

# COMPARATIVE PATENT QUALITY

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On June 8, 1999, the Patent Office (“USPTO”), like it does every Tuesday,<sup>1</sup> published the names and numbers of newly issued patents. Among them was the 6,032,137 (“the ‘137 patent”), a patent that described a way of depositing a check by imaging and sending it, rather than physically transferring it to the bank.<sup>2</sup> The inventor, Claudio Ballard, tried for several years to develop the invention. He failed, but the technology thrived. After unsuccessful talks with JP Morgan Chase, Ballard’s company, DataTreasury, sued a dozen or so banks and companies for patent infringement.<sup>3</sup> In 2003, Congress passed the “Check 21” Act, clearing the way for check imaging to become standard.<sup>4</sup> In February 2006, DataTreasury used the ‘137 patent and related patents to sue thirty banks.<sup>5</sup> In 2010, after DataTreasury won its first

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1. The U.S. Patent Office published the names and numbers of newly issued patents every Tuesday, with few exceptions, since Tuesday, January 18, 1848. KENNETH W. DOBYNS, *THE PATENT OFFICE PONY: A HISTORY OF THE EARLY PATENT OFFICE* 164 (2d ed. 2016).

2. U.S. Patent No. 6,032,137 (issued Feb. 29, 2000).

3. Jennifer A. Kingson, *Small Company Is Specializing in Suing Banks*, N.Y. TIMES (Dec. 25, 2004), [http://www.nytimes.com/2004/12/25/business/small-company-is-specializing-in-suing-banks.html?\\_r=0](http://www.nytimes.com/2004/12/25/business/small-company-is-specializing-in-suing-banks.html?_r=0). These cases include: *DataTreasury Corp. v. J.P. Morgan Chase & Co.*, No. 5:02-CV-124-DF, 2004 WL 5694909 (E.D. Tex. June 9, 2004); *DataTreasury Corp. v. Elec. Data Sys.*, No. 3:02-CV-02643-K, 2003 WL 22019528, at \*1 (N.D. Tex. Aug. 26, 2003); *DataTreasury Corp. v. First Data Corp.*, 243 F. Supp. 2d 591, 592 (N.D. Tex. 2003); *DataTreasury Corp. v. Bank One Corp.*, No. 3:03-cv-00059 (E.D. Tex. filed Jan. 9, 2003); *DataTreasury Corp. v. Ingenico S.A.*, No. 5:02-cv-00095 (E.D. Tex. filed May 2, 2002); *DataTreasury Corp. v. First Data Corp.*, No. 5:02-cv-00094-DF-CMC (E.D. Tex. filed May 2, 2002).

4. See Kingson, *supra* note 3.

5. *DataTreasury Corp. v. Wells Fargo & Co.*, 490 F. Supp. 2d 749, 752 (E.D. Tex. 2006).

lawsuit, based on the finding that JP Morgan had knowingly infringed Ballard's patents,<sup>6</sup> Ballard was named inventor of the year.<sup>7</sup>

In 2013, Fidelity National Information Services, after being sued by Ballard, asked the USPTO to take a second look at the Ballard patents.<sup>8</sup> It agreed.<sup>9</sup> In 2015, a panel of patent judges revoked the '137 patent as overly broad and vague, and therefore invalid.<sup>10</sup> The Independent Community Bankers Association hailed the verdict "a victory for community banks."<sup>11</sup> But by then, DataTreasury and its two employees had already collected \$350 million in licensing fees.<sup>12</sup>

Stories like this one contribute to the perception that the most significant problem with the patent system is the presence of too many poor quality patents.<sup>13</sup> Mistaken transfers, like the \$350 million paid from banks to DataTreasury for its invalid patents, lead to higher prices and a loss of consumer welfare.<sup>14</sup> The dynamic effect of allowing patents over routine and incremental advances that would have happened anyway has led to more patents over less innovation<sup>15</sup> and a higher cost of innovation, as small and large firms dedicate resources to filing applications to avoid litigation, rather than to promote innovation.<sup>16</sup> The perception that the USPTO makes many

6. Jim Hammerand, *U.S. Bank Ordered to Pay \$53 Million in Check Imaging Lawsuit*, MINNEAPOLIS/ST. PAUL BUS. J. (Sept. 28, 2010), <http://www.bizjournals.com/twincities/stories/2010/09/27/daily20.html>.

7. *DataTreasury Founder Claudio Ballard Named 2010 "Inventor of the Year" by U.S. Business and Industry Council*, BUS. WIRE (Oct. 5, 2010), <http://www.businesswire.com/news/home/20101005007171/en/DataTreasury-Founder-Claudio-Ballard-Named-2010-%E2%80%9CInventor#.VgFXdBFVhBc>.

8. Alex Lawson, *Controversial DataTreasury Patents Face Biz Method Review*, LAW360 (Nov. 8, 2013), <http://www.law360.com/articles/487185/controversial-datatreasury-patents-face-biz-method-review>.

9. *Id.*

10. Matthew Bultman, *DataTreasury Patents Nixed by PTAB in AIA Review*, LAW360 (Apr. 29, 2015), <http://www.law360.com/articles/649511/datatreasury-patents-nixed-by-ptab-in-aia-review> (describing the invalidation of the '137 and 5,910,988 patents).

11. *ICBA Applauds Patent Board's Ruling Against DataTreasury*, INDEP. COMMUNITY BANKERS AM. (May 8, 2015), <https://www.icba.org/news/latest-news/2015/05/08/icba-applauds-patent-board-s-ruling-against-datatreasury>.

12. Lawson, *supra* note 8.

13. DataTreasury's patents, in fact, motivated passage of the America Invents Act. See Ryan Davis, *Singled out in Patent Bill, DataTreasury Files New Suit*, LAW360 (Sept. 9, 2011), <http://www.law360.com/ip/articles/270394>.

14. See, e.g., FED. TRADE COMM'N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY 2–3 (2003) (explaining that consumer welfare decreases with higher patent costs).

15. See *infra* Figure 3.

16. Colleen V. Chien, *From Arms Race to Marketplace: The Complex Patent Ecosystem and Its Implications for the Patent System*, 62 HASTINGS L. J. 297, 321–22 (2010) (describing the

mistakes—leading to a partial or complete invalidation of 42% of the patents reviewed by courts<sup>17</sup> and a much higher share of patents that the USPTO’s Patent Trial and Appeal Board agrees to review<sup>18</sup>—invites legal maneuvers and game playing by applicants. One such tactic involves refiling the same application multiple times until a favorable outcome is achieved,<sup>19</sup> even if it takes over a decade.<sup>20</sup>

Why do patent quality issues persist? There are several reasons. First, there is no consistent definition of patent quality, much less a consensus about how to measure it.<sup>21</sup> Second, while many lament poor patent quality, the incentives in patent examination are stacked in favor of granting, rather than denying, applications.<sup>22</sup> Patent lawyers are paid to succeed, not fail, in applying for patents. As much as patent examiners are committed to thoroughly vetting applications, the USPTO is rewarded when it grants, rather than denies applications, leading to maintenance revenues<sup>23</sup> and avoided appeals and reversals.<sup>24</sup> Third, patent quality is hard. Reviewing a patent application and discerning whether the invention has been done before or is obvious from the perspective of an artisan in the field, as required by law, is a challenging

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origins and practice of defensive patenting, the filing of patents in order to ensure freedom to operate and pay reduced license fees, by large and small firms).

17. John R. Allison et al., *Understanding the Realities of Modern Patent Litigation*, 92 TEX. L. REV. 1769, 1787 (2014).

18. U.S. PATENT & TRADEMARK OFFICE, PATENT TRIAL AND APPEAL BOARD STATISTICS 10 (2017) [hereinafter 2017 PTAB STATISTICS], [https://www.uspto.gov/sites/default/files/documents/AIA%20Statistics\\_March2017.pdf](https://www.uspto.gov/sites/default/files/documents/AIA%20Statistics_March2017.pdf) (indicating that 81% of all *inter partes* review trials that reached a final decision resulted in all or some of the claims being deemed unpatentable).

19. Mark A. Lemley & Kimberly A. Moore, *Ending Abuse of Patent Continuations*, 84 B.U. L. REV. 63, 66–71 (2004) (describing and critiquing the practice of allowing applicants to seek without limit review of their patent applications); see also discussion *infra* Part III.

20. Cyrus Farivar, “Podcasting Patent” Is Totally Dead, Appeals Court Rules, ARS TECHNICA (Aug. 7, 2017, 12:33 PM), <https://arstechnica.com/tech-policy/2017/08/appeals-court-upholds-invalidity-of-podcasting-patent/>.

21. See discussion *infra* Part I.

22. See Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 U. PA. L. REV. 1, 77 (2005) (arguing that by its design, the modern patent system favors the seeking and granting of patents of low quality).

23. Michael D. Frakes & Melissa F. Wasserman, *Does Agency Funding Affect Decisionmaking?: An Empirical Assessment of the PTO’s Granting Patterns*, 66 VAND. L. REV. 67, 76–80 (2013) (finding that the USPTO acts, in part, on financial incentives that favor the issuance of patents in order to receive maintenance fees on patentability decisions).

24. Jonathan Masur, *Patent Inflation*, 121 YALE L.J. 470, 531 (2011) (arguing that the USPTO’s ability to avoid costly appeals and reversals by overgranting leads to an inflationary pressure in the patent system).

task.<sup>25</sup> Even Thomas Jefferson struggled with it, writing in 1813, “I know well the difficulty of drawing a line between the things which are worth to the public the embarrassment of an exclusive patent, and those which are not.”<sup>26</sup> It is not always clear that getting patent quality right is worth the effort—many, and perhaps most, patents are economically worthless.<sup>27</sup>

This Article takes the position that before we can expect to make progress towards improving patent quality, we need to address these first-order problems. I borrow an age-old practice—benchmarking—to do so. Because just as patent quality presents challenges to examiners in the United States, it also presents challenges to examiners in other countries.<sup>28</sup> And so looking at the comparable experiences of one jurisdiction in particular—the European Patent Office (“EPO”), whose covered GDP is comparable to the USPTO’s<sup>29</sup> and which in recent years has come to be viewed by many as the “gold standard” in patent quality<sup>30</sup>—can help overcome several of the long-standing obstacles that confront patent quality theory and practice.

First, a comparative view provides a way to actually measure patent quality. Using benchmarks can reveal the extent and direction of the difference, if any, between USPTO and EPO practice in any particular area. Second, though the details vary, the basic dynamic of *ex parte* examination in which “[u]nder-resourced patent-officers . . . struggle against well-heeled patent-lawyers”<sup>31</sup> applies across patent offices. The specific practices the EPO uses to counterbalance the tilt towards granting and yet achieve the highest quality ratings can yield useful insights. Finally, EPO examiners face the same basic challenge in vetting their applications as their USPTO counterparts.

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25. See, e.g., Mark A. Lemley et al, *What to Do About Bad Patents*, REGULATION, Winter 2005–2006, at 10, 10 (2005) (describing the task of vetting patent applications as long).

26. Letter from Thomas Jefferson to Isaac McPherson (Aug. 13, 1813), in THE FOUNDERS’ CONSTITUTION (Philip B. Kurland & Ralph Lerner eds., 1987), [http://press-pubs.uchicago.edu/founders/documents/a1\\_8\\_8s12.html](http://press-pubs.uchicago.edu/founders/documents/a1_8_8s12.html).

27. Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1531 (2001) (arguing that the insignificance of most patents does not support greater investment in their quality).

28. See, e.g., John R. Thomas, *The Responsibility of the Rulemaker: Comparative Approaches to Patent Administration Reform*, 17 BERKELEY TECH. L.J. 727, 728–30 (2002) (describing patent quality reform agendas in Japan and Europe).

29. See discussion *infra* Part I.

30. See discussion *infra* Part I.

31. *Time to Fix Patents*, ECONOMIST (Aug. 8, 2015), <http://www.economist.com/news/leaders/21660522-ideas-fuel-economy-todays-patent-systems-are-rotten-way-rewarding-them-time-fix>.

Leveraging these insights, this Article proceeds in several parts.

Part I addresses what patent quality is, why it's hard to measure, and how comparative metrics (U.S. versus EPO) pertaining not only to the behavior of examiners, but also the behavior of patent applicants and patentees illuminates the various contributors to and drivers of patent quality. The EPO is recognized by many as the "gold standard" among patent offices in terms of patent quality, however, quantity and quality of patents in force in a given jurisdiction are the product of the rates of filing, allowance, and renewal. This Part shows how differences in U.S. and EPO grant rates (which are primarily controlled by examiners) are amplified by, and arguably dwarfed by, differences in filing and renewal rates (which are primarily controlled by applicants and patentees).

Part II considers patent quality levers at the patent application stage. Although patent quality is usually thought of as the responsibility of patent examiners, the quality of applications submitted to the office in the first place are an obviously critical input. As Part II describes, the ratio of U.S. R&D investment to each successful U.S. origin patent application has declined dramatically in recent years among electrical engineering patents and is far less than the ratio of U.S. R&D investment to successful U.S. origin patent application in the chemicals sector. Industry effects, and in particular the rise of defensive and portfolio patenting, have contributed to the decline in investment per patent in electrical engineering industries, with implications for the average quality of these patents.

Part III considers patent quality levers at the search and examination stages, which are separate in the EPO as in most of the rest of the world, but combined in the United States. It documents the EPO's lower grant rate and traces this lower rate to a surprising and often overlooked source—not the rejection of patents as such by EPO examiners but by applicants withdrawing from patenting, particularly after receipt of a search report from the EPO, which provides the applicant with a good sense of the likely scope, if any, of the forthcoming patent. The EPO's considerable investment in search is reflected in its much higher likelihood of citing to non-patent literature, which in turn reflects a more thorough search process.

Part IV considers post-quality patent quality levers and in particular how applicant decisions to maintain patents impact the quantity and quality of patents in force. The EPO requires fees to be paid every year, as compared to the United States which only requires fees to be paid every three and a half years. U.S. fees per GDP are also among the lowest in the world. These factors contribute to a relatively higher maintenance rate in the United States. It proposes aligning U.S. maintenance fee design with patent quality priorities, potentially by introducing European-style fees and frequency. It

also discusses a novel approach to patent quality—to advance quality on the back end by adoption of a “defensive only” patent option in the United States that only has defensive enforcement rights, akin to the license of right patent available in Europe, and costs less to keep in force.

## I. WHAT PATENT QUALITY IS AND WHY IT’S HARD TO MEASURE

### A. Defining Patent Quality

Patent quality encompasses two concepts—one hard: avoiding legal mistakes in issuing (or declining to issue) a patent,<sup>32</sup> and one really hard: ensuring that society is better off granting rather than denying a patent.<sup>33</sup> The two concepts are separate but related. While legal mistakes generally lead to the loss of social welfare, this loss can occur even if the decision to grant is technically correct.<sup>34</sup>

To assess and effect measurable improvements to patent quality, patent quality needs to be, well, measurable. To date, however, there have been no consistent, agreed-upon ways of telling whether or not a particular patent, or patent system, is high quality. In 2016, the General Accounting Office, based on an in-depth study of the USPTO, reported that despite the USPTO’s investments in quality, the office lacked “a consistent definition for patent quality articulated in agency documents and guidance.”<sup>35</sup>

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32. The most common definition of a quality patent is a valid patent. *See, e.g.*, PETER DRAHOS, *THE GLOBAL GOVERNANCE OF KNOWLEDGE: PATENT OFFICES AND THEIR CLIENTS* 69–79 (2010) (describing quality patent as a legally correct patent); Ronald J. Mann & Marian Underweiser, *A New Look at Patent Quality: Relating Patent Prosecution to Validity*, 9 J. EMPIRICAL LEGAL STUD. 1, 5–6 (2012).

33. *E.g.*, Michael Abramowicz & John F. Duffy, *The Inducement Standard of Patentability*, 120 YALE L. J. 1590, 1627 (2010) (arguing that a patent should only be awarded when it acts as an “inducement” for innovation) (citing *Roberts v. Sears, Roebuck & Co.*, 697 F.2d 796, 797 (7th Cir.), *vacated en banc*, 723 F.2d 1324, 1329 (7th Cir. 1983) (“[T]he framers of the Constitution and the Patent Code would not have wanted patents to be granted where the invention would have been made anyway, and about as soon, without any hope of patent protection.”)); *see also* Mariagrazia Squicciarini et al., *Measuring Patent Quality: Indicators of Technological and Economic Value* 59–62 (Org. for Econ. Co-operation & Dev. Sci., Tech. & Indus., Working Paper No. 03, 2013), <http://dx.doi.org/10.1787/5k4522wkw1r8-en> (proposing a wide array of patent quality metrics based on economic and technical, rather than legal criteria).

34. Though not the focus of this Article, the same may be true of a patent application that fails to claim statutory subject matter, but would enhance, on net, social welfare.

35. U.S. GOV’T ACCOUNTABILITY OFFICE, GAO-16-490, *INTELLECTUAL PROPERTY: PATENT OFFICE SHOULD DEFINE QUALITY, REASSESS INCENTIVES, AND IMPROVE CLARITY* 2 (2016).

The academic and policy conversation has focused on several other measures of patent quality—reversal rate, grant rate, and consistency in patent examination. As discussed below, each of these has serious shortcomings.

### 1. Reversal Rate

One indicia of quality is the extent to which issued patents are overturned in proceedings such as the USPTO “second look” programs used to invalidate the podcasting and check imaging patents described at the outset of this Article.<sup>36</sup> In *inter partes* review proceedings, 81% of adjudicated patents have at least one claim canceled.<sup>37</sup> However, this number is the product of selection effects and only applies to claims that are actually adjudicated.<sup>38</sup> Out of all petitions, only 28% result in one or more claims being invalidated.<sup>39</sup> When post-grant challenge outcomes at the EPO and USPTO are compared, the outcomes are not statistically distinguishable.<sup>40</sup> Litigation outcomes suffer similar selection effects—the small handful of patents that are actually worth fighting about, and sufficiently uncertain that the parties do not settle, are generally of higher value and do not necessarily represent all issued patents.

### 2. Allowance Rate

A simpler description of the patent quality problem is that the USPTO too readily grants patents, applying such a low bar that a crustless peanut butter and jelly sandwich<sup>41</sup> and a method of swinging on a swing,<sup>42</sup> infamously, have qualified. To manage public perception, the USPTO created a secret

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36. Farivar, *supra* note 20.

37. 2017 PTAB STATISTICS, *supra* note 18, at 10 (indicating that only 19% of patent adjudications resulted in all claims being upheld).

38. See Colleen V. Chien & Christian Helmers, *Inter Partes Review and the Design of Post-Grant Patent Reviews* 14–16 (Santa Clara Univ. Legal Studies, Working Paper No 10-15, 2015) [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2601562](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2601562) (describing the stages of petition and review in *inter partes* review).

39. U.S. PATENT OFFICE, *INTER PARTES REVIEW PETITIONS TERMINATED TO DATE 1* (2015), [http://www.uspto.gov/sites/default/files/documents/inter\\_partes\\_review\\_petitions\\_%2004%2030%202015\\_0.pdf](http://www.uspto.gov/sites/default/files/documents/inter_partes_review_petitions_%2004%2030%202015_0.pdf) (finding 25% of challenged claims unpatentable).

40. In both European opposition and post-grant U.S. reexamination, both of which lack an initiation filter, about 60% to 65% of challenged patents are either amended or rejected, and in 25% to 30% of the cases, all the claims are rejected and the patent is revoked. See Chien & Helmers, *supra* note 38, at 19.

41. U.S. Patent No. 6,004,596 (issued Dec. 21, 1999).

42. U.S. Patent No. 6,368,227 (issued Apr. 9, 2002).

“sensitive application program” in 1994 to flag applications that seemed “trivial, mundane, frivolous . . . silly or extremely basic.”<sup>43</sup> The program only applied to 0.04% of applications and was retired when it came to light in 2015.<sup>44</sup> However, it is striking because it shows that the risks of implausible applications over “a method for curing baldness” or “a perpetual motion machine” becoming U.S. patents were significant enough that a program to reduce them was needed.<sup>45</sup> Whether the initiative succeeded or not is an open question. During the program’s tenure, the USPTO issued patents over ideas such as using a computer to facilitate and record communication between a doctor and patient<sup>46</sup> and a cure for cancer that combines “evening primrose oil, rice, sesame seeds, green beans, coffee, meat, cheese, milk, green tea extract, evening primrose seeds, and wine” entitled “Diane’s Manna.”<sup>47</sup>

But determining what the USPTO’s “actual” grant rate is, much less what it should be, has proven elusive. One cannot simply compare applications to grants within a single year because it takes several years and sometimes even decades for a patent application to resolve, and the number of applications rises every year. Unlike anywhere else in the world, it’s impossible to finally reject a U.S. patent application, further complicates attempts to discern the fates of a set of applications. The USPTO’s own economists have estimated the grant rate to be around 56% during this period,<sup>48</sup> but they do not take into account the variety of ways in which applicants can continue examination even after a patent has been finally rejected.

### 3. Examiner Inconsistency

Inconsistent examination has also been blamed for poor patent quality. Studies have found that a number of factors that have nothing to do with the importance of the invention or strength of the application have had a

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43. Joe Mullin, *USPTO Ends “Warning System” for Outlandish Patents*, ARS TECHNICA (Mar. 5, 2015), <http://arstechnica.com/tech-policy/2015/03/uspto-ends-program-for-patents-that-could-create-unwanted-media-coverage/>.

44. *Sensitive Application Warning System*, USPTO (Mar. 2, 2015), <http://www.uspto.gov/patent/initiatives/patent-application-initiatives/sensitive-application-warning-system>.

45. *See id.*

46. Method and Apparatus for Indirect Medical Consultation, U.S. Patent No. 8,762,173 (issued June 24, 2014).

47. U.S. Patent No. 8,609,158 (issued Dec. 17, 2013).

48. Michael Carley, Deepak Hegde & Alan Marco, *What is the Probability of Receiving a U.S. Patent?*, 17 YALE J.L. & TECH. 203, 209 (2015).

significant influence on outcomes, including Examiner tenure,<sup>49</sup> cohort,<sup>50</sup> the number of patents the Examiner has examined,<sup>51</sup> experience level,<sup>52</sup> and the amount allocated to rejections.<sup>53</sup> Some examiners are perceived as “too easy,” while others are “too hard.”<sup>54</sup> But as troubling as a high level of inconsistency in examination is, it provides only an indirect measure of patent quality. Further, like grant rate, there is no consensus about how much consistency would be optimal in light of the tradeoffs between consistency and other aspects of the management of patent examination, including cost and hiring. The size of the patent backlog and variations in the pendency of patents have also been cast as matters of patent quality,<sup>55</sup> insofar as untimely examination is considered “low-quality.”

### B. Towards a Comparative Approach to Patent Quality

Although each is imperfect, existing approaches together provide a wish list of sorts for measuring patent quality. Patent quality metrics should be independently calculable and observable by neutral third parties.<sup>56</sup> They should accurately measure applicant and Examiner behavior across a representative, not just highly selected set of patents. Finally, patent quality metrics should bear upon not only the behavior of patent examiners, but also the behavior of patent applicants and patent holders, and their contributions to quality.

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49. Iain M. Cockburn et al., *Are All Patent Examiners Equal? Examiners, Patent Characteristics, and Litigation Outcomes*, in PATENTS IN THE KNOWLEDGE-BASED ECONOMY 19, 47 (Wesley M. Cohen & Stephen Merrill eds., 2003); see also Ronald J. Mann, *The Idiosyncrasy of Patent Examiners: Effects of Experience and Attrition*, 92 TEX. L. REV. 2149, 2171 (2014) (finding the variation between examiners to be relatively slight, but documenting the relative importance of tenure, over experience, to the examination).

50. Michael D. Frakes & Melissa F. Wasserman, *Patent Office Cohorts*, 65 DUKE L.J. 1601, 1629 (2016).

51. Cockburn et al., *supra* note 49, at 47.

52. Mark A. Lemley & Bhaven Sampat, *Examiner Characteristics and Patent Office Outcomes*, 94 REV. ECON. & STAT. 817, 821 (2012).

