1-1-2011

Predicting Patent Litigation

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Recommended Citation
90 Texas L. Rev. 283 (2011)

Articles

Predicting Patent Litigation

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Patent lawsuits are disruptive, unpredictable, and costly. The inability to anticipate patent litigation makes it practically uninsurable, exposes companies to costly lawsuits, and drives companies to accumulate patents in order to ward off litigation. This Article confronts this systemic problem by examining the factors that lead a particular patent to be litigated—only around 1%–2% of patents ever are. It relates the eventual litigation of a patent to earlier events in the patent's life, including changes in ownership of the patent (assignments, transfers, and changes in owner size), continued investment in the patent (reexamination and maintenance fees), collateralization of the patent, and citations to the patent. To date, these "acquired" characteristics, developed after a patent has issued, in contrast to the intrinsic qualities with which a patent is "born" have been the subject of limited academic study.

The results are dramatic: along the dimensions studied, patents that end up in litigation have markedly different characteristics than patents that do not. Importantly for predictive purposes, these differences develop prior to the time of litigation, suggesting that litigation-bound patents can be identified ahead of time. The results are also surprising, showing that the likelihood of litigation depends on not only how valuable the patent is but also on its owner and transaction history. The ability to sort among many patents has many potential applications, including in patent risk management, patent portfolio management, and patent planning. The findings presented here draw attention to a policy area that has been long overlooked—ensuring that the public has notice not just of what a patent covers but who owns it and what happens to it. Where a thicket of patents covers a single product, this information can help to highlight its thorniest parts. In addition, the ease with which patent owners can hide who they are and what they are doing with their patents raises cause for concern and potential reform of the patent system.

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* Assistant Professor, Santa Clara University School of Law. I thank Lee Petherbridge, Michael Risch, Matthew Sag, John Allison, Eric Goldman, Dave Schwartz, Jeanne Fromer, Ted Sichelman, Mark Lemley, Chester Chuang, Sonya Katyal, Rochelle Dreyfuss, Barton Beebe, Kathy Strandburg, David Friedman, and student and academic participants at the NYU IP Colloquium, Fordham IP Colloquium, Boston University Works-in-Progress IP Colloquium, DePaul IP Scholars Conference, and Kansas University Patent Conference for their input on earlier drafts; William Sundstrom, Amit Nigam and Maria Perez for their helpful statistical support; Gazelle Technologies, DocketX, and Lex Machina for access to their databases of patent data; Don Cung, Lee-Ann Smith-Freeman, Justin Mueller, Aashish Karkhanis, Jonathan Hicks and Sehyun Kim for excellent research assistance; and Dirk Calcoen, as always, for his support.

Introduction

The ability to predict that an event will occur varies widely.[1] Car accidents fall into the more predictable category.[2] The likelihood of a driver getting into an accident depends on a number of factors. Some of these

1. For an overview of the application of statistical forecasting methods to a variety of fields, with more and less success, see FRANCIS X. DIEBOLD, ELEMENTS OF FORECASTING 1–3 (1998) and J. Scott Armstrong, *Introduction* to PRINCIPLES OF FORECASTING: A HANDBOOK FOR RESEARCHERS AND PRACTITIONERS 1, 2–3 (J. Scott Armstrong ed., 2001).

2. Human factors, rather than roadway or vehicle conditions, are mostly to blame. *See, e.g.*, Harry Lum & Jerry A. Reagan, *Interactive Highway Safety Design Model: Accident Predictive Module*, PUB. ROADS, Winter 1995, at 14, 17 & fig.3 (finding that the majority of accidents are due solely to drivers and that 93% of accidents are due, at least in part, to drivers); Eleni Petridou & Maria Moustaki, *Human Factors in the Causation of Road Traffic Crashes*, 16 EUR. J. EPIDEMIOLOGY 819, 819 (2000) ("[I]n three out of five crashes, driver-related behavioral factors dominate the causation of a motor vehicle accident while they contribute to the occurrence of 95% of all accidents.").

factors, like experience and driving habits,[3] reflect common sense; others are less intuitive.[4] Together they can be used to calculate the risk of a collision and the insurance premiums a driver must pay.[5] Catastrophic earthquakes fall on the other side of the spectrum. Scientists have been studying earthquakes for years, yet no one can predict when the next large earthquake is going to take place.[6] "Big Ones"—earthquakes of a certain size—happen infrequently.[7] The processes that lead to them are complex and hard to model.[8]

It is popular to characterize patent litigation as uncertain and unpredictable.[9] One source of this uncertainty is not knowing in advance

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3. *See, e.g.*, Felix Famoye et al., *On the Generalized Poisson Regression Model with an Application to Accident Data*, 2 J. DATA SCI. 287, 291–92 (2004) (demonstrating that demographic factors, driving habits, and medication use affect how often elderly drivers are involved in automobile accidents); Petridou & Moustaki, *supra* note 2, at 820 tbl.1 (identifying driver inexperience, habitual speeding, habitual disregard of traffic regulations, drug and alcohol use, and nonuse of a seat belt or helmet as human factors that affect the likelihood of traffic injuries).

4. *See, e.g.*, Petridou & Moustaki, *supra* note 2, at 820 tbl.1 (citing "macho attitude," "[i]nappropriate sitting while driving," and "[b]inge eating" as contributing risk factors to the likelihood of traffic injuries); Eric A. Morris, *Who Drives Better, Men or Women?*, FREAKONOMICS (Mar. 10, 2010), http://www.freakonomics.com/2010/03/10/who-drives-better-men-or-women/ (addressing the role that gender plays and concluding that women have fewer accidents overall but more on a per mile basis).

5. *Cf. Car Insurance Discounts*, GEICO, http://www.geico.com/information/discounts/car-insurance-discounts/ (listing available discounts on GEICO auto insurance premiums for good drivers (available for drivers with "squeaky clean driving record[s]"), for good students (potentially available for any student who is a "smarty-pants," that is, a full-time student with a "good academic record"), and for drivers who always wear seat belts and who only carry passengers that wear seat belts).

6. *See* SUSAN HOUGH, PREDICTING THE UNPREDICTABLE: THE TUMULTUOUS SCIENCE OF EARTHQUAKE PREDICTION 222 (2010) ("The next Big One in California might be next year, or thirty years from now. It might not happen for one hundred years."); Hiroo Kanamori, *Earthquake Prediction: An Overview*, *in* 81B INTERNATIONAL HANDBOOK OF EARTHQUAKE AND ENGINEERING SEISMOLOGY 1205, 1212 (William H.K. Lee et al. eds., 2003) (characterizing short-term earthquake prediction as "very uncertain"). Some earthquakes, including aftershocks and certain small "repeating" earthquakes, on the other hand, are predictable. HOUGH, *supra*, at 47–48.

7. *See Earthquake Facts and Statistics*, U.S. GEOLOGICAL SURVEY, http://earthquake.usgs.gov/earthquakes/eqarchives/year/eqstats.php (last modified July 22, 2011) (showing that, on average, sixteen earthquakes above a magnitude 7 take place each year out of the over 1.4 million earthquakes of magnitude 2 or greater that are estimated to occur annually).

8. *See* Kanamori, *supra* note 6, at 1205 (explaining that an earthquake "is a long-term complex stress accumulation and release process").

9. These terms have been applied to many aspects of patent litigation, including claim construction, patent juries, and Federal Circuit decision making. *See, e.g.*, Gretchen Ann Bender, *Uncertainty and Unpredictability in Patent Litigation: The Time Is Ripe for a Consistent Claim Construction Methodology*, 8 J. INTELL. PROP. L. 175, 175 (2001) ("[T]he field of patent infringement litigation currently lacks the certainty and predictability necessary to efficiently litigate (and resolve) cases."); Paul M. Janicke, *On the Causes of Unpredictability of Federal Circuit Decisions in Patent Cases*, 3 NW. J. TECH. & INTELL. PROP. 93, 93–94 (2005) (noting other scholars' criticisms of "inconsistency" and "unpredictability" in Federal Circuit patent law decisions); Gerald J. Mossinghoff & Donald R. Dunner, *Increasing Certainty in Patent Litigation: The Need for Federal Circuit Approved Pattern Jury Instructions*, 83 J. PAT. & TRADEMARK OFF. SOC'Y 431, 432–33 (2001) (arguing for the adoption of uniform jury instructions for patent cases to reduce unpredictability in decisions). *But see, e.g.*, Ted Sichelman, *Myths of (Un)certainty at the*

what patents will be asserted. In certain industries, patent clearance—the process of surveying relevant patents to inform research and development or product development—is the exception rather than the rule.[10] Anyone who holds a patent can initiate a suit, and finding the problematic patents is difficult.[11] "Successful" searching carries a penalty—the risk of treble damages.[12] As a result, many companies do not even try to identify the patents that their products may tread upon, remaining ignorant of the risks they run until it is too late.[13]

While scholars have acknowledged that patents are routinely ignored,[14] they have paid scant attention to the consequences of this behavior. Yet ignorance breeds insecurity—causing companies to spend millions of dollars in acquiring patents they hope will discourage patent lawsuits.[15] Ignorance

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Federal Circuit, 43 LOY. L.A. L. REV. 1161, 1188–89 (2010) (asserting that patent litigation is not unpredictable or panel dependent); Michael J. Mazzeo et al., Excessive or Unpredictable? An Empirical Analysis of Patent Infringement Awards 25–29 (June 17, 2011) (unpublished manuscript), *available at* http://ssrn.com/abstract=1765891 (presenting a model to explain much of the variance in patent-damage awards).

10. *See* JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK 70 (2008) (citing a survey of the Intellectual Property Owners organization, in which 65% of respondents disagreed with the statement, "[w]e always do a patent search before initiating any R&D or product development effort").

11. This is in part because of the difficulty of determining what a patent's claim terms mean, a difficulty experienced by courts and others alike. *See* Kimberly A. Moore, Markman *Eight Years Later: Is Claim Construction More Predictable?*, 9 LEWIS & CLARK L. REV. 231, 239 (2005) ("In the cases in which one or more term was wrongly construed, the erroneous claim construction required the Federal Circuit to reverse or vacate the district court's judgment in 29.7% of the cases."); David L. Schwartz, *Practice Makes Perfect? An Empirical Study of Claim Construction Reversal Rates in Patent Cases*, 107 MICH. L. REV. 223, 249 (2008) (reporting that 29.7% of the patent cases studied "had to be reversed, vacated, and/or remanded because of an erroneous claim construction").

12. *See* 35 U.S.C. § 284 (2006) ("[T]he court may increase the damages up to three times the amount found or assessed."); *In re* Seagate Tech., LLC, 497 F.3d 1360, 1371 (Fed. Cir. 2007) (en banc) ("[T]o establish willful infringement, a patentee must show by clear and convincing evidence that the infringer acted despite an objectively high likelihood that its actions constituted infringement of a valid patent.").

13. *See* Mark A. Lemley, *Ignoring Patents*, 2008 MICH. ST. L. REV. 19, 21 [hereinafter Lemley, *Ignoring Patents*] ("[B]oth researchers and companies in component industries simply ignore patents. . . . They do it at all stages of endeavor. Companies and lawyers tell engineers not to read patents in starting their research, lest their knowledge of the patent disadvantage the company by making it a willful infringer.").

14. *See, e.g.*, *id.* at 21–22 (arguing that researchers and companies ignore patents until and sometimes even after they are sued); Katherine J. Strandburg, *User Innovator Community Norms: At the Boundary Between Academic and Industry Research*, 77 FORDHAM L. REV. 2237, 2250 (2009) (noting the "norm of ignoring patents" among scientists); John P. Walsh et al., *Where Excludability Matters: Material Versus Intellectual Property in Academic Biomedical Research*, 36 RES. POL'Y 1184, 1189–90 (2007) (reporting that, based on surveys conducted by the authors, only a small percentage of researchers regularly check patents related to their research).

