binge, spending on patents and acquiring small startups” and “beef[ed] up its digital imaging IP”); see also *Complaint and Jury Claim at 2-7*, *Eastman Kodak Co. v. Apple Inc.*, No. 6:10-CV-06022-MAT-JWF (W.D.N.Y. Jan. 14, 2010) (filing an action against Apple for allegedly infringing multiple Kodak patents by selling a number of products including iPhones, MacBooks, and iPods); *Complaint at 2-3, 5*, *Research in Motion, Ltd. v. Eastman Kodak Co.*, No. 3:08-CV-02075-K (N.D. Tex. Nov. 20, 2008) (stating that Kodak had previously sent a letter to Research in Motion alleging infringement of three patents and “demanded exorbitant royalties from RIM for this alleged infringement,” and filing an action for a declaratory judgment against Kodak). Kodak recently put more than 1000 patents up for sale with the possibility of generating more than \$3 billion in revenues. Chris Burritt, *Kodak CEO Says a ‘Large Number’ of Buyers Evaluating Patents for Purchase*, BLOOMBERG (Aug. 30, 2011, 4:27 PM), <http://www.bloomberg.com/news/2011-08-30/kodak-says-large-number-of-buyers-evaluating-its-patents-1-.html>.

¹⁴³ Encyclopaedia Britannica announced in March 2012 that its 2010 print edition would be its last. Julie Bosman, *After 244 Years, Encyclopaedia Britannica Stops the Presses*, N.Y. TIMES MEDIA DECODER (Mar. 13, 2012, 5:54 PM), <http://mediadecoder.blogs.nytimes.com/2012/03/13/after-244-years-encyclopaedia-britannica-stops-the-presses>.

notoriously broad software patent.¹⁴⁴ Other suits were filed by product-producing companies that acquired patent rights purely for litigation purposes. Gemstar-TV Guide,¹⁴⁵ for example, acquired the right to assert, among others, patents owned by former satellite-TV company SuperGuide¹⁴⁶ in a long-running patent battle with the DVR industry.¹⁴⁷ Other product-producing companies suddenly asserted aging high-tech patents that had changed hands several times or asserted these patents against an entire industry.¹⁴⁸ These suits, the likes of which do not occur earlier in the patent

¹⁴⁴ See Complaint for Patent Infringement and Jury Demand at 5, 8-9, Encyc. Britannica, Inc. v. Alpine Elecs. of Am., Inc., No. 1:05-CV-00359-LY (W.D. Tex. Sept. 30, 2008) (alleging that Garmin and other defendants infringed a patent on a “novel computer search system for retrieving various types of information”); Encyc. Britannica, Inc. v. Magellan Navig’n, Inc., 512 F. Supp. 2d 1169, 1171-72 (W.D. Wis. 2007) (describing Encyclopaedia Britannica’s suit against six parties, including Magellan Navigation, for infringing the search system); Mike Masnick, *It Appears that the Encyclopedia Britannica Entry on Shaking Down GPS Providers with a Bogus Patent Needs Updating*, TECHDIRT (June 28, 2010, 11:56 AM), <http://www.techdirt.com/articles/20100625/2351149966.shtml> (describing the history of the search system patent at issue in Encyclopaedia Britannica’s lawsuits against GPS companies).

¹⁴⁵ Gemstar merged with TV Guide, Inc. in July 2000. *U.S. Settles Antitrust Case Against Gemstar*, N.Y. TIMES, Feb. 7, 2003, at C3. Macrovision (now Rovi Corp.) acquired Gemstar-TV Guide in May 2008. Rafat Ali, *TVGuide No More: Macrovision’s Acquisition of Gemstar Complete; To Be Called Macrovision Solutions*, WASH. POST (May 2, 2008), <http://www.washingtonpost.com/wp-dyn/content/article/2008/05/02/AR2008050202391.html>.

¹⁴⁶ See *SuperGuide Corp. v. DirecTV Enters., Inc.*, 358 F.3d 870, 873 (Fed. Cir. 2004) (noting that Gemstar obtained an exclusive license from SuperGuide on three patents that would subsequently become the subject of litigation).