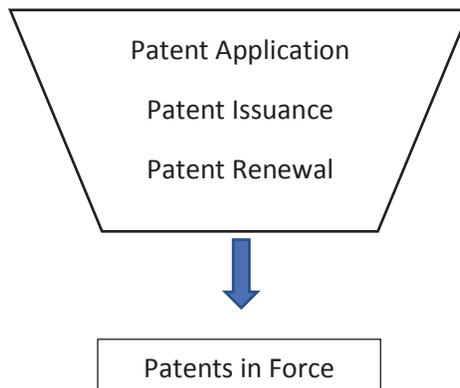
53. Michael Frakes & Melissa Wasserman, *Is the Time Allocated to Review Patent Applications Inducing Examiners to Grant Invalid Patents?: Evidence from Micro-Level Application Data* 39–40 (Nat'l Bureau of Econ. Research, Working Paper No. 20337, 2014).

54. Sean Tu, *Luck/Unluck of the Draw: An Empirical Study of Examiner Allowance Rates*, 2012 STAN. TECH. L. REV. 10, 31.

55. See, e.g., MARC ADLER, PATENT PUB. ADVISORY COMM., PATENT QUALITY TASKFORCE: PRELIMINARY REPORT 14 (2010), [http://www.uspto.gov/sites/default/files/about/advisory/ppac/patent\\_quality\\_tf\\_report.pdf](http://www.uspto.gov/sites/default/files/about/advisory/ppac/patent_quality_tf_report.pdf).

56. David J. Kappos & Stuart Graham, *The Case for Standard Measures of Patent Quality*, 53 MASS. INST. TECH. SLOAN MGMT. REV. 19, 22 (2012) (calling for independent analysis).

Structured correctly, comparative patent metrics satisfy a number of these criteria. Tracing what happens when the same patent application is filed in multiple jurisdictions enables directly observable comparisons of their diverse fates. Since 1996, the five Patent Offices have collected and published statistics on several patenting milestones, enabling comparisons of all applications, issuances, and in-force patents,<sup>57</sup> not just a subset of them. The collaborative reports of the so-called “IP5” (U.S., Japanese, European, Korean, and Chinese Patent Offices) provide year-over-year, standardized, and granular views of the production of all patents,<sup>58</sup> supporting comparisons across time and jurisdictions.



Being able to track outcomes at different phases in a patent’s lifecycle has another benefit. Existing patent quality metrics tend to focus exclusively on patent examination—its mistakes, too-high grant rate, and lack of consistency. But the quality and quantity of patents in force are the product of three sets of decisions: to submit applications of certain quality to the patent office (by the applicant), to grant the patent (by the USPTO), and to keep pursuing or keep in force an applicant or patent (by the applicant/patentee). For example, neither the U.S. podcasting nor the U.S. check imaging patent discussed at the beginning of this Article was ever the subject of a counterpart European patent, but decisions by the applicant as well as by the EPO led to this result. The application that matured into U.S. Patent 6,032,137 over check imaging was also the basis of seven patent

57. *IP5 Statistics Reports*, FIVEIPOFFICES, <http://www.fiveipoffices.org/statistics/statisticsreports.html> (last visited Mar. 11, 2018) (listing reports of the IP5 Patent Offices from 2011, and from 2006–2010, from the IP3 Offices of the EPO).

58. *Statistical Data Resources*, FIVEIPOFFICES, <http://www.fiveipoffices.org/statistics/statisticaldata.html> (last visited Mar. 11, 2018).

applications at the EPO,<sup>59</sup> but none were granted.<sup>60</sup> Patent protection outside the United States over the ‘504 podcasting patent was never even sought.<sup>61</sup> To understand the impact of both Examiner and applicant decisions on patent quality, it is important to observe and compare metrics at each of the three main phases of a patent’s life—application, issuance, and renewal. The sections below do so, after explaining why the EPO provides the best point of comparison, despite the limits of a comparative approach.

### C. Why Compare the USPTO and EPO

Among options for comparing the USPTO regarding patent quality, the EPO stands out. The GDP of the EPO’s forty member states<sup>62</sup> is roughly equivalent to the U.S. GDP,<sup>63</sup> and the EPO’s covered population is roughly double that of the United States.<sup>64</sup> Industry surveys conducted in 2010, 2011, 2012, and 2015–2016 have each consistently found the EPO to have the highest ratings among the five leading Patent Offices around the world.<sup>65</sup> This

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59. *Remote Image Capture with Centralized Processing and Storage*, GOOGLE PATENTS <http://www.google.com/patents/US6032137> (last visited Mar. 27, 2018) (listing related applications EP1008086A2, EP1008086A4, EP1688876A2, EP1688876A3, EP1986148A1, EP2267652A1, EP2267653A1).

60. *Id.* (showing no “B” (or granted) EP publication).

61. *System for Disseminating Media Content Representing Episodes in a Serialized Sequence*, GOOGLE PATENTS, <http://www.google.com/patents/US8112504> (last visited Mar. 11, 2018) (listing related applications, showing only U.S. applications).

62. The EPO includes EU member states and a number of others including Albania, Iceland, Lichtenstein, Macedonia, Monaco, Slovenia, Serbia, Switzerland, and Turkey. *See* THE IP5 OFFICES, THE IP5 STATISTICS REPORT: 2016 EDITION, at 6 (USPTO ed., 2017), <https://www.fiveipoffices.org/statistics/statisticsreports/2016edition/IP5SR2016full.pdf> (listing members).

63. *See World Economic Outlook Database*, INT’L MONETARY FUND, <http://www.imf.org/external/pubs/ft/weo/2016/01/weodata/index.aspx> (last visited Mar. 27, 2018) (estimating U.S. GDP in 2015 to be \$18.6 trillion, as compared to \$17.8 trillion including the European Union, Turkey, and Switzerland).

64. The combined population of the EPO member states is about 700 million. *See* THE IP5 OFFICES, *supra* note 62, at 6. The U.S. population is approximately 320 million. *Population, Total*, WORLD BANK, <http://data.worldbank.org/indicator/SP.POP.TOTL> (last visited Mar. 11, 2018).

65. EUROPEAN PATENT OFFICE, QUALITY AND PROCUREMENT 62, 62 (2015), [http://documents.epo.org/projects/babylon/eponet.nsf/0/4783c6465d9a2b5fc1257e5900242b3f/\\$FILE/IAM72\\_benchmarking\\_q\\_p\\_en.pdf](http://documents.epo.org/projects/babylon/eponet.nsf/0/4783c6465d9a2b5fc1257e5900242b3f/$FILE/IAM72_benchmarking_q_p_en.pdf); JOFF WILD, 2010: THE EPO’S YEAR IN STATISTICS 9, 10 (2011), <http://www.iam-media.com/Intelligence/Patents-in-Europe/2011/Features/2010-the-EPOs-year-in-statistics>; *see* Sara-Jayne Clover, *USPTO Still Struggling to Convince on Quality*, IAM (May 12, 2011), <http://www.iam-media.com/Blog/Detail.aspx?g=4ae808a6-8240-41bf-a6e0-9b1828bfe372>; *EPO is Number One for Quality, Survey Says*, EUR. PAT. OFF. (June 2, 2016), <https://www.epo.org/news-issues/news/2016/20160602a.html>; Joff Wild, *The EPO Tops*

perception is robust across the subgroups surveyed—companies, patent lawyers, and non-practicing entities.<sup>66</sup> Based on interviewing about 140 examiners from countries all around the world from the period covering 2004 to 2008, Peter Drahos found that the EPO had the best reputation, including for its searching capabilities and *esprit de corps*—the personal pride examiners took in the quality of their work product.<sup>67</sup>

But while Europe may be closer to the United States than other patent jurisdictions, significant differences remain. As detailed later, the two systems are different in law, procedure, and administration, and to some degree that is actually the point: to look at how such differences translate into different outcomes. Parts III and IV of this article, for example, explore the consequences of the EPO's "once and done" approach to examination, as opposed to the USPTO's approach of allowing patent-seekers to continue examination even after final rejection, as well as the relatively more aggressive schedule of renewal fees in Europe than the United States, as departure points for considered discussion.

It is important to acknowledge, however, that some differences are much harder to compensate for than others. At the EPO,<sup>68</sup> the average Examiner is exempt from national taxes<sup>69</sup> and gets nearly double the salary of her American counterpart, whose salary is dictated by U.S. civil service grades.<sup>70</sup> Buoyed by the strong demand for technical and legal talent in the United States, U.S. patent examiners often have opportunities to advance professionally by leaving the USPTO to become patent lawyers or engineers at a startup or existing firm,<sup>71</sup> whereas EPO examiners tend to view EPO jobs as prestigious and conferring lifetime tenure.<sup>72</sup> Because the USPTO lacks substantive rulemaking authority,<sup>73</sup> anytime it does something that appears to

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*the Quality Table Once Again, as the USPTO and SIPO Make Forward Strides*, IAM (May 29, 2012), <http://www.iam-media.com/blog/detail.aspx?g=f7470c76-8fe7-42e3-a4bb-fce2b4fa1a17>.

66. See, e.g., EUROPEAN PATENT OFFICE, *supra* note 65, at 63 (showing EPO ratings to be consistently highest).

67. DRAHOS, *supra* note 32, at 62, 76–77.

68. Bruno van Pottelsberghe de la Potterie, *The Quality Factor in Patent Systems*, 20 INDUS. & CORP. CHANGE 1755, 1776–77 (2011) (detailing wage incentives).

69. Pierre M. Picard & Bruno van Pottelsberghe de la Potterie, *Patent Office Governance and Patent System Quality* 11 (Ctr. Econ. & Policy Research, Working Paper No. DP8338, 2011).

70. Pottelsberghe de la Potterie, *supra* note 70, at 1776–77 (detailing wage incentives).

71. DRAHOS, *supra* note 32, at 153.

72. *Id.* at 316.

73. Arti K. Rai, *Growing Pains in the Administrative State: The Patent Office's Troubled Quest for Managerial Control*, 157 U. PA. L. REV. 2051, 2053 (2009).

heighten the burden on applicants<sup>74</sup> it is vulnerable to claims by patent applicants, sometimes bitterly fought, that it is overstepping its authority.<sup>75</sup> While Europe and the United States have similar GDPs, European patents must be perfected and enforced in individual countries whose markets are much smaller than the United States.<sup>76</sup> EPO practice is also continuously evolving, making it a moving target.<sup>77</sup> Differences both within and outside the control of patent system administrators and patent policy mean that particular insights gleaned below may be actionable to different extents and based on varying degrees of effort. With these caveats in mind, the next part of this Article details my methodological approach for carrying out the empirical portion of comparison, then implements it.

### 1. Methodological Approach

Empirical analyses are limited by the quality and completeness of available data, issues that are compounded in comparative studies. Fortunately, analyses of patents filed in multiple jurisdictions have been of interest for several decades,<sup>78</sup> and this Article draws primarily on familiar approaches and data sources. For numbers of patents applied for and granted, the legal status of claims, and their technology classifications, I relied upon data available through the publicly available Google Patents Research Dataset, which, through partner IFI Claims, consolidates data from seventeen Patent Offices, including the U.S. and the EPO.<sup>79</sup> Much of the underlying data

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74. For example, by requiring more fulsome disclosure or the up-to-date disclosure of a patentee's owner, or to limit the options of patentees to get multiple chances to get a patent granted.

75. See, e.g., *Tafas v. Dudas*, 530 F. Supp. 2d 786, 791 (E.D. Va. 2008) (challenging the USPTO's changes to the so-called "continuation rules"); see also Arti K. Rai, *Improving (Software) Patent Quality Through the Administrative Process*, 51 HOUS. L. REV. 503, 506 (2013) (describing the controversy within the patent community and suit).

76. See THE IP5 OFFICES, *supra* note 62, at 6–8 (describing the process of perfecting and enforcing European patents).

77. See, e.g., Katrin Cremers et al., *Patent Litigation in Europe*, 44 EUR. J.L. & ECON. 1, 5–16 (2017) (discussing the anticipated introduction of the "European Patent" to the EPO, changing the enforcement of patents from being country-by-country to being effective across the member states of the EPO).

78. Catalina Martínez, *Patent Families: When Do Different Definitions Really Matter?*, 86 SCIENTOMETRICS 39, 40–41 (2010) (describing work in the 1980s done by German economist Konrad Faust). Comparisons have been used, for example, to identify valuable inventions (that are subject to multiple applications), understand trends in technological internationalization, and to compare patent filing strategies. *Id.*

79. Data available at [https://bigquery.cloud.google.com/dataset/patents-public-data:google\\_patents\\_research](https://bigquery.cloud.google.com/dataset/patents-public-data:google_patents_research) [hereinafter *Google Patents Research Dataset*], discussed in Ian

draws from the same sources as one of the most widely used patent databases, PATSTAT,<sup>80</sup> created by the EPO at the request of the international patent offices.<sup>81</sup>

This Article associates each patent with one of five technological sectors (electrical engineering, instruments, chemistry (and pharmaceuticals), mechanical engineering, and other fields) and thirty-five technological fields based on its first-listed class and the scheme used by the World Intellectual Property Organization (“WIPO”) by Schmoch.<sup>82</sup> In focusing on patents applied for through the EPO, this Article excludes the minority of filings in individual European country pursued directly through national offices.<sup>83</sup> Non-utility patents (e.g., design patents, utility model patents), some of which

Wetherbee, *Google Patents Public Datasets: Connecting Public, Paid, and Private Patent Data*, GOOGLE CLOUD (Oct. 31, 2017), <https://cloud.google.com/blog/big-data/2017/10/google-patents-public-datasets-connecting-public-paid-and-private-patent-data>.

80. Some of the statistics reported *infra* and earlier versions of this Article relied solely on PATSTAT, EUR. PAT. OFF. (last updated Jan. 9, 2018), <https://www.epo.org/searching-for-patents/business/patstat.html#tab-1>, one of the most widely used patent databases for researchers. See generally Gianluca Tarasconi & Byeongwoo Kang, *PATSTAT Revisited* (Inst. of Developing Econs., Discussion Paper No. 527, 2015), <https://ideas.repec.org/p/jet/dpaper/dpaper527.html>. The underlying data comes from the same sources, and many of the results were the same, save for truncation effects.

81. *Id.* at 6. Mindful of the limitations of these patent data, I took several precautions. The EPO was formed in 1978 and so continent-wide data is not available before then. The United States only began systematically publishing patent applications in March 2001, so this Article relies on application data reported starting then. The technology field and sector data technology categories reported are based on international patent classes whose definitions change often, and a patent is often assigned to more than one class (with the sector assignment based on the first, or primary, class), reducing the precision of technology category data.

82. ULRICH SCHMOCH, CONCEPT OF A TECHNOLOGY CLASSIFICATION FOR COUNTRY COMPARISONS 9–10 tbl.2 (2008), [http://www.wipo.int/edocs/mdocs/classifications/en/ipc\\_ce\\_41/ipc\\_ce\\_41\\_5-annex1.pdf](http://www.wipo.int/edocs/mdocs/classifications/en/ipc_ce_41/ipc_ce_41_5-annex1.pdf).

83. Patents can be obtained in a contracting state of the EPO, such as Germany, in one of three ways: 1) through “national” filing directly at the country’s local patent office; 2) through “regional” filing directly at the EPO; or 3) through “international” filing through the Patent Cooperation Treaty (“PCT”) that has designated the EPO at the national phase. See Jay Erstling & Isabelle Boutillon, *The Patent Cooperation Treaty: At the Center of the International Patent System*, 32 WM. MITCHELL L. REV. 1583, 1587–88 (2006); see also Patent Cooperation Treaty, June 19, 1970, 28 U.S.T. 7645. Unless otherwise indicated, the EPO statistics presented in this Article represent EPO applications and grants, received through both “regional” and “international” routes. While the percentage of patents pursued through national filings is small, it varies by country. For example, in the years 2006 and 2012, the EPO received about 70% of all applications for Germany, and 90% of all applications for the United Kingdom. In 2006 and 2013, the EPO received 135,231 and 147,987 patent applications, respectively, Germany received 60,585 and 63,167 applications, respectively, and the United Kingdom received 25,745 and 22,938 applications, respectively. *WIPO IP Statistics Data Center*, WORLD INTEL. PROP. ORG., <https://www3.wipo.int/ipstats/index.htm> (last visited Mar. 20, 2018) (using “Indicator” 1, “Report type” as “Total count by filing office” and 2006 to 2013 as “Year range” to access these statistics).

are offered by the United States and certain countries in Europe were also excluded.

#### D. Comparative Applications, Patents, and Renewals

This Article draws primarily from the universe of USPTO and EPO patent application “twins” filed in both jurisdictions in 2002, the first full year for which USPTO application data is available following the USPTO’s implementation of the American Inventor’s Protection Act of 1999.<sup>84</sup> Approximately 106,243 utility patent applications were filed at the EPO in 2002.<sup>85</sup> The USPTO received more than double that number—273,619.<sup>86</sup> By 2018, the USPTO had granted about 69% of these applications, and the EPO had granted about 52% of these applications<sup>87</sup> with less than 0.2% of U.S. applications still pending.<sup>88</sup> This translates into about 188,000 USPTO patents and 53,000 EPO patents from filing year 2002.<sup>89</sup> At the time of this writing, not enough time had passed to know the number of patents in force at the end of the eligible patent term of twenty years. However, the USPTO

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84. See STUART GRAHAM & DEEPAK HEGDE, DO INVENTORS VALUE SECRECY IN PATENTING? EVIDENCE FROM THE AMERICAN INVENTOR’S PROTECTION ACT OF 1999, at 1–2 (2014), [http://www.law.northwestern.edu/research-faculty/searlecenter/events/innovation/documents/Hegde\\_Graham\\_AIPA.pdf](http://www.law.northwestern.edu/research-faculty/searlecenter/events/innovation/documents/Hegde_Graham_AIPA.pdf).

85. TRILATERAL STATISTICAL REPORT: 2002 EDITION 7 tbl.2.1 (2002), <http://www.trilateral.net/statistics/tsr/2002/TSR.pdf> (reporting, in 2002, 106,243 total Euro-Direct and Euro-PCT regional phase patent applications and 165,066 total Euro-Direct and Euro-PCT international phase applications, and calculated based on filing date, rather than priority date). I chose to base my calculations on the former category because there is a higher chance that international phase applications will never mature into Examiner applications.

86. PATSTAT, *supra* note 80 (excluding PCT applications); see Alan C. Marco et al., *The USPTO Historical Patent Data Files: Two Centuries of Innovation* 3 fig.4 (Off. of Chief Economist at the USPTO, Working Paper No. 2015-1, 2015), [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2616724](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2616724); *Historical Patent Data Files*, USPTO (last updated Aug. 28, 2017), <http://www.uspto.gov/learning-and-resources/electronic-data-products/historical-patent-data-files> (reporting, in 2002, 289,762 U.S. patent applications, excluding PCT internationally filed applications, a number that includes unpublished and continuation applications); *cf.* TRILATERAL STATISTICAL REPORT: 2002 EDITION, *supra* note 85, at 15 tbl.2.3 (reporting 334,445 applications from 2002, including about 40,000 PCT applications); E-mail correspondence with Alan Marco, Chief Economist, U.S. Patent & Trademark Office (Sept. 8, 2015).

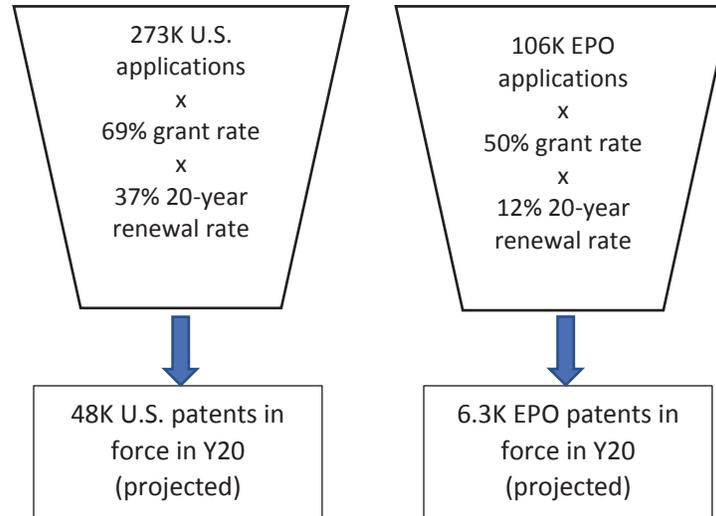
87. *Google Patents Research Dataset*, *supra* note 79 (using the \_\_\_\_ status field in the Research Data for the 2002 patents available in that database); see Figure 4 *infra*.

88. 0.18% of U.S. applications as of February 2018. EPO status data is not available in bulk form but I assumed that the ratio of unresolved applications was similarly negligible.

89. These ratios are roughly in line, for example, with grants in 2013, which totaled 277,800 and 66,700 by the USPTO and the EPO, respectively (numbers include PCT-filed applications). *WIPO IP Statistics Data Center*, *supra* note 83.

and EPO project that 37% and 12% of USPTO and EPO patents, respectively, filed in 2002 will remain in force twenty years after filing,<sup>90</sup> so this Article uses these numbers in its estimate.

FIG. 1: Projected Patents in Force based on Patent Applications filed at the USPTO and EPO in 2002<sup>91</sup>



The data show that at every stage in the patent lifecycle, the U.S. system tilts towards a higher quantity patent system than does the EPO. In 2002, the USPTO received more than double the applications than the EPO did and granted about 40%<sup>92</sup> more of its applications than did the EPO, resulting in about three to four times more issued patents. Holders of U.S. patents were projected to be three times more likely to leave their patents in force for twenty years after filings than were holders of EPO patents validated in member states. Collectively, this translates into a projected 48,000 U.S.

90. TRILATERAL STATISTICAL REPORT: 2002 EDITION, *supra* note 85, at 33 fig.4.8; *cf. IP5 Statistics Report 2013 Edition*, FIVEIPOFFICES, <http://www.fiveipoffices.org/statistics/statisticsreports/2013edition.html/2013statisticaltables.xls> x (click “Statistical Tables”) (providing renewal projections of 40% and 20% in the USPTO and EPO, respectively, for patents filed in 2013).

91. TRILATERAL STATISTICAL REPORT: 2002 EDITION, *supra* note 85, at 33 (using renewal rates); *PATSTAT*, *supra* note 80 (using application and grant numbers). Patents originally issued by the EPO and validated in at least one member state.

92. 19% / 50% = ~40%.

patents in force in year twenty, as compared to 6,300 patents expected to be in force somewhere in an EPO member state,<sup>93</sup> a striking difference.

The data suggest strong technology effects. The most dramatic gaps between EPO and USPTO performance appear among applications that belong to the “electrical engineering” category, a field that includes computer technology, digital communication, telecommunications, and related fields.<sup>94</sup> Three times as many applications were filed in 2002, and five times as many technology patents were issued on these applications by the USPTO than by the EPO, resulting in a seventeen-fold difference in the number of patents in force by year twenty after filing.<sup>95</sup> In contrast, less than two times as many chemical and pharmaceutical patents were filed in the USPTO than the EPO, and fewer than three times as many patents were issued in the USPTO than were issued in the EPO.<sup>96</sup> Although there have been many demands to reform software patents,<sup>97</sup> it is worth noting that just applying European grant and renewal rates to U.S. applications would reduce, dramatically, the number of U.S. patents in force.

This overall view reveals the relative contribution of applicant and Examiner decisions regarding the quality and quantity of patents in force. Although the U.S. grant rate is about 40% higher than the EPO grant rate, even greater gaps exist between the two jurisdictions in the number of applications filed and the number of patents maintained. A number of variables determine the application rate, including patent doctrine, industry norms, and uses for patents that do not require exclusivity (e.g., signaling).

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93. As noted before, the EPO’s numbers exclude national patent applications filed directly within a country, and patent holders may choose not to validate their EPO patents within those countries, so the number of patents within an individual European country will vary from this total.

94. SCHMOCH, *supra* note 82, at 9 tbl.2.

95. The USPTO and EPO received 99,764 and 32,861 non-PCT electrical engineering patent applications, and issued 75,557 and 13,464 patents on these applications, respectively. *PATSTAT*, *supra* note 80. Assuming a 37% and 12% Year 20 in-force rate, TRILATERAL STATISTICAL REPORT: 2002 EDITION, *supra* note 85, at 33 fig.4.8, this would result in 27,956 and 1,615 USPTO and EPO electrical engineering patents, respectively, a ratio of approximately seventeen to one.

96. The USPTO and EPO received 51,662 and 30,295 non-PCT “chemical” patent applications, and issued 34,192 and 14,452 patents on these applications, respectively, a ratio of approximately 2.4 to 1. *PATSTAT*, *supra* note 80.