15. *See* Colleen V. Chien, *From Arms Race to Marketplace: The Complex Patent Ecosystem and Its Implications for the Patent System*, 62 HASTINGS L.J. 297, 299 (2010) [hereinafter Chien, *Arms Race*] (noting the acquisition of large numbers of patents by companies in order to build defensive-patent portfolios). Two recent high-profile purchases of patent portfolios for defensive

also makes patent litigation—a high-stakes endeavor that can result in a company losing the right to sell its products[16]—practically uninsurable.[17] It makes companies complicit in the high costs of resolving disputes through their failure to address the relevant rights until after a product has been developed and changing it is costly.[18] Not knowing which patents are most likely to be asserted or the litigation risk associated with a particular field of endeavor hampers decision making on how to allocate research-and-development resources.

For these reasons, it is worth investigating the extent to which a U.S. patent's likelihood of suit can be predicted. This Article attempts to do so. Previous studies have focused on how the intrinsic qualities that a patent is born with, such as its number of claims and references, correlate with its value and litigation.[19] In contrast, this study considers the relationship between the likelihood that a patent will be litigated and, in addition to its intrinsic traits, the acquired traits it develops after it has issued but before litigation. Using data first made widely available in 2010, I compare litigated and unlitigated patents on a number of previously unexplored dimensions.

The results are dramatic, revealing that in every way considered, patents that do end up in litigation differ markedly from patents that do not. Litigation-bound patents start out with different intrinsic traits than unlitigated patents and develop different acquired traits over their lifetime. Specifically, they are more likely to be transferred, reexamined, maintained, and cited, and are more likely to have owners of different sizes and have money borrowed against them.[20] These results support the basic claim that just as the type of car, driver of the car, and how the car is driven impact the risk of accident, the identity of a patent's owner, the characteristics of the

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reasons include Google's purchases of IBM and Motorola Mobility patents. *See* Amir Efrati, *Google Buys IBM Patents*, WALL ST. J. (July 29, 2011), http://online.wsj.com/article/SB10001424053111904800304576475663046346104.html (describing Google's purchase of IBM patents) and Michael J. de la Merced, *In the World of Wireless, It's All About Patents*, DEALBOOK (Aug. 15, 2011), http://dealbook.nytimes.com/2011/08/15/in-the-world-of-wireless-its-all-about-patents/ (describing Google's purchase of Motorola Mobility's patents and wireless business).

16. *See* 35 U.S.C. § 283 (granting district courts the power to issue injunctions to prevent violation of patents); *see also* 19 U.S.C. § 1337(d) (allowing the International Trade Commission to exclude any article that infringes upon a valid U.S. patent). When a core technology is involved, the dispute may be characterized as "bet-the-company" patent litigation.

17. *See infra* notes 69–75 and accompanying text (describing the lack of viable defensive-patent-insurance options).

18. *Cf.* Lemley, *Ignoring Patents*, *supra* note 13, at 21–22 (describing how companies ignore patents, even when they get sued for patent infringement); Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1509 (2001) [hereinafter Lemley, *Rational Ignorance*] (noting that annually "the total cost of patent litigation is $2.1 billion, and the total cost of licensing outside of litigation is $525 million").

19. *See infra* subpart II(C).

20. *See infra* Figure 2.

patent, and the way in which the patent is used influence the likelihood of its litigation.

These findings have implications for patent practice and patent policy. They suggest that higher risk patents may in fact be identified ahead of time, based on a number of criteria. From a risk-management perspective, this insight can be used to help companies sift through a multitude of patents, focus attention on the patents that are most likely to be litigated, and assess the risk associated with a field of endeavor. From a policy perspective, this analysis reveals that patent-litigation risk is a function not only of the patent itself but also of its owner and what happens to the patent. A great deal of scholarly and policy attention has been focused on how the patent system has failed to provide "notice" of the rights of patent holders.[21] Most of the attention has focused on how hard it is to tell what activities fall inside or outside a patent's claims,[22] the so-called fuzzy-boundaries problem.[23] But the present analysis reveals that ownership and transactional information also matter and are particularly important for understanding and assessing patent risk. Yet much of this information, including whether or not a patent remains in force, has been cited, or is the subject of a reexamination request is not readily ascertainable.[24] It may be impossible to tell the basic fact of who owns a patent, as patent purchases are not required to be recorded.[25] These deficiencies add up to a kind of patent-notice failure that has not yet been explored,[26] one that pertains to the commercial rather than technical aspects of a patent.

Part I provides the empirical and policy contexts of patent clearance and explains why improving clearance is an important goal. Part II presents a description of the events that occur over the lifetime of a patent and why they may be relevant to the patent owner's decision to litigate. Part III describes the methodology and datasets that form the basis of the predictive model I developed. Part IV provides the results of my empirical analysis and explores the practical and policy implications of this work. Part V concludes.

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21. *See, e.g.*, BESSEN & MEURER, *supra* note 10, at 71 (listing inventors' concealment of patent claims, difficulty in claim interpretation, claim interpretation changes, and search costs as factors contributing to the "notice problem"). *See generally* FED. TRADE COMM'N, THE EVOLVING IP MARKETPLACE: ALIGNING PATENT NOTICE AND REMEDIES WITH COMPETITION (2011), *available at* http://www.ftc.gov/os/2011/03/110307patentreport.pdf (providing a comprehensive, policy-oriented report on patent notice and remedies based off of primary sources including governmental hearings and workshops attended by business representatives, patent scholars, and patent practitioners).

22. *See, e.g.*, BESSEN & MEURER, *supra* note 10, at 46 ("[I]nnovators find it increasingly difficult to determine whether a technology will infringe upon anyone's patents . . . .").

23. *Id.* at 53.

24. The difficulty of obtaining this information is described in section III(A)(3), *infra*.

25. *See* Carlos J. Serrano, *The Dynamics of the Transfer and Renewal of Patents*, 41 RAND J. ECON. 686, 690 & n.14 (2010) (noting that patent transfers and related transactions are often recorded at the Patent & Trademark Office (PTO) but that such recordation is not mandatory).

26. They are the subject of my current work in progress, tentatively entitled *Commercial Patent Notice*.

I. The Case for Improved Patent Clearance

In today's technologically advanced society, a given product may incorporate the technology of hundreds or thousands of patents.[27] According to one widely cited estimate, for example, 250,000 patents cover smartphone technology.[28] Of these patents, only a small fraction will end up in the courtroom.[29] Determining which of many patents have a higher chance of being litigated has been the subject of limited academic inquiry.[30] In part that is because the task of searching for relevant patents is daunting. However, it is also because scholars disagree about whether ignorance of risky patents really is a problem.

Jim Bessen and Michael Meurer are among those that believe that the high cost of patent clearance is problematic. They contend that the patent system fails to provide clear notice, including in the context of patent clearance.[31] Four factors contribute to this failure: patents have "[f]uzzy and unpredictable boundaries," patent owners can hide these boundaries, the scope delineated by these boundaries is overbroad, and there are a large number of patents.[32] The lack of clear notice is unacceptably costly, they argue, resulting in "especially fruitless" clearance,[33] increased patent litigation,[34] and the failure of the patent system to encourage innovation.[35]

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27. *See* Lemley, *Ignoring Patents*, *supra* note 13, at 19–20 (noting that companies in industries such as telecommunications often "must aggregate hundreds or thousands of different components to make an integrated product"); Rick Merritt, *Dealing with Mad Patent Disease*, EE TIMES (May 4, 2009), http://www.eetimes.com/electronics-news/4082731/Dealing-with-mad-patent-disease (reporting Intel Corporation's estimation that about 600,000 patents relate to its business and that that number is growing by up to 80,000 per year).

28. Numerous entities cite this estimate in a variety of contexts. *See, e.g.*, RPX Corp., Registration Statement (Form S-1) 59 (Sept. 2, 2011), *available at* http://www.sec.gov/Archives/edgar/data/1509432/000119312511240287/ds1.htm ("Based on our research, we believe there are more than 250,000 active patents relevant to today's smartphones . . . .").

29. *See, e.g.*, Lemley, *Rational Ignorance*, *supra* note 18, at 1501 (reporting that a maximum of about 2% of patents are litigated and that less than 0.2% of issued patents go to court).

30. At least to this author's knowledge, based on a search of Google Scholar, SSRN, and proprietary databases of "patent clearance," "patent search," and "patent" and "hazard" or "predict." In a notable related study, Professors Bessen and Meurer have estimated the hazard that a particular firm (rather than patent) will be involved in a patent litigation. *See* James E. Bessen & Michael J. Meurer, *The Patent Litigation Explosion* 18 (Bos. Univ. Sch. of Law, Law & Econ. Working Paper No. 05-18, 2005), *available at* http://ssrn.com/abstract_id=831685 (reporting, among other results, that firms with less than 500 employees are subject to an "enforcement hazard" approximately four times that faced by larger firms).

31. *See* BESSEN & MEURER, *supra* note 10, at 53–54 (listing explanations for the poor performance of notice in the patent system); *id.* at 69–70 (examining poor notice performance in the specific context of patent clearance).

32. *Id.* at 53–54.

33. *Id.* at 71.

34. *See id.* at 150–55 (presenting evidence that problems associated with notice may have contributed to an apparent spike in patent litigation in recent years).

35. *See id.* at 147 ("[N]otice failure and the resulting inadvertent infringement are central to the failure of patents to provide positive innovation incentives.").

The Federal Trade Commission (FTC) has agreed. In a 2011 report, it identified "difficulties in sifting through a multitude of patents" as a major challenge facing firms in the information technology (IT) sector.[36] According to the report, many industry representatives "view[] the 'sheer numbers' of potentially applicable patents as a primary obstacle to reliable clearance."[37] Clearance is particularly problematic in IT because there is no common vocabulary, product cycles are short, and products incorporate multiple technologies.[38] While a "smartphone" can be referred to as a "mobile device," "personal digital assistant," "communication apparatus," "one-to-many communications device," or many other names, there are arguably fewer ways, for example, to describe a chemical molecule.[39]

Other scholars and practitioners have a more sanguine view, however. The problem of clearance is really a "nonproblem,"[40] they argue, because innovators and firms have found ways to head off patent conflicts and carry on with their work.[41] In the biomedical field, academic researchers do not appear to be concerned about patent infringement.[42] For example, clearance is viewed as "manageable" in commercial-biopharmaceutical settings.[43] In the IT industry, clearance is not routinely performed,[44] but companies often accumulate patents to deter patent lawsuits as part of the patent arms race.[45]

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36. FED. TRADE COMM'N, *supra* note 21, at 90, 135.

37. *Id.* at 90; *see also* BESSEN & MEURER, *supra* note 10, at 53–54 (citing the "patent flood" as one of the primary reasons behind ineffective notice).

38. FED. TRADE COMM'N, *supra* note 21, at 90–91 (reporting that IT-industry representatives stated that these factors make performing clearance searches impractical).

39. *See, e.g.*, *id.* at 92 ("[I]n biotech . . . [there's] a very standardized vocabulary that is very easily searchable." (second alteration in original) (internal quotation marks omitted)).

40. The term *nonproblem* is borrowed from Rebecca Eisenberg. *See* Rebecca S. Eisenberg, *Noncompliance, Nonenforcement, Nonproblem? Rethinking the Anticommons in Biomedical Research*, 45 HOUS. L. REV. 1059, 1075–76 (2008) (compiling research to show that problems with patent clearance are not seriously affecting downstream product development).

41. *See id.* at 1079–80 (observing, in the context of biomedical research, that "in most cases firms are able to work through the patent issues and find R&D projects to pursue that are not unduly burdened with IP rights" and noting that in upstream research, scientists typically ignore patents without repercussions).

42. *See* Walsh et al., *supra* note 14, at 1189–90 (reporting that only a small percentage of surveyed researchers regularly check patents related to their research); *see also* Eisenberg, *supra* note 40, at 1063–72, 1076 (describing additional surveys reporting limited patent obstacles to research and acknowledging that academic researchers typically ignore patents); Strandburg, *supra* note 14, at 2250 (noting a norm of ignoring patents among scientists).