¹⁴⁷ See, e.g., *id.* at 873-74 (noting that Gemstar was impleaded as a third-party defendant to SuperGuide’s infringement suit, and that Gemstar alleged that defendant EchoStar infringed each of the three asserted patents); *Certain Set-Top Boxes and Components Thereof*, Inv. No. 337-TA-454, USITC Pub. 3564 (Nov. 2002) (Final) (discussing an investigation into a patent-infringement case brought by Gemstar against several companies, including Pioneer Corp. and EchoStar Communications Corp.); see also 2 RICHARD RAYSMAN ET AL., *EMERGING TECHNOLOGIES AND THE LAW* § 8.05[5] (2003) (describing how Gemstar “expanded its portfolio of patents through various licensing arrangements” and began to enforce those rights aggressively in an effort to gain “a controlling position in the market for interactive program guides,” a market which matured to include technology far more advanced than what was envisioned in Gemstar’s “aging patent portfolio”).

¹⁴⁸ My sample included a number of high-tech patents originally assigned to AT&T Bell Labs that changed hands after the company’s spin-off to Lucent and eventually found their way into court in the mid-to-late 2000s. See, e.g., *Timing Dataset*, U.S. Patent No. 5,298,047; *id.*, U.S. Patent No. 5,287,427; *id.*, U.S. Patent No. 5,243,229; *id.*, U.S. Patent No. 5,235,659. Another high-tech patent, owned by Anvik Corp., was asserted in twelve suits against thirty-five defendants (essentially every flat-panel display/TV manufacturer) in the late 2000s. See *Timing Dataset*, U.S. Patent No. 5,285,236. One other software patent changed hands in 2009 and was asserted for the first time that same year in three suits against six defendants. See *Timing Dataset*, U.S. Patent No. 5,233,629.

term, support one point that NPEs have made for years: product-producing companies are just as capable of filing suspect patent suits as NPEs are.¹⁴⁹

B. Patent Term Reform

Together, the suspect quality of litigation brought by NPEs and product-producing companies late in the patent term suggests that Congress might enhance innovation by shortening the patent term by three years or even longer. In these final years of the patent term, product-producing companies seem to have all but abandoned enforcement of patents for products from years earlier. Many of those product-producing companies still litigating aging patents appear to have the same motives and characteristics attributed to their much-maligned troll adversaries—and presumably impose the same social costs.¹⁵⁰ All other things being equal,¹⁵¹ a three-year term reduction would impact almost 50% of all NPE suits,¹⁵² while affecting roughly 13% of product-company suits.¹⁵³ On a per-assertion basis, a three-year term reduction could cut short¹⁵⁴ more than 26% of all NPE assertions and eliminate another 35% of NPE assertions,¹⁵⁵ while cutting short less

¹⁴⁹ See *Merges*, *supra* note 6, at 1610-11 (“[T]ypically, it is not specific entities, but rather specific tactics or practices that are most relevant Trolling, to put it simply, is a matter of behavior rather than status.”).

¹⁵⁰ In a study of accused infringers’ stock prices following a lawsuit, Bessen et al. found that the average NPE suit cost accused infringers \$122 million. Bessen et al., *supra* note 102, at 16. Between 1990 and 2010, the aggregate wealth lost to NPE suits was approximately \$500 billion. *Id.* at 17. In a subsequent article, Bessen and Meurer estimate that in 2011, firms spent approximately \$29 billion defending against NPE infringement claims. James Bessen & Michael J. Meurer, *The Direct Costs from NPE Disputes* 19 (Bos. Univ. Sch. of Law, Working Paper No. 12-34, 2012), available at <http://ssrn.com/abstract=2091210>.

¹⁵¹ Of course, all things might not remain equal following patent term reform. See *infra* Section III.C.

¹⁵² Of 288 total NPE suits, 72 were filed in the last three years of the patent-in-suit’s term and another 71 were resolved within the same time period though filed a bit earlier. See *Timing Dataset*.

¹⁵³ Of 456 total product company suits, 31 were filed in the last three years of the patent-in-suit’s term and another 29 were resolved within the same time period though filed a bit earlier. *Id.*

¹⁵⁴ By “cut short,” I mean that the patent-in-suit would expire during litigation. Patentees could continue to litigate for past infringement, but they would be precluded from receiving an injunction or ongoing royalty after winning summary judgment or at trial because the alleged infringer’s future activities would no longer potentially infringe.