97. E.g., Colleen V. Chien, *Reforming Software Patents*, 50 HOUS. L. REV. 325, 331 n.30 (2012) (describing proposals including a five-year software patent term for mitigating the harms associated with software patents); see also Pamela Samuelson, *Benson Revisited: The Case Against Patent Protection for Algorithms and Other Computer Program-Related Inventions*, 39 EMORY L.J. 1025, 1139 (1990) (describing opposition to software patents by many mathematicians, computer scientists, and others in the software development community).

In addition, while relatively less attention has been paid to post-grant, as opposed to pre-grant, quality control mechanisms, the potential gains from a shorter patent life are just as considerable as the gains from increased quality.

Over time, the numbers in this snapshot have changed, though in different directions. The gap in applications has decreased, with the USPTO only receiving about 20% more applications than the EPO in 2016.<sup>98</sup> Reported application allowance rates in the USPTO and the EPO have also fluctuated from 2002 through 2013, however, the 20% to 30% higher grant rate in the United States as compared to Europe has remained.<sup>99</sup> Finally, the gap in renewal rates has narrowed a bit, from patents being three times as likely to remain in force in the United States to two times as likely to remain in force by the end of year twenty.<sup>100</sup> With this baseline established, the following parts proceed to explore the determinants of quality at each stage in a patent application and throughout a patent's life.

## II. QUALITY (AND QUANTITY) LEVERS AT THE PATENT APPLICATION STAGE

The quality and quantity of patent applications submitted to the USPTO is a function of a number of factors including levels of R&D, the pace of innovation, industry norms, and the letter and administration of patent law. While it has been widely noted that the United States experienced growth in patent applications with the expansion of patentable subject matter and strengthening of U.S. patents by the Federal Circuit in the 1990s, quantifying the relative contribution of this and other factors, like fluctuations in innovation or R&D, industry dynamics, and technology trends, has remained elusive. A comparative view helps control for these factors and disaggregates legal, technology, applicant, and other effects on patent quality.

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98. Including national and regional direct and PCT filings, see *IP5 Statistics Report 2016 Edition*, <https://www.fiveipoffices.org/statistics/statisticsreports/2016edition.html> (click "Statistical Tables") (last visited Mar. 19, 2018) (reporting 437,004 total EPO applications and 517,156 total U.S. applications under "Patent applications filed" tab).

99. Christopher A. Cotropia et al., *Patent Applications and the Performance of the U.S. Patent and Trademark Office*, 23 *FED. CIR. B.J.* 179, 187–88 fig.9 (2013).

100. THE IP5 OFFICES, *supra* note 62, at 74 fig.4.8 (showing maintenance rates of about 50% and about 25% by year 20 in the USPTO and EPO, respectively).

A. *The Differences in Application Rates (Including Over Time) and What Explains Them*

1. Technology Effects—The Software Patent Problem

As noted earlier, in 2002 the USPTO received more than twice the patent applications than the EPO, which has nearly double the covered population. However, this snapshot of patenting behavior and outcomes doesn't reveal when and how the relative increase in demand for U.S. patents occurred. Looking more closely at patent grants by year (since U.S. applications are not available prior to 2001), we can see that a surge in digital technology patents in particular has grown the gap.<sup>101</sup> From 1996 to 2008, in the United States, the percentage of "electrical engineering" patents, which includes computer technology, digital communication, telecommunications, and related fields,<sup>102</sup> nearly doubled, from 24% to 46%<sup>103</sup> of all patents by the USPTO issued annually. During this time shares of electrical engineering patents at the JPO and EPO grew, but much more modestly, to about 25% of total issued patents.<sup>104</sup> Driven by legal, technological, and industry developments, the increase in filings strained patent examination resources in the United States. As the USPTO attempted to cope with the backlog, there was a decline and then an increase in patent grant rate.<sup>105</sup>

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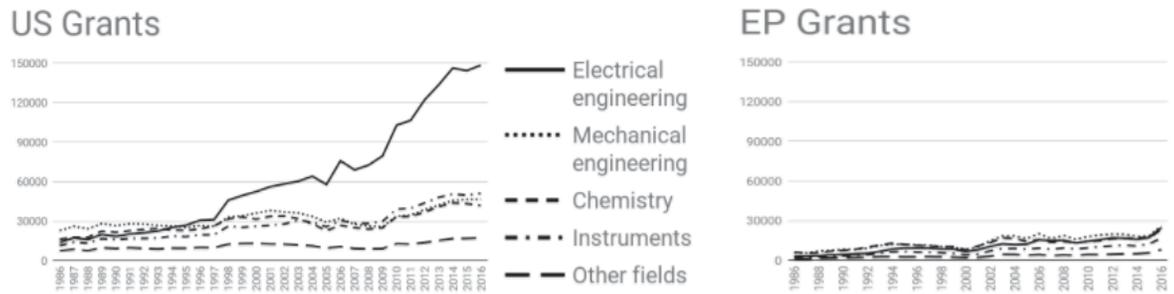
101. See *infra* Figure 2. As to the EPO patents, it should be noted that patents in Europe may be sought outside of the EPO, however the proportion of non-EPO European patent applications is generally small, around 10% to 30%. See discussion *supra* Part I.

102. See SCHMOCH, *supra* note 82, at 9 tbl.2.

103. See Marco et al., *supra* note 86, at 35 fig.9 (showing disproportionate growth in U.S. electrical and electronics and computers and communication patent applications from 1995 to 2015).

104. In the EPO and JPO the share of electrical engineering patent grants grew from 24% to 29% and 28% to 35% of patents, respectively, based on analysis of PATSTAT data. See PATSTAT, *supra* note 80. This time period was chosen because of the availability of Japanese data, which is hard to obtain reliably by class IPC prior to 1996 and after 2008. Accord THE IP5 OFFICES, IP5 STATISTICS REPORT: 2012 EDITION 51 fig.4.3 (2013), <https://www.fiveipoffices.org/statistics/statisticsreports/statisticsreport2012edition/IP5statistics2012.pdf> (reporting, by 2011, that 28% of EPO patent applications, versus 48% of USPTO applications, and 35% of JPO application were electrical engineering patents). Earlier year views by these categories are not available.

105. Dennis Crouch, *USPTO Allowance Rate*, PATENTLY-O (Aug. 10, 2015), <http://patentlyo.com/patent/2015/08/uspto-allowance-rate.html> (depicting and describing, regarding the PTO allowance rate, the "Dudas-Drop in the second-half of the last decade and the subsequent Kappos-Climb").

FIG. 2: EPO and USPTO Patent Grants by Industry, 1986 to 2016<sup>106</sup>

This Article is hardly the first one to note the prominent role that software and business method patents, and disputes about them, have played in the U.S. patent system. The share of overall patents covering software, which spans several technological categories, grew from 20% of patents in 1991 to more than half of all issued patents in 2011,<sup>107</sup> and software-related patents were associated with nearly 90% of the increase in defendants to patent litigations initiated from 2007 through 2011,<sup>108</sup> a period also associated with an increasing share of assertions brought by patent assertion entities.<sup>109</sup> Non-practicing entities tend to assert software patents.<sup>110</sup> Software patents have overwhelmingly lost when put to the test in litigation, but only after they have been asserted multiple times.<sup>111</sup>

106. Author's calculation using *Google Patents Research Dataset*, *supra* note 79 and relying on SCHMOCH, *supra* note 82, at 7–8 (explaining the “Electrical Engineering” category includes Computer Technology, Basic Communication Processes, IT Methods For Management, Semiconductors, Electrical Machinery, Audio-Visual Technology, Telecommunications, and Digital Communication)

107. U.S. GOV'T ACCOUNTABILITY OFFICE, ASSESSING FACTORS THAT AFFECT PATENT INFRINGEMENT LITIGATION COULD HELP IMPROVE PATENT QUALITY 13 (2013), [http://www.uspto.gov/sites/default/files/aia\\_implementation/GAO-12-465\\_Final\\_Report\\_on\\_Patent\\_Litigation.pdf](http://www.uspto.gov/sites/default/files/aia_implementation/GAO-12-465_Final_Report_on_Patent_Litigation.pdf); accord Colleen V. Chien, *Opening the Patent System: Diffusionary Levers in Patent Law*, 89 S. CAL. L. REV. 793, 809 fig.2 (2016).

108. U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 107, at 14.

109. EXEC. OFFICE OF THE PRESIDENT, PATENT ASSERTION AND U.S. INNOVATION 5 (2013), [https://obamawhitehouse.archives.gov/sites/default/files/docs/patent\\_report.pdf](https://obamawhitehouse.archives.gov/sites/default/files/docs/patent_report.pdf).

110. See John R. Allison et al., *How Often Do Non-Practicing Entities Win Patent Suits?*, 32 BERKELEY TECH. L.J. (forthcoming 2018).

111. John R. Allison et al., *Patent Quality and Settlement Among Repeat Patent Litigants*, 99 GEO. L.J. 677, 694–96 (2011); see also Shawn P. Miller, *What's the Connection Between Repeat Litigation and Patent Quality? A (Partial) Defense of the Most Litigated Patents*, 16 STAN. TECH. L. REV. 313, 316 (2013) (concurring that software and NPE-owned patents lose more).

## 2. Legal Effects and Approaches to Software

Although software has not always been broadly patentable, the Federal Circuit's *State Street* decision in 1998 ruled that inventions that produced "a useful, concrete and tangible result" could be patented.<sup>112</sup> For three decades, the Supreme Court did not find any patent barred on subject matter restrictions, although inventions could still be ineligible on other grounds. The little-known Federal Circuit case *In re Vaeck*,<sup>113</sup> in combination with USPTO practice, made it harder to reject inventions as obvious. The case held that an invention would not be considered obvious unless there was a teaching, suggestion, or motivation in the prior art to combine old elements to make the invention.<sup>114</sup> Taking the three-judge panel's decision literally, the USPTO instituted a practice of requiring examiners to complete the difficult task of searching for writings that, in a sense, reflected the obvious, in order to reject patents.<sup>115</sup> In 2006, Justice Kennedy's concurrence in the *eBay* case noted that a "burgeoning number" of business-method patents were of "potential vagueness and suspect validity."<sup>116</sup>

In 2013, twenty-five years after the Federal Circuit's *State Street* decision, the Supreme Court broke with its pattern of not rejecting patents on eligibility grounds. Denying a patent application over a method of hedging risk in energy commodities trading, in *Bilski v. Kappos*,<sup>117</sup> the Supreme Court rejected the *State Street* test, and indeed, any reliance on a single test.<sup>118</sup> In

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112. *State St. Bank & Tr. Co. v. Signature Fin. Grp., Inc.*, 149 F.3d 1368, 1373 (Fed. Cir. 1998).

113. *In re Vaeck*, 947 F.2d 488, 493 (Fed. Cir. 1991).

114. MPEP 126 (8th ed. Rev. 5, Aug. 2006) ("To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure." (citations omitted)).

115. Jake Ward, *The Evolution of MPEP 2143—Prima Facie Case of Obviousness*, PAT. & TRADEMARK L. BLOG (Feb. 23, 2008), <https://anticipatethis.wordpress.com/2008/02/23/the-evolution-of-mpep-2143-prima-facie-case-of-obviousness/> (showing that pre-KSR MPEP guidance to examiners reflected the *Vaeck* standard).

116. *eBay Inc. v. MercExchange, L.L.C.*, 547 U.S. 388, 397 (2006) (Kennedy, J., concurring) (discussing the increasing economic and legal significance of patents over business methods and that the "potential vagueness and suspect validity of some of these patents may affect the calculus under the four-factor test [used]").

117. *Bilski v. Kappos*, 561 U.S. 593, 594 (2010).

118. *Id.* at 612–13.

*Alice Corp. v. CLS Bank International*,<sup>119</sup> the Court decided that merely implementing an abstract idea on a computer did not make it patentable. These cases, along with a few others on the patentability of subject matter, have called into question scores of already issued as well as pending patents, not only on software but diagnostic methods<sup>120</sup> and DNA. The check imaging patent described at the outset of this Article, as well as patents over recognizing different data formats<sup>121</sup> and using digital signatures to identify spam email,<sup>122</sup> have since been deemed ineligible.

The courts have elevated other patent-quality standards as they apply to software. In June 2013, the White House and USPTO announced an initiative to apply greater scrutiny to functional claims, the practice of drafting claims in order to capture broad, many would argue unwarranted, scope.<sup>123</sup> However, the USPTO's job is to apply the law, and few court decisions had addressed the sort of scrutiny that is warranted. The Federal Circuit's *Williamson v. Citrix Online, LLC* en banc decision<sup>124</sup> in 2015 addressed this void. Further, the Supreme Court's decision in *Nautilus, Inc. v. Biosig Instruments, Inc.* did away with the incredibly low bar set by the Federal Circuit that only "insolubly ambiguous" patents are too vague to warrant protection.<sup>125</sup> The Court's earlier decision in *KSR International Co. v. Teleflex Inc.*, part of the same stretch of decisions that made the Federal Circuit the most overturned

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119. 134 S. Ct. 2347, 2355–56 (2014).

120. See, e.g., *Mayo Collaborative Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 77 (2012) (invalidating patents that involved using thiopurine drugs to treat autoimmune diseases because a process reciting a law of nature is not patentable unless it has "additional features that provide practical assurance that the process is more than a drafting effort designed to monopolize the law of nature itself"); *Bilski*, 561 U.S. at 611 (finding that patent claims that explain the basic concept of hedging or protecting against risk are not a patentable process because it is an unpatentable abstract idea); *Exergen Corp. v. Thermomedics, Inc.*, 132 F. Supp. 3d 200, 207–08 (D. Mass. 2015) (invalidating a patent on a forehead thermometer based on the insight that forehead measurements are reliable); Kevin Noonan, *Patent Watch: Diagnostic Patents at Risk After Federal Circuit Decisions*, 15 NATURE REVIEWS: DRUG DISCOVERY 377, 377 (May 20, 2016), <http://www.nature.com/nrd/journal/v15/n6/full/nrd.2016.105.html> (describing cases of diagnostic tools being deemed ineligible for patent protection).

121. *Content Extraction & Transmission LLC v. Wells Fargo Bank, Nat'l Ass'n*, 776 F.3d 1343, 1345, 1351 (Fed. Cir. 2014).

122. *Intellectual Ventures I LLC v. Symantec Corp.*, 100 F. Supp. 3d 371, 386 (D. Del. 2015), *aff'd in part, rev'd in part*, *Intellectual Ventures I LLC v. Symantec Corp.*, 838 F.3d 1307, 1313–16 (Fed. Cir. 2016).

123. Mark A. Lemley, *Software Patents and the Return of Functional Claiming*, 2013 WIS. L. REV. 905, 907.

124. *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1349 (Fed. Cir. 2015) (en banc), *superseding* 770 F.3d 1371 (Fed. Cir. 2014).

125. *Nautilus, Inc. v. Biosig Instruments, Inc.*, 134 S. Ct. 2120, 2124 (2014).

circuit court in the United States,<sup>126</sup> did away with the rigid rule that a finding of obviousness requires a teaching, suggestion, or motivation, and enabled examiners to rely more on common sense.<sup>127</sup>

The long-term impact on patent quality of recent case law shifts will depend on how these cases influence the behavior of applicants and the USPTO. Already these recent shifts have had a significant impact on the existing stock of challenged patents<sup>128</sup> and, all other things being equal, fewer inventions should be patent eligible. Some commentators believe that the U.S. patent system's patent quality woes began with the formation of the Federal Circuit as well as the *State Street* decision.<sup>129</sup> Whether they end with the current slate of decisions will depend, at least in part, on the robustness of other non-doctrinal dynamics.

The EPO's approach was, and continues to be, different. According to Chapter 52 of the European Patent Convention, only inventions with a technical character are eligible for patents, and methods of doing business and computer programs "as such" are explicitly excluded.<sup>130</sup> However, software inventions that nonetheless represent an "inventive step" towards solving a technical problem are patentable.<sup>131</sup>

### 3. Industry Effects—Defensive, Strategic, and Portfolio Patenting

The quality of issued patents depends on the quality of applications submitted to the patent office. But a number of factors independent of patent

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126. Roy E. Hofer, *Supreme Court Reversal Rates: Evaluating the Federal Courts of Appeals*, 2 LANDSLIDE 8, 8–9 (2010), [http://www.americanbar.org/content/dam/aba/migrated/intelprop/magazine/LandslideJan2010\\_Hofer.authcheckdam.pdf](http://www.americanbar.org/content/dam/aba/migrated/intelprop/magazine/LandslideJan2010_Hofer.authcheckdam.pdf) (documenting an 83% reversal rate for the Federal Circuit from 1999–2008, the highest among all circuits, and a 92.3% reversal rate in patent cases).

127. *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 407 (2007).

128. Robert R. Sachs, #*Alicestorm: July is Smoking Hot, Hot, Hot . . . And Versata is Not, Not, Not*, BILSKI BLOG (July 14, 2015), <http://www.bilskiblog.com/blog/2015/07/alicestorm-july-is-hot-hot-hotand-versata-is-not-not-not.html> (reporting an invalidation rate of ~70% of patents challenged on patentable subject matter grounds in the first thirteen months following the *Alice Corp v. CLS Bank International* decision).

129. JAMES BESSEN & MICHAEL J. MEURER, *PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK* 151 (2008).

130. See Convention on the Grant of European Patents art. 52, ¶ 2, Oct. 5, 1973, 1065 U.N.T.S. 199 [hereinafter European Patent Convention].

131. EUROPEAN COMM'N, *PROPOSAL FOR A DIRECTIVE ON THE PATENTABILITY OF COMPUTER-IMPLEMENTED INVENTIONS—FREQUENTLY ASKED QUESTIONS* 5 (2002), [europa.eu/rapid/press-release\\_MEMO-02-32\\_en.pdf](http://europa.eu/rapid/press-release_MEMO-02-32_en.pdf) (describing the standard for patentability applied by the EPO to software patents and noting that, by 2002, at least 30,000 patents for computer-implemented inventions had been issued by the EPO).

law have put upward pressure on the number of patents filed, and a corresponding downward pressure on the amount of time and money dedicated to each patent. Unpacking these motives reveals that the demand for patents will remain even as the courts remove some of the scope of patentable subject matter, reducing the chance that dramatic changes to the law will alone translate into dramatic changes in the number of application filings.

In technology areas characterized by cumulative innovation, for example, the purpose of patents has become largely strategic: entities seek patents in order to have something to trade with others and thereby achieve freedom to innovate, rather than to exclude others from the technology. The pursuit of patents over incremental improvements in order to build defensive arsenals, a dynamic that was spurred by the licensing campaigns of IBM and Texas Instruments in the late 1990s in software and technology industries, has been well-documented.<sup>132</sup> “Defensive” patenting is now pervasive in many industries besides computers.<sup>133</sup> The embrace of strategic or portfolio<sup>134</sup> patenting has also placed a greater emphasis on the quantity of the whole rather than the quality of the individual parts within a set of patents.

In a number of surveys, half or more of patentees say they pursue patents for defensive reasons,<sup>135</sup> and that the proportion of patents pursued primarily for those reasons is plausibly at least as high. Among the top fifty owners of patents,<sup>136</sup> many if not most of them are “high-tech” companies that depend on freedom of action in order to keep up with the rapid pace of competition.

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132. See, e.g., James Bessen & Robert M. Hunt, *An Empirical Look at Software Patents*, 16 J. ECON. & MGMT. STRATEGY 157, 157, 162 (2007) (providing empirical accounts of the apparent “arms race” in the semiconductor and software industries); Chien, *supra* note 16, at 299; Bronwyn H. Hall & Rosemarie Ham Ziedonis, *The Patent Paradox Revisited: An Empirical Study of Patenting in the U.S. Semiconductor Industry, 1979–1995*, 32 RAND J. ECON. 101, 101 (2001) (examining the propensity of semiconductor firms to obtain patents despite their ineffectiveness in appropriating returns to research and development (“R&D”)); Wesley M. Cohen et al., *Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not)* 26–27 (Nat’l Bureau of Econ. Research, Working Paper No. 7,552, 2000) (documenting the prevalence of defensive motives in patenting).

133. See, e.g., JESSICA SILBEY, *THE EUREKA MYTH: CREATORS, INNOVATORS, AND EVERYDAY INTELLECTUAL PROPERTY* 44–45 (2014) (documenting the prevalence of defensive patenting in biopharma industries).

134. Parchomovsky, *supra* note 22, at 5–6.

135. See Chien, *supra* note 107; see also discussion *supra* Section II.A for an overview of surveys.

136. *IFI CLAIMS 2014 Top 50 U.S. Patent Assignees*, IFI CLAIMS PAT. SERVICES (last updated Jan. 29, 2015), [http://www.ificlaims.com/index.php?page=misc\\_top\\_50\\_2014](http://www.ificlaims.com/index.php?page=misc_top_50_2014).

Over 2,000 companies, including five out of the top ten, have taken steps to commit some or all of their patents to defensive uses.<sup>137</sup>

Comparing national R&D and national patenting trends also provides information about the amount of investment reflected in each individual patent. As described earlier, the vast majority of companies doing R&D do not file for patents making the match between R&D and patents inexact at best.<sup>138</sup> However, based on independent calculations carried out for this Article and building on the work done by Hunt and Bessen,<sup>139</sup> I observe that the rise in the number of technology patents over the past few decades has been accompanied by a diminishing amount of R&D per patent.<sup>140</sup> This is

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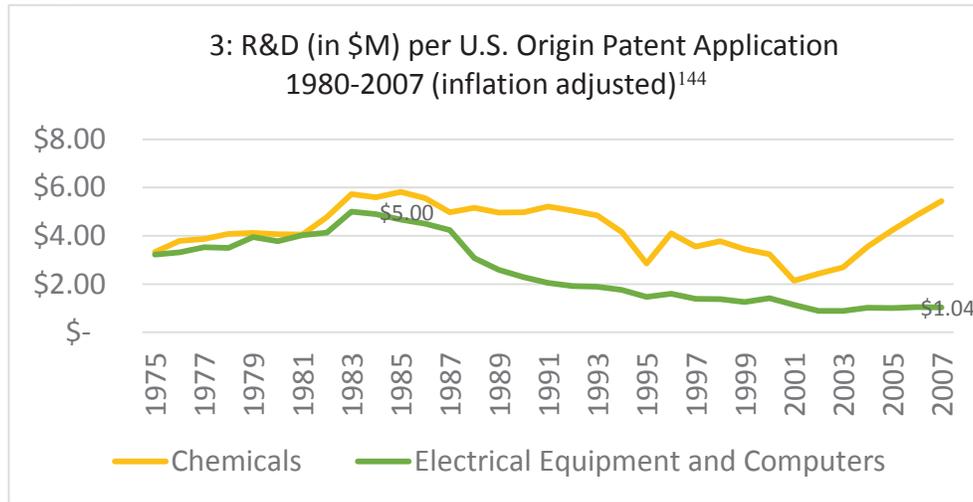
137. *The OIN Community*, OPEN INVENTION NETWORK, <http://www.openinventionnetwork.com/community-of-licensees/> (last visited Mar. 11, 2018) (listing over 2,050 companies as within the Open Invention Network community as licensees, members, or affiliate members, that commit themselves to the OIN patent non-aggression pledge). For further discussion of the OIN pledge and others, see Jorge L. Contreras, *Patent Pledges*, 47 ARIZ. ST. L.J. 543, 552 (2015).

138. Brandon Shackelford, *One in Five U.S. Businesses with R&D Applied for a U.S. Patent in 2008*, NAT'L SCI. FOUND., <http://www.nsf.gov/statistics/infbrief/nsf13307/> (last visited Mar. 11, 2018).