43. FED. TRADE COMM'N, *supra* note 21, at 81. To promote a greater degree of operational freedom in the biosciences, the Australian website PatentLens makes available patent-searching tools and landscapes in several bioscience areas. *Explore Technology Landscapes*, PATENT LENS, http://www.patentlens.net/daisy/patentlens/landscapes-tools.html.

44. *See* FED. TRADE COMM'N, *supra* note 21, at 90 ("Hearing testimony described how, in the IT and telecommunications industries, it is 'almost cost prohibitive' to perform clearance searches, and explained that searches are likely to produce 'false positives and false negatives.'").

45. *See generally* Chien, *Arms Race*, *supra* note 15.

Companies systematically ignore patents, notes Mark Lemley, yet they still manage to make and sell products.[46]

They can do so, Rebecca Eisenberg has explained, by relying on widespread nonenforcement.[47] Though many patents are likely infringed, the transaction and information costs associated with enforcing patents are high.[48] Not only must the right patents be identified and then asserted, but there is a risk that the patent will be invalidated in litigation. A lawsuit may invite a countersuit.[49] The awkwardness of suing a company that is also a partner makes companies less likely to pull the trigger.[50] Practically speaking, the benefits of patent litigation may be limited. Short life cycles and the ability to design around patents in the IT sector contribute to what Henry Chesbrough characterizes as a "weak appropriability" regime in which it is more difficult for innovators to exclusively benefit from their innovations.[51]

Thus, companies do not search because, in some sense, they can get away with not doing so. If 98%–99% of patents are never enforced, it does not make sense to identify all 100% of the potentially infringed ones. This rationale applies especially to smaller companies that fly under the radar.[52]

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46. Lemley, *Ignoring Patents*, *supra* note 13, at 20–21.

47. *See* Rebecca S. Eisenberg, *Patent Costs and Unlicensed Use of Patented Inventions*, 78 U. CHI. L. REV. 53, 59 (2011) (describing the patent system as characterized by "pervasive noncompliance and nonenforcement"). The heightened pleading standard recently confirmed by the Supreme Court in *Ashcroft v. Iqbal*, 129 S. Ct. 1937, 1950 (2009), has further raised barriers to suits. *See generally* Damon C. Andrews, Note, Iqbal-*ing* Seagate*: Plausibility Pleading of Willful Patent Infringement*, 25 BERKELEY TECH. L.J. 1955 (2010) (arguing that *Iqbal*'s heightened pleading standard, coupled with the Federal Circuit's opinion in *In re Seagate Technology, LLC*, 497 F.3d 1360 (Fed. Cir. 2007), "raise[d] the bar for sufficiently pleading willful patent infringement beyond any attainable level").

48. *See* LAW PRACTICE MGMT. COMM., AM. INTELLECTUAL PROP. LAW ASS'N, REPORT OF THE ECONOMIC SURVEY 2011, at 35 (2011) (estimating the costs of litigation at nearly $2.5 million when damages of $1 million to $25 million are at stake).

49. *Cf.* Chien, *Arms Race*, *supra* note 15, at 320 (discussing the litigation freedom enjoyed by patent-assertion entities that "do not have competing demands on their time and are invulnerable to countersuit," which advantages them in part by enabling them to "more credibly threaten to exercise the right to exclude conferred by a patent"); Eisenberg, *supra* note 47, at 69 (identifying norms that prevent companies from bringing suit).

50. However, this awkwardness does not prevent companies from suing partners. A prominent example is Apple's decision in 2011 to sue Samsung over iPhone and iPad technology, despite having been Samsung's second-largest customer of memory chips and mobile processors in 2010. Miyoung Kim, *Samsung Counter Sues Apple over iPhone, iPad*, REUTERS (Apr. 22, 2011), http://www.reuters.com/article/2011/04/22/uk-samsung-apple-idUSLNE73L00520110422.

51. HENRY CHESBROUGH, EMERGING SECONDARY MARKETS FOR INTELLECTUAL PROPERTY: US AND JAPAN COMPARISONS 31 (2006) (citing David J. Teece, *Profiting from Technological Innovation: Implications for Integration, Collaboration, Licensing and Public Policy*, 15 RES. POL'Y 285 (1986)), *available at* http://www.inpit.go.jp/blob/katsuyo/pdf/download/H17esm-e.pdf.

52. Author's conversations with patent counsel at several small companies in S.F., Cal. (May 5, 2011).

The benefits of patent clearance seem small, especially compared to the costs.[53]

Yet the characterization of a lack of clearance as a nonproblem is flawed for several reasons. The first is that one of the facts it depends on—the high cost of enforcement—has come under attack recently. Patent-assertion entities (PAEs, also known as patent trolls)—which I have defined as companies that use patents primarily to obtain license fees rather than to support the development or transfer of technology[54]—have figured out ways to reduce the costs of enforcement.[55] When they pursue multiple targets at a time,[56] assert the same patents over and over again,[57] and use contingency-fee lawyers,[58] they drive down the cost of litigating on a per-defendant and per-suit basis.[59] PAEs suffer from some disadvantages in litigating.[60] However,

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53. *See* Eisenberg, *supra* note 47, at 55 ("Information costs and transaction costs may dwarf potential gains to users from identifying and clearing rights or to owners from identifying infringers and asserting rights against them.").

54. Chien, *Arms Race*, *supra* note 15, at 300; *see also* FED. TRADE COMM'N, *supra* note 21, at 8 n.5 (describing PAEs as "firms whose business model primarily focuses on purchasing and asserting patents").

55. *See* Colleen V. Chien, *Turn the Tables on Patent Trolls*, FORBES (Aug. 9, 2011), http://www.forbes.com/sites/ciocentral/2011/08/09/turn-the-tables-on-patent-trolls/ [hereinafter Chien, *Turn the Tables*] (explaining tactics that PAEs use to lower the costs of enforcement).

56. Ronald A. Katz Technology Licensing, a well-known PAE, filed 107 suits against 1,295 defendants over a ten-year period. *Who Is Suing for Patent Infringement?*, PATENTLYO (Mar. 14, 2011), http://www.patentlyo.com/patent/2011/03/who-is-suing-for-patent-infringement.html. Likewise, in 2010, GeoTag, Inc. sued 397 companies for patent infringement in the Eastern District of Texas. Florian Mueller, *Microsoft and Google Jointly Sue GeoTag Inc. in Order to Invalidate a Patent Asserted Against More than 300 Entities*, FOSS PATENTS (Mar. 3, 2011), http://fosspatents.blogspot.com/2011/03/microsoft-and-google-jointly-sue-geotag.html.

57. *See* John R. Allison et al., *Extreme Value or Trolls on Top? The Characteristics of the Most-Litigated Patents*, 158 U. PA. L. REV. 1, 3 (2009) (finding "most-litigated patents" to be disproportionately owned by nonpracticing entities).

58. *See* Chien, *Arms Race*, *supra* note 15, at 311–12 (noting that the many lawsuits brought by the famed independent inventor Jerome Lemelson and his attorney, Gerald Hosier, popularized the contingency-fee model for use in patent litigation).

59. *See* Chien, *Turn the Tables*, *supra* note 55 (describing how patent trolls have reduced litigation costs and developed a profitable model of patent enforcement).

60. PAEs are not entitled to obtain lost profits and have a harder time than practicing entities getting district court injunctions. *See* Colleen Chien, *Protecting Domestic Industries at the ITC*, 28 SANTA CLARA COMPUTER & HIGH TECH. L.J. (forthcoming 2011) (manuscript at 4–5), *available at* http://ssrn.com/abstract=1856608 (documenting a post-*eBay* injunction grant rate of 54% to NPEs (including universities, research organizations, and PAEs), as compared to a 72%–77% overall rate for patent plaintiffs, in the district court). Small patent plaintiffs may have a harder time finding experienced patent counsel willing to represent them, including due to the pressure that large practicing-company clients have put on larger firms to "not represent trolls" and are likely to be less able to afford them. *See, e.g.*, Gwendolyn G. Ball & Jay P. Kesan, *Transaction Costs and Trolls: Strategic Behavior by Individual Inventors, Small Firms and Entrepreneurs in Patent Litigation* 23–24 (Ill. Pub. Law & Legal Theory Papers Series, Research Papers Series No. 08-21; Ill. Law & Econ. Papers Series, Research Papers Series No. LE09-005; 2009), *available at* http://ssrn.com/abstract=1337166 (finding evidence that small patent plaintiffs generally only brought strong claims and inferring from this that small firms are disadvantaged by being unable to bring claims of "average" strength under the contingency-fee model); *cf.* Joby A. Hughes & Kate L. Birenbaum, *Insuring Intellectual Property Risks: Creative Solutions on the Cutting Edge*, *in* PROTECTING YOUR

because "trolls" are not focused on developing or commercializing technology, they have less to lose from litigation—in terms of reputation, disruption, business partners, or countersuit—than a practicing company. These traits endow PAEs with a freedom to litigate[61] not shared by their practicing-company counterparts.[62] As the information- and transaction-cost barriers associated with litigation fall away, so too does the protective shelter that these costs have historically provided to infringers.[63]

Another reason it makes sense to try to improve the ability of companies to forecast patent risks is that while ignorance may be rational,[64] it is not optimal. When firms are forced to operate without knowledge of the patents that "read on" their products, both sides lose. Firms are deprived of the

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INTELLECTUAL PROPERTY ASSETS 203, 218–20 (Practising Law Inst. ed., 1999) (discussing how the litigation chances of certain small patent holders are negatively affected by their shallower pockets and less experienced counsel).

61. Elsewhere, I have used the term *freedom to litigate* to describe one of the primary contrasts between participants in the patent arms race, who have the general objective of securing the freedom to operate, and participants in the patent marketplace, where companies have exploited their freedom to litigate. *See* Chien, *Arms Race*, *supra* note 15, at 320 (contrasting research-and-development firms that acquire patents defensively in order to preserve their freedom to operate with PAEs that exploit their freedom to use their patents offensively in litigation).

62. Practicing companies do not enjoy the freedom to litigate when they assert their patents directly. However, they have found other ways to capture the benefits of the PAE business model. Operating companies Hewlett-Packard and Philips, for example, have formed ventures to enforce their patents separate from the parent companies. *See* Chien, *Arms Race*, *supra* note 15, at 324–25 (describing Sisvel, which licenses the patents of Philips and other companies, and related efforts). In addition, a company may support, through funds or patents, assertions by nonpracticing third parties for the benefit of the company, often unbeknownst to the target. Tom Ewing has called this practice "privateering." *See generally* Tom Ewing, *Introducing the Patent Privateers*, INTELL. ASSET MGMT. MAG., Jan.–Feb. 2011, at 31.

63. *See* Eisenberg, *supra* note 47, at 53 ("The costs of the patent system provide shelter for infringing behavior that might otherwise lead to either licensing or liability, perhaps mitigating excesses in the patent system while retaining strong rights that motivated owners may enforce.").