¹⁵⁵ Of 1069 total NPE assertions, 376 were brought within three years of the patent-in-suit’s expiration and another 278 were resolved during the same period but filed earlier. See *Timing Dataset*.

than 8% of product company assertions and eliminating less than 6% of product company assertions.¹⁵⁶

Though the majority of affected patents would merely expire during their final assertions (rather than before those are filed), there is good reason to believe the balance of power would still shift dramatically in these cases. Without live patents, patentees cannot seek permanent injunctions¹⁵⁷ or ongoing royalties¹⁵⁸ even if they ultimately win their infringement claims. The possibility of both remedies gives patentees leverage to hold up accused infringers for outsized settlements.¹⁵⁹

Furthermore, there is good reason to believe that product-producing companies could easily be, and as a practical matter would be, insulated from a term reduction to a degree greater than the statistics above suggest. For one, any legislation reforming the patent term could exclude practicing patentees in the biotech, pharmaceutical, and medical-device industries, which collectively assert about 24% of product-company patents litigated in the final three years of the patent term. Unlike their high-tech counterparts, these patents cover well-defined and well-known products approved by the Food and Drug Administration (FDA), and are frequently litigated at the very end of the patent term against generic manufacturers seeking a leg up in the production of low-cost alternatives to successful name brand drugs, diagnostics, and devices. Would a term reduction harm incentives to produce more of these life-saving inventions? Perhaps not. Pharmaceutical companies are exceedingly skillful at extending their market power over drugs by filing newer patents covering related subject matter—a process

¹⁵⁶ Of 964 total product company claims, 56 were brought within 3 years of the patent-in-suit's expiration and another 76 were resolved during the same period but filed earlier. See *Timing Dataset*.

¹⁵⁷ After *eBay, Inc. v. MercExchange, L.L.C.*, the possibility that a successful NPE will receive injunctive relief is diminished, but certainly nonzero. See 547 U.S. 388, 393-94 (2006) (rejecting the Federal Circuit's "general rule" . . . that a permanent injunction will issue once infringement and validity have been adjudged"), *rev'g MercExchange L.L.C. v. eBay*, 401 F.3d 1323 (Fed. Cir. 2005); see also Lily Lim & Sarah E. Craven, *Injunctions Enjoined; Remedies Restructured*, 25 SANTA CLARA COMPUTER & HIGH TECH. L.J. 787, 798 (2009) (noting that, post-*eBay*, "a patentee who directly competes in the marketplace with the infringing party gets an injunction 79.6% of the time, while an NPE's chance of an injunction falls precipitously to 33.3%").

¹⁵⁸ See Mark A. Lemley, *The Ongoing Confusion Over Ongoing Royalties*, 76 MO. L. REV. 695, 702-03 (2011) (noting, for example, that some courts have granted *treble* ongoing royalties on the theory that adjudicated infringers who continue to sell the infringing products are "willful" infringers).

¹⁵⁹ See Lemley & Shapiro, *supra* note 5, at 2008 (explaining that a threat of injunction can "enable a patent holder to negotiate a settlement for an amount of money significantly exceeding the amount that the patent holder could expect to earn in damages based on reasonable royalties . . . [because of] the cost to the defendant of switching technologies [in their products] midstream . . .").

known as “evergreening.”¹⁶⁰ In fact, for this very reason, a term reduction would impact product-producing companies far less than one might anticipate because, unlike NPEs, a product company can always file new patents covering improved, next-generation versions of its products. That is, while a product company with an expired patent likely has recourse to additional similar patents, an NPE with an expired patent is out of luck and must purchase a replacement.

In any event, it would be logistically simple to exclude medical, biotech, and pharmaceutical patents from any legislation curtailing late-term patent rights because the PTO already has experience singling out such inventions for special treatment. For example, current law already permits term extensions for patents covering products that require FDA approval.¹⁶¹ These existing provisions could be reformed to lower the bar for term extensions or simply to exclude patents owned by the makers of FDA-approved medicines, diagnostics, or devices from any term reduction reforms.¹⁶²

Excluding cases and assertions brought by pharmaceutical, biotech, and medical device firms, a modified three-year term reduction would impact less than 10% of all product-company suits and roughly 11% of assertions.¹⁶³ Taking product-company “trolling” into account would reduce this percentage even further. Additionally excluding those suits and assertions brought

¹⁶⁰ See Rebecca S. Eisenberg, *The Role of the FDA in Innovation Policy*, 13 MICH. TELECOMM. & TECH. L. REV. 345, 354 (2007) (providing examples of evergreening, such as “patents on ‘metabolites’ (i.e., the products into which drugs are transformed in a patient’s body); patents on intermediate products used in producing drugs; patents on new uses for drugs; and patents on new formulations or preparations”); see also Tamsen Valoir, *Six Methods of Preserving Market Exclusivity*, 18 INTELL. PROP. & TECH. L.J. 12, 14 (2006) (“[A] generic class of drug molecules might be claimed in an initial patent application, but specific members can be claimed in later unrelated applications as the pharmaceutical data for such members becomes available. Because the follow-on patent does not claim priority to the original application, its term will run from the new filing date.”).