139. Bessen & Hunt, *supra* note 132, at 162–63.

140. In order to correlate R&D and patenting activity, I drew from two sets of data. For R&D data, I relied on the National Science Foundation's Survey of Industrial Research and Development, "the primary source of information on research and development performed or funded by businesses within the United States." The annual survey conducted by the Census Bureau examines a nationally representative sample of companies in manufacturing and nonmanufacturing industries, and establishes total U.S. R&D expenditures by the government and private companies. See *Business Research and Development and Innovation Survey*, NAT'L SCI. FOUND., <http://www.nsf.gov/statistics/srvyindustry/> (last visited Mar. 19, 2018). The survey reports on total manufacturing and non-manufacturing R&D by SIC code up to 1998, and NAICS code in 1999 and after. I took several steps to compensate for deficiencies in the data. First, at the individual line item level (encompassing one or more SIC codes), data over the time series was at times missing or suppressed for confidentiality reasons. To reduce distortions that could be caused by missing data, I selected for analysis the two subcategories—Chemicals and Computer and Electronic products—where few data points were missing: eight out of sixty-eight. I approximated these eight missing values by applying simple averaging or ratio functions based on available data, consistent with other researchers (correspondence with the NSF). The transition from SIC- to NAICS-based reporting created a discontinuity in the data in 1999. Although the SIC and NAICS categories that represent Chemicals and Computer/Electronic Products are similar, they are not a perfect match. To compensate, I applied a smoothing function to enable a time series view and performed checks on the individual time series before doing so. For patent counts, I relied on the USPTO's databases of patent and patent applications. I also relied upon their primary IPC number to associate them, using the "Algorithmic Links with Probabilities" ("ALP") concordance devised by Lybbert and Zolas to specific SIC and NAICS categories of interest. See Travis J. Lybbert & Nikolas J. Zolas, *Getting Patents and Economic Data to Speak to Each Other: An "Algorithmic Links with Probabilities" Approach for Joint Analyses of Patenting and Economic Activity* 7–10 (World Intellectual Prop. Org., Working Paper No. 5, 2012), [http://www.wipo.int/export/sites/www/econ\\_stat/en/economics/pdf/wp5.pdf](http://www.wipo.int/export/sites/www/econ_stat/en/economics/pdf/wp5.pdf). The match

consistent with the evolving industry dynamic discussed above, and likely due to other factors as well. Using R&D figures provided by the National Science Foundation by SIC/NAICS category, and the numbers of patents successfully applied for by U.S. entities during the same period within these categories,<sup>141</sup> I calculated the ratio between R&D and patents from 1980 to 2008. At its peak, in 1983, \$5 million of national R&D was spent per electrical equipment and computing patent. By 2007, according to the same methodology, this number had declined to about a fifth of that, \$1.04 million of national R&D per patent in inflation-adjusted dollars.<sup>142</sup> In contrast, chemicals patents have reflected a declining, but then rising R&D per patent ratio.<sup>143</sup>



from patents to industrial categories was inexact as, for example, patents were at times assigned to multiple IPCs, which were in turn associated with particular SIC or NAICS codes. I used the first IPC class to assign each patent to an industrial class, making each patent count potentially both under and over inclusive.

141. I relied on granted patents, rather than application data as it was not available for the entire period, however the results are reported by application, not grant date.

142. Based on applying a smoothing function to compensate for a change from SIC to NAICS-based reporting in 1999. *See infra* Figure 3.

143. *See* Helene Dernis & Mosahid Khan, *Triadic Patent Families Methodology* 22 fig.12 (OECD Sci., Tech. & Indus. Working Papers, No. 2004/02, 2004) (reporting relatively constant ratios of triadic patent families to industry-financed R&D from 1985 to 1999, based on residence of the inventor); *see infra* Figure 3.

144. Author analysis based on datasets from 1975–2007 found at NAT'L SCI. FOUND., <https://www.nsf.gov/> (last visited Mar. 19, 2018) and U.S. PAT. & TRADEMARK OFF., <https://www.uspto.gov/> (last visited Mar. 19, 2018).

Other studies, using different methodologies and timeframes, have shown mixed results regarding the overall ratio between R&D and patents.<sup>145</sup> However, two studies disaggregate patent per R&D by technology category and report findings consistent with my study, Kim and Marschke find that until 1983 patents per R&D in the computer industry declined, but from 1983 to 2000 it increased.<sup>146</sup> Patents per R&D decreased for the pharmaceutical industry through 2000.<sup>147</sup> In contrast, patents per million dollars in R&D doubled in information technology between 1989 and 1998, but patents per R&D remained stable for chemical and other technology categories.<sup>148</sup>

The downward trend in R&D per tech patent is consistent with the perception that over the past few decades more technology patent applications, each covering less, have been filed. Empirical work, generally surveys, have also led to a better understanding of the proliferation of reasons companies file for patents. For specialized innovators, like universities and technology specialists, patents facilitate transfer of the technology to commercialization partners.<sup>149</sup> Small companies and startups are motivated to file for patents in order to attract financing, in addition to reasons of exclusion and defense.<sup>150</sup>

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145. Compare Daniel Wilson, *Are We Running out of New Ideas? A Look at Patents and R&D*, FED. RES. BANK S.F. (Sept. 12, 2003), <http://www.frbsf.org/economic-research/publications/economic-letter/2003/september/are-we-running-out-of-new-ideas-a-look-at-patents-and-research-and-development/>, and WORLD INTELLECTUAL PROP. ORG., 2011 WORLD INTELLECTUAL PROPERTY INDICATORS 8 (2011), [http://www.wipo.int/edocs/pubdocs/en/intproperty/941/wipo\\_pub\\_941\\_2011.pdf](http://www.wipo.int/edocs/pubdocs/en/intproperty/941/wipo_pub_941_2011.pdf) (finding that U.S. R&D expenditures have increased faster than U.S. patenting has over the periods 1953–1999 and 1995–2010, respectively), with Samuel Kortum, *Equilibrium R&D and the Patent—R&D Ratio: U.S. Evidence*, 83 AM. ECON. REV. 450, 451 (1993) (finding that the ratio of patents to R&D fell between 1975 and 1989).

146. Jinyoung Kim & Gerald Marschke, *Accounting for the Recent Surge in U.S. Patenting: Changes in R&D Expenditures, Patent Yields, and the High Tech Sector*, 13 ECON. INNOVATION & NEW TECH. 543 (2004).

147. *Id.*

148. Diana Hicks et al., *The Changing Composition of Innovative Activity in the US—A Portrait Based on Patent Analysis*, 30 RES. POL'Y 681, 701 (2001).

149. Described, for example, in Ashish Arora et al., *The Acquisition and Commercialization of Invention in American Manufacturing: Incidence and Impact* 32 (Nat'l Bureau of Econ. Research, Working Paper No. 20264, 2014).

150. Stuart J.H. Graham et al., *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 BERKELEY TECH. L.J. 1255, 1303 (2009).

*B. Application Patent Quality Levers*

## 1. Separating the Wheat from the Chaff at the Application Stage

Certain patent mistakes are very expensive. Take the example of the ‘137 check imaging patent that was only invalidated after it had helped to generate licensing fees of \$350 million. None of the seven related applications at the EPO became a patent—four were refused outright by the EPO, and three were withdrawn.<sup>151</sup> In an ideal world, more resources would be allocated to examining such applications, while less would be used to vet those that will never be enforced. But on the same day the USPTO granted the ‘137 patent, it granted thousands of other patents. The vast majority were never asserted. A number of the patents likely served as the basis for a technology transaction, enhanced a company’s reputation for innovation, or were used to recognize the contributions of an inventor. Most probably just sat on the shelf, so economically unimportant that they were left to lapse before their full twenty-year term.<sup>152</sup> How important is it to ensure the quality, for example, of a patent relied upon by a young company to secure a bank loan but which the company has no intention of enforcing? Somewhat, two scenarios suggest. First, it is impossible for follow-on innovators to know that the intention of the patentee is to use the patent only in non-exclusionary ways, leading to greater inefficiency as others unnecessarily “design-around” the patent. Second, even if the original owner of the patent disavows exclusionary motives, things can change, for example, in the bankruptcy or sale of a company, or a shift in company strategy.<sup>153</sup> Patent trolls often buy patents from defunct or still operating companies that themselves often aren’t in a position to assert the patents, due, for example, to the threat of retaliation, reputational costs, or a lack of alignment with the business. If a patent is broad, even if its validity is highly suspect, it can still be used as the basis of a licensing campaign or lawsuits.

Still, given the diverse purposes of patents, it is worthwhile to consider how we might distinguish between applications that, once they mature into

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151. Based on reviewing the “Legal Events” of each application at *Google Patents Research Dataset*, *supra* note 79.

152. Patent holders abandon their patents before their full term in the majority of cases. *See, e.g.,* Kimberly Moore, *Worthless Patents* 14 (George Mason L. & Econ. Research, Working Paper No. 04-29, 2004); Dennis Crouch, *Maintenance Fees 2015*, PATENTLY-O (July 21, 2015), <http://patentlyo.com/patent/2015/07/maintenance-fees-2015.html> (showing that less than 50% of patentees pay the third renewal fee).

153. *See* Chien, *supra* note 16, at 342–44 (describing the phenomenon of “once defensive” patents turning offensive).

patents, are likely to matter, from the rest, and to allocate examination resources accordingly. One option would be to create two tiers of patent applications—one that receives little examination, and one that receives a lot. The move to a patent registration system in 1793 that Jefferson carried out<sup>154</sup> effected half of this transition, and both Germany and China allow inventors to apply for “petty patents,” that are registered with little examination, alongside regular utility patents.<sup>155</sup> In a similar vein, Lemley and colleagues have proposed allowing patentees to designate the applications they think matter and elect more rigorous examination for them. The applications that withstand the higher level of scrutiny would be considered “gold-plated” and would receive a heightened presumption of validity.<sup>156</sup> This proposal has often been coupled with another of Lemley’s ideas, that, regarding the other, less significant, patents, examiners are justified in remaining “rationally ignorant,” because the patents don’t matter.<sup>157</sup> An alternative to allowing applicants to “upgrade” their patent before they issue through heightened reviews, is to allow third parties to “downgrade” or invalidate after they issue, through post-grant quality reviews.

Differentially applying quality filters in these ways has problems, however. It is difficult for patentees to know ahead of time which patents are worth gold-plating, as a patent’s value only emerges over time.<sup>158</sup> The idea of relegating all remaining patents to limited review, because they don’t seem to matter, has been roundly criticized.<sup>159</sup> While post-grant challenges that take place after a patent has issued have the advantage of reflecting evolving market and technical conditions and information, they are expensive and time-consuming, and because they are largely brought by third-party challengers, in a sense, come “too late”—after the challenger has been accused in a patent case. An ideal mechanism would combine the virtues of these two approaches and eliminate their vices—by enabling the identification and heightened scrutiny of patents that are likely to be enforced to come later in a patent’s life and be initiated by the patentee as well as third

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154. See *infra* note 160.

155. See Dan Prud’homme, Creating a “Model” Utility Model Patent System: A Comparative Analysis of the Utility Model Patent Systems in Europe and China 9–12 (Dec. 23, 2014) (unpublished manuscript), <http://www.ipkey.org/en/ip-law-document/download/3842/3275/23>.

156. Mark A. Lemley et al., *supra* note 25, at 12 (recommending reducing the overall presumption of validity while strengthening it for certain patents that undergo more rigorous search and examination).

157. See Lemley, *supra* note 27, at 1497.

158. Colleen V. Chien, *Predicting Patent Litigation*, 90 TEX. L. REV. 283, 314–16 (2011) (analysis showing that the ability to identify which patents will be enforced improves over time).

159. See, e.g., Bronwyn H. Hall & Dietmar Harhoff, *Post-Grant Reviews in the U.S. Patent System—Design Choices and Expected Impact*, 19 BERKELEY TECH. L.J. 989, 992–94 (2004).

parties. I discuss one proposal for doing so, through the implementation of a “defensive only” patent, in Part IV.

However, if designating only certain applications for heightened quality reviews when they are applied for isn’t possible, another alternative is to increase quality for all patents during the examination process, which I explore next.

### III. PATENT QUALITY LEVERS AT THE EXAMINATION STAGE

Conversations about patent quality tend to devolve into discussions about patent office shortcomings. This Part begins differently, by following the lead of one of America’s first patent examiners, whose challenges with patent quality were discussed earlier, Thomas Jefferson. As historian P.J. Federico recounts, Jefferson was:

quite favorable to the granting of patents, and granted them with great consideration, the other duties of members of this Board, in view of their high offices, made it impossible for them to devote much time to this work, and as a result the law was changed in 1793 to make the granting of patents a clerical function.<sup>160</sup>

This transition reflected the sense that if examination couldn’t be done properly, it shouldn’t be done at all.

The case study described at the beginning of this Article highlights the challenges. Before the ‘137 check imaging patent was revoked by the USPTO, it was upheld by the USPTO,<sup>161</sup> in a proceeding called reexamination, as well as by a Texas jury.<sup>162</sup> The question of patent validity is not purely a technical determination, but also a legal and evidentiary one. To examine a patent, as described in Part II, requires interpreting and understanding the claims, applying external knowledge and references to an evolving legal standard, and arriving at a legal conclusion. To evaluate the application that eventually became the ‘704 podcasting patent, a Patent Examiner had to search for references that were more than a decade old. One of the references ultimately relied on to invalidate the patent, supplied by an

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160. P.J. Federico, *Commentary on the New Patent Act*, U.N.H. SCH. LAW, [https://ipmall.law.unh.edu/sites/default/files/hosted\\_resources/lipa/patents/federico-commentary.asp#\\_ednref1](https://ipmall.law.unh.edu/sites/default/files/hosted_resources/lipa/patents/federico-commentary.asp#_ednref1) (last visited Jan 23, 2018).

161. See discussion *supra* Part I; see also Lisa Lerer, *Senate, Old Legal Woes Drawn into Patent Fight*, POLITICO (Mar. 25, 2008), <http://www.politico.com/story/2008/03/senate-old-legal-woes-drawn-into-patent-fight-009202>.

162. See Hammerand, *supra* note 6.

outsider, not the USPTO or applicant, was an unpublished master's thesis from MIT.<sup>163</sup>

While examiners in the USPTO and EPO carry out the tasks described above in very different ways, they apply largely the same standards. There are some differences in how the tests are articulated—for example, European examiners apply an “inventive step,” rather than “obviousness” filter and, unlike American examiners, use a “problem-solution” approach to determine whether or not a patent application meets the standard.<sup>164</sup> For years, certain classes of prior art were not available in the United States, due to the American grace period, but these differences, minor to start with, have narrowed in recent years.<sup>165</sup> Trilateral studies of patent examination conducted by the USPTO, EPO, and JPO have found that, despite the different articulation of legal standards in each jurisdiction, the application of them and the same technical references to the same application yields largely the same outcomes.<sup>166</sup>

What explains, then, the differences in outcomes between the two jurisdictions? In the following paragraphs, I document that there are differences, not only with respect to the grant rate, which is higher for the USPTO, but also with respect to customer satisfaction and quality, which are also higher for the EPO. I focus on two practices that contribute to the EPO's favorable quality ratings. First, the EPO invests heavily in getting quality right upfront—it invests in more examiners, more time, and more checks in its initial determinations. The USPTO examination process, in contrast, has a high tolerance for mistakes, because it allows applicants to refile their rejected applications, and in many cases, get these cases allowed.<sup>167</sup> This

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163. Pers. Audio, LLC v. Elec. Frontier Found., 867 F.3d 1246, 1249 (Fed. Cir. 2017).

164. See, e.g., Stephen G. Kunin & Philippe J.C. Signore, *A Comparative Analysis of the Inventive Step Standard in the European and Japanese Patent Offices from a U.S. Perspective*, IP LITIGATOR, Jan.–Feb. 2008, at 15, 19–20.

165. Robert P. Merges, *Priority and Novelty under the AIA*, 27 BERKELEY TECH. L.J. 1023, 1046 (2012) (describing the redefined scope of prior art under the America Invents Act and closer, though not complete, alignment with global standards).

166. See, e.g., EUROPEAN PATENT OFFICE, JAPAN PATENT OFFICE & U.S. PATENT & TRADEMARK OFFICE, *COMPARATIVE STUDY ON HYPOTHETICAL/REAL CASES: INVENTIVE STEP/NON-OBVIOUSNESS 55* (2008), [https://www.jpo.go.jp/torikumi/kokusai/kokusai3/pdf/sinsa\\_jitumu\\_3kyoku/sinpo\\_en01.pdf](https://www.jpo.go.jp/torikumi/kokusai/kokusai3/pdf/sinsa_jitumu_3kyoku/sinpo_en01.pdf) (reporting that, out of six cases independently reviewed by the USPTO and EPO, the same result was reached in all of them); Melanie J. Howlett & Andrew F. Christie, *An Analysis of the Approach of the European, Japanese and United States Patent Offices to Patenting Partial DNA Sequences (ESTS)*, 34 INT'L REV. INDUS. PROP. & COPYRIGHT 581, 600 (2003) (finding that, “[d]espite the varied approaches [of the three offices] . . . the end result with respect to the success of the six claims was very similar for all offices”).

167. See Alisa S. Kao, *Peer Review of Patents: Can the Public Make the Patent System Better?*, 2007 U. ILL. J.L. TECH. & POL'Y 395, 401.

practice, while it limits the negative consequences associated with any single bad Examiner decision, makes Examiner inconsistency and mistakes tolerable, in turn, driving lower patent quality and satisfaction. Second, the EPO process has several notable safeguards for overcoming the tunnel vision that results from the ex parte nature of the examination process. Significant time and resources are dedicated to searching and accurately reflecting the state of the art resulting in a higher reliance on non-patent literature (“NPL”). A team examination approach is also used to reduce inconsistency and promote the application of “common sense” perspectives.

#### A. *The Differences in Grant Rates and What Explains Them*

This Article is not the first study to document the disparities in EPO and USPTO grant rates. Jensen and colleagues did a series of studies looking at comparative outcomes.<sup>168</sup> Analyzing a cohort of patent applications submitted to the Australian, European, and Japanese Patent Offices from 1990 to 1995 that matched as equivalents 9,618 U.S. patents,<sup>169</sup> they found that the Australian Patent Office granted almost all (86%) of these applications, while the JPO granted less than half of them (42.6%) with the EPO grant rate (74%) between them.<sup>170</sup> Harhoff and Graham analyzed the EPO counterparts of a sample of 2,474 U.S. patents litigated from 1973–2003 and their non-litigated counterparts, and report comparable grant rates, between EPO grant rates of 68% (among counterparts to non-litigated U.S. patents) and 80% (among counterparts to litigated U.S. patents), as compared to U.S. patents (100% grant rate).<sup>171</sup>

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168. Paul H. Jensen et al., *Disharmony in International Patent Office Decisions*, 15 FED. CIR. B.J. 679, 679–82 (2006); Alfons Palangkaraya et al., *Misclassification Between Patent Offices: Evidence from a Matched Sample of Patent Applications*, 93 REV. ECON. & STAT. 1063, 1063–64 (2011); Elizabeth Webster et al., *Characteristics of International Patent Application Outcomes*, 95 ECON. LETTERS 362, 367–68 (2007); Elizabeth Webster, Paul H. Jensen & Alfons Palangkaraya, *Patent Examination Outcomes and the National Treatment Principle*, 45 RAND J. ECON. 449, 464 (2014) [hereinafter Webster et al., *Patent Examination Outcomes*] (finding that local offices tend to favor local applicants).

169. Paul H. Jensen et al., *Application Pendency Times and Outcomes Across Four Patent Offices* 3–4 (Melbourne Inst. of Applied Econ. & Soc. Research, Working Paper No. 6/08, 2008), [http://melbourneinstitute.unimelb.edu.au/downloads/working\\_paper\\_series/wp2008n06.pdf](http://melbourneinstitute.unimelb.edu.au/downloads/working_paper_series/wp2008n06.pdf).

170. *Id.* at 11 tbl.1. These estimates are slightly deflated, as 1.7% to 13% of applications were still pending at the time of the analysis. *Id.*

171. Stuart J.H. Graham & Dietmar Harhoff, *Separating Patent Wheat from Chaff: Would the U.S. Benefit from Adopting Patent Post-Grant Review?*, 43 RES. POL'Y 1649, 1652–54 (2009) [hereinafter Graham & Harhoff, *Wheat from Chaff*]. In other work by the same authors, they found that EPO equivalents of U.S. litigated patent applications were more likely to be awarded EPO patent protection than were equivalents of non-litigated patents. Stuart J.H. Graham & Dietmar

One limitation of both of these studies is that they are based on U.S. patents, rather than applications, necessarily excluding applications that never matured into patents in the United States. It could be the case, for example, that while the EPO only grants a portion of U.S. patents, the inverse is also true—that the USPTO only grants a portion of EPO patents, reducing any perceived gap in allowance rates. Quillen and Cotropia have documented the relatively lower overall grant rate in the EPO, as compared to the USPTO, using official data.<sup>172</sup> But while their analysis, as well as the one that I report earlier in this Article, of applications from both jurisdictions, addresses the mismatch caused by comparing applications to patents, it could still be the case that the applications submitted to the EPO are weaker than those submitted to the USPTO, downward biasing the EPO grant rate, relative to the U.S. one. Another weakness of these studies is that, due to their design, they do not observe time and technology effects.

To address these limitations, I created a set of matched EPO-USPTO patent application twins from 2002. Patent rights are territorial, so an inventor seeking protection over the same invention in multiple jurisdictions must file multiple applications. If an applicant for a U.S. patent also seeks protection in Europe, she will typically file the same application, with slight modifications,<sup>173</sup> within a year to the EPO or WIPO. While there are numerous ways to associate EPO and USPTO patent applications, this Article used the most conservative approach and matched USPTO and EPO patent documents with identical priority dates and “family ID” numbers.<sup>174</sup> I

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Harhoff, *Can Post-Grant Reviews Improve Patent System Design? A Twin Study of U.S. and European Patents* 3 (Governance and the Efficiency of Econ. Sys., Discussion Paper No. 38, 2006), <https://epub.ub.uni-muenchen.de/13510/1/38.pdf>.

172. Christopher A. Cotropia et al., *Patent Applications and the Performance of the U.S. Patent and Trademark Office as of FY 2014*, at 3 (Intellectual Prop. Inst., Research Paper No. 2015-01, 2015) <https://law.richmond.edu/docs/FY-2014-Update-Figures-and-Tables-1996-2014-29.pdf>.

173. See Graham & Harhoff, *Wheat from Chaff*, *supra* note 171, at 1658.

174. Under the Patent Cooperation Treaty, a claim of “priority” to the first application by the second application confers the important benefit that the second application is treated as if it were filed on the same day as the first application. Patent Cooperation Treaty art. 8(2)(a), *supra* note 83. Subsequent applications can claim priority to one or more applications, within the same or different jurisdictions, creating the possibility of multiple applications within a single patent “family.” See *Patent Families*, EUR. PAT. OFF., <http://www.epo.org/searching-for-patents/helpful-resources/first-time-here/patent-families.html> (last visited Mar. 25, 2018). A patent family, in turn, can be either “simple” or “extended”—the members of a simple family share at least one common priority or “parent,” while members of an extended family include documents linked directly or indirectly through common priority claims. See *DOCDB Simple Patent Family*, EUR. PAT. OFF., <http://www.epo.org/searching-for-patents/helpful-resources/first-time-here/patent-families/docdb.html> (last visited Mar. 25, 2018); *INPADOC Extended Patent*

included in the set all available pairs from 2002<sup>175</sup> (N=82,758) and traced the fate of each application through the two jurisdictions.

Based on the same set of applications, 69% were granted in the United States,<sup>176</sup> while only 52% were granted in the EPO.<sup>177</sup> This difference was robust across all five sector categories—in each case, more U.S. than EPO patents were granted. Among technology sectors, the differences were most pronounced for electrical engineering applications.<sup>178</sup> While electrical engineering patent applications had a less than one in two chance of maturing into a patent in the EPO, they had a nearly three out of four chance of maturing into a U.S. patent.<sup>179</sup> This translated into a 28% difference between EPO and USPTO grant rates among electrical engineering patents. The difference was less pronounced, but still significant for the other classes of patents. Chemistry and mechanical engineering applications were about 9% more likely to mature into granted patents in the United States as compared to the EPO.<sup>180</sup>

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*Family*, EUR. PAT. OFF., <http://www.epo.org/searching-for-patents/helpful-resources/first-time-here/patent-families/inpadoc.html> (last visited Mar. 25, 2018). Patent families may also be formed through “expert-review,” for example through priority information as well as the review of content by experts as performed by the Derwent World Patent Index. *See also* Martínez, *supra* note 78, at 45. These matches, called “equivalents,” were determined in both PATSTAT and *Google Patents Research Dataset*, *supra* note 79.

175. That is, with a U.S. filing date in 2002. If a patent family included two or more applications filed in one patent office, I selected the application with the earliest filing date.