64. Ignorance may also be a misnomer for the response of the IT industry to patents. While they may be ignoring individual patents, manufacturers have paid millions of dollars to each other and to patent aggregators like Intellectual Ventures and RPX in order to secure the rights to large numbers of patents. *See* Nathan Myhrvold, *Funding Eureka!*, HARV. BUS. REV., Mar. 2010, at 40, 48–49 (stating that Intellectual Ventures has a portfolio of over 30,000 patents and that the company has earned more than $1 billion from licensing patent bundles); Tom Taulli, *RPX's Plan: Make a Fortune by Fixing the Patent Mess*, DAILYFINANCE (Jan. 25, 2011), http://www.dailyfinance.com/2011/01/25/rpx-fixing-the-patent-mess/ (describing RPX's growth as a patent aggregator as "torrid," stating that the company had added forty-seven additional clients at the end of 2010 over the five it added in 2008 and noting that these clients included Google, Samsung Electronics, Verizon, and Panasonic). In addition, rather than ignoring the patent system, the IT industry has paid careful attention to it and has demanded refinements to the patent system from Congress, the courts, and the Executive Branch. *See* Colleen V. Chien, *Patent Amicus Briefs: What the Courts' Friends Can Teach Us About the Patent System*, 1 U.C. IRVINE L. REV. 397 (2011) (reporting that 48% of patent amicus briefs filed by individuals or individual entities are filed by IT and financial companies); *see also* FED. TRADE COMM'N, *supra* note 21, app. C at 280–91 (listing representatives from a number of sectors as participants in FTC hearings on the patent system); Rick Merritt, *House Passes Patent Reform Bill*, EE TIMES (June 23, 2011), http://www.eetimes.com/electronics-news/4217213/House-passes-patent-reform-bill (reporting on lobbying by the Coalition for Patent Fairness, a group that includes many prominent electronics manufacturers, and its contribution to the America Invents Act).

opportunity to use patent information to make choices about how to design their products or prioritize their research-and-development efforts, and patent holders are deprived of the opportunity to transfer and commercialize their technology. When product companies "fly blind" in this way, they expose themselves to assertions and litigation. As the FTC has said, "resolving these claims often involves expensive litigation, which diverts resources and disrupts business operations. If the firm pays royalties, costs may increase and consumers may be deprived of the full benefit of competition among technologies."[65] There are many other contexts in which the ability to sort through a large number of patents and determine which ones are at the greatest risk of being asserted would be useful. Confronted with a large number of patents, the ability to efficiently identify the ones that really matter can greatly reduce the transaction costs associated with patent search, licensing, and purchase. It can also help companies manage their own portfolios, for example, when they are deciding which patents to maintain or abandon, which to try to sell, and which to donate.

Taken together, these developments make a compelling case for improving the ability of firms to identify litigation-bound patents. The following part discusses how data on patent disputes can be leveraged to identify such risks, and it contains the analyses I performed to address the specific problem of patent clearance.

II. Predicting Patent Litigation

A. The Use of Patent Data to Manage Patent Risk

The unpredictability of patent litigation is present at a number of stages in the product life cycle. When deciding what research areas to pursue, companies that do not search for related patents have limited information about how crowded the relevant patent landscape is and about who holds the rights. After a product has launched, a company may receive demand letters from patent holders. However, the company does not know which of these demands represent a credible threat of suit.[66] Even after a lawsuit has been filed, it is not always clear which plaintiffs intend to go to trial and which are focused on early-stage settlement. Once in litigation, it is difficult to predict

65. FED. TRADE COMM'N, *supra* note 21, at 3.

66. My experiences in practice and comments made to me by in-house counsel suggest this to be the case. *See also* Lemley, *Ignoring Patents*, *supra* note 13, at 22 ("Even then, it is common in many industries characterized by a significant number of 'patent trolls' to ignore the first cease-and-desist letter one receives from a patent owner, secure in the knowledge that patent litigation is expensive and uncertain and that some letter-writers will never follow up with a serious threat of suit."); *cf.* Mallun Yen, Cisco Systems, Written Adapation of Oral Remarks Delivered at the Federal Trade Commission Hearings on the Evolving IP Marketplace (Dec. 5, 2008), *available at* http://www.ftc.gov/bc/workshops/ipmarketplace/dec5/docs/myen2.pdf (describing how Cisco receives many requests that it license or purchase patents and how some of the requesting parties sue after their requests are declined, even though those parties and their patents were usually previously unknown to Cisco).

how long a suit will take,[67] what outcomes may be reached, and, should the patent be found valid and infringed, how large of a damages verdict the court may return. The skew in patent value, as measured by these outcomes, resembles lottery odds.[68]

Against this backdrop, it is unsurprising that the market for patent insurance is "extremely small and highly inefficient."[69] Offerings are limited and expensive.[70] Defensive policies,[71] which protect against the costs from unwanted lawsuits,[72] fail to cover many situations. Analysis of one policy found International Trade Commission proceedings, counterclaims, some unauthorized appeals, and more than twenty other situations excluded from coverage.[73] Coverage is generally capped based on the cost of the policy.[74] Unless enough companies are enrolled, the risk cannot be spread to reduce the costs of coverage, a well-known problem in the insurance industry known as "adverse selection."[75] In order for the market for patent insurance to develop, these obstacles to its growth will need to be addressed.

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67. *See* Jay P. Kesan & Gwendolyn G. Ball, *How Are Patent Cases Resolved? An Empirical Examination of the Adjudication and Settlement of Patent Disputes*, 84 WASH. U. L. REV. 237, 259–60 (2006) (reporting that a small number of cases filed in the years 1995, 1997, and 2000 were still active as of June 2006).

68. *See* Dennis D. Crouch, *The Patent Lottery: Exploiting Behavioral Economics for the Common Good*, 16 GEO. MASON L. REV. 141, 149–50 & n.39 (2008) (reviewing and agreeing with literature characterizing the patent system as a "lottery").

69. Leib Dodell & Kimberly Cauthorn, *Using Insurance to Manage Patent Risks*, INTELL. ASSET MGMT. MAG., Mar.–Apr. 2011, at 37, 37. The patent-insurance market, however, is not particularly young—patent insurance has reportedly been available since at least 1995. *See* Mark A. Hofmann, *Patent Coverage Lags Well Behind Infringement Suits*, BUS. INS., Jan. 2, 1995, at 3 (stating in 1995 that the first "patent infringement liability polic[y]" was issued "less than a year ago"); *see also* Jean O. Lanjow & Josh Lerner, *The Enforcement of Intellectual Property Rights: A Survey of the Empirical Literature* 1 (Nat'l Bureau of Econ. Research, Working Paper No. 6296, 1997), *available at* http://www.nber.org/papers/w6296 ("There is also a nascent patent enforcement insurance market.").

70. *See* Dodell & Cauthorn, *supra* note 69, at 37 (stating that patent-related insurance is perceived as "hard to come by" and "too expensive"). Annual premiums for patent insurance begin at about 1%–10% of the indemnity limit. *Id.* at 41.

71. Besides defensive insurance, other forms of patent insurance are available. *See* Luigi Buzzacchi & Giuseppe Scellato, *Patent Litigation Insurance and R&D Incentives*, 28 INT'L REV. L. & ECON. 272, 274–83 (2008) (noting that offensive patent insurance policies, known as "pursuit policies," have been available in the United States since 1995 and modeling a form of offensive patent insurance). Insurance policies may also be written to protect against the invalidation of a patent or to cover IP-related representations and warranties in M&A transactions. Dodell & Cauthorn, *supra* note 69, at 40.

72. "Offensive" patent insurance policies, by contrast, cover the costs of bringing patent lawsuits. Buzzacchi & Scellato, *supra* note 71, at 274 & n.8.

73. J. Rodrigo Fuentes, Note, *Patent Insurance*: *Towards a More Affordable, Mandatory Scheme?*, 10 COLUM. SCI. & TECH. L. REV. 267, 273–74 (2009).

74. *See* Dodell & Cauthorn, *supra* note 69, at 41 (noting that patent-infringement policies are generally priced according to their limits on liability coverage).

75. *Cf.* Fuentes, *supra* note 73, at 289 (stating that the high costs of patent insurance policies will not be lowered unless more companies join the "risk pool" of insured companies but that these companies will not join unless insurance costs are first lowered); Peter Siegelman, *Adverse Selection in Insurance Markets: An Exaggerated Threat*, 113 YALE L.J. 1223, 1223–24 (2004)

Besides conventional risk-management solutions, the collective experience of the patent community may reveal patterns that can help product developers and patent holders reduce unpredictability. This experience is increasingly being collected and shared through various patent databases. Lex Machina, formerly known as the Stanford IP Litigation Clearinghouse, collects data on various facets of patent litigation.[76] This data can be used to determine which venues are most favorable to patent plaintiffs,[77] when to settle and license,[78] and what types of arguments have been successful before particular judges.[79] PricewaterhouseCoopers maintains a damage-awards database that has been used by Michael Mazzeo and his colleagues to identify the determinants of damage awards and explain the variances between them to an exceptional degree.[80] Groups like Patent Freedom and RPX, through their membership and intelligence-gathering activities, have amassed data about the litigation tactics, portfolios, and profiles of particular PAEs.[81]

These services both demonstrate and address the need for greater predictability about patent litigation. However, they focus almost exclusively on what happens after a patent suit has been filed or a demand made. Less attention has been paid to how to leverage recently-made-available data toward reducing uncertainty at the patent-clearance stage.

("The phrase 'adverse selection' . . . describe[s] the process by which insureds utilize private knowledge of their own riskiness when deciding to buy or forgo insurance. . . . [I]nsurers find themselves charging an average rate to a population that contains only the worst risks, and end up losing money by virtue of having their products selected by only high-risk individuals."); David M. Cutler & Richard J. Zeckhauser, *Adverse Selection in Health Insurance* 9 (Nat'l Bureau of Econ. Research, Working Paper No. 6107, 1997), *available at* http://www.nber.org/papers/w6107.pdf ("[A] loss from adverse selection is that there is less risk spreading than is optimal. In the adverse selection equilibrium, sick people end up paying substantially more for health insurance than healthy people because they choose the more expensive plan and because they are mixed in with other sick people.").

76. Lex Machina generously provides this data to its academic subscribers for free. For more information on the venture, see *The Genesis of Lex Machina*, LEX MACHINA, https://lexmachina.com/about/genesis.

77. *See, e.g.*, Mark A. Lemley, *Where to File Your Patent Case*, 38 AIPLA Q.J. 401, 404, 407 tbl.3, 415 tbl.5 (2010) (using the Lex Machina database to find that patent holders had the highest win rate in the Northern District of Texas and to find that claims were resolved most quickly in the Western District of Wisconsin).

78. *LMI Reports*, LEX MACHINA, https://lexmachina.com/reports/overview.

79. *Id.*

80. *See* Mazzeo et al., *supra* note 9, at 27, 37, 40 (presenting an econometric model based on 340 cases that explains 75% of the variation in damage-award amounts and suggests that awards "are highly predictable" and correlated with patents' economic values).

81. *See, e.g.*, *Home*, PATENT FREEDOM, https://www.patentfreedom.com/ (noting that Patent Freedom "provides information on the activities, techniques, staff, funding, and patent holdings of non-practicing entities"). Avancept, which specializes in gathering market intelligence about Intellectual Ventures, has also amassed significant data. *See Three Intellectual Property Reports*, AVANCEPT LLC, http://avancept.com/Publications.html (describing available reports on Intellectual Ventures).

This Article fills this gap by exploring differences between litigated and unlitigated patents based on a variety of characteristics.

B. Comparing Litigated and Unlitigated Patents

The traits of litigated patents have been the subject of extensive study. However, past studies have tended to focus on the "intrinsic" traits that a patent is born with, such as the number of claims or time spent in prosecution.[82] In part, this is because data on the intrinsic characteristics of patents has been readily available.[83] Scholars have paid relatively little attention to litigated patents' acquired characteristics,[84] which include whether the patent has been traded, experienced a reexamination, or been used as security for a loan.[85]

Yet post-issuance events provide improved insight into a patent's worth and likelihood of litigation. They develop later in time than a patent's intrinsic characteristics, reflecting updated information about the value of the patent.[86] While the intrinsic characteristics of patents are largely within the control of the patentee,[87] the acquired characteristics of patents are more likely to reflect the evaluation of members of the public with respect to the worth of the patent. For example, while a patentee can easily change an intrinsic characteristic like the number of claims in a patent, it is more difficult, for example, to get patent examiners to cite the patent in the examination of subsequent patents owned by others. At the very least, these traits can provide additional indicia of patent value and the likelihood of litigation.