¹⁶¹ See 35 U.S.C. § 156 (2006) (establishing that a product patent can receive a term extension if, among other conditions, the product has “been subject to a regulatory review period [by the FDA] before its commercial marketing or use”). Thus, while it may be exceedingly difficult, if not impossible, to draw bright lines between many other industries, it appears to be relatively simple to separate this cohort of patents. None of the pharmaceutical, biotech, or medical device patents in my sample received a term extension. For a list of extended patents, see *Patent Term Extensions*, U.S. PATENT AND TRADEMARK OFFICE (Apr. 4, 2012, 3:57 PM), <http://www.uspto.gov/patents/resources/terms/156.jsp>.

¹⁶² Requiring the commercialization of a product would exclude NPE-asserted medical device patents—more than 12% of all NPE patents, see *Timing Dataset*—from the benefit of any such reform.

¹⁶³ Collectively, these patentees filed fifteen suits, accounting for twenty-five assertions, resolved within three years of the patent-in-suit’s expiration. See *Timing Dataset*.

by the troll-like product-producing companies mentioned above, a three-year reduction in the patent term would disrupt roughly 5.5% of “legitimate” product company patent suits and assertions.¹⁶⁴

C. Limitations

One thing this study cannot predict, however, is how patentees would adjust their litigation timing in response to a term reduction. Though, as discussed above, patents often do not reach NPEs for years, a substantial component of NPE litigation delay is simply that: delay. On average, NPEs wait about 3.1 years to file suit after obtaining a patent.¹⁶⁵ Is it possible, then, that NPEs could dodge a term reduction simply by filing suit several years earlier than they presently do? The answer is almost certainly “no” for the vast majority of NPEs, which overwhelmingly target successful high-tech products.¹⁶⁶ NPEs cannot file suit before targeted products hit the market and generally will not do so before those products go on to become popular with consumers. Thus, because the lifecycles of very few high-tech products exceed three years, as a practical matter very few NPE claims can be expedited beyond three years.¹⁶⁷ Put simply, most of the products that NPEs target today did not exist three years ago. In any event, requiring NPEs to race to the courthouse would, by itself, produce significant benefits. It would, for example, force some NPEs to litigate before allegedly infringing products are incorporated into technology standards or costly fixed investments,¹⁶⁸ thus weakening NPEs’ hold-up power.¹⁶⁹ Nonetheless, the results reported above must be discounted to some extent by uncertainty about NPEs’ ability to sue at an earlier time.

Further, while I have used the terms “enforcement” and “litigation” interchangeably above, the results of this study are only as strong as the degree

¹⁶⁴ Collectively, these patentees filed twenty suits, accounting for fifty-three assertions, resolved within three years of the patent-in-suit’s expiration. See *Timing Dataset*.

¹⁶⁵ See *supra* Table 5.

¹⁶⁶ See Mark A. Lemley, *Should Patent Infringement Require Proof of Copying?*, 105 MICH. L. REV. 1525, 1526 (2007) (noting that patent trolls “assert patents against successful companies that independently develop and manufacture technology without knowledge of those patents”); Shrestha, *supra* note 1, at 140 (noting that NPEs tend to sue “manufacturers of successful products”).

¹⁶⁷ See Moore, *supra* note 114, at 37 (observing that computing power advances at a rapid rate, doubling every two years).

¹⁶⁸ Cf. Robert P. Merges & Jeffrey M. Kuhn, *An Estoppel Doctrine for Patented Standards*, 97 CALIF. L. REV. 1, 13-15 (2009) (describing the “snake-in-the-grass strategy” whereby patentees hide “the existence of patents in order to assert them against industry members who become locked into a standard”).

¹⁶⁹ See *supra* note 159 and accompanying text.

to which the temporal bounds of litigation match those of all patent enforcement. Because patent licenses negotiated outside the court system are almost always kept confidential, it is virtually impossible to measure the total level of patent enforcement that product-producing companies undertake after ceasing litigation, that NPEs undertake before filing suit, and that all patentees undertake with patents that are never asserted in court.