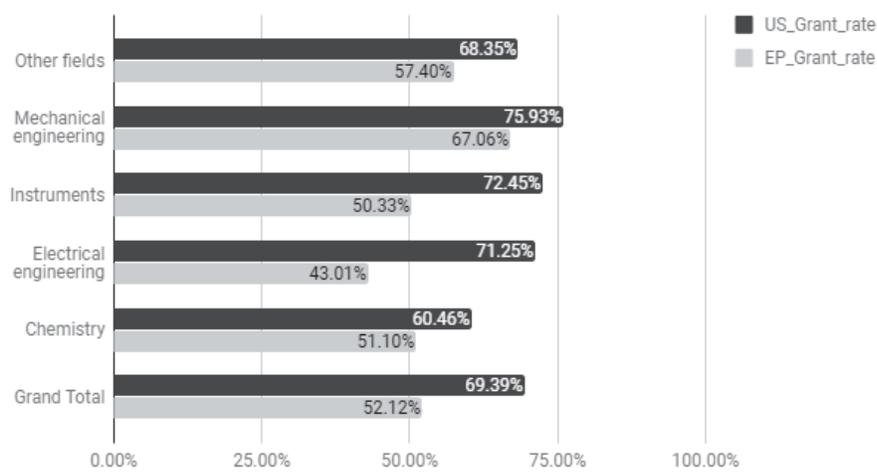
176. Designated by a “Granted” status in PATSTAT, the parallel “patentCaseMetadata.applicationStatusCategory” variable in the Google Patents Research Database, *supra* note 79 for U.S. patents, and the kind code variable in the same database for EPO Patents, drawing from the same source. While PATSTAT’s “granted” variable is viewed as very reliable by PATSTAT researchers, in two cases, it may not reflect the current status—first, because PATSTAT is not updated in real time, it does not always reflect the most recent months of grants. Second, where there is a subsequent revocation of a patent, the granted status does not reflect the change in status. Because, as reported *supra*, the number of U.S. applications in this paired set at the time of this analysis is less than 0.2% of the total, and revocations are rare, these issues should have limited, if any, impact on the reported results.

177. *See infra* Figure 4.

178. *See infra* Figure 4.

179. Of the 2,784 applications classified as “electrical engineering,” 76%, or 2,105, became U.S. patents, while 43%, or 1,273, became EPO patents. Colleen Chien, Harmony and Disharmony in International Patent Law n.85 (Feb. 1, 2016) (unpublished manuscript), <http://digitalcommons.law.scu.edu/cgi/viewcontent.cgi?article=1926&context=facpubs>.

180. *See infra* Figure 4.

FIG. 4: Comparative Grant Rates (N=82,758 matched pairs)<sup>181</sup>

To test the consistency and persistence of the observed difference, I compared grant rates across technology sectors and fields.<sup>182</sup> In every one of the thirty-five fields defined by WIPO, I found, the USPTO was more likely to grant a patent than was the EPO.<sup>183</sup> However, it is possible that the higher U.S. grant rates are an artifact of the period of time-tested, as the fluctuations in USPTO grant rates over time have been well-documented. To rule out this possibility, I expanded the analysis to a sample that included EPO applications matched to USPTO grants from the period from 1975 to 2014. I found the relatively lower EPO grant rate to persist over time, consistent with the findings of Quillen and Cotropia<sup>184</sup> and observed that the relative EPO grant rate, in fact, declined over the tested period, though I believe some of the decline is due to time effects. These results confirm and expand upon earlier results.<sup>185</sup>

181. Analysis from SCHMOCH, *supra* note 82 and *Google Patents Research Dataset*, *supra* note 79; accord Webster et al., *Patent Examination Outcomes*, *supra* note 168, at 460 tbl.3.

182. Using the PATSTAT dataset.

183. I performed t-tests on each difference, finding p-values between 0 and 2.49341704573321E-32, enabling rejection of the null hypothesis that the difference in grant rates was the result of chance.

184. Cotropia et al., *supra* note 99, at 3 fig.9 (documenting a persistently lower EPO grant rate from 1996 to 2013).

185. See, e.g., *id.* (documenting a lower EPO grant rate over time); Graham & Harhoff, *Wheat from Chaff*, *supra* note 171, at 1658 (finding the EPO to grant a fraction of USPTO patents in their samples); Webster et al., *Patent Examination Outcomes*, *supra* note 168, at 464. Webster and colleagues also reported comparative grant rates by select international patent classifications.

The pervasiveness of the gap in grant rates across technology areas between the two jurisdictions is striking. What explains it? There are several possibilities. One is that EPO patents are seen as less valuable than U.S. patents, and more prone to be abandoned during the application process due to factors outside of the examination process. Though this possibility can't be ruled out, the considerable expense that goes into preparing a patent application would seem to screen in only high-value applications worth filing in both jurisdictions. Another explanation might be differences in the stringency of examiners and the relative leniency of USPTO examiners. If this was the case, we would expect a lower rate of rejection in the USPTO than the EPO, a testable hypothesis.

To probe whether or not applicants experienced fewer rejections at the USPTO than the EPO, consistent with the hypothesis of Examiner leniency, I compared the outcomes of non-granted and granted cases, taking into account key differences among possible outcomes. The allowability of an application filed at the EPO is determined over a series of steps, culminating, if it proceeds all the way, in an Examiner's decision to grant or refuse the application.<sup>186</sup> Along the way, the applicant may withdraw from the application process, affirmatively or passively, or the application may remain pending, leading to each application having one of four statuses: granted, withdrawn, refused, or still pending.<sup>187</sup> The USPTO process is similar in a number of ways, allowing applicants to "abandon" their cases by not responding to an office action or paying a patent issue fee, but it also differs in one important way—a U.S. Patent Examiner can never definitively refuse an application after examining it.<sup>188</sup> This is because, in the USPTO, unlike anywhere else in the world, applicants have the right to continue examination with the patent office despite a final rejection, by filing a request for continued examination ("RCE"), or, within a limited period of time, a continuation application. There are no limits to the number of times an applicant can refile the same application, and the negotiation can go on for

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Webster et al., *Patent Examination Outcomes*, *supra* note 168, at 459. While they do not correspond with the industry sectors from WIPO that I considered, they also found relatively smaller differences in the treatment of mechanical and instruments patent applications and relatively larger differences in grant rates of hardware and communications applications. *Id.* at 451–52.

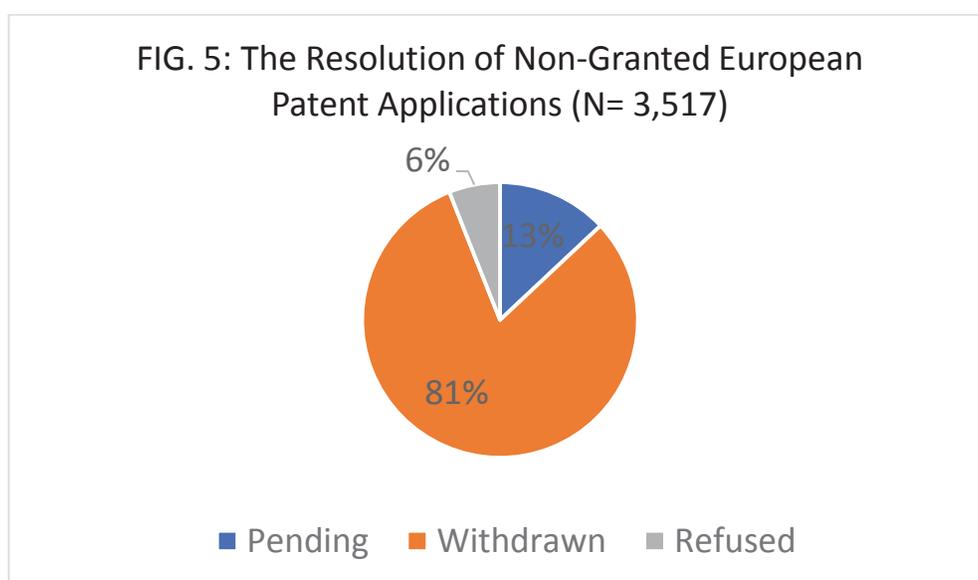
186. See *Guide for Applicants: How to Get a European Patent*, EUR. PAT. OFF. (July 1, 2017), <http://www.epo.org/applying/european/Guide-for-applicants/html/e/index.html>.

187. See Jensen et al., *supra* note 168, at 680 (describing the four potential outcomes of a patent application).

188. Lemley & Moore, *supra* note 19, at 66–67.

years.<sup>189</sup> As a result, patent applications filed at the USPTO only have three effective statuses: granted, withdrawn (or abandoned), or still pending.

I looked at the legal status histories of EPO non-granted patent applications in my cohort to determine how they were resolved.<sup>190</sup> But the results of the analysis revealed a surprising result—that when an application was not granted at the EPO, in most cases, the reason was not that a case had been refused, but instead that it had been withdrawn.<sup>191</sup> Among the 3,517 applications that were not granted in the EPO, 81% of non-granted cases were withdrawn by the applicant, while 13% were pending and 6% were refused. Of the USPTO counterparts to these non-granted EPO applications, in contrast, the majority (64%) were granted, and the rest were abandoned.<sup>192</sup>



189. Although delays that are not attributed solely to the patent office count against the effective term of the patent.

190. For non-granted EPO applications, I relied upon the “Legal Status” filed in PATSTAT associated with each patent application in the September 2002 cohort.

191. See *infra* Figure 5.

192. Out of the 3,516 matched applications that were not granted in the EPO, 2,257 or 64% were granted in the U.S., the rest were abandoned, based on my hand-inspection of a sample comprising 295 file histories associated with these patents (yielding a 95% confidence rating / 5% confidence interval).

*B. Investing in Accuracy at the EPO v. Tolerating Error at the USPTO*

When one looks at the EPO examination process to explain the large share of withdrawn applications, a few features stand out. First, in the EPO, as in other jurisdictions,<sup>193</sup> search and examination are separate, and examination only takes place if there is an affirmative request for examination.<sup>194</sup> This results in a large percentage of applications being abandoned even before examination has taken place; as EPO President Battistelli has stated, “[p]atents are granted in 49% of total filings, with 22% of applications abandoned after the search report and 29% abandoned after examination.”<sup>195</sup> In the cohort studied in this Article, in which 81% of non-granted European cases were withdrawn, that translates into 35% of cases withdrawn after search, and 46% after examination.<sup>196</sup>

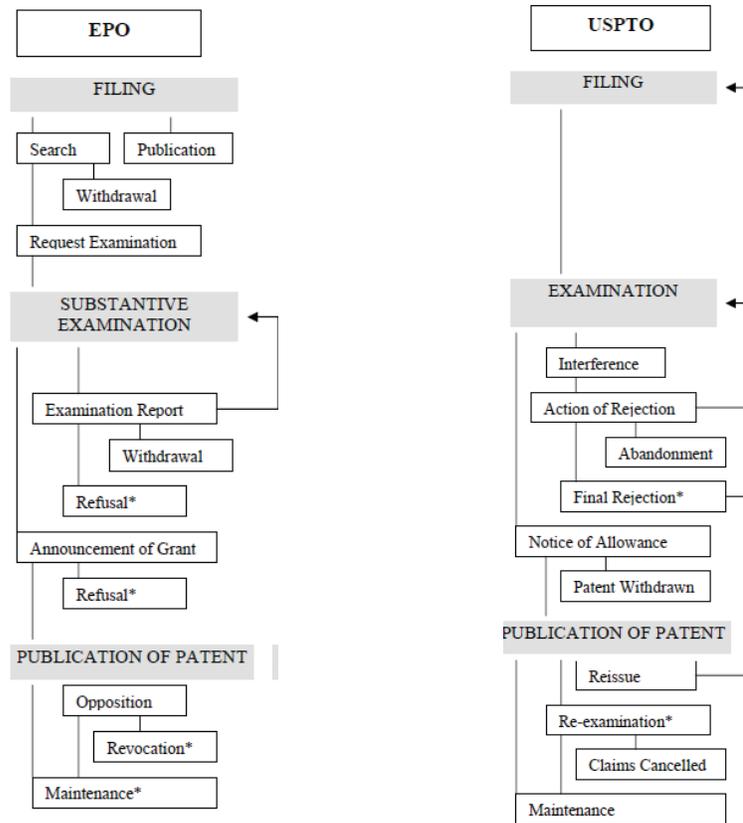
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193. The Japanese, Korean, and Chinese patent offices also share this feature. IP5 STATISTICS REPORT, FIVEIPOFFICES 58 fig.4.9 (2013), <http://www.fiveipoffices.org/statistics/statisticsreports/2013edition/ip5sr2013corr.pdf>.

194. See *infra* Figure 6.

195. Press Release from John B. Pegram, Delegate of Am. Intellectual Prop. Law Ass’n, 30th Annual U.S. Bar-EPO Liaison Council Meeting (Oct. 30, 2014), [http://www.aipla.org/committees/committee\\_pages/IP-Practice-in-Europe/Committee%20Documents/Annual%20Meeting%202014/US%20Bar-EPO%20Liaison%20Council/EPO%20Liaison%20Report%2010%2030%202014.docx](http://www.aipla.org/committees/committee_pages/IP-Practice-in-Europe/Committee%20Documents/Annual%20Meeting%202014/US%20Bar-EPO%20Liaison%20Council/EPO%20Liaison%20Report%2010%2030%202014.docx). These figures include rejections, which are overwhelmingly provided during the examination, not search, phase of patent prosecution. *Id.*

196. See *supra* Figure 5.

FIG. 6: Examination Procedures at the EPO and the USPTO<sup>197</sup>

But while the EPO process affords the applicant discretion during examination, this discretion in principal ends when the patent is refused. At this point, the applicant's options are limited<sup>198</sup> as the EPO has decided the

197. See THE IP5 OFFICES, IP5 STATISTICS REPORT: 2013 EDITION (2014), <https://www.fiveipoffices.org/statistics/statisticsreports/2013edition/ip5sr2013corr.pdf>.

198. The applicant can still do two things: file an appeal, which will be heard by the Boards of Appeal, or, if time limits permit, file a divisional application. See Dietmar Harhoff, *Patent Quality and Examination in Europe*, 106 AM. ECON. REV. 193, 195–96 (2016). The EPO does not have “continuation” or “continuation in part” applications, and if a parent application is refused it is possible that the child application is also refused. See *id.* at 193 n.1. Since the application is searched as a whole, and the content of the divisional cannot extend beyond the originally filed application (the parent), the chances of success are viewed as not great. *Id.* However, this apparently has not deterred the consistent use of divisional applications at the EPO in recent years even as the fees charged by the EPO have risen. See *id.* at 195–96 (describing effects of recent administrative reforms at the EPO, resulting in claims numbers declining, claims sections in patents becoming shorter, and independent claims longer and presumably more specific, but continued use of divisional filings).

merits of the case, and reached a determination that the patent as filed does not meet its requirements. In contrast, in the United States, even if the Examiner has reached a “final” decision about the application’s success or lack of success, the applicant has the right to file the application over and over and have new claims submitted and considered.<sup>199</sup>

The ability of applicants to extend examination has benefits for applicants who can use the additional time to determine whether or not their invention is commercially valuable, as well as to avoid the consequences of an Examiner that improperly rejects their claims. But the ability to extend examination indefinitely has also raised concerns because it enables applicants to draft patent claims to cover emerging developments in the marketplace, interfering with competition.<sup>200</sup> “Submarine” patents, patents which are delayed in examination before being “launched” onto a mature industry, have been a feature of the U.S. patent since at least 1873, when the Woodbury planing-machine patent was issued twenty-four years after it was filed, and subsequently used as the basis for mass litigation.<sup>201</sup>

The inability of U.S. patent examiners to definitively dispense of patent applications has consequences for patent quality. It effectively incorporates a high tolerance for mistakes made by an Examiner in her rejection of the application, as a continued filing or a refiling can overcome an Examiner’s adverse “final rejection.” This, in combination with the high levels of inconsistency among examiners documented by others,<sup>202</sup> encourages patentees who at first do not succeed to try, and try again, in what has been described as an attempt to “wear down” the Examiner,<sup>203</sup> or get another, “better” or more favorable one. This fact contributes to an overall dynamic in which the failure of the applicant and Examiner to get it right, in a sense, is viewed as routine and expected, and lacking in permanent consequence as to the eventual grant of the application.

The same tolerance for error is not present in the EPO process. Instead, the EPO invests more upfront in ensuring that the prior art search report is comprehensive and that the substantive examination of the invention and application are technically correct. This greater investment translates into more people, more time, and more checks during the process.

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199. Tu, *supra* note 54, at 16.

200. See Lemley & Moore, *supra* note 19, at 78 (criticizing this practice because it “invites abuse of the system” and “seems fundamentally unfair”).

201. CHRISTOPHER BEAUCHAMP, INVENTED BY LAW 100 (2015).

202. See discussion *supra* Part I.

203. Lemley & Moore, *supra* note 19, at 74–75.

For example, in the EPO, an Examination Division of at least three examiners<sup>204</sup> makes the decision to grant a patent.<sup>205</sup> When an application advances to the examination phase, a first Examiner, a second Examiner, and a chairman are assigned to the case, “[f]or maximum objectivity.”<sup>206</sup> Although the first Examiner bears primary responsibility, she confers with her colleagues and the decision to grant or refuse a patent is issued by the entire Division.<sup>207</sup> This panel approach reduces the risk of inconsistency, and the impact of an individual outlier Examiner as decisions are the product of a group review. Although the process of search at the EPO is carried out by a single Examiner, the Examiner is required to consult with other examiners if her search report is positive, to avoid improperly raising the expectations of the applicant. In the United States, an application is also assigned to an art unit or group of examiners. However, the decision to allow the patent is the responsibility of a single Examiner, though a Supervisory Patent Examiner (“SPE”) may weigh in.<sup>208</sup>

The significant investment by the EPO in upfront patent examination is also reflected in the amount of time that examiners are allocated. According to a study by van Pottelsberghe de la Potterie, former EPO Chief Economist, EPO examiners on average get about thirty hours to examine a patent, versus thirteen at the USPTO.<sup>209</sup> Much of the extra time is spent earlier, rather than later in prosecution, as further discussed below.

### C. Looking Beyond the Patent Office, at Non-Patent Literature

To be clear, through this comparative analysis, this Article does not take the position that the United States reduce its grant rates to EPO levels or move overnight to separate examination from search, for example. The relatively greater investment of the EPO in quality comes at a cost—for example, while U.S. examiners have less time to carry out search and examination tasks, their output is also higher than their counterparts—each U.S. Examiner examines an average of 1,700 claims per year, versus 500 per EPO Examiner.<sup>210</sup> The

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204. At times, a fourth legal counselor, is added to the Division. E-mail correspondence with Alfred Spigarelli, Dir. Patent Procedures Mgmt., European Patent Office (Sept. 11, 2015).

205. Van Pottelsberghe de la Potterie, *supra* note 70, at 1779.

206. *The Patenting Process*, EUR. PAT. OFF., <http://www.epo.org/learning-events/materials/inventors-handbook/protection/patents.html> (last updated May 9, 2011).

207. European Patent Convention, *supra* note 130, art. 18, ¶ 2.

208. See Carley et al., *supra* note 48, at 207–09 (providing an overview of the examination process).

209. Van Pottelsberghe de la Potterie, *supra* note 70, at 1778–79 n.9.

210. *Id.* at 1778.

fees associated with a U.S. patent are lower, and are among the lowest in the world per capita, when examination and maintenance fees are taken into account.<sup>211</sup> While discussion of the tradeoffs between cost and efficiency is saved until later in this Article, this section discusses the outcomes associated with the EPO's additional investment in quality, keeping in mind technical accuracy, social calculus, and applicant satisfaction.

To do so requires returning to the basic task of a patent Examiner—to ensure that patents are granted to novel and nonobvious ideas. Although seemingly simple, finding the closest reference to an invention has long been recognized as challenging. For example, in 1967, a Presidential Commission opposed granting software patents for this reason, stating that “[t]he Patent Office now cannot examine applications for programs because of the lack of a classification technique and the requisite search files. Even if these were available, reliable searches would not be feasible or economic because of the tremendous amount of prior art being generated.”<sup>212</sup> To carry out searches requires an Examiner to be “a living encyclopedia of science. . . . His multifarious duties require an intimate and thorough knowledge of the whole circle of science and art.”<sup>213</sup> While the U.S. Patent Commissioner in his Annual Review wrote these words in 1845, the challenges remain.

It is no longer feasible, for example, if it ever were, for patent examiners to know the relevant art in all technology fields. This puts pressure on the classification of applications, which in turn determines the universe of prior art that is searched in the first instance. Compounding the problem, particularly within high-technology areas, is the prevalence of non-standard ways of referring to technical object, and the diversity of relevant technology precursors to any particular invention. An Examiner looking for prior references to “smartphones” may need to search the literature on pagers, telephony, mobile communication, and personal computers, for example. In contrast, there are only a limited number of ways to refer to a hydrogen molecule.<sup>214</sup>

Perhaps the most significant problem, however, is the large volume of innovation that happens outside of the patent system. The job of an Examiner

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211. See *infra* Figure 9.

212. S. COMM. ON THE JUDICIARY, 90TH CONG., REPORT OF THE PRESIDENT'S COMMISSION ON THE PATENT SYSTEM 21 (1967), <http://digitalcommons.law.scu.edu/historical/9>.

213. H.R. COMM. ON PATENTS, 29TH CONG., REPORT OF THE COMMISSIONER OF PATENTS 4 (1846); see DRAHOS, *supra* note 32, at 149 n.27.

214. FED. TRADE COMM'N, THE EVOLVING IP MARKETPLACE: ALIGNING PATENT NOTICE AND REMEDIES WITH COMPETITION 128 (2011), <https://www.ftc.gov/sites/default/files/documents/reports/evolving-ip-marketplace-aligning-patent-notice-and-remedies-competition-report-federal-trade/110307patentreport.pdf>.

is to evaluate the invention before them in light of the current state of the art. While patents provide some indicia, the patent statute requires many other classes of references, including any written materials (digitized or not), sales, and prior uses of inventions, to be considered. Only one in five companies doing research and development files for patents,<sup>215</sup> and in many industries technology is now openly disseminated in written yet non-standard form, whether through shared source code, standards, or technical disclosures. There are ways for the patent office to access these outside perspectives, including through submissions by the applicant, who is required to disclose all relevant references to the patent office. However, the limited amount of time that U.S. examiners have to conduct prior art searches, and the ex parte nature of the patent examination, as I have previously described, tend towards tunnel vision and the decision to grant, rather than deny, applications.

A number of scholars have looked at the adequacy—or inadequacy—of references relied upon during examination. These studies have documented the heterogeneity in citation patterns,<sup>216</sup> and compared references provided by the applicant to references found independently by the Examiner.<sup>217</sup> However, to date there has been no systematic way to measure the quality of examination based on prior art, raising again the problem of measurement.

An important indicia of the quality of examination is the extent to which non-patent references are cited by the Examiner. Working scientists and engineers, whose knowledge is to serve as the yardstick for evaluating the technical merit of an invention, largely do not rely on patents to figure out whether or not something has been done before or how to do it.<sup>218</sup> Neither should patent examiners, although patents may be the easiest source for them to access, since they are generated for examiners and with the input of examiners (on the claims). Studies have documented the greater prevalence of non-patent prior art references among certain, highly litigated patents,<sup>219</sup> as well as the greater propensity of applicants to submit non-patent references

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215. BRANDON SHACKELFORD, ONE IN FIVE U.S. BUSINESSES WITH R&D APPLIED FOR A U.S. PATENT IN 2008 1 (2013), <https://www.nsf.gov/statistics/infbrief/nsf13307/nsf13307.pdf>.

216. Juan Alcácer, Michelle Gittelman & Bhaven Sampat, *Applicant and Examiner Citations in U.S. Patents: An Overview and Analysis*, 38 RES. POL'Y 415, 427 (2009).

217. See Christopher A. Cotropia, Mark A. Lemley & Bhaven Sampat, *Do Applicant Patent Citations Matter?*, 42 RES. POL'Y 844, 844 (2013).

218. See Colleen V. Chien, *Contextualizing Patent Disclosure*, 69 VAND. L. REV. 1849, 1860–61 (2016), for a summary of the relevant literature on the use of patents as sources of technical information.