For these reasons, I considered both the intrinsic and the acquired characteristics of patents. I found that litigated patents are not only

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82. *See, e.g.*, John R. Allison et al., *Valuable Patents*, 92 GEO. L.J. 435, 436–38 (2004) (identifying key characteristics of valuable patents); Michael Risch, *Patent Troll Myths*, 42 SETON HALL L. REV. (forthcoming 2012) (manuscript at 20–26), *available at* http://ssrn.com/abstract_id=1792442 (evaluating the value of patents held by nonpracticing entities); *see also* Sannu K. Shrestha, *Trolls or Market-Makers? An Empirical Analysis of Nonpracticing Entities*, 110 COLUM. L. REV. 114, 128–30 (2010) (arguing that nonpracticing entities may serve a valuable function by searching for high-value patents to purchase and assert).

83. *See generally* Bronwyn H. Hall et al., *The NBER Patent-Citations Data File: Lessons, Insights, and Methodological Tools*, *in* PATENTS, CITATIONS & INNOVATIONS 403 (Adam B. Jaffe & Manuel Trajtenberg eds., 2002) (presenting and describing the NBER Patent-Citations Data File).

84. With the exception of the acquired characteristic of how many times the patent has been cited, which has been studied widely. *See, e.g.*, Allison et al., *supra* note 82, at 449 & n.60 (describing the literature studying forward citations).

85. These events are depicted in Figure 1, *infra*.

86. *See* Christopher A. Cotropia, *The Folly of Early Filing in Patent Law*, 61 HASTINGS L.J. 65, 69, 109–10 (2009) (noting that when inventions are patented early in the development process, their inventors have not had time to explore their commercial viability and stating that "[a]s time passes, the true value of the [patent]—the value of commercialization—becomes clearer"). Such post-issuance events provide much more insight into a patent's worth than does, for example, increasing the number of prior art citations through the submission of more references.

87. Even the number of prior art citations is largely influenced by applicant-submitted prior art and the length of prosecution. In addition, the patentee could submit a prior art citation to the PTO in the prosecution of a later-filed patent application, a process called "self-citation."

prosecuted differently but are also treated differently after they issue. The following subparts discuss both intrinsic and acquired characteristics and explore their relationship to litigation.

C. Intrinsic Characteristics

Previous studies have found that patents that end up in litigation differ from the start from patents that do not. The initial characteristics of both the patent and the patent owner have relevance to the eventual litigation of the patent. Litigated patents are prosecuted[88] differently than their unlitigated counterparts,[89] and they are more likely to be assigned to certain types of patentees.[90]

Litigated patents have more claims,[91] more prior art citations,[92] and larger families,[93] for example, than unlitigated patents. These traits reflect a greater investment in the patent by the patentee, signaling a heightened expectation of its value.[94] It costs more money and takes more time to pursue more claims.[95] Applicant-submitted prior art is often generated during the prosecution of a foreign counterpart case,[96] which requires filing and translation fees.[97] Having an extended family of patent applications—

88. "Prosecution" is the process of securing a patent from the PTO. ROBERT P. MERGES ET AL., INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE 181 (5th ed. 2010). Generally, prosecution includes the process beginning with the filing of a patent application and ending with the grant of a patent, and it involves exchanges with one or more patent examiners. *See* Gene Quinn, *An Overview of the U.S. Patent Process*, IPWATCHDOG (July 31, 2011), http://ipwatchdog.com/2011/07/31/an-overview-of-the-u-s-patent-process/ (describing steps in the patent prosecution process).

89. *See* Allison et al., *supra* note 82, at 456–60 (reporting findings that litigated patents had a "more involved" prosecution process and spent a "significantly longer" period of time in prosecution compared to issued patents).

90. *See infra* notes 99–100 and accompanying text.

91. Jean O. Lanjouw & Mark Schankerman, *Characteristics of Patent Litigation: A Window on Competition*, 32 RAND J. ECON. 129, 140–41 (2001).

92. Allison et al., *supra* note 82, at 438; *see also* Katrin Cremers, *Determinants of Patent Litigation in Germany* 13 (Ctr. for European Econ. Research (ZEW), Discussion Paper No. 04-72, 2004), *available at* ftp://ftp.zew.de/pub/zew-docs/dp/dp0472.pdf ("In all cases litigated patents are more frequently cited than those unlitigated . . . .").

93. *See* Cremers, *supra* note 92, at 13 (reporting that, on average, litigated patents have larger family sizes as compared to unlitigated patents).

94. *Cf. id.* at 7 (noting that citations play a role as "an indicator for the importance of the patent").

95. *See* 37 C.F.R. § 1.16(h)–(i) (2011) (listing U.S. Patent and Trademark Office fees for filing more than three independent claims or more than twenty total claims).

96. *See* Christopher A. Cotropia et al., *Do Applicant Patent Citations Matter? Implications for the Presumption of Validity* 17 (Stanford Law & Econ. Olin Working Paper No. 401, 2010), *available at* http://ssrn.com/abstract=1656568 ("Frequently, though not always, [prior] art [references] emanate[] from search reports from the examination of related U.S. or foreign counterpart applications.").

97. According to one estimate, average costs for directly filing an application in a national patent office range from $2,000 to $12,000 per country. Rajiv P. Patel & Neil F. Maloney, *International Patent Strategy: Springboard to Going Global*, FENWICK & WEST LLP (June 18, 2007), http://www.fenwick.com/docstore/publications/ip/int_patent_strategy.pdf; *see also* U.S.

through the pursuit of additional claim scope by the filing of a "continuation," "continuation in part," or "divisional" application[98]—requires more money in filing and legal fees.

Studies have shown that who owns the patent also impacts whether the patent is litigated. Patents originally assigned to individuals and small companies are more likely to be litigated.[99] Patents initially owned by domestic, as opposed to foreign, entities are also more likely to be litigated.[100]

The prosecution characteristics of patents have been used by academics[101] and patent brokers[102] to identify valuable patents. In this study, I use these characteristics to identify the patents most likely to end up in court. In particular, I note the number of claims each patent had, whether it was issued to a small-entity owner, how many foreign-counterpart applications it had, and how many members were in the patent's family, including direct "ancestor" patents from which the patent claimed a priority benefit and "descendant" patents that claimed a benefit from the patent in question.[103] As the intrinsic characteristics of patents and the choices that these characteristics reflect have been well documented in previous studies, the paragraphs below focus on the acquired characteristics of patents and their relationship to litigation.

D. Acquired Characteristics

After a patent issues, it can follow one of a number of routes or patent "pathways."[104] Although the patent system has been described as a "two-stage bargain" of prosecution and litigation,[105] there are many

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GOV'T ACCOUNTABILITY OFFICE, GAO-03-910, INTERNATIONAL TRADE: EXPERTS' ADVICE FOR SMALL BUSINESSES SEEKING FOREIGN PATENTS 26–27 (2003) (describing the costs of obtaining foreign patents).

98. Litigated patents are associated with higher numbers of each of these forms of filing. *See* Allison et al., *supra* note 82, at 456–57 (reporting that, on average, 0.72 continuations are filed per litigated patent, compared with 0.24 per issued patent; 0.60 continuation-in-part applications are filed per litigated patent, compared with 0.18 per issued patent; and 0.25 divisionals are filed per litigated patent, compared with 0.11 per nonlitigated patent).

99. *Id.* at 438.

100. *See* Lanjouw & Schankerman, *supra* note 91, at 136 (reporting that patents owned by domestic entities have an aggregate litigation rate almost five times that of patents owned by foreign entities).

101. A good review of these studies is provided by Allison, Lemley, and Walker. Allison et al., *supra* note 57, at 3 n.4.

102. *See* James E. Malackowski & Jonathan A. Barney, *What Is Patent Quality? A Merchant Banc's Perspective*, LES NOUVELLES, June 2008, at 123, 129–34 (discussing factors and methods used by investors to value patents).

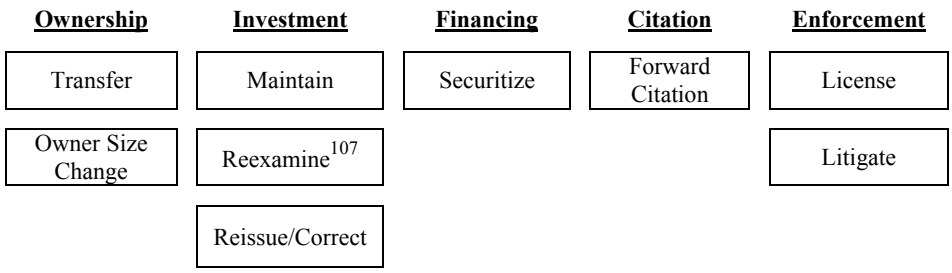
103. *See infra* Table 1.

104. *See* Chien, *Arms Race*, *supra* note 15, at 341–42 (describing how patents traverse "pathways" over their lifespans through changes in, among other things, ownership and the purposes for which they are used).

105. Jay P. Kesan, *Carrots and Sticks to Create a Better Patent System*, 17 BERKELEY TECH. L.J. 763, 772–73 (2002).

additional decision points in a patent's lifetime. The potential post-issuance events in a patent's lifetime are presented in Figure 1.[106]

Figure 1. Post-issuance Patent Events



With some notable exceptions,[108] post-issuance patent "transactions" have been the subject of limited systemic empirical study. In part, this is because the data regarding such transactions have not been readily available. Previously, the U.S. Patent and Trademark Office (PTO) would provide this data upon request but charge a hefty fee.[109] In 2010, the PTO, under the leadership of its director, David Kappos, and in partnership with Google, made a large amount of transactional data about patents, including grants, assignments, and maintenance fees, publicly available for free.[110]

This newly available data,[111] as well as data obtained from the PTO website and other sources, provided the basis for the analysis reported in this Article. This data have the potential to greatly enhance our understanding of how patents are actually being used as opposed to how they are viewed (as

106. For statistics describing the prevalence of a number of these events, see *infra* Figure 2.

107. The America Invents Act creates a number of additional forms of review in the patent office of a patent. *See infra* note 148 and accompanying text.

108. *See supra* note 30 and accompanying text.

109. E-mail from PTO official to author (July 18, 2011, 9:05 AM) ("The Patent Assignment Daily XML File used to be approximately $5,000 ($5,350) for the front file, 365 files, one calendar year. The Patent Assignment Retrospective XML File used to be approximately $10,000 ($10,200) for the backfile, 8 large files, 25+ calendar years.").

110. Thomas Claburn, *Google Hosts Free Bulk Patent, Trademark Data*, INFORMATIONWEEK (June 2, 2010), http://www.informationweek.com/news/storage/virtualization/225300208. This data was available before, but some companies spent "hundreds of thousands of dollars" to acquire it. *Id.*; *see also* Jon Orwant, *Free Download: 10 Terabytes of Patents and Trademarks*, GOOGLE PUB. POL'Y BLOG (June 2, 2010, 2:40 PM), http://googlepublicpolicy.blogspot.com/2010/06/free-download-10-terabytes-of-patents.html (noting that another patent-database project had previously spent "hundreds of thousands of dollars" on acquiring data from the PTO).

111. To view this data as archived by Google, see *USPTO Bulk Downloads: Patents*, GOOGLE, http://www.google.com/googlebooks/uspto-patents.html.

documented through surveys)[112] or pursued (as documented through patent-prosecution studies).[113]

1. Changes in Patent Ownership.—Patents are initially issued to inventors or the organizations they work for.[114] Subsequently, ownership of the patent can be transferred by assignment.[115] Patent transfers, or "reassignments," are growing: in 1980, less than 2,000 U.S. reassignments were reported; by 2003, this number had grown to nearly 90,000.[116] The growth in the secondary market for patents[117] is a phenomenon that has been widely noted, including by the FTC[118] and by academics.[119]

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112. *See, e.g.*, Stuart J.H. Graham & Ted Sichelman, *Why Do Start-Ups Patent?*, 23 BERKELEY TECH. L.J. 1063, 1088 n.115 (2008) [hereinafter Graham & Sichelman, *Why Do Start-Ups Patent?*] (describing many of the seminal surveys carried out to assess large-company attitudes towards IP). For details of a more recent study, the Berkeley Patent Survey, see generally *id.* at 1091–97 and 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 (2009) [hereinafter Graham et al., *High Technology Entrepreneurs*].