While the amount of each type of nonlitigation patent enforcement is certainly nonzero, there is good reason to believe that this source of uncertainty is not fatal to studies of this kind. First, while some NPEs do license their patents without litigation,¹⁷⁰ they face at least one very strong incentive not to do so: the importance of forum selection. If litigation appears imminent, a threatened product company can and generally will file a declaratory judgment action in a favorable jurisdiction to prevent the impending suit from proceeding in a patentee-friendly district.¹⁷¹ What it almost certainly will not do is closely review unsolicited license offers from small NPEs.¹⁷² Accordingly, it seems reasonable to assume that the most sophisticated NPEs, especially those who are repeat players, adopt a litigate-first strategy, and that sophisticated product-producing companies do, too, when confronted with serious NPE infringement claims.

Unlike NPEs, however, product-producing companies more frequently resolve patent disputes without litigation. One reason is that patent litigation is especially costly for accused infringers. Thus, unlike NPEs, which cannot be counter-sued for patent infringement, product-producing companies are exposed to potential patent infringement claims, and must therefore be careful about suing other product-producing companies.¹⁷³ In

¹⁷⁰ See Michael J. Meurer, *Controlling Opportunistic and Anti-competitive Intellectual Property Litigation*, 44 B.C. L. REV. 509, 517 (2003) (noting that E-Data, a company that “owns a patent which arguably covers financial transactions on the Internet,” reportedly sent demand letters to 75,000 alleged infringers before suing forty-one companies for patent infringement).

¹⁷¹ See Kimberly A. Moore, *Forum Shopping in Patent Cases: Does Geographic Choice Affect Innovation?*, 79 N.C. L. REV. 889, 921 (2001) (“When the patent holder selects the forum, the patent holder wins 58% of the claims. When the accused infringer brings a declaratory judgment action and thereby chooses the forum, the patent holder win rate drops to 44%.”). *But cf.* Chester S. Chuang, *Offensive Venue: The Curious Use of Declaratory Judgment to Forum Shop in Patent Litigation*, 80 GEO. WASH. L. REV. 1065, 1084 (2012) (finding a significantly higher transfer rate for declaratory judgment cases relative to non-declaratory judgment cases, and concluding that “accused infringers are often unable to secure their desired forum via declaratory judgment”).

¹⁷² See Mark A. Lemley, *Ignoring Patents*, 2008 MICH. ST. L. REV. 19, 21-22 (2008) (noting that companies generally ignore patents in all stages of product development, including research and design, patent filing, product launches, and even after the receipt of cease-and-desist letters from patent owners).

¹⁷³ See Christopher A. Cotropia, *The Individual Inventor Motif in the Age of the Patent Troll*, 12 YALE J.L. & TECH. 52, 55 (2009) (“If a defendant is sued by [a] patent troll[], the alleged infringers do not have the usual retaliatory mechanism—the ability to assert their own patents in

addition to litigation expenses, competitors face other strong incentives not to challenge each other's patents. For example, they bear the cost of the challenge but share the benefit of invalidation with the rest of the industry, including competitors.¹⁷⁴ All of these factors suggest that, among product-producing companies, patent litigation is generally a last resort used against especially recalcitrant competitors. Finally, at least among product-producing companies that actively license their patent portfolios, it is standard practice to license relatively large pools of patents, rather than a select few.¹⁷⁵ It is unlikely that removing the oldest patents from a large pool would substantially reduce the pool's value to a competitor looking to clear a path to commercialize a new, cutting edge product. Accordingly, only very little, if any, of the value of such a license should be attributed to the most aged patents in the pool.¹⁷⁶

Finally, some in the patent community perceive an increase in the share of patent litigation attributable to NPEs in recent years. If this trend does exist, my findings on late-term NPE litigation could be inflated by the fact that fewer NPEs existed during the 1990s and early 2000s when, perhaps, they might have enforced younger patents. One oft-repeated narrative explains the NPE business model as a recent phenomenon popularized after the burst of the dot-com bubble.¹⁷⁷ Recent scholarship, however, casts serious doubt on this conventional wisdom. Michael Risch reports, for example, that large-scale NPE operations date back to at least the mid-1980s,

return—because the patent troll does not sell any products or offer any services which could infringe.”); Crane, *supra* note 29, at 286 (“[T]rolls and commercializers supposedly have asymmetrical incentives, since trolls are only interested in exacting payments whereas commercializers often resolve infringement disputes with other commercializers through cross-licensing arrangements.”).