219. John R. Allison, Mark A. Lemley & Joshua Walker, *Extreme Value or Trolls on Top? The Characteristics of the Most-Litigated Patents*, 158 U. PA. L. REV. 1, 15 (2009) (finding most-litigated patents to cite ten times as many non-patent prior art references when compared to a controlled set).

to the Examiner for her consideration.<sup>220</sup> However, just because a reference was submitted to the Patent Examiner does not mean that the reference was meaningfully considered in the course of examination. Indeed, Cotropia and colleagues have documented the disproportionate reliance by examiners upon the references they find themselves, and on patent references, and the tendency of examiners to ignore art that is submitted by applicants.<sup>221</sup> To put yourself in the eyes of someone in the field, the Examiner's basic job requires one to read what those in the field are reading and to understand the references that one in the field understands. An important indicator that the Patent Examiner is doing her job is the Examiner's citation of non-patent literature.

The metric of Examiner reliance on non-patent literature has several advantages. To a greater degree than in other areas of patent law, there's little debate about the centrality of prior art to the core examination function.<sup>222</sup> The extent of U.S. Examiner reliance on non-patent literature is also readily observable, due to a policy change in 2001 in the way in which patent citations are reported.<sup>223</sup> Perhaps most importantly, the USPTO itself has recognized the importance of "ways to get the best prior art in front of an Examiner as soon as possible in the examination process," making it a priority in its most recent patent quality initiative.<sup>224</sup> As part of a number of executive actions undertaken by the Obama White House including during my tenure there, the USPTO launched a number of initiatives to bolster the use of non-patent literature and consideration of outside perspectives.<sup>225</sup>

To take stock of the extent of U.S. and EPO Examiner reliance on non-patent literature in examination, I returned to the matched sample of patents, focusing in particular on patent applications filed in 2002. In the United States, Examiner citation patterns are memorialized in two ways in U.S.

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220. See Cotropia et al., *supra* note 99, at 846–47.

221. *Id.* at 849.

222. See, e.g., Letter from Alan J. Kasper, President, Am. Intellectual Prop. Law Ass'n, to David J. Kappos, Dir. of the U.S. Patent & Trademark Office (June 23, 2010), <https://www.uspto.gov/sites/default/files/patents/law/comments/aipla23jun2010.pdf> ("Core to substantive quality is the prior art search.").

223. See Memorandum from Nicholas P. Godici, Comm'r for Patents, U.S. Dep't. of Commerce, on Advance Notice of Change to "References Cited" on the Front Page of a Patent (Nov. 29, 2000), <http://www.uspto.gov/web/offices/com/sol/og/2000/week52/patrefr.htm> (noting that "[w]hen an examiner lists references on a Form PTO-892, the examiner lists references that are relied upon in a prior art rejection or mentioned as pertinent").

224. Request for Comments on Enhancing Patent Quality, 80 Fed. Reg. 6475 (Feb. 5, 2015).

225. See, e.g., *USPTO-Led Executive Actions on High Tech Patent Issues*, USPTO (June 4, 2013), <https://www.uspto.gov/patent/initiatives/uspto-led-executive-actions-high-tech-patent-issues>.

patent records. First, during the course of examination, the Examiner lists the references that she relies upon in a prior art rejection or mentions as pertinent in a separate form.<sup>226</sup> Each reference is designated as belonging to one of three categories: U.S. patent reference, foreign patent reference, or non-patent document.<sup>227</sup> Second, whenever a patent application or patent is published, the same references “relied upon by Examiner” are memorialized through an asterisk on the face of the publication, according to a practice that was introduced in 2001.<sup>228</sup> Just as is the case with references cited by the Examiner during examination, front page citations are designated as falling into one of three categories: “U.S. Patent documents,” “Foreign Patent documents,” or “Other Publications.” The Examiner is allowed, but not required, to draw from search reports provided by international searching authorities or references provided by applicants when they decide which references to rely upon.

In the EPO, search and examination proceed separately.<sup>229</sup> During the search phase, the EPO Examiner, in consultation with other examiners as described earlier, reviews the prior art. A report including the results of the search, as well as an initial opinion regarding patentability based on the search, is published by the EPO.<sup>230</sup> In cases where EPO applications have been first filed internationally, and the EPO is designated as the search authority, preparation of the international search report fulfills the search phase, and the Examiner that performs this search becomes part of the EPO team assigned to the application, should it advance to the examination phase.<sup>231</sup> When the internationally filed patent application is subject to an earlier search carried out by another office, the EPO Examiner may generate an additional, “supplementary search,”<sup>232</sup> to complement the existing

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226. See Memorandum from Godici, *supra* note 223.

227. See Form PTO-892, USPTO, [http://www.uspto.gov/web/offices/pac/mpep/graphics/707\\_05a.png](http://www.uspto.gov/web/offices/pac/mpep/graphics/707_05a.png) (last visited Mar. 27, 2018); see also MPEP § 1302.12 (9th ed. 2015).

228. See Memorandum from Godici, *supra* note 223.

229. See *supra* Figure 6.

230. Generally, EPO search reports are published as an Annex to the “A1” publication of the patent application eighteen months after the application was filed, an “A2” or “A3” publication of the application, or a “A4” supplementary search. See *infra* note 234. EPO “B” publications, which are granted patents, do not include search report results (U.S. “B” publications do contain the citation history of the patent). KRIS LOVENIERS, HOW TO INTERPRET EPO SEARCH REPORTS 13 (2014), <http://people.unica.it/liaisonoffice/files/2014/05/How-to-Interpret-EPO-Search-Reports.pdf>; *Basic Definitions*, EUR. PAT. OFF. (last updated Apr. 18, 2017), <http://www.epo.org/searching/essentials/definitions.html>.

231. See E-mail correspondence with Alfred Spigarelli, *supra* note 204.

232. *Basic Definitions*, *supra* note 230.

international search. The search report designates the ways in which the Examiner is relying on the references through a series of codes, with the most common codes representing documents that establish the application's lack of novelty ("X" document) or inventive step ("Y").<sup>233</sup> The references cited by the EPO Examiner and in international search reports are accessible in the EPO at two different websites, "Espacenet" and "EP Register," the latter of which also includes search results associated with EPO applications that have been filed internationally and searched by a non-EPO national office, and some applicant filed citations.<sup>234</sup> Each cite identifies the source of the citation: international search report, European Patent ("EP") search, or applicant search, and I included the first two categories as "Examiner-cited."

The USPTO distinguishes between prior art that is actually relied upon by the Examiner and art that is merely provided to the Examiner, for example through an information disclosure statement, by designating the former with a \* (star) citation on the face of the patent. The EPO similarly distinguishes between core ("X" or "Y") and non-core references ("A" and "B") through letter designations reported in the search report.<sup>235</sup> In consultation with

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233. See LOVENIERS, *supra* note 230, at 27.

234. The two databases vary in scope and purpose, but for the identification of Examiner-cited prior art, have few differences except that the EP Register includes references generated by non-EP searching authorities in the case of EP patents first filed through the PCT (it also includes some additional references cited by the applicant, but I do not include such references in my analysis as they are not "Examiner-cited"). Espacenet is a database of publications and documents, comprising patent publications from all around the world, including those from the EPO. *Espacenet Patent Search*, EUR. PAT. OFF., <https://www.epo.org/searching-for-patents/technical/espacenet.html#tab-1> (last visited Mar. 17, 2018). Espacenet also includes other prior art documents such as non-patent literature, designs, utility models, etc. Espacenet is, in short, a "prior art" database. EUROPEAN PATENT OFFICE, *ESPACENET RESOURCE BOOK 95* (2.1 ed. 2017). The European Patent Register is a database of legal and procedural status data, only for patents processed by the EPO. It also contains access to the file wrapper associated with each patent dossier. See *European Patent Register*, EUR. PAT. OFF., <https://www.epo.org/searching-for-patents/legal/register.html#tab-1> (last visited Mar. 9, 2018). References at both websites can be found in the "citations" tab of an application, however, the EP Register consolidates information from all publications into a single website, whereas Espacenet has different pages for each publication. See *Bibliographic Data: EP2021283 (A1)*, EUR. PAT. OFF. (Feb. 11, 2001), <http://worldwide.espacenet.com/publicationDetails/biblio?CC=EP&NR=2021283A1&KC=A1&FT=D> (providing EPO patent application for EP2021283 with publications A1 and A4); *Bibliographic Data: EP2021283 (A4)*, EUR. PAT. OFF. (July 7, 2010), <http://worldwide.espacenet.com/publicationDetails/biblio?CC=EP&NR=2021283A4&KC=A4&FT=D> (noting the separate Espacenet links to publications A1 and A4 listing); *EP2021283—Mechanically Reversible Gel*, EUR. PAT. OFF. (Apr. 10, 2017), <https://register.epo.org/application?number=EP07748672&tab=main>.

235. In particular I focused on the following fields: "citation.publication\_number," "citation.application\_number," "citation.npl\_text," which are from the table "patents:publications." Where "citation.npl\_text" was equal to a non-null value, I considered the citation

officials from both offices, I developed logic to track the extent to which an EPO or USPTO Examiner, in the course of examining a patent application, relied upon non-patent literature references, designated with a star in the case of U.S. patents, or an X or Y reference in the case of an EP reference.

I used this data to calculate two metrics of Examiner cited NPL—first, whether or not “any NPL” had been relied upon by an Examiner, and second, the share of all Examiner-cited references in a given patent application that were non-patent literature. If, for example, the Examiner relied upon ten references during a case’s prosecution, one reference consisting of non-patent literature, that case was coded as including Examiner-cited NPL and an Examiner-cited NPL share of 10%.

I first probed both metrics among U.S. patents granted on the basis of 2002 filings and counterpart EPO publications (N= 38,397 matched pairs). Because star citation data is reliable only among U.S. granted patents, not applications,<sup>236</sup> I excluded applications that were filed but never matured into issued patents, introducing some selection effects. Also excluded were EP cases that relied only on an international search report, as their characteristics are not reflected in the bulk data.<sup>237</sup> These adjustments winnowed the total number of matches with full data to 19,122.

The results are shown in Figure 7A. They suggest that, among the matched pairs in this sample, EPO examiners cite NPL to a greater extent than U.S. examiners. While U.S. examiners cited NPL in about 15% of the matched cases, in EP cases the comparable figure was more than double that, 31%. The finding that European examiners are more likely to cite NPL than their U.S. counterparts was robust across all technology sectors.<sup>238</sup> Strong sector effects could also be observed; EP electrical engineering patents are three times more likely to include examiner-cited NPL (35% versus 12%) than

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to be non-patent literature except in the small share of cases of “See references of WO . . .” or “See also references of WO . . .” references, which refer to an international search report. In both U.S. and EP cases, I only counted NPL that was Examiner-cited (as opposed to “APP,” or applicant-cited), as designated by an “SEA, ISR, SUP, PRS, and EXA” (SEA = Search report; ISR = International search report; SUP = Supplementary search report; PRS = Pre-grant pre-search; EXA = Examiner) in the “citation.category.” Moreover, in EP cases, because I cared only about “X” or “Y” citations, I also excluded data where the filed “citation.type” was “A.” From a manual inspection of the results, it appeared that foreign patent references were not captured by the search above. Foreign patent references (which often need to be translated) arguably have traits that make them like both patent and non-patent literature, and for the purposes of this analysis, we excluded them, however, how to characterize such references warrants further investigation.

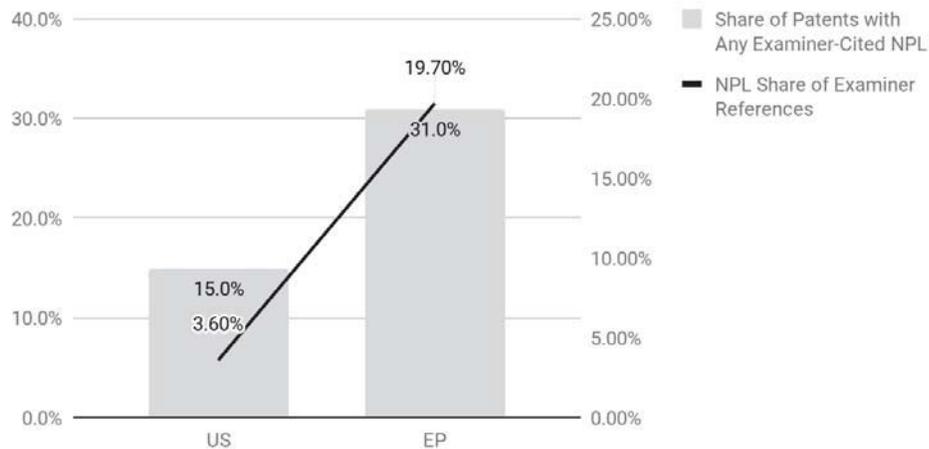
236. E-mail correspondence with Alan Marco, Chief Economist, U.S. Patent & Trademark Office (Sept. 17, 2015).

237. Though the high odds that such searches are carried out by the EPO provides some reassurance that the reported results are representative of the excluded international search reports

238. *See infra* Appendix Figure A1.

their U.S. counterparts. In addition, Examiners of “Chemistry” patents, in both U.S. and EP settings, were much more likely to cite NPL than were Examiners of non-Chemistry patents.<sup>239</sup>

Fig. 7A: Non-Patent Literature Citation in the US and EPO  
(N=19,122 Matched Pairs)



Not only did EP examiners more frequently cite any NPL, NPL also made up a larger share of the references they, as compared to U.S. Examiners, cited. As Figure 7A shows, the share of examiner references that were NPL in the case of EP patents was about 19.7%. The comparable figure among EP cases that matched U.S. patents was 3.6%. To test the robustness of this finding, we looked at the breakdown by sector. In every sector, EPO examiners relied to a greater degree on NPL than did their U.S. counterparts.<sup>240</sup> Again, industry effects were strong: as before, Chemistry patents in both jurisdictions incorporated NPL to a greater degree than did other types of patents.

Though the relatively weaker reliance on non-patent literature by U.S. examiners is an interesting finding, whether it matters to a patent’s strength or outcomes, if at all, has not, to my knowledge, been thoroughly explored. Intuitively, it makes sense that a patent that has been vetted using a process that considers all prior art, holding all else equal, would be stronger than a

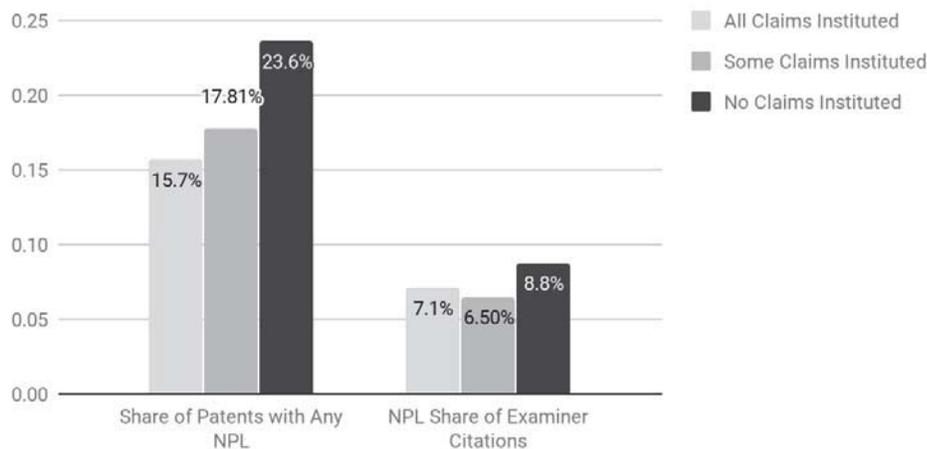
239. See *infra* Appendix Figure A1.

240. See *infra* Appendix Figure A2.

patent issued on the basis of only prior patents. However, little has been done to explore this relationship.

To begin to probe this question, I took data provided by Unified Patents on how challenged patents fared in *inter partes* review proceedings decided through March 2018 and compared these outcomes<sup>241</sup> with upstream patent examiner behavior. When a patent is initially challenged as part of such a proceeding, a panel of judges decides whether or not the USPTO believes there was a reasonable likelihood of invalidating at least one of the challenged claims.<sup>242</sup> Though the patents that are subject to *inter partes* review challenges are highly selected and likely non-representative of patents in general, one can see whether or not relative, rather than absolute differences in prosecution distinguish patents whose claims were “fully instituted on”, “partially instituted on” or “not instituted on.” The results are presented in Figure 7B.

Fig. 7B: Examiner NPL Citation and Inter Partes Review Institution Outcomes



Patents that did better (having had no claims instituted) had about a 24% likelihood of Examiner-cited NPL, compared to about a 16% likelihood among patents that had all claims instituted. That is to say, patents that had no claims instituted had about a 50% greater likelihood of NPL than patents that did worse, and had all claims instituted. Patents with some but not all

241. Considering all *inter partes* review challenges with an institution decision by March 2018 (N= 4,949).

242. 35 U.S.C. § 314 (2012).

petitioned claims challenged had about a likelihood in between. The difference between instituted and non-instituted claims with respect to the NPL share of Examiner claims also suggested a correlation between NPL citation and the survival of challenged patents, but a weaker one: 7.1% of the art cited by the Examiner in cases where all challenged claims were instituted was NPL as compared to 8.8% among cases where no claims were instituted. Claims with mixed institution results had an even lower share of NPL citation. While far from conclusive, the data suggests that there may be a relationship between patent strength and Examiner non-patent literature citation, which deserves further exploration.

#### *D. Taking Time to Get It Right*

From a comparative quality perspective, the gaps between USPTO and EPO citation patterns is striking. Why and how do EPO examiners rely so heavily on non-patent prior art relative to U.S. examiners? There are a number of reasons, beginning with the way in which examination is designed. Search is separated from examination and EPO examiners are instructed to, at the outset, carry out “thorough, high-quality, all-embracing search . . . [and] reduce to a minimum the possibility of failing to discover complete anticipations [sic] for any claims.”<sup>243</sup> The intent of the search report is to support a decision by the applicant, “whether to continue prosecuting their applications and have them examined,” and overall, to “make it possible to determine, on the basis of the documents mentioned in the search report, whether and to what extent the invention is patentable,”<sup>244</sup> in the words of the EPO Board of Appeal. Almost half of all withdrawn cases are withdrawn during the search phase before examination, as mentioned earlier.<sup>245</sup>

The EPO also makes efforts to ensure that its examiners have access to the best prior art, including non-patent literature. The EPO’s “EPOQUE” search system, which contains more than a hundred databases, is viewed by many to

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243. *Guidelines for Examination*, EUR. PAT. OFF., [http://www.epo.org/law-practice/legal-texts/html/guidelines/e/b\\_iii\\_2\\_1.htm](http://www.epo.org/law-practice/legal-texts/html/guidelines/e/b_iii_2_1.htm) (last updated Sept. 28, 2017) (“The European search is essentially a thorough, high-quality, all-embracing search. Nevertheless, it must be realised that in a search of this kind, 100% completeness cannot always be obtained, because of such factors as the inevitable imperfections of any information retrieval system and its implementation. The search should be carried out in such a manner as to reduce to a minimum the possibility of failing to discover complete anticipations for any claims, or other highly relevant prior art. For less relevant prior art, which often exists with a fair amount of redundancy amongst the documents in the search collection, a lower recall ratio can be accepted.”).

244. Decision of Technical Board of Appeal T1242/04, 2007 O.J. (C 431) 7.

245. Pegram, *supra* note 195.

be the best in the world.<sup>246</sup> For example, it maintains a partnership with the Institute of Electrical and Electronics Engineers and other standards-setting bodies to collect non-patent specifications,<sup>247</sup> and the USPTO has been urged to do the same.<sup>248</sup> The Patent Cooperation Treaty, which supplies a large number of EPO applications,<sup>249</sup> requires “mandatory search” of certain databases of non-patent references that the public can submit prior art to.<sup>250</sup>

But greater access to outside perspectives alone can’t explain the EPO’s higher rate of non-patent literature citation. The USPTO examination process actually arguably provides more access than does the EPO examination process to the relevant references that applicants know about, by requiring them to be provided to the Examiner under the applicant’s duty of disclosure.<sup>251</sup> In fact, when there is a matching case before the EPO, the EPO search report normally will be submitted to the USPTO through this route. However, while applicant references generally include a high share of non-patent literature, they are infrequently used by U.S. examiners, who overwhelmingly rely upon only the references they find themselves.<sup>252</sup> This makes intuitive sense, particularly when the motivation for submission by applicants may be unclear,<sup>253</sup> and presumably, applicants have reviewed the art that they have supplied and are submitting claims that steer clear of those references. However, it also means that USPTO examiners are not focusing

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246. DRAHOS, *supra* note 32, at 62.

247. COMM. ON INTELLECTUAL PROP. MGMT. IN STANDARD-SETTING PROCESSES, NAT’L RESEARCH COUNCIL, PATENT CHALLENGES FOR STANDARD-SETTING IN THE GLOBAL ECONOMY: LESSONS FROM INFORMATION AND COMMUNICATION TECHNOLOGY 32 (Keith Maskus & Stephen A. Merrill eds., 2013) (describing collaborations between the EPO and a standard-setting organization to include technical, non-patent documents in its search).

248. Letter from Linda Kahl, Dir., Legal Program, BioBricks Found., to Nicole Haines, USPTO (Apr. 18, 2014) (on file with USPTO) (recommending that the USPTO ensures that existing registries of biological parts are available to and searchable by USPTO examiners), [http://www.uspto.gov/sites/default/files/patents/law/comments/cr\\_f\\_kahl\\_20140418.pdf](http://www.uspto.gov/sites/default/files/patents/law/comments/cr_f_kahl_20140418.pdf).

249. EUR. PATENT OFFICE, FACTS AND FIGURES 13 (2014) (estimating that the EPO receives 60,000 direct European filings, and 214,000 international filings under the PCT), [http://documents.epo.org/projects/babylon/eponet.nsf/0/af3a2fbb58589e51c1257def00465dc3/\\$FILE/epo\\_facts\\_and\\_figures\\_2015\\_en.pdf](http://documents.epo.org/projects/babylon/eponet.nsf/0/af3a2fbb58589e51c1257def00465dc3/$FILE/epo_facts_and_figures_2015_en.pdf).

250. RES. DISCLOSURE, <http://www.researchdisclosure.com/> (last visited Mar. 27, 2018) (“Patent examiners are required to search Research Disclosure by PCT statute.”).

251. 37 C.F.R. § 1.56 (2017). In the EPO, examiners also have the ability to request information from applicants but doing so is not the norm. *See* Cotropia et al., *supra* note 99, at 850 n.17.

252. Cotropia et al., *supra* note 99, at 844, 845–46 tbl.1 (showing that 94% of non-patent literature and 66% of patent literature cited by patents are applicant supplied).

253. Lemley & Sampat, *supra* note 52, at 818–19 (describing the “flooding” or “burying” of patent examiners through applicant disclosure submissions).

or relying on the most relevant prior art—that which the applicant and other examiners know about.

The simpler explanation is that USPTO examiners are not allocated enough time to do their job, in particular to search for, review, and apply prior art, as others have noted.<sup>254</sup> Searches for prior art are reportedly performed, on average, in about two hours or less at the USPTO, as compared to eight hours at the EPO,<sup>255</sup> and the average in 2015 is believed to be even higher, around twelve hours.<sup>256</sup> In both jurisdictions, the amount of time allocated to search tasks depends on the technology.<sup>257</sup> Finding and digesting new references applicable to the particular case takes time and reduces Examiner output on a per hour basis. It is also required in order for examiners to fulfill their statutory mandate to grant patents only on novel and non-obvious inventions. The substantially greater amount of time dedicated to search in the EPO, which leads to substantially higher rates of NPL citation, is consistent with the overall contrast I have drawn between the USPTO and EPO, and the substantial, early investment of the EPO in examination.

#### *E. Quality v. Efficiency of Examination*

That a greater investment in search leads examiners to cite a more diverse set of references hardly surprises. But the different approaches that the USPTO and EPO apply have largely overlooked consequences for the quantity and quality of granted patents. In the United States, the upfront investment in quality by the Patent Office is relatively lower, in terms of Examiner time, but the risks associated with examination mistakes or inconsistencies is also reduced through the ability of patent applicants to refile their application if they get outcomes they are dissatisfied with. Examination and grants come earlier and more often to U.S. applicants, and at a lower cost.