113. Dennis Crouch has authored many of these studies. *See, e.g.*, Dennis Crouch, *The Rising Size and Complexity of the Patent Document* (Univ. of Mo. Sch. of Law Legal Studies Research Paper No. 2008-04, 2008), *available at* http://ssrn.com/abstract=1095810 (reporting that the average number of words and the average number of claims in patent applications rose from 1987 to 2007); Dennis Crouch & Jason Rantanen, *Beating the Deadline: Timing the Responses to Non-final Office Actions*, PATENTLYO (Jun. 14, 2010, 5:26 AM), http://www.patentlyo.com/patent/2010/06/beating-the-deadline-timing-the-repsonses-to-non-final-office-actions.html (studying how long patent prosecutors wait before responding to PTO actions); Dennis Crouch & Jason Rantanen, *Dropping: Average Number of Claims Per Patent*, PATENTLYO (Jan. 7, 2010, 7:01 AM), http://www.patentlyo.com/patent/2010/01/dropping-average-number-of-claims-per-patent.html (reporting a more recent decline in the number of claims per issued patent).

114. Bd. of Trs. of the Leland Stanford Junior Univ. v. Roche Molecular Sys., Inc., 131 S. Ct. 2188, 2194–95 (2011) ("In most cases, a patent may be issued only to an applying inventor, or—because an inventor's interest in his invention is 'assignable in law by an instrument in writing'—an inventor's assignee." (citing 35 U.S.C. §§ 151–152, 261 (2006))). The practice of inventors assigning their patents after issue is old; according to a historical account by Naomi Lamoreaux and Kenneth Sokoloff, the high volume of patent assignment contracts in 1870 indicated that trade in patents was well developed by that time. Naomi R. Lamoreaux & Kenneth L. Sokoloff, *Inventors, Firms, and the Market for Technology in the Late Nineteenth and Early Twentieth Centuries*, *in* LEARNING BY DOING IN MARKETS, FIRMS, AND COUNTRIES 19, 25 (Naomi R. Lamoreaux et al. eds., 1999).

115. *See* United States v. Dubilier Condenser Corp., 289 U.S. 178, 187 (1933) ("A patent is property and title to it can pass only by assignment.").

116. CHESBROUGH, *supra* note 51, at 63. Chesbrough documents a similar rise in patent transfers in Japan, from less than 5,000 in 1997 to more than 35,000 in 2005. *Id.* at 101.

117. As distinguishable from the market for technology, which includes not only patent transfers but also licenses and the transfer of know-how. Writing in 2001, Arora, Fosfuri, and Gambardella estimated that the world market for technology was about $35 to $50 billion annually. ASHISH ARORA ET AL., MARKETS FOR TECHNOLOGY: THE ECONOMICS OF INNOVATION AND CORPORATE STRATEGY 43 (2001).

118. *See* FED. TRADE COMM'N, *supra* note 21, at 58–67 (presenting a report on the development of secondary patent markets).

119. *See, e.g.*, Chien, *Arms Race*, *supra* note 15, at 310–17 (describing the different actors within the patent market and noting the history of the patent market's growth); Ashby H.B. Monk, *The Emerging Market for Intellectual Property: Drivers, Restrainers, and Implications*, 9 J. ECON. GEOGRAPHY 469, 470 (2009) (explaining how IP strategies and intermediaries are causing the

a. Changes in Patent Ownership and Patent Litigation.—The relationship between reassignment and litigation has not been studied in depth. One reason companies purchase patents on the secondary market is for litigation. Indeed, the FTC has defined a PAE as a company focused on "*purchasing* and asserting patents."[120] Transferred patents and litigated patents have more forward citations[121] than nontransferred, nonlitigated patents.[122]

Universities, defunct start-ups, and healthy companies have all transferred their patents to companies that have litigated them.[123] For example, the patents of Conexant, a publicly traded company, have been litigated by a three-person PAE called WiAV, LLC,[124] and the patents of former "Baby Bell" Ameritech have been used by Intellectual Ventures to sue several technology companies.[125]

In his study of litigated patents, Michael Risch found that PAEs sourced their patents from healthy operating companies as well as from defunct start-ups.[126] John Allison and his colleagues reported that the "most-litigated patents" are more likely to be reassigned than once-litigated patents.[127] According to one estimate, large companies are the source of 7%–12% of

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patent market to grow); Timo Fischer & Joachim Henkel, Patent Trolls on Markets for Technology: An Empirical Analysis of Trolls' Patent Acquisitions 23 (Apr. 28, 2011) (unpublished manuscript), *available at* http://ssrn.com/abstract_id=1523102 (identifying an increase over time in the number of patents acquired by trolls); *see also* CHESBROUGH, *supra* note 51, at 3 (noting "signs of an emerging secondary market for IP").

120. FED. TRADE COMM'N, *supra* note 21, at 8 n.5 (emphasis added).

121. *See infra* section II(D)(4).

122. *See* Serrano, *supra* note 25, at 699 ("[Y]ounger, frequently cited, more original, and recently traded patents were more likely to be traded and renewed."); *see also* Allison et al., *supra* note 57, at 6, 13 tbl.2 (reporting that the "most-litigated patents" have significantly higher numbers of forward citations than patents litigated only once); Lanjouw & Schankerman, *supra* note 91, at 138 (reporting that litigated patents have higher numbers of forward citations).

123. *See* Chien, *Arms Race*, *supra* note 15, at 312–15 (describing the secondary-market sellers of patents, including defunct start-ups, very large corporations, and universities); Risch, *supra* note 82, at 26–27 (noting that studied patents that were ultimately litigated were originally held by extant and defunct companies, partnerships, a university, and a hospital).

124. Chien, *Arms Race*, *supra* note 15, at 343–44.

125. *See* Dennis Crouch, *Intellectual Ventures Takes First Overt Legal Actions to Enforce its Mammoth Patent Portfolio*, PATENTLYO (Dec. 8, 2010), http://www.patentlyo.com/patent/2010/12/intellectual-ventures-takes-first-overt-legal-actions-to-enforce-its-mammoth-patent-portfolio.html (describing three lawsuits brought by Intellectual Ventures against other companies and the assignment histories of the patents involved). For the assignment record of one of the patents in the suit, see *Patent Assignment Abstract of Title*, U.S. PAT. & TRADEMARK OFF., http://assignments.uspto.gov/assignments/q?db=pat&qt=pat&reel=&frame=&pat=5987610&pub=&asnr=&asnri=&asne=&asnei=&asns=.

126. *See* Risch, *supra* note 82, at 31 (reporting that, of ninety-one companies surveyed whose patents were acquired by PAEs, only nine were defunct, while seventy-eight appeared to be still in operation in some form); *see also* Colleen Chien, *From Arms Race to Patent World War: The Promise and Perils of Defensive Patenting*, INTELL. ASSET MGMT. MAG. (forthcoming 2012) (manuscript at fig.2) (on file with author) [hereinafter Chien, *Promise and Perils*] (indicating that small companies and individual inventors are the main source of patents for NPEs).

127. Allison et al., *supra* note 57, at 22 tbl.6.

NPE patents, while small companies account for 49%–50% and independent inventors for 26%–28% of the total.[128] For many of the studied patents, the transfer of the patent was a precursor to its litigation.[129] Thus, it seems worthwhile to explore the relationship between patent transfer and patent litigation.

I coded three types of variables to reflect changes in patent ownership. First, I counted the number of recorded assignments for each patent.[130] By itself, this number is not particularly meaningful, as the same number of assignments can mean different things; having multiple assignments on a patent can indicate, for example, that the inventors of a patent recorded their assignments separately or that a patent was actually reassigned from one owner to another. A single recorded assignment in a patent, on the other hand, may be associated with a nontransferred patent or a reassigned patent in which the subsequent assignment has not been recorded. In my review, for example, I found a number of patents that listed one owner on their front page but also listed a single subsequently recorded assignment to another owner in the patent assignment record.

To identify true transfers, I individually analyzed each patent's assignment record and noted reassignments beyond a patent's initial assignee.[131] I excluded merger-and-acquisition-based transfers, name-change-based transfers, and intracompany transfers.[132] As other scholars have documented, however, the identification of standalone patent reassignments is hampered by several limitations.[133] Unless the assignment record identifies the purpose of the patent transfer as a merger or acquisition, it is hard to tell whether the assignment is part of a larger business transaction. This is particularly an issue among the patents I studied because of the merger waves of the late 1990s.[134] Therefore, I developed another metric—

128. Chien, *Promise and Perils*, *supra* note 126 (reporting data taken from Q1 2010 through Q1 2011).

129. *See id.* at 21 (reporting that out of the 106 most-litigated patents, 44 of them were assigned prior to the filing of the first lawsuit).

130. I relied on patentee self-designations used in the recordation form and searches based on terms developed from the review of one thousand assignment records. I included assignments prior to the issuance of the patent, as is maintained in the patent record.

131. Many cases did not fit the prototypical *A* assigns to *B*, *B* assigns to *C* pattern; the following include some that I classified as reassignments: assignment back to the inventor, joint inventors assigning to different entities at different times, single recorded assignment to an assignee other than the one identified on the front page of the patent, and partial subsequent transfers to different assignees.

132. I identified and excluded mergers and intracompany transfers through Internet-based company research.

133. *See, e.g.*, Serrano, *supra* note 25, at 691 (describing as a drawback the inability to "distinguish the acquisition of a firm from the acquisition of a bundle of patents").

134. *See* Martin Lipton, Partner, Wachtell, Lipton, Rosen & Katz, The Davies Lecture: Merger Waves in the 19th, 20th, and 21st Centuries 6 (Sept. 14, 2006), *available at* http://osgoode.yorku.ca/media2.nsf/58912001c091cdc8852569300055bbf9/1e37719232517fd0852571ef00701385/$file/mer

whether the size of the patent's owner changed, based on the fees paid to maintain the patent—to track a particular type of change in ownership experienced over a patent's lifetime.[135] When Patent 5,987,610 transferred hands between Ameritech Corporation and the University of Texas, for example, it went from being owned by a "large entity" to being owned by a "small entity," according to the PTO's definition of small entity, which includes nonprofits. Conversely, when Patent 7,084,859 was sold from Timothy Pryor to Apple Corporation,[136] it traded up into a larger-entity setting. Both patents were asserted by their subsequent owners.[137] These anecdotes suggest that three metrics are worth investigating: assignment, transfer, and change in size of patent owner.

2. Post-issuance Investment in the Patent.—Scholars have found that patentees spend more money and time prosecuting the patents that end up in litigation.[138] I thus explored the extent to which continued investment in the patent after issuance, through the successful completion of reexamination proceedings and the payment of maintenance fees, also correlated with a higher likelihood of litigation.[139]

a. Maintenance Fees.—In order to keep a patent in force, maintenance fees must be paid at 3.5, 7.5, and 11.5 years after the patent has issued.[140] Small entities pay half the fees required of large entities.[141] At a cost of $980 to $4,110 per fee,[142] the cost of maintaining a large portfolio can

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ger%20waves_toronto_lipton.pdf (describing the wave of mergers that took place between 1993 and 2000, including a "five-year burst" of mergers in the technology field).

135. The coding of which is described in section III(A)(1), *infra*. Not all size changes were associated with a detectable transfer, but many of them were.