¹⁷⁴ See Joseph Farrell & Robert P. Merges, *Incentives to Challenge and Defend Patents: Why Litigation Won't Reliably Fix Patent Office Errors and Why Administrative Patent Review Might Help*, 19 BERKELEY TECH. L.J. 943, 958 (2004) (“[A] challenger bears the cost of litigation but its rivals and downstream buyers will capture almost all the benefits of successful challenge . . .”).

¹⁷⁵ See Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 U. PA. L. REV. 1, 8-9 (2005) (“While large firms provide perhaps the most compelling example of patent portfolios in practice . . . we also find real world case studies of patenting behavior consistent with our theory among startups and acquisition-centric firms. Indeed, the rise of patent portfolios in the business community has become so significant that portfolios have become the credo of firm value in the modern innovation environment.”).

¹⁷⁶ See *id.* at 77 (“We find that for patents, the whole is greater than the sum of its parts. The true value of patents lies not in their individual worth, but in their aggregation into a collection of related patents—a patent portfolio.”); cf. Mark A. Lemley, *Software Patents and the Return of Functional Claiming* 35 (Stanford Pub. Law, Working Paper No. 2117302, 2012), available at <http://ssrn.com/abstract=2117302> (“Smartphone companies, for instance, would likely take little solace in being told that they need only clear rights for 25,000 essential patents, not 250,000.”).

¹⁷⁷ See, e.g., John A. Marlott, *NPEs and Pre-Litigation Considerations*, 1020 PLI/Pat 453, 457 (2010).

were very active in the 1990s, and, in some instances, markedly decreased their activity in the 2000s.¹⁷⁸ Other scholars have documented the existence of NPEs throughout U.S. history.¹⁷⁹ Nonetheless, there appears to be at least a kernel of truth to the conventional wisdom that NPEs ascended from the ashes of the 2000–2001 tech stock crash. Two recent studies of patent suits filed post-2000 suggest that the percentage of patent suits brought by NPEs has, on net, increased over the last decade.¹⁸⁰ Pending additional, broader studies on this topic, my findings should be interpreted with the caveat that they reflect some degree of selection bias caused by an increase over time in the percentage of litigation activity attributable to NPEs.¹⁸¹

D. Maintenance Fee Reform

Is the potential disruption of roughly 5.5% of product-company assertions (54 claims in this study) worth trading for the potential elimination of more than 35% of NPE claims and the dilution of another 26% of claims (654 total claims in this study)? Perhaps not, given the limitations discussed

¹⁷⁸ See Risch, *supra* note 1, at 475 (reporting that, of the ten most litigious NPEs since 2003, two filed their first suit in 1986, nine filed their first suit before 2000, and three ceased filing suits during the 2000s).

¹⁷⁹ See Merges, *supra* note 6, at 1592–96 (summarizing the long history of patent-related “rent-seeking” in the United States, especially in the agricultural industry in the 1860s and 1870s, in the railroad industry during the next few decades, and in the automobile industry after the turn of the century); see also Colleen V. Chien, *Reforming Software Patents*, 50 HOUSTON L. REV. 325, 335–36 (2012) (recounting similar historical examples of patent trolling).

¹⁸⁰ See Chien, *supra* note 3, at 1604 fig.2 & n.168 (finding, in a study of 2300 high-tech patent suits filed between 2000 and 2008, that NPEs filed 10% of all suits between 2000 and 2001, 16% between 2002 and 2003, 16% between 2004 and 2005, and 20% between 2006 and 2008); Jeruss et al., *supra* note 24, at 378 (finding, in a study of 100 patent suits filed each year from 2007 to 2011, that the percentage asserted by “monetizers,” or NPEs, was roughly 22% in 2007, 27% in 2008, 33% in 2009, 30% in 2010, and 40% in 2011). Neither study makes any findings with respect to the ages of asserted patents.