The EPO process has other strengths and weaknesses. The measured and staged nature of the EPO examination process invites applicants to evaluate at each phase of the process their options for pursuing the patent and to develop a strong sense of the patent's likely fate within the EPO. Cases that

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254. See Cotropia et al., *supra* note 99, at 851 (discussing the time pressures faced by examiners); Frakes Wasserman, *supra* note 53 (“Our analysis finds that as examiners are given less time to review applications upon certain types of promotions, the less prior art they cite, the less likely they are to make time-consuming obviousness rejections, and the more likely they are to grant patents.”).

255. Van Pottelsberghe de la Potterie, *supra* note 70, at 1778 n.9.

256. See E-mail correspondence with Alfred Spigarelli, Dir. Patent Procedures Mgmt., European Patent Office (Sept. 17, 2015).

257. Frakes & Wasserman, *supra* note 254, at 4.

are not granted are withdrawn, often just based on the search, conveying the sense that even though applicants often do not get the patents they apply for at the PTO, they decide, at least in part, the fate of their applications. This leads applicants to withdraw their European applications to an extensive level and to fail much more often in the pursuit of European as compared to U.S. patents. The process is high-touch with a number of quality checks, supported by examination teams who are careful not to raise applicant expectations along the way.

From a social welfare perspective, the fewer unnecessary patents—patents that don't disclose anything new or nonobvious, or that induce innovation—the better. But what about the private value of patent quality? Surprisingly, when asked, patent holders and companies have given the highest marks to the jurisdiction that is less likely to give them what they want (a granted patent), more slowly, and at a higher cost—the EPO. In surveys, the EPO has earned the highest marks of any patent office for the quality of the patents it issues, and also the highest levels of customer satisfaction. In a 2015 survey, for example, 62% of practicing lawyers and 60% attorneys and corporate IP managers gave EPO-issued patents a rating of excellent or very good quality.<sup>258</sup> The USPTO received ratings of 30% and 35% from the same populations.<sup>259</sup> In the 2015 survey, the EPO also received the highest marks of all five “IP5” offices in terms of customer service.<sup>260</sup> The strong support for the highly structured, quality-focused European model is striking. Though applicants don't necessarily get the patents they seek at the EPO, or the unlimited freedom to continue having their patents examined, they remain in control of the process, receiving early warnings of an application's likely fate.

These findings imply that applicants favor European style examination, reflecting greater upfront investment and a more circumscribed patent examination process. In 2006, the USPTO moved to implement the latter when it proposed curtailing the use of “continuation” applications and requests for continued examination,<sup>261</sup> in order to address existing backlogs. Patent lawyers and biopharmaceutical companies who file early in their product's lifecycle, and use the continuation process to refine their applications based on marketplace developments strenuously resisted this

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258. EUROPEAN PATENT OFFICE, *supra* note 65, at 62; *see also* Clover, *supra* note 65 (reporting 2011 and 2010 results that report the EPO as having the highest quality rankings).

259. EUROPEAN PATENT OFFICE, *supra* note 65, at 63.

260. *Id.* at 64.

261. *Tafas v. Dudas*, 541 F. Supp. 2d 805, 813 (E.D. Va. 2008).

initiative.<sup>262</sup> While this sort of strategic game playing<sup>263</sup> is detrimental to the system, to the extent it reflects a legitimate mismatch between product and patent lifecycles, as discussed below, other ways of addressing this mismatch that are more narrowly tailored would be preferable. However, if the resistance to curtailing continuations is based on the perception that the USPTO makes a lot of mistakes in examination, it is worth considering whether a commitment to fewer mistakes through a greater investment could offset this resistance.

The benefits of thoroughly considering prior art when a patent is examined, rather than later in the patent's life, are real. To probe them, I took patents that had been the subject of a finally decided *inter partes* review challenge as of summer 2015 (N=311) and determined that over half of them (N=169) had a European counterpart application. Of these 169 applications, less than half have matured into European patents.<sup>264</sup> This means that, though most of the claims that have been reviewed in the *IPR* proceedings have been invalidated completely by the Board, many never even made it out of the European Patent Office, and were rejected much earlier. It is also notable that, while U.S. examiners cited non-patent literature in 16% of the U.S. applications, EPO relied on non-patent literature 30% of the time, and the PTAB relied on non-patent literature in its final decision in 40% of these cases.<sup>265</sup> According to a study by John King, a 1% increase in examination hours might reduce the amount of litigation by an estimated 3.74 cases per year.<sup>266</sup> Whether this a good deal, of course, depends on how much the increased costs and how much the reduction nets are.<sup>267</sup>

In recent years, the USPTO has recognized that patent quality is a major priority, and announced initiatives around search and non-patent references. During the Obama Administration, the USPTO made significant efforts to increase the stock of available non-patent references, noting that “the most relevant information” about a particular technology in an application is sometimes difficult for examiners to locate and use. Because this information often resides with the technical and scientific community, crowdsourcing and

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262. Scott D. Barnett, *The Controversy Surrounding Continuing Applications and Requests for Continued Examination*, 7 J. MARSHALL REV. INTELL. PROP. L. 545, 546–47 (2008).

263. See Steve Blount & Louis S. Zarfes, *The Use of Delaying Tactics to Obtain Submarine Patents and Amend Around a Patent That a Competitor Has Designed Around*, 81 J. PAT. & TRADEMARK OFF. SOC'Y. 11, 13 (1999).

264. See discussion *supra* Section III.C

265. See discussion *supra* Section III.E.

266. John L. King, *Patent Examination Procedures and Patent Quality*, in PATENTS IN THE KNOWLEDGE-BASED ECONOMY 54, 70 (Wesley M. Cohen & Stephen Merrill eds., 2003).

267. *Id.*

third-party submissions are promising ways to uncover “hard-to-find prior art,” and securing agreements from a number of companies to provide hard-to-find references such as manuals to the office.<sup>268</sup> In 2010, the Office created the Patent Examiner Technical Training Program (PETTP), in order to help patent examiners keep up with fast-changing technological fields, inviting technologists, engineers, and other experts to provide relevant technical training and guidance to patent examiners,<sup>269</sup> and hundreds of companies have participated.<sup>270</sup>

However, the low citation of non-patent literature already provided to examiners through applicant disclosures casts serious doubt that greater access alone to references, without more time to consider them, will translate into the more robust consideration of relevant references. Fortunately, the Examiner-cited non-patent literature metric, and progress on this dimension, can independently be measured over time, using the techniques described in this Article. In this way, it has several advantages over some of the metrics discussed at the outset of this Article. Unlike grant rates, which reflect not only the quality of examination but also changes in the law and the quality of applicant submission, the references that an Examiner reviews and cites are largely within the Examiner’s control. Citation behavior is also observable for all patents and immune from the selection issues that accompany court and PTAB reversals. Comparisons against an EPO benchmark are also possible, as I have demonstrated. Finally, as a process, rather than outcome-based metric, Examiner citation of non-patent literature can be measured and tracked in real-time, at the granular level of an art unit, class, or even Examiner.

Being able to track the benefits associated with a greater investment in quality will be important because, just as the downstream benefits of increased quality are real, the upfront costs of increased quality could also be significant. If all USPTO cases received a six-fold increase in the amount of time allocated to search, and allocated a three-person panel to each case, for example, holding all other things equal, the growth in costs and backlog and examination backlog could also be considerable. There are two ways of limiting these effects, however.

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268. Michelle K. Lee, *Calling on the Crowd to Help Increase Patent Quality*, USPTO: DIRECTOR’S FORUM (Mar. 13, 2014), [http://www.uspto.gov/blog/director/entry/calling\\_on\\_the\\_crowd\\_to1](http://www.uspto.gov/blog/director/entry/calling_on_the_crowd_to1).

269. Patent Examiner Technical Training Program, 75 Fed. Reg. 56,059 (Sept. 15, 2010).

270. *PETTP 2015 Companies and Speaker(s)*, USPTO, <http://www.uspto.gov/patent/initiatives/patent-examiner-technical-training-program/pettp-2015-companies-and-speakers> (last visited Mar. 27, 2018).

First, Examiners could be selectively allocated more time to, for example, consider novel search results that include non-patent literature. The applications that are the subject of international search are more valuable, insofar as they reflect a greater investment of resources by the applicant, and therefore are likely to be the ones that applicants want to be sure will withstand later challenges, and any supplemental fees could be passed on to applicants, particularly large ones. The examination units that feature the cases where missing non-patent literature is most likely to matter could also get more time. These could include the USPTO art units that have the most patents invalidated at the PTAB, on the basis that they are novel or obvious, or which have the highest litigation hazard,<sup>271</sup> or which show the greatest gaps when compared to their EPO counterparts. Sorting for greater scrutiny in these ways has the benefit of incorporating insights from related and past patterns of examination and litigation.

Another risk is that, higher costs, if passed on directly to applicants, could disproportionately impact those who are more sensitive to them, including start-ups and small and medium-sized enterprises.<sup>272</sup> Low filing fees have been the feature of the U.S. patent system for many years,<sup>273</sup> and they facilitate greater access to the patent system. However, there is no reason that the costs of higher quality standards must be borne disproportionately by small and medium enterprises, and a number of schemes could be used to prevent this result; indeed, the fee increases that the USPTO introduced following passage of the America Invents Act actually reduced the fees for the smallest applicants, “microentities” that are now entitled to a 75% discount off examination fees, while it raised them for larger entities.<sup>274</sup> I would favor continuing to distribute future application rate increases in this way, that is to say, disproportionately on larger companies, for whom an additional incremental patent filing, on a portfolio of thousands, is likely to matter less to the health of the company than for a company with a small portfolio.

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271. See, e.g., James Bessen & Brian J. Love, *Make the Patent “Polluters” Pay: Using Pigovian Fees to Curb Patent Abuse*, 4 CALIF. L. REV. CIR. 84, 91 (2013) (suggesting the idea of using hazard rates to curb patent abuse); Josh Lerner, *The Litigation of Financial Innovations 2* (Nat’l Bureau of Econ. Research, Working Paper No. 14324, 2008) (documenting that financial patents are twenty-seven to thirty-nine times more likely to be litigated than average patents).

272. Gaétan de Rassenfosse & Bruno van Pottelsberghe de la Potterie, *On the Price Elasticity of Demand for Patents*, 74 OXFORD BULL. ECON. & STAT. 58, 62 (2010).

273. DRAHOS, *supra* note 32, at 100–09 (describing how U.S. fees were set below UK fees during the 19th century).

274. See 37 C.F.R. § 1.16 (2017).

There are a number of arguments that fee rises should, all things being equal, take place during the maintenance, rather than examination phase of a patent. First, administrative fees at the examination stage are only one component of the total cost to the applicant, as the cost of preparing an application currently far outstrips patent office costs on the average application, reducing their impact.<sup>275</sup> Second, although raising fees at the examination stage can also reduce congestion and increase the quality of submitted patents, studies that have looked at changing patent filing behavior by adjusting patent filing fees, including some by several of us, aren't encouraging.<sup>276</sup> Increasing fees after a patent has issued, rather than before it, aligns the private costs with the costs to society.<sup>277</sup> The next Part considers this policy lever.

#### IV. POST-GRANT QUALITY MECHANISMS

Because a patent's value only emerges over time, the point of a patent's grant (or denial) can both be thought of as "too late" to make a difference, since the patent has already issued (or denied) as well as "too early" to know whether the patent actually matters. During the post-grant period, the ability of members of the public to ask USPTO judges to take a closer look at an issued patent, through post-grant review procedures available both in the EPO and in the U.S. patent system, is a critical check on patent quality. In the United States, post-grant review is expensive, costing each side in a review hundreds of thousands of dollars to complete.<sup>278</sup> It is also narrow, only

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275. De Rassenfosse & van Pottelsberghe de la Potterie, *supra* note 272, at 73.

276. See William M. Landes & Richard A. Posner, *An Empirical Analysis of the Patent Court*, 71 U. CHI. L. REV. 111, 114 (2004) (finding a short-term price elasticity of patent fees of only -0.03); Petra Moser, *How Do Patent Laws Influence Innovation? Evidence from Nineteenth-Century World's Fair*, 95 AM. ECON. REV. 1214, 1221 (2005) ("Although the upfront costs of patenting were extremely high in Britain, at the equivalent of 37,000 current U.S. dollars . . . but modest in the United States (at 618 U.S. dollars), the share of innovations that were patented was similar in Britain and in the United States: 11.1 percent in Britain compared to only 14.2 percent in the United States . . . . Moreover, British and American inventors chose to patent (and not to patent) in the same industries."); Gaétan de Rassenfosse & Bruno van Pottelsberghe de la Potterie, *USPTO Section 10 Fee Setting—Description of Elasticity Estimates 5* (2013) (unpublished manuscript) (finding a short-term price elasticity of pre-grant fees of just -.09, but a long run price elasticity of -.30), [http://www.uspto.gov/sites/default/files/aia\\_implementation/AC54\\_Final\\_Elasticity\\_Supplement.pdf](http://www.uspto.gov/sites/default/files/aia_implementation/AC54_Final_Elasticity_Supplement.pdf).

277. See, e.g., de Rassenfosse & van Pottelsberghe de la Potterie, *supra* note 272, at 58–62 (arguing that when there is limited information by the time of filing to assess an invention's value, it is better to raise fees as time goes on, rather than at the outset).

278. Jay P. Kesan et al., *Strategic Decision Making in Dual PTAB and District Court Proceedings*, 31 BERKELEY TECH. L.J. 45, 55 (2016).

enabling review on certain grounds or under certain circumstances.<sup>279</sup> As a result, post-grant review is generally justified only for patents that are the subject of an active litigation or dispute.<sup>280</sup> In Europe, for example, whose well-regarded “opposition” system provided one model for the design of the current U.S. system,<sup>281</sup> the share of patents subject to post-grant review is about 5%.<sup>282</sup> Thus, while considered the primary mechanism of post-grant patent quality control, post-grant reviews can only provide limited relief.

In this Part, rather than focusing on only the few patents that are contested, this Article considers ways of influencing the quality and quantity of the vast majority of patents that are not challenged in court or through an administrative process. For example, the patent term of twenty years is longer than the lifecycle of many products, as discussed below. But relatively low U.S. renewal fees enable patent holders to hold on to their patents for longer. In this section, I discuss adjusting renewal fees and several other “post-grant” quality levers to reward patent owners for voluntarily reducing the risks associated with their patents and putting the public on notice concerning the patents its owners are practicing or planning to enforce. Consistent with the use of patents for many purposes, many of them non-exclusionary, it is likely that patentees would respond to these incentives and therefore, many would voluntarily opt into reduced effective terms beyond the life of a product covered by a patent.

#### A. *Aligning Maintenance Fee Policy with Social Welfare*

After a patent is granted, its owners must pay to keep it in force. United States “maintenance fees” were introduced to the United States in 1980;<sup>283</sup> before that, the owners of a patent were automatically entitled to the full term. The change was dramatic when it took place—following the introduction of fees, the growth in patents abruptly stopped, as expiring patents offset new

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279. See Chien & Helmers, *supra* note 38, at 8 (explaining that post-grant review is only available for the first nine months after issue, covered business method review is only available for financial services patents, and only novelty and obviousness can be revisited in *inter partes* review).

280. See *id.* at 8–13 (documenting the high proportion of *inter partes* reviewed patents that are the subject of parallel litigation, and the low percentage of litigated patents that are the subject of a post-grant review).

281. See Joe Matal, *A Guide to the Legislative History of the America Invents Act: Part I of II*, 21 FED. CIR. B.J. 435, 438–47 (2012).

282. Chien & Helmers, *supra* note 38, at 5.

283. Marco et al., *supra* note 86, at 10 (citing Act of Dec. 12, 1980, Pub. L. No. 96-517, § 41(b), 94 Stat. 3015, 3017 (codified as amended at 35 U.S.C. § 41 (2012))).

patents.<sup>284</sup> In the same vein, changes to current maintenance fees, if significant enough, would impact the quality and quantity of patents in force. Right now, U.S. fees are among the cheapest in the world, on a per capita GDP basis.<sup>285</sup> United States patents are also kept in force longer than other leading jurisdictions,<sup>286</sup> leading to a longer period of monopoly and higher supracompetitive prices.

Some inventions arguably deserve a longer exclusivity term than twenty years. Budish and colleagues have noticed that company cancer researchers tend to invest less in earlier-stage cancer drugs than late-stage cancer drugs because they are much slower to bring to the market, leaving a limited amount of time to recoup development expenses.<sup>287</sup> But many product lifecycles are shorter than the twenty-year term offered by a patent.<sup>288</sup> During a typical five-year period, two-thirds of U.S. manufacturing firms switch their products,<sup>289</sup> and in the United States, people replace their cellphones every two to three years.<sup>290</sup> According to a study by Bilir, the shortest product life cycles are in the electronics machinery (6.7 years) and computer and office equipment (8.4 years) industries, and the longest product lifecycles are in non-electric heating equipment (10.9 years) and metal cans and shipping containers (10.6 years).<sup>291</sup> Broda and Weinstein find that computer software ranks third highest in turnover of the 100 product types they studied.<sup>292</sup> The misalignment of patent and product times in the software industry extends to the application process as well. In July 2016, it took about twenty-five months to get a

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284. *See id.* at 32 fig.6.

285. *See infra* Figure 9.

286. THE IP5 OFFICES, *supra* note 62, at 74 fig.4.8 (showing the USPTO, by year twenty after the filing date, to have the highest rate of renewal (~48%), followed by the JPO (~27%), SIPO, EPO, and KIPO).

287. *See* Eric B. Budish, Benjamin N. Roin & Heidi Williams, *Do Fixed Patent Terms Distort Innovation?: Evidence from Cancer Clinical Trials 2* (Stanford Inst. for Econ. Policy Research, Paper No. 13-001, 2013), [https://siepr.stanford.edu/sites/default/files/publications/heidi.paper\\_\\_6.pdf](https://siepr.stanford.edu/sites/default/files/publications/heidi.paper__6.pdf) (explaining that it takes a median of 9.1 years to conduct a study on early-stage prostate cancer treatment, as compared to a 12.8-month median for treatments of late-stage cancer).

288. Roger Entner, *2014 US Mobile Phone Sales Fall by 15% and Handset Replacement Cycle Lengthens to Historic High*, RECON ANALYTICS (Feb. 10, 2015), <http://reconanalytics.com/2015/02/2014-us-mobile-phone-sales-fall-by-15-and-handset-replacement-cycle-lengthens-to-historic-high/>.

289. Andrew B. Bernard, Stephen J. Redding & Peter K. Schott, *Multiple-Product Firms and Product Switching*, 100 AM. ECON. REV. 70, 70–72 (2010).

290. Entner, *supra* note 288.

291. L. Kamran Bilir, *Patent Laws, Product Life-Cycle Lengths, and Multinational Activity*, 104 AM. ECON. REV. 1979, 1993 (2013).

292. Christian Broda & David E. Weinstein, *Product Creation and Destruction: Evidence and Price Implications*, 100 AM. ECON. REV. 691, 701 (2010).

patent.<sup>293</sup> But in certain markets, for example, the mobile app market, “fast followers” that mimic aspects of the original are often introduced in less time.<sup>294</sup> It has been reported that half of the revenue in the semiconductor industry is derived from products that have been on the market for less than six months.<sup>295</sup>

One risk of patents that outlive the products they support is that they are sold to patent assertion entities (“PAEs”), or trolls, and then asserted. Love has found that non-practicing entities disproportionately assert their patents at the end of a patent’s life, rather than the beginning,<sup>296</sup> while the reverse is true of operating companies. Replicating his analysis, among patents litigated in 2010 and 2012, and relying on codings by Cotropia and colleagues,<sup>297</sup> I find a similar pattern—that PAE assertions were weighted towards the later years of a patent’s term.<sup>298</sup> Returns that outlast the original product that the

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293. See *Traditional Total Pendency*, U.S. PAT. & TRADEMARK OFF., <https://www.uspto.gov/corda/dashboards/patents/kpis/kpiOverallPendency.kpixml> (last visited Mar. 27, 2018).

294. Sebastian G. J. Brandes Kraaijenzank, *Innovation Without Patents? Evidence from the Smartphone App Markets* 28–31 (June 30, 2013) (unpublished M.B.A. thesis, Universidad Carlos III de Madrid), <http://ssrn.com/abstract=2529669> (providing examples of mobile app introductions and “fast followers,” most within one to two years).

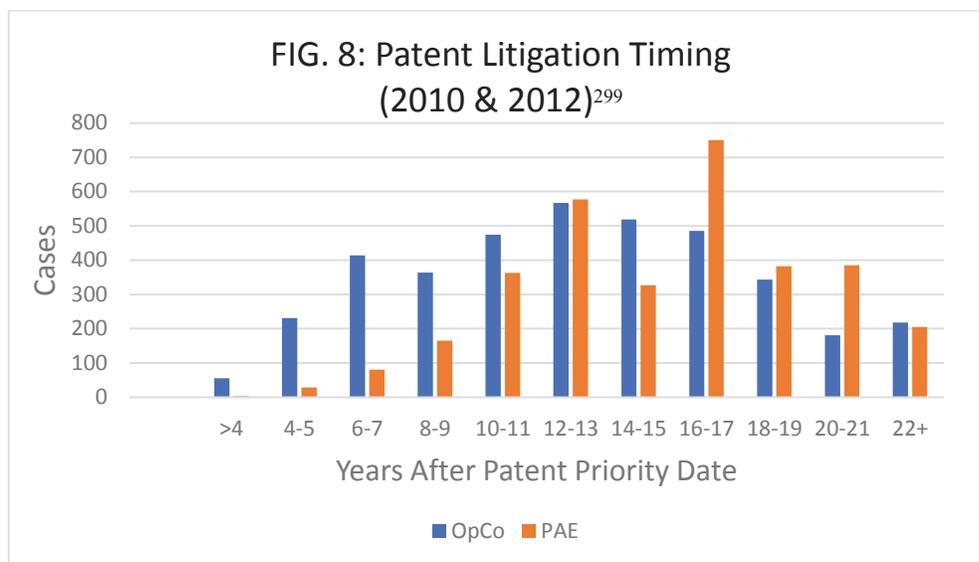
295. Brian J. Love, *Patent Duration*, in 2 RESEARCH HANDBOOK ON THE ECONOMICS OF INTELLECTUAL PROPERTY LAW 7, 7 (Peter S. Menell & David L. Schwartz eds.) (forthcoming 2018) (citing Aaron Aboagye, Sri Kaza & Nick Santhanam, *Finding the Next \$100 Billion in Semiconductor Revenues*, 2 MCKINSEY ON SEMICONDUCTORS 4, 6 (2012), <https://www.mckinsey.com/our-people/aaron-aboagye>).

296. Brian J. Love, *An Empirical Study of Patent Litigation Timing: Could a Patent Term Reduction Decimate Trolls Without Harming Innovators?*, 161 U. PA. L. REV. 1309, 1359 (2011).

297. Christopher A. Cotropia, Jay P. Kesan & David L. Schwartz, *Unpacking Patent Assertion Entities (PAEs)*, 99 MINN. L. REV. 649, 673–82 (2014). The authors coded each case from 2010 as belonging in one of ten categories. For ease of viewing I grouped patent holding companies, large aggregators, individuals and failed operating company/failed start-up in the PAE category, due to their inability to be retaliated against, and included operating companies (including IP arms of Operating companies) and technology development companies in “OpCo.” I conducted the analysis based on the first named patent in each case and omitted from the analysis cases in which the plaintiff’s status or the asserted patents could not be determined. For the patent numbers associated with each case, I received data from Lex Machina, and for the patent priority dates, I used data from Innography.

298. See *infra* Figure 8.

patent was filed to support are more likely to reflect an unexpected windfall than from any incentive to innovate that a patent may provide.