136. *See generally* Thomas Claburn, *Apple's "Kinected" Kitchen*, INFORMATIONWEEK (Nov. 30, 2010), http://www.informationweek.com/news/hardware/mac/228400171 (describing the assignment by Pryor to Apple). The patent issued in 2006 and was assigned in March 2010. *Patent Assignment Abstract of Title*, U.S. PAT. & TRADEMARK OFF., http://assignments.uspto.gov/assignments/q?db=pat&qt=pat&reel=&frame=&pat=7084859&pub=&asnr=&asnri=&asne=&asnei=&asns=.

137. Patent 7,084,859 was asserted by Apple against HTC Corporation. Complaint for Patent Infringement at 5, Apple Inc. v. HTC Corp., No. 1:11-cv-00611-GMS (D. Del. Jul. 11, 2011), ECF No. 1. Patent 5,987,610 was asserted by Intellectual Ventures against Check Point Software Technologies. Complaint for Patent Infringement at 5, Intellectual Ventures I LLC v. Check Point Software Techs., Ltd., No. 1:10-cv-01067-UNA (D. Del. Dec. 8, 2010), ECF No. 1.

138. *See, e.g.*, Allison et al., *supra* note 82, at 438 (noting that litigated patents tend to spend longer periods of time in prosecution than nonlitigated patents).

139. The completion of reissue proceedings under 35 U.S.C. § 251 also reflects continued investment in the patent, and I considered including reissue statistics in my study. However, because the number of reissuances is so small, there were too few reissued patents in my sample to make any statistically significant comparisons. *See* Curtis B. Hamre et al., *Reissue and Reexamination*, 29 IDEA 311, 312 (1989) ("[B]y comparison to the number of patents issued, the number of reissues may be relatively small . . . .").

140. 37 C.F.R. § 1.20(e)–(g) (2011).

141. *Id.*

142. *Id.* These fees are those for a large entity.

be substantial. The decision to maintain a patent signals its private value to the patent owner.[143] In addition, in order for a patent to be litigated, it must remain in force. For these reasons, one would expect litigation-bound patents to be more readily maintained than non-litigation-bound ones.

b. Ex Parte Reexamination.—The PTO can take another look at a patent after it has issued through a process called reexamination.[144] A patentee or a member of the public can initiate the process by showing a "substantial new question of patentability."[145] There are two kinds of reexamination: "ex parte" reexamination, which closely resembles normal prosecution,[146] and "inter partes" reexamination, in which a third party requests and participates in the reexamination.[147] The America Invents Act made several changes to the procedures available to change a patent post-grant, creating supplemental examination and post-grant review and enacting changes to the inter partes reexamination procedures.[148]

The litigation and the reexamination of a patent are related. A patentee may initiate reexamination proceedings to hone and ultimately strengthen claims before enforcing the patent.[149] A defendant may initiate reexamination proceedings in hopes of limiting the scope of, or invalidating what they believe to be, a weak patent.[150] According to the PTO, 33% of patents in ex parte reexaminations are concurrently in litigation;[151] the figure is 71%

143. Kimberly A. Moore, *Worthless Patents*, 20 BERKELEY TECH. L.J. 1521, 1525–26 (2005) (empirically analyzing patent value by looking at maintenance fees).

144. *See* 35 U.S.C. § 302 (2006) ("Any person at any time may file a request for reexamination by the Office of any claim of a patent on the basis of any prior art cited under the provisions of section 301 of this title.").

145. *Id.* §§ 303, 312.

146. *Compare id.* §§ 302–307 (prescribing ex parte patent-reexamination procedures), *with id.* §§ 131–134 (prescribing patent-application-examination procedures).

147. *See id.* § 311–318 (prescribing inter partes reexamination procedures).

148. Leahy-Smith America Invents Act, Pub. L. No. 112-29, § 12, 125 Stat. 284, 325–27 (2011) (to be codified at 35 U.S.C. § 257) (supplemental examination); Leahy-Smith America Invents Act, Pub. L. No. 112-29, § 6, 125 Stat. 284, 299–313 (2011) (to be codified at 35 U.S.C. §§ 311–329) (post-grant review proceedings); *see also* Matthew C. Phillips & Kevin B. Laurence, *Changes to Reexamination Under the America Invents Act*, INTELL. PROP. TODAY, Nov. 2011, at 22, 22–23, *available at* http://www.stoel.com/files/Changes_to_Reexamination_under_the_America_Invents_Act_November_2011_IP_Today.pdf (describing the changes to reexamination implemented by the America Invents Act (AIA)).

149. *See* Tremesha S. Willis, Note, *Patent Reexamination Post Litigation: It's Time to Set the Rules Straight*, 12 J. INTELL. PROP. L. 597, 601–02 (2005) ("If a patent passes reexamination muster and maintains its validity, the patentee will have a stronger patent . . . .").

150. Greg H. Gardella & Emily A. Berger, *United States Reexamination Procedures: Recent Trends, Strategies and Impact on Patent Practice*, 8 J. MARSHALL REV. INTELL. PROP. L. 381, 401, 403 (2009).

151. U.S. PATENT & TRADEMARK OFFICE, EX PARTE REEXAMINATION FILING DATA (2011) [hereinafter EX PARTE DATA], *available at* http://www.uspto.gov/patents/EP_quarterly_report_June_2011.pdf.

among patents undergoing inter partes reexamination.[152] Yet reexamination differs in several key respects from patent litigation. The PTO does not presume that a patent is valid like a court does.[153] Claims are construed according to their broadest reasonable interpretation rather than to the canons of claim construction that apply in a courtroom.[154]

At the end of the reexamination process, the patent claims may be amended, cancelled, or left alone.[155] Forty-five percent of patents subjected to inter partes reexamination have been cancelled entirely,[156] compared to only 11% of patents that have undergone ex parte reexamination.[157] The reexamination process strengthens the patents that survive it. As was once remarked to me, "A patent that survives reexamination has been through a fire. What emerges, then, can be considered Teflon-coated."[158] As inter partes reexamination is only available for patents filed on or after November 29, 1999,[159] in the present study I coded patents for which ex parte reexamination procedures were completed.[160]

3. Patent Collateralization.—Companies can borrow money against their patents.[161] Secured loans have several advantages over other types of loans—they are available to companies that do not have the proven track

152. U.S. PATENT AND TRADEMARK OFFICE, INTER PARTES REEXAMINATION FILING DATA (2011) [hereinafter INTER PARTES DATA], *available at* http://www.uspto.gov/patents/IP_quarterly_report_June_2011.pdf.

153. *See Parallel Universe*, REEXAMINATION CENTER, http://reexamcenter.com/2009/09/parallel-universe/ (noting that "[i]n the district court, patent claims enjoy a presumption of validity, which may be overcome only by clear and convincing evidence," but that there is no such presumption in reexamination proceedings).

154. *See In re* Yamamoto, 740 F.2d 1569, 1571 (Fed. Cir. 1984) (affirming the U.S. Patent and Trademark Office Board of Appeals's decision to give claims their "broadest reasonable interpretation consistent with the specification" in reexamination proceedings).

155. *See* 35 U.S.C. § 307(a) (2006) (stating that at the end of a reexamination proceeding, "the Director will issue and publish a certificate canceling any claim . . . determined to be unpatentable, confirming any claim . . . determined to be patentable, and incorporating in the patent any proposed amended or new claim determined to be patentable").

156. INTER PARTES DATA, *supra* note 152.

157. EX PARTE DATA, *supra* note 151.

158. Paraphrased from a telephone conversation with Benjamin Singer, Attorney, Ditthavong Mori & Steiner, P.C. (Sept. 2011). Even when narrowed, the claims may be more tailored to the patentee's purposes.

159. 37 C.F.R. § 1.913 (2011).

160. As signaled by the issuance of a certificate of reexamination. *See id.* § 1.570(a) ("To conclude an *ex parte* reexamination proceeding, the Director will issue and publish an *ex parte* reexamination certificate in accordance with 35 U.S.C. 307 setting forth the results of the *ex parte* reexamination proceeding and the content of the patent following the *ex parte* reexamination proceeding."). Such a certificate issues even if no claims survive reexamination. *See infra* note 199.

161. *See* Alicia Griffin Mills, *Perfecting Security Interests in IP: Avoiding the Traps*, 125 BANKING L.J. 746, 747 (2008) (explaining that because intellectual property is a "general intangible" within the scope of Article 9 of the Uniform Commercial Code, the UCC controls the creation of security interests in intellectual property).

record traditional bank lenders prefer and, unlike equity financing, they do not require companies to give up ownership or control.[162] However, they require the borrower to give the creditor a security interest in collateral in addition to a promise to repay the loan. If the borrower defaults, the creditor can claim the collateral. The patent may be sold off at auction to the highest bidder[163] and end up being litigated. While both large and small companies use their intellectual property to get loans,[164] for many start-up companies, their intellectual property may be their most valuable collateralizeable asset.[165] In obtaining a loan, a company may use its entire patent portfolio as collateral, or just select patents.[166] Under either scenario, if most uses of patents as collateral ultimately result in default and liquidation, a strong relationship between a patent's collateralization and its litigation would be expected.

Creditors have incentives to record their security interests at the PTO, although the benefits of doing so, as compared to recording their interests through Uniform Commercial Code (UCC) filings alone, are not entirely clear.[167] Because patents are federally created intellectual property, however,

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162. Traditional bank loans, by contrast, are available to companies with an established track record, and equity-based financing involves investors such as venture capitalists who provide financing in exchange for ownership and control. *See* Xuan-Thao Nguyen, *Collateralizing Intellectual Property*, 42 GA. L. REV. 1, 13–16 (2007) (reviewing conventional debt- and equity-financing methods and outlining their limitations). *But see* Ronald J. Mann, *Strategy and Force in the Liquidation of Secured Debt*, 96 MICH. L. REV. 159, 160 (1997) (arguing that one of the primary rationales for extending a secured loan to a debtor is to use the threat of forced liquidation to exert control over the debtor's actions).

163. *See* U.C.C. § 9-610(a) (2007) ("After default, a secured party may sell, lease, license, or otherwise dispose of any or all of the collateral in its present condition or following any commercially reasonable preparation or processing.").

164. Xuan-Thao Nguyen notes that secured financing involving intellectual property is common in certain industries, notably that of film production. Nguyen, *supra* note 162, at 19. Lenders to the film-production industry often receive a security interest in such intellectual property as film copyrights as well as licenses of scripts and music. *Id.*

165. *Id.* at 11; *cf.* Graham & Sichelman, *Why Do Start-Ups Patent?*, *supra* note 112, at 1077–79 (describing the role that patents play in securing loans and increasing the company's value upon liquidation).

166. *Cf.* CHESBROUGH, *supra* note 51, at 68–69 ("According to some IP lawyers, in situations of a patent infringement suit, we were told that it is not unusual that banks ask their clients to secure a loan to cover the legal costs of the trial with the group of patents that are at the core of the litigation.").

167. Article 9 of the UCC, as adopted by all states, governs the creation, perfection, and enforcement of security interests in personal property, which encompasses intellectual property under the classification of "general intangibles." *See* U.C.C. § 9-102(42) ("'General intangible' means *any* personal property . . . .") (emphasis added); *id.* § 9-102 cmt. 5(d) (stating that "rights that arise under a license of intellectual property" are included within the category of general intangibles). The Ninth Circuit has held that the UCC, rather than federal patent law, governs and that an additional recording at the PTO is not required to perfect a security interest in a patent. *In re* Cybernetic Services, Inc., 252 F.3d 1039, 1057–59 (9th Cir. 2001). However, a certificate of acknowledgment of the assignment's recordation with the PTO is "prima facie evidence of the execution of an assignment, grant or conveyance of a patent or application for patent." 35 U.S.C. § 261 (2006). This leads to an ambiguity as to whether a secretary-of-state UCC filing is sufficient. *See* Christina Lui, Comment, *Navigating Through the Legal Minefield of State and Federal Filing*

the recommended practice is to record security interests in patents at both the secretary of state's office according to the provisions of the UCC and at the PTO.[168] I used the PTO records to code whether each of the studied patents had been used as collateral.