¹⁸¹ The availability of *inter partes* reexamination is another possible confounding influence. Potential infringers have the option to request the *inter partes* reexamination of patents filed on or after November 29, 1999. 37 C.F.R. § 1.913 (2011); see also Leahy-Smith America Invents Act, Pub. L. No. 112-29, § 6, 125 Stat. 284, 299–313 (2011) (developing procedures for new “post grant review” and “inter partes review” proceedings). Thus, during this time period, patentees concerned about the prospect of *inter partes* reexamination had an incentive to assert patents filed before the November 1999 deadline. Greater fear of *inter partes* reexamination by NPEs than by product-producing companies might introduce some bias into the analysis of my data. However, the risk of bias appears low given the infrequency of *inter partes* reexaminations. Compare *Inter Partes Reexamination Filing Data—June 30, 2012*, U.S. PATENT & TRADEMARK OFFICE (June 2012), http://www.uspto.gov/patents/stats/IP_quarterly_report_June_30_2012.pdf (showing that, since 2000, there have been 1659 total requests for *inter partes* reexamination), with LEX MACHINA, *supra* note 23 (showing that more than 37,000 total patent suits were filed in the United States since 2000).

above. Furthermore, recall that the United States is a party to the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS),¹⁸² which requires WTO member nations to offer a minimum of twenty years' patent protection.¹⁸³ Were the United States to formally reduce the patent term without first renegotiating with the WTO, it could face trade sanctions from most of the industrialized world.¹⁸⁴

A less drastic reform, and one that has the added benefit of not violating the United States' obligations under TRIPS, would be to increase the frequency and magnitude of maintenance fee payments in the latter half of the patent term. Today, patent owners are free from payment obligations less than twelve years after issue, not long after the tide of patent litigation shifts toward NPEs.¹⁸⁵ Congress, or the PTO itself,¹⁸⁶ could require additional annual fees for years nine through eleven and thirteen through sixteen (or longer) and, moreover, could substantially increase the fee required for each year.

This sort of reform could operate as something of a porous *de facto* term reduction, bringing about the premature expiration of many patents that would otherwise end up in the hands of patent acquisition firms,¹⁸⁷ while at the same time permitting product-producing companies that profit from lucrative confidential licensing agreements to extend their patents up to

¹⁸² See *supra* note 85.

¹⁸³ TRIPS Agreement, *supra* note 85, at 314.

¹⁸⁴ TRIPS incorporates the dispute settlement provisions set forth in the General Agreement on Tariffs and Trade. See General Agreement on Tariffs and Trade, arts. XXII, XXIII, Oct. 30, 1947, 55 U.N.T.S. 187, 266; TRIPS Agreement, *supra* note 85, at 327. As a practical matter, however, WTO member nations including the U.S. violate various aspects of the TRIPS agreement quite often without ramification. See Colleen V. Chien, Tailoring the Patent System to Work for Software and Technology Patents 1 (Nov. 15, 2012) (unpublished manuscript), available at <http://ssrn.com/abstract=2176520> ("The open secret among international law scholars is that despite TRIPS' broad pronouncements, the treaty actually contains many flexibilities and exceptions.").

¹⁸⁵ Under current law, maintenance fees are due at 3.5 years (\$980), 7.5 years (\$2480), and 11.5 years (\$4110). 37 C.F.R. § 1.20(e)-(g) (2012). Patentees that qualify as "small entities" pay only half this amount. *Id.* Those that qualify as "micro entities" pay one quarter. Leahy-Smith America Invents Act, Pub. L. No. 112-29, § 10, 125 Stat. 284, 316-17 (2011) (to be codified at 35 U.S.C. § 41). The size, but not the timing, of these fees may change soon. See *infra* note 191.

¹⁸⁶ The America Invents Act grants the PTO power to set its own fees "to recover the aggregate estimated costs to the Office for processing, activities, services, and materials relating to patents." Leahy-Smith America Invents Act § 10. As interpreted by the PTO, this provision gives the agency "flexibility to set individual fees in a way that furthers key policy considerations." Setting and Adjusting Patent Fees, 77 Fed. Reg. 55,028 (proposed Sept. 6, 2012).

¹⁸⁷ Under the current fee regime, approximately 50% of issued patents expire prematurely for failure to make one of the three required payments. Dennis Crouch, *Patent Maintenance Fees*, PATENTLYO (Sept. 26, 2012, 9:51 PM), <http://www.patentlyo.com/patent/2012/09/patent-maintenance-fees.html>.

twenty years from filing. Moreover, the rates at which patentees renewed their patent rights late in the term would shed additional light on the private value of aging patents—information that could help tailor a potential term reduction years down the road.¹⁸⁸

Such a reform would be far from radical.¹⁸⁹ By international and historical standards, United States patent fees seem to have a considerable amount of room to grow. Many countries, including the United Kingdom, Germany, and Canada, already charge annual maintenance fees after the first few years of patent life.¹⁹⁰ Also, relative to GDP per capita, United States patent fees this decade have been at or near an “all-time low”—about ten times cheaper than they were in 1800.¹⁹¹