For a variety of reasons, then, the duration of a patent has a considerable impact on the costs and benefits to society associated with the patent. The longer a patent supports supracompetitive pricing, the greater the deadweight loss to society.<sup>300</sup> Renewal fees influence a patentee's decision to keep a patent in force, or not, and are an important driver of patent quality. Comparatively speaking, U.S. fees are on the low to lowest end of the range on a per capita basis. This is because USPTO fees have been in an almost continuous decline (relative to GDP per capita) since 1800.<sup>301</sup> As a result, Park has found, the United States charges the least, among major jurisdictions, on a GDP per capita basis, to pursue and maintain a patent.<sup>302</sup> On an absolute basis, it costs approximately \$15,320 (large entity) for the full twenty-year term,<sup>303</sup> compared to €23,855 in Europe for twenty years

299. For a discussion of how these figures were calculated, see *supra* text accompanying note 297.

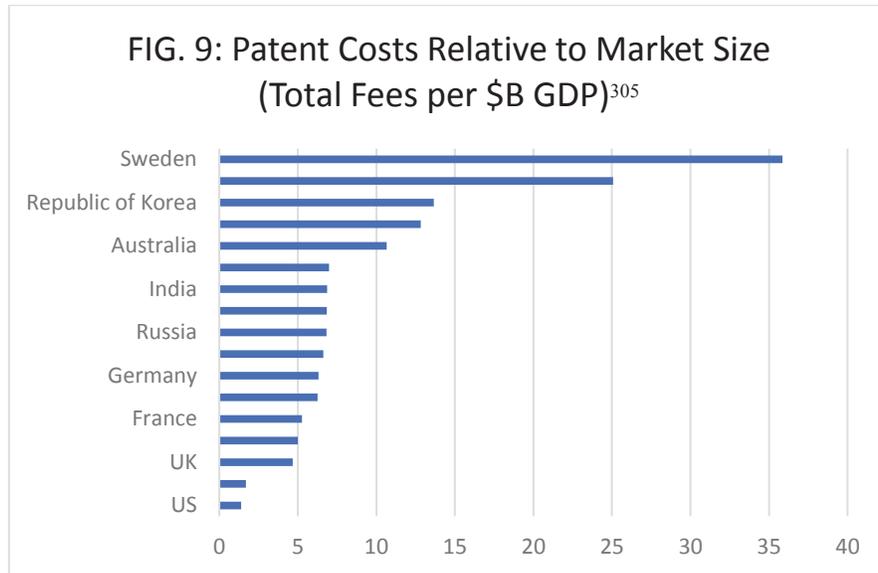
300. F.M. Scherer, *Nordhaus' Theory of Optimal Patent Life: A Geometric Reinterpretation*, 62 AM. ECON. REV. 422, 427 (1972).

301. *Id.* at 426.

302. See *infra* Figure 9.

303. See *USPTO Fee Schedule*, USPTO (Jan. 16, 2018), <http://www.uspto.gov/learning-and-resources/fees-and-payment/uspto-fee-schedule> (\$300 filing fee, \$660 search fee, \$760 examination fee, \$1,000 issue fee, \$1,600 renewal fee due by 3.5 years, \$3,600 renewal fee due by 7 years, \$7,400 renewal fee due by 11.5 years).

(approximately \$26,270).<sup>304</sup> Changing how much it costs to keep a patent in force would likely lead to the earlier expiry of patents that are “sitting on the shelf.”



For all of these reasons, renewal fees should be set with social welfare considerations in mind. Long-standing policy doesn't fully permit the USPTO to do so, however, specifying that fee collections are required to be dictated by the principle of cost recovery.<sup>306</sup> As a historical study documents, consistent with the U.S. patent system's emphasis on accessibility and

304. EUROPEAN PATENT OFFICE, SCHEDULE OF FEES AND EXPENSES 2–8 (2014), <http://www.epo.org/law-practice/legal-texts/official-journal/2014/etc/se3/p1/2014-se3-p1.pdf>.

305. Includes official filing fees, agent (legal) fees, issuance fees, and maintenance fees and assumes large entity status and twenty-year term. Excludes translation fees. *The PCT Applicant's Guide*, WIPO (last updated Mar. 15, 2018), <http://www.wipo.int/pct/en/appguide/index.jsp> (filing fees); *World Economic Outlook Database, October 2015*, INT'L MONETARY FUND, <https://www.imf.org/external/pubs/ft/weo/2015/02/weodata/weoselgr.aspx> (last visited Mar. 18, 2018) (GDP and global inflation rates); see Walter G. Park, *On Patenting Costs*, 2 WIPO J. 38 (2010) (legal fees).

306. Leahy-Smith America Invents Act, Pub. L. No. 112-29, § 10(a)(2), 125 Stat. 284, 317 (2011) (codified as amended at 35 U.S.C. § 41 (2012)) (specifying that “[f]ees may be set or adjusted under paragraph (1) only to recover the aggregate estimated costs to the Office for processing, activities, services, and materials relating to patents (in the case of patent fees) and trademarks (in the case of trademark fees), including administrative costs of the Office with respect to such patent or trademark fees (as the case may be)”). This represents greater authority over the setting of all patent and trademark fees charged under Title 35 of the U.S. Code and the Trademark Act of 1946.

affordability, from the beginning, “[patent] payments were not intended to exact a price for the patent privilege or to raise revenues for the state . . . rather, they were imposed to merely cover the administrative expenses of the office.”<sup>307</sup> For most of the USPTO’s history, the Office has been funded primarily with taxpayer revenues through annual appropriations legislation, not fees.<sup>308</sup>

Since 1990, Congress has required the USPTO to be self-funded.<sup>309</sup> Initially, Congress set most fees, and the USPTO was only authorized to set relatively minor fees and make adjustments to reflect changes in the Consumer Price Index.<sup>310</sup> This changed with the America Invents Act, as Congress was seen as a relatively poor steward of USPTO charges.<sup>311</sup> Though the total collection must still be limited to those needed to cover the “aggregate estimated costs to the Office for processing, activities, services and materials,”<sup>312</sup> the USPTO now has much greater freedom to determine fee levels.<sup>313</sup> To its credit, the USPTO has made the sorts of adjustments, directionally, that align patent fees with social welfare. It has lowered examination fees but made up the difference in increases to maintenance fees.<sup>314</sup> It has also explored, through its Chief Economists, the idea of limiting continuation practice by raising fees.<sup>315</sup>

Within this ambit, if the USPTO decided to invest significantly more in upfront examination, for example, it could pass these expenses on to applicants, at the examination phase, or patentees, in the maintenance phase.

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307. B. Zorina Kahn, *Looking Backward: Founding Choices in Innovation and Intellectual Property Protection*, in *FOUNDING CHOICES: AMERICAN ECONOMIC POLICY IN THE 1790S* 315, 332 (Douglas A. Irwin & Richard Sylla eds., 2011).

308. GLENN J. MCLOUGHLIN, CONG. RESEARCH SERV., RS20906, U.S. PATENT AND TRADEMARK OFFICE APPROPRIATIONS PROCESS: A BRIEF EXPLANATION 1 (2014).

309. Omnibus Budget Reconciliation Act of 1990, Pub. L. No. 101-508, § 10101(d), 104 Stat. 1388, 1778.

310. 35 U.S.C. § 41(f) (1994) (current version at 35 U.S.C. § 41(f)).

311. H.R. REP. NO. 112-98, pt. 1, at 46 (2011) (“History has shown that [having Congress set fees] does not allow the USPTO to respond promptly to the challenges that confront it. The USPTO has argued for years that it must have fee-setting authority to administer properly the agency and its growing workload.”).

312. Leahy-Smith America Invents Act, Pub. L. No. 112-29, § 10(a)(2), 125 Stat. 284, 317 (2011) (codified as amended at 35 U.S.C. § 41) (explaining that patent fees must recover patent costs).

313. Subject to statutorily specified discounts available for small and micro-entities. *Id.* at § 10(b).

314. *See* Setting and Adjusting Patent Fees, 78 Fed. Reg. 4212, 4212 (Jan. 18, 2013) (to be codified at 37 C.F.R. pts. 1, 41, 42) (estimating that “the routine fees to obtain a patent (i.e., filing, search, examination, publication, and issue fees) will decrease by at least 23 percent” while the maintenance fees were increased).

315. Graham, *supra* note 150, at 1287.

However, it would have to move cautiously when doing so, as there are several procedural hurdles that the USPTO would need to overcome in order to increase fees. Any new fee proposals must be submitted to the Patent Public Advisory Committee,<sup>316</sup> and the USPTO must engage the Committee at least forty-five days before publishing the proposed rule and give the Committee thirty days to consider the proposal.<sup>317</sup> The Committee must then hold a public hearing and produce written recommendations, which the USPTO must consider.<sup>318</sup> At this point, the Director must notify Congress of the proposed change and publish the proposed fee in the Federal Register, along with a description of the reasons for the fee.<sup>319</sup> Next, there is a public comment period of forty-five days, after which the fee can be published; forty-five days following publication, the rule can go into effect absent a congressional override.<sup>320</sup>

There are other problems with further skewing USPTO reliance towards maintenance, rather than examination fees. Already, the USPTO subsidizes examination with maintenance fees, and small and micro-entity fees, with large entity fees.<sup>321</sup> Wasserman and Frakes have found that these distortions cause the USPTO, in times of urgency, to overgrant patents to large entities that are more likely to renew their patents.<sup>322</sup> The USPTO is not the only governmental agency that is vulnerable to criticisms, at times grave, that its revenue-making authority interferes with fairly carrying out its mission.<sup>323</sup>

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316. § 10(d), 125 Stat. at 317.

317. § 10(d)(1), (2)(A), 125 Stat. at 317.

318. § 10(d)(2)(B), (d)(3), (d)(4), 125 Stat. at 317.

319. § 10(e)(4), 125 Stat. at 317.

320. § 10(e)(3), (e)(4), 125 Stat. at 317–18.

321. Frakes & Wasserman, *supra* note 23, at 69 (documenting how patent examination fees cover less than one-third of the examination costs, and issuance fees cover an even smaller percentage of examination costs, leaving maintenance fees to make up the difference).

322. *Id.* at 72.

323. Take for example, civil forfeitures, actions in which the police take the assets of people who are “suspected” of a crime; no warrant is needed to seize the assets, and it is not necessary to charge anyone with a crime in order to retain the assets. In fact, most civil forfeitures are simply seizures of cash, frequently on interstate highways. Since 1984, local law enforcement agencies have been allowed to keep the majority of the profits from civil forfeitures (the “Equitable Sharing Program”), and the amount of assets seized has risen considerably. See Tamara R. Piety, *Scorched Earth: How the Expansion of Civil Forfeiture Doctrine Has Laid Waste to Due Process*, 45 U. MIAMI L. REV. 911, 975 (1991). The amount of revenue derived from civil forfeitures is huge; since 2001, “police have seized \$2.5 billion [in cash] . . . from people who were not charged with a crime and without a warrant being issued.” Michael Sallah et al., *Stop and Seize: Aggressive Police Take Hundreds of Millions of Dollars from Motorists Not Charged with Crimes*, WASH. POST (Sept. 6, 2014), <http://www.washingtonpost.com/sf/investigative/2014/09/06/stop-and-seize/?hpid=z3>. Two former United States Department of Justice Asset Forfeiture Office directors called for the abolition of the Equitable Sharing Program in a *Washington Post* op-ed, stating,

Nor is it the only government agency that has to balance competing revenue pressures. However, the USPTO does appear to lack a number of the safeguards that other offices have to reduce the need to balance revenues and expenses on an annual basis. For example, the EPO, like the USPTO, subsidizes examination renewal fees, and the office is also self-funded. But the EPO also owns substantial financial assets that are sometimes used to supplement the funding derived from patent fees.<sup>324</sup> In addition, the European Patent Convention states that the Contracting States of the EPO must finance any deficit that the office faces,<sup>325</sup> an important backup source of revenue. In addition, some other permitting agencies receive significant funding as part of the federal budget, such as the Environmental Protection Agency (“EPA”), which requested \$8.3 billion in funding in 2012,<sup>326</sup> and brought in just \$252 million in fines in 2012.<sup>327</sup> The USPTO’s ledger, in contrast, is substantially more balanced. To enable the USPTO to operate in a way that is dictated by its mission, rather than its finances, Congress should consider creating such buffers as well.

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“[I]aw enforcement agents and prosecutors began using seized cash and property to fund their operations, supplanting general tax revenue, and this led to the most extreme abuses: law enforcement efforts based upon what cash and property they could seize to fund themselves, rather than on an even-handed effort to enforce the law.” John Yoder & Brad Cates, Opinion, *Government Self-Interest Corrupted a Crime-Fighting Tool into an Evil*, WASH. POST (Sept. 18, 2014), [http://www.washingtonpost.com/opinions/abolish-the-civil-asset-forfeiture-program-we-helped-create/2014/09/18/72f089ac-3d02-11e4-b0ea-8141703bbf6f\\_story.html?wpmk=MK0000203](http://www.washingtonpost.com/opinions/abolish-the-civil-asset-forfeiture-program-we-helped-create/2014/09/18/72f089ac-3d02-11e4-b0ea-8141703bbf6f_story.html?wpmk=MK0000203). Another example is the red light camera program in Chicago, in which the City of Chicago shortened the time of its yellow lights, leading to an additional \$8 million in revenue per year, but also, significantly more car accidents. David Kidwell, *City’s Yellow Light Change Caught 77,000 Drivers*, CHI. TRIB. (Oct. 10, 2014), <http://www.chicagotribune.com/news/chi-yellow-light-standard-change-20141010-story.html>; David Kidwell, *Experts: Chicago’s Short Yellow Light Times, Red Light Cameras a Risky Mix*, CHI. TRIB. (Dec. 23, 2014), <http://www.chicagotribune.com/news/watchdog/redlight/ct-yellow-light-timing-met-20141223-story.html#page=1>.

324. Michelangelo Temmerman, *The Structure of Patent Costs and Patent Offices’ Funding: The (Missing) Link to Patent Quality* 7 (Swiss Nat’l Ctr. of Competence in Research, Working Paper No. 2013/14, 2013).

325. *Id.*

326. ENVTL. PROT. AGENCY, EPA-190-S-12-001, FY 2013 EPA BUDGET IN BRIEF 1 (2012), [https://yosemite.epa.gov/sab/sabproduct.nsf/2B686066C751F34A852579A4007023C2/\\$File/FY2013\\_BIB.pdf](https://yosemite.epa.gov/sab/sabproduct.nsf/2B686066C751F34A852579A4007023C2/$File/FY2013_BIB.pdf).

327. ENVTL. PROT. AGENCY, ENFORCEMENT ANNUAL RESULTS FOR FISCAL YEAR 2012 (2012), <https://archive.epa.gov/enforcement/annual-results/web/pdf/eoy2012.pdf>.

### B. Redesigning Renewal Fees

With these challenges in mind, there are at least two ways that U.S. maintenance fees should be reconsidered. First, in line with considerations of equity, the USPTO should consider raising U.S. fees to historical and global norms and using the balance to improve patent examination quality. Second, the USPTO should consider adopting the practice of other jurisdictions of requiring maintenance fees to be paid yearly, rather than periodically. Right now, for example, to keep a European patent in force for twenty years not only costs roughly double what it costs to keep a U.S. patent in force,<sup>328</sup> but, because maintenance fees are due yearly, also requires the patentee to make seventeen separate decisions to keep a patent in force, and to make seventeen payments. In contrast, in the United States, a patentee only makes three affirmative decisions to keep a U.S. patent in force. The systems therefore set different defaults—in the United States, for example, once the third payment is made, the patent defaults to staying in effect for the remaining five or more years of its term.<sup>329</sup> Under the EPO system, if the patentee does nothing, the patentee must make an affirmative choice in order to keep the patent alive; under the default scenario it will expire. Support for using behavioral science insights like defaults is now embedded in the federal government.<sup>330</sup> It would be worth using this power to explore the consequences of the USPTO switching to a different fee schedule.

### C. Removing Offensive Threats through Defensive Only Patents

I offer one final, simpler way to reduce the risks associated with patent quality while still preserving the benefits of the current system—low cost, flexibility, and inertia. Though facially neutral, this option has the potential to particularly impact software patents in light of the industry dynamics driving their use. The alternative is to offer holders of patents, software or otherwise, the option to designate their patents as “defensive only.”<sup>331</sup> “Defensive only” patents would be examined like ordinary patents. However, they would be enforceable only if a patent holder were the subject to an offensive threat, for example, a demand letter or lawsuit. The patent holder could elect the “defensive only” designation at any time, entitling the owner to a discount off of any applicable fees, say 50%.<sup>332</sup> Once the patent

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328. See discussion *supra* Part III.

329. Assuming that the patent takes 2 to 2.5 years to be granted, giving it an effective term of 17.5 to 18 years.

330. Exec. Order No. 13,707, 80 Fed. Reg. 56,593 (Sept. 15, 2015).

331. This option is described in detail in Chien, *supra* note 107, at 859–60.

332. *Id.*

application or patent was designated as defensive, it would retain that status until lapsed. That way, a patentee could gain many of the advantages associated with holding a patent—signaling to the world innovative potential, providing a basis for financing (to some degree), and ensuring some measure of freedom of operation—without imposing many of the costs to society generally associated with patent holding. The cost savings would likely be appealing for those whose large patent portfolios require large payments to maintain and which pose the greatest threats to smaller companies. Some smaller companies may also find this option appealing in order to signal to their employees their commitment to open source sharing or defensive intentions.

While this idea may sound radical, it is not. Under Germany’s “License of Right” (“LOR”) scheme, a patent owner that declares that anyone can practice the invention in return for reasonable compensation receives a 50% discount off their maintenance fees;<sup>333</sup> the UK has long featured a similar scheme.<sup>334</sup> In addition, a number of the most innovative companies in the world have already made public commitments to commit their patents to defensive uses only. Under the Inventor Protection Agreement (“IPA”) adopted by Twitter, the company has promised to its employees that it will only use their patents for “defensive purposes,”<sup>335</sup> a commitment that has been used to attract talent and build culture at the firm.<sup>336</sup> Tesla has made a similar commitment, to “open source” its patents over electric vehicles and battery storage technology and make them freely available except to those who assert their patents against the company.<sup>337</sup> IBM, which has been the top filer for patents for years, as well as Sony, Google, LG Electronics, Canon,

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333. Ilya Rudyk, *The License of Right, Compulsory Licensing and the Value of Exclusivity 2* (Governance and the Efficiency of Econ. Sys., Working Paper No. 415, 2012) (describing Section 23 of the German Patent Act).

334. Intellectual Prop. Office, *Licensing Intellectual Property*, GOV.UK, <https://www.gov.uk/licensing-intellectual-property> (last updated Feb. 22, 2016) (for “license of right” endorsed patents a patent holder must grant a license to anyone who wants one; annual renewal fees are cut in half).

335. Benjamin Lee, *Brewing Our First IPA Patent, and New Adopters*, TWITTER: TWITTER BLOG (May 21, 2013), <https://blog.twitter.com/2013/brewing-our-first-ipa-patent-and-new-adopters>.

336. Joe Brockmeier, *Why Every Company Should Adopt Twitter’s Innovator’s Patent Agreement*, READWRITE (Apr. 17, 2012), <http://readwrite.com/2012/04/17/why-every-company-should-adopt> (describing the recruiting benefits of Twitter’s move).

337. Elon Musk, *All Our Patent Are Belong To You*, TESLA (June 12, 2014), <http://www.teslamotors.com/blog/all-our-patent-are-belong-you>; *Patent Pledge*, TESLA, <https://www.teslamotors.com/about/legal> (last visited Mar. 21, 2018) (defining what it means for a party to not act in good faith as asserting patents against Tesla, challenging Tesla patents, or knocking off Tesla’s trademark).

and about 2,050 other companies<sup>338</sup> are signatories to the Open Invention Network's ("OIN") "non-aggression" pact, which commits them to granting royalty-free patent licenses over Linux technology to other signatories.<sup>339</sup> These various pledges and promises demonstrate the strong interest in defensive uses of patents, as well as shortcomings with existing solutions—like other promises, one-way pledges are unenforceable in the absence of reasonable reliance.<sup>340</sup>

Offering a defensive only patent option would enable sorting between high and low value (defensive only) patents. However, unlike gold-plating during examination, a defensive patent option would be available any time, including after the patent has been granted and more information about the patent's value has emerged. It would not require development of a second, heightened tier of review. And though it should appeal most to companies that engage in defensive patenting, which are concentrated in the tech sector, it would be voluntary, thereby avoiding running afoul of bans on technological discrimination or the requirement of a twenty-year patent term enshrined in international law.<sup>341</sup>

According to surveys, 45% to 60% of companies acquire patents for defensive reasons, though even more obtain patents to prevent copying.<sup>342</sup> But Tesla's experience is instructive. The company originally got patents, "out of concern that the big car companies would copy our technology."<sup>343</sup> However, over time, Tesla discovered "[w]e couldn't have been more wrong. The unfortunate reality is the opposite: electric car programs . . . at the major manufacturers are small to non-existent."<sup>344</sup> However, just because Tesla is abandoning the desire to prevent copying, it isn't abandoning its patents. Instead, it has used them to encourage adoption of its technology and for defensive purposes,<sup>345</sup> has also used its patents to secure financing.<sup>346</sup> Though perhaps not the primary reason Tesla acquired patents, these non-

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338. See OIN, *supra* note 137.

339. OIN License Agreement, OPEN INVENTION NETWORK (May 1, 2012), <http://www.openinventionnetwork.com/joining-oin/oin-license-agreement/>.

340. Contreras, *supra* note 137, at 548.

341. See Marrakesh Agreement Establishing the World Trade Organization Annex 1C Agreement on Trade-Related Aspects of Intellectual Property Rights pt. 2, § 5, art. 33, ¶ 1, Apr. 15, 1994, 1869 U.N.T.S. 3, 311–12, <https://treaties.un.org/doc/Publication/UNTS/Volume%201867/volume-1867-I-31874-English.pdf>.

342. See Chien, *supra* note 107, at 814–24 (discussion of surveys).

343. Musk, *supra* note 337.

344. *Id.*

345. Patent Pledge, *supra* note 337.

346. Jack Ellis, *Despite the Patent 'Giveaway', Tesla Has Been Monetising Its Portfolio All Along*, IAM (June 27, 2014), <http://www.iam-magazine.com/Blog/Detail.aspx?g=b6ef62d3-99a7-4637-bea6-c696c61810b1>.

exclusionary uses promote innovation at the company. In the same way, companies may hold their patents for non-defensive reasons, but then transition to a primarily defensive purpose over time.

#### CONCLUSION

The challenge of how to ensure that patents are of high quality is neither new nor unique. In recognition that one of the major problems with improving patent quality is our inability to measure it, this Article systematically reviewed the drivers of patent quality at the application, examination, and renewal phases of a patent's life and quantified aspects of each of these phases for paired applications filed at both the USPTO and the EPO. This comparative perspective provides a way to reframe patent quality not as an elusive ideal but as the product of achievable milestones and performance metrics. It further reveals some of the operational and design features that contribute to patent quality at the EPO and USPTO, creating an important bridge to higher quality. Whether or not this exercise in naming and observing the factors that contribute to the quantity and quality of patents in force—including examiner-cited non-patent literature, grant and withdrawal, and renewal rates—succeeds will depend on the extent to which they can be used to quantify and reinforce improvements over time, in support of a shared responsibility and commitment to greater patent quality and a more stable patent system.

## APPENDIX

Fig. A1: Share of Patents with Any Examiner-Cited NPL (N= 19,122 Matched Pairs from Filing Year 2002)

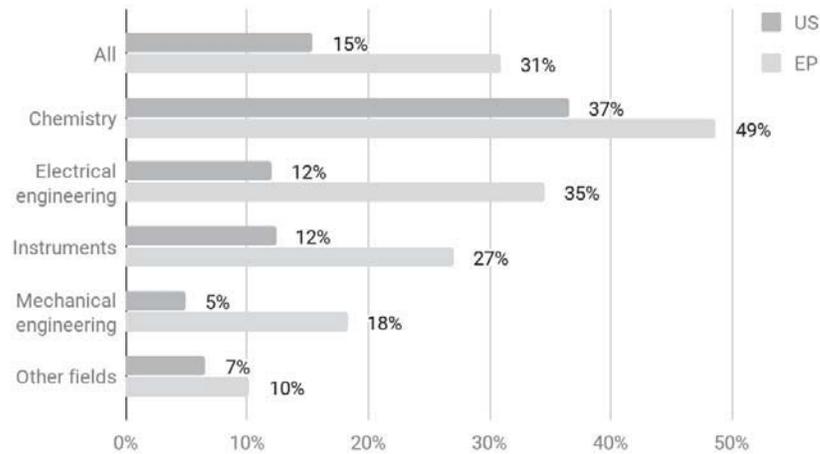


Fig. A2: NPL Share of Examiner Citations (N= 19,122 Matched Pairs from Filing Year 2002)