¹⁸⁸ See Chien, *supra* note 24, at 305 (“The decision to maintain a patent signals its private value to the patent owner.”). Other possible reforms exist that might mitigate the costs of late-term patent enforcement. For example, the United States could implement a rule, loosely related to the “working requirements” in effect in many other countries, that patent rights expire unless they have been the subject of at least one bona fide license or good faith patent suit within a certain number of years following issue. See Janice M. Mueller, *The Tiger Awakens: The Tumultuous Transformation of India’s Patent System and the Rise of Indian Pharmaceutical Innovation*, 68 U. PITT. L. REV. 491, 595 (2007) (“[S]everal advanced developing countries including India and Brazil have retained domestic working requirements . . .”). Alternatively, Congress or the courts could institute a new defense akin to laches that denies relief to patentees who fail to quickly seek out potential infringers and initiate licensing negotiations before filing suit. See Tun-Jen Chiang, *The Reciprocity of Search*, 66 VAND. L. REV. 1, 50-58 (2013) (arguing that 35 U.S.C. § 287 should be interpreted to “reallocate the search duty to patentees”).

¹⁸⁹ Many commentators throughout the years have called for an increase in the size or frequency of patent maintenance fee payments. See Chien, *supra* note 179, at 361 (noting arguments in favor of increasing maintenance fees that were voiced as early as the nineteenth century); Francesca Cornelli & Mark Schankerman, *Patent Renewals and R&D Incentives*, 30 RAND J. ECON. 197, 208 (1999) (finding that “renewal fees should rise much more with patent length than existing fee schedules”); Magliocca, *supra* note 16, at 1836-37 (describing a “[d]ormancy [t]ax . . . scheme in which [maintenance] fees are sharply increased and assessed more frequently”); Kimberly A. Moore, *Worthless Patents*, 20 BERKELEY TECH. L.J. 1521, 1551-52 (2005) (recommending annual maintenance fee payments).

¹⁹⁰ *Renewing Your Patent*, INTELL. PROP. OFFICE (U.K.), <http://www.ipo.gov.uk/types/patent/p-manage/p-renew.htm> (last visited Mar. 15, 2013) (explaining that in the UK patents must be renewed “on the 4th anniversary of the filing date and every year after that . . . up to 20 years”); GERMAN PATENT & TRADE MARK OFFICE, PCT APPLICANT’S GUIDE 5 (2012), available at <http://www.wipo.int/pct/guide/en/gdvol2/annexes/de.pdf> (explaining that fees are “payable for the third and each subsequent year following the international filing date”); CANADIAN INTELLECTUAL PROP. OFFICE, MANUAL OF PATENT OFFICE PRACTICE § 24.02.01 (last updated 2010), available at <http://www.ic.gc.ca/eic/site/cipointernet-internetopic.nsf/vwapj/rpbb-mopop-eng.pdf> (“In order to maintain a patent application in effect, an applicant must pay maintenance fees for each one-year period from the second anniversary of the filing date of the application.”).

¹⁹¹ Gaétan de Rassenfosse & Bruno van Pottelsberghe, *The Role of Fees in Patent Systems: Theory and Evidence* 6 (Intellectual Prop. Research Inst. of Austl., Working Paper No. 7/10, 2010), available at http://www.ipria.org/publications/wp/2010/Working%20Paper%207_2010.pdf. Recently proposed changes to the maintenance fee schedule would increase (for small and large entities) the

CONCLUSION

Whatever the precise mechanism employed, the results presented in this Article suggest that society might be better off if patent rights diminished earlier than they do under current law. In a world in which at least some products are out of date by the time they hit store shelves, the last few years of a two decade-long patent term seem unlikely to incentivize greater innovation. To the contrary, it appears that the waning years of patent protection primarily benefit litigation-oriented patentees who do little more with their aging patent rights than impose steep legal costs on those selling successful products. Perhaps through future research that dispels concerns raised by the limitations discussed above, we will soon gain a deeper understanding of the practical costs and benefits of the final years of the patent term that will spur legislative action to trim the nation's ever-increasing thicket of aging patents.

first fee by 42%, the second by 26%, and the third by 56%. *See* Setting and Adjusting Patent Fees, 77 Fed. Reg. 55,028, 55,040 tbl.4 (proposed Sept. 6, 2012) (displaying the current and proposed fee structure).