4. Adjusted Forward Citations to the Patent.—Once a patent issues, it can be cited in the examination of a patent application, creating a forward citation to the patent.[169] The link between forward citation and litigation has previously been confirmed: litigated patents are more cited than unlitigated patents.[170] In general, the more citations a patent receives, the more relevant it is to the patents that come after it. For these reasons, scholars and others have relied upon forward citations as a measure of the economic value of a patent.[171] To minimize the effect of inventors citing to their own patents, as have other studies, the present analysis adjusts the number of forward citations by excluding citations that have at least one inventor in common with the cited patent.[172]

III. Methodology and Approach

To identify the patents most likely to end up in litigation, I focused on three questions: First, how do litigated patents differ from unlitigated patents? Second, do the differences between litigated and unlitigated patents develop before the first litigation? Third, how do patents litigated by different types of plaintiffs differ from each other? In this part, I describe the patents I studied, the data I used, and the approaches I used to explore the relationship between patent characteristics and patent litigation. Much of the credit for coding the data is due to the efforts of my hard-working and talented research assistants; for ease of reference in this Article, however, I will describe the tasks performed in the first person.

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for Perfecting Security Interests in Intellectual Property, 51 SANTA CLARA L. REV. 705, 720–22 (2011) ("The law controlling whether it is necessary to record a lien with the USPTO to perfect a security interest in a patent is ambiguous.").

168. *See* Lui, *supra* note 167, at 728 ("[D]ual-filing is the prudent thing to do . . . .").

169. *See* Lanjouw & Schankerman, *supra* note 91, at 134 ("An inventor must cite all related prior U.S. patents in the patent application.").

170. *See supra* notes 91–92 and accompanying text.

171. *See, e.g.*, John R. Allison & Mark A. Lemley, *The (Unnoticed) Demise of the Doctrine of Equivalents*, 59 STAN. L. REV. 955, 965 n.50 (2007) (claiming that forward citations are one of the "strongest predictors" of "patent value"). *But see* James E. Bessen, *The Value of U.S. Patents by Owner and Patent Characteristics*, 37 RES. POL'Y 932, 944 (2008) (arguing that such citations are not meaningful measures of patent quality based on a statistical analysis in which citations failed to explain much of the variance in patent value).

172. I am thankful to Ted Sichelman and David Schwartz for independently suggesting this adjustment to me. The difference in absolute terms is not insignificant. The average number of forward citations to litigated and unlitigated patents, excluding forward citations to patents with at least one inventor in common with the cited patent, was thirty-three and sixteen, respectively. Without the exclusions, however, the average number of forward citations to litigated and unlitigated patents was thirty-nine and nineteen, respectively. *See infra* Figure 2.

A. Patents and Data Studied

To identify the patent traits that distinguish litigated patents from unlitigated patents, I assembled a randomly selected group of 659 litigated patents issued in 1990.[173] When filed, each patent application is assigned by the PTO to at least one of over 400 technology classes.[174] For each litigated patent, I randomly selected an additional three patents issued in the same year and assigned to the same first-listed technology class, creating a matched-pair set that included 2,636 patents.[175] I used these sets, rather than a random sample drawn from patents generally, because the application of statistical analysis to rare events like patent litigation tends to distort and understate the probability that the events will occur.[176]

Using patents from this single year ensured that I had captured all of the events that occurred over the patents' potential terms and reduced the need to perform adjustments to compensate for time effects. However, it also meant that impacts of more recent changes in the patent system were not fully captured by this analysis. For example, inter partes reexamination was not available for the studied patents, as it is available only for patents issued after November 29, 1999.[177] In addition, the "troll" phenomenon is a relatively recent one, beginning in the early 2000s,[178] and many of the studied patents had expired prior to its development.[179] This means that certain of the studied characteristics, such as reexamination and transfer, may be more correlated with litigation of patents currently in force than they were with the

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173. I identified patents litigated in 1990 using the LIT-REEXAM segment within LexisNexis's Utility Patents database. I confirmed the later litigations using two proprietary databases, DocketX and Lex Machina. In accordance with other scholars, I excluded patents owned by Ronald S. Katz Technology Licensing LP, whose numerous litigations, if included in the samples, could disproportionately impact the results of this study. *See, e.g.*, Allison et al., *supra* note 57, at 20 & n.39 (describing the impact of Katz's lawsuits on an empirical analysis of patent lawsuits and excluding the Katz patents from an entity-size analysis).

174. MPEP § 902.01 (8th ed. Rev. 5, Aug. 2006).

175. Based on my conversation with a former PTO examiner, the first-listed, or "primary," patent classification is the most important, while the other listed classes often pertain to dependent or less "core" claims. E-mail from Aashish Karkhanis, Former Exam'r, U.S. Patent & Trademark Office, to author (Aug. 10, 2011, 9:33 AM) (on file with author).

176. There are shortcomings to using random samples with rare-events data; thus, matched pairs may provide more reliable results. *See* Gary King & Langche Zeng, *Logistic Regression in Rare Events Data*, 9 POL. ANALYSIS 137, 138 (2001) (explaining that "most popular statistical procedures, such as logistic regression, can sharply underestimate the probability of rare events" and that using a large, unselective study sample can produce "poorly measured[] explanatory variables" but asserting that better explanatory variables may be obtained through the careful, nonrandom selection of a more limited study sample).

177. *See supra* note 159 and accompanying text.

178. *See, e.g.*, FED. TRADE COMM'N, *supra* note 21, at 58 (reporting, in 2011, that "[p]anelists from IT manufacturing companies uniformly reported a dramatic increase in the number of patent infringement lawsuits filed against their companies compared to seven to ten years ago").

179. Patents issued in 1990 would need to have had their second maintenance fee paid in order to be in force in 2001. *See supra* subsection II(D)(2)(a) (describing the schedule of maintenance fees). Among the studied patents, approximately 34% of patents had lapsed by that time.

studied patents. As such, the results presented here may understate the relationships that currently exist between certain patent traits and litigation.

I checked whether differences detected in the sample in general were robust and observable across the patents' general technology area. I did so by identifying which PTO "technology center" each patent was associated with[180] and aggregating these centers into one of five general technology areas.[181] In almost all cases, perceived differences in the general population were also observable across technology areas, as described in the paragraphs that follow. However, because my sample size was limited, and because the PTO's categories do not necessarily reflect up-to-date boundaries between industries or technology areas,[182] I leave industry and technology comparisons for future research.

For the patents' intrinsic characteristics, I used a proprietary database of patent data,[183] access to which was generously donated for this project. For their acquired traits, I used a combination of data sources, including the PTO's assignment and maintenance databases. As these databases have been the subject of limited study, I describe them in greater depth below.

1. Assignment and Conveyance Data.—Owners of patents can record changes in ownership and related events, termed *conveyances*, at the PTO.[184] The PTO's "recordation" form asks parties to specify the purpose of the conveyance.[185] Thus, in addition to assignments, licenses, mergers, security agreements, name changes, and corrective changes, a host of other events can be registered using this process. The aggregate data are stored in the PTO's assignment database.[186] In this analysis, I focused on recorded patent assignments and security agreements.[187] I identified these events by using the

180. Each patent class is associated with an "art unit," and each of these, in turn, is associated with one of nine technology centers. *See Patent Classification: Classes Arranged by Art Unit*, U.S. PAT. & TRADEMARK OFF., http://www.uspto.gov/patents/resources/classification/art/index.jsp (last modified Oct. 3, 2011) (listing art units); *Patent Technology Centers*, U.S. PAT. & TRADEMARK OFF., http://www.uspto.gov/about/contacts/phone_directory/pat_tech/ (last modified Feb. 17, 2010) (listing technology centers).

181. I aggregated the patents, based primarily on technology center, into five general technology areas: BioChemAg, Mechanical, Semiconductors, Tech, and Other.

182. The USPTO's classification scheme has been described as not reflective of actual industry differences. *See* FED. TRADE COMM'N, *supra* note 21, at 16–17 ("The PTO provides public access to paper and electronic files of patents, but organizes them under a system that differs from industry-based classifications."). At present, however, there is no alternative scheme in place.

183. GAZELLE TECHNOLOGIES, http://www.gazelletech.com/. Although the underlying data is also publicly available, I used this database for its format.

184. U.S. PATENT & TRADEMARK OFFICE, FORM PTO-1595 (2011), *available at* http://www.uspto.gov/web/forms/pto1595.pdf.

185. *Id.*

186. *See USPTO Bulk Downloads: Patent Assignment Text*, GOOGLE, http://www.google.com/googlebooks/uspto-patents-assignments.html (providing access to the PTO's patent-assignment records).

187. I did not rely on the assignments database to identify licensed patents because most licenses are not registered with the PTO.

PTO's pre-designated categories and by searching key terms I developed through the review of 1,000 assignment records.

The analysis reported here does not include unrecorded conveyances. There is no consensus regarding whether the number of unrecorded conveyances is significant. Several prior studies have asserted that the number of unrecorded assignments is likely small.[188] This is because recording patent assignments puts third parties who might otherwise claim ownership on notice and confers legitimacy to patent plaintiffs.[189] A scholar who performed an anecdotal analysis of gaps in chains of patent ownership found few gaps.[190] Others, however, assert that the number of unrecorded assignments is significant,[191] particularly among small companies who tend to lack formal legal processes and procedures. In a test analysis, I found that of 100 patents that listed a non-inventor assignee on the front page of the patent, an assignment to that "front-page" assignee was not recorded with respect to thirty of them.[192] However, this figure may overstate the level of overall nonrecording, as a company may feel less need to record an assignment when their ownership is stated clearly on the front page of the patent. Additional investigation of this issue may be warranted.

In addition, it is unknown how many collateralizations of patents are never recorded. As described above, the prudent practice is to record collateralizations in both the PTO and the secretary of state's office.[193] However, because patents tend to be identified by reference to general intangibles on UCC financing statements, rather than by reference to the individual patents, it is difficult to estimate the number of security interests unrecorded at the PTO.[194]

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188. *See, e.g.*, CHESBROUGH, *supra* note 51, at 71 ("In spite of the limitations of reassignment data, we believe that the vast majority of patent asset transfers are reported . . . .").

189. *See* Fischer & Henkel, *supra* note 119, at 10 (explaining that registering a patent acquisition legitimizes the patent owner and prevents "good faith" defenses by third parties).

190. *See* CHESBROUGH, *supra* note 51, at 70–71 (finding that for a random group of PTO patents, most significant intellectual property market transactions were regularly registered and most reassignment histories did not possess gaps).

191. *See* Graham et al., *High Technology Entrepreneurs*, *supra* note 112, at 1274 ("USPTO records on patents reassigned to different entities after grant are notoriously incomplete.").

192. Analysis on file with the author.

193. *See supra* notes 167–68 and accompanying text. However, my correspondence with bank and corporate counsel has revealed that dual-filing is not uniformly done at all banks. *Compare* E-mail from Partner, Fenwick & West LLP, to author (Aug. 3, 2011, 9:13 AM) (stating that dual-filing is the standard practice); *with* E-mail from In-house Counsel, SVB Financial Group, to author (July 27, 2011, 4:59 PM) (declaring that SVB's typical practice is to not file with the PTO).

194. *See supra* note 167 and accompanying text; *see also* Lissa Lamkin Broome, *Supergeneric Collateral Descriptions in Financing Statements and Notice Filing*, 46 GONZ. L. REV. 435, 452 (2010–2011) (noting that under former Article 9, all that was required in financing statements was the "listing [of] a generic collateral type, even when the security agreement only extended to a specific subset of that collateral type").

2. Maintenance, Entity, and Reexamination Data.—The PTO's maintenance-fee-event database[195] contains details about payments made to keep a patent active. The database records the number of fees paid, as well as whether the fees are paid at the normal or the small-entity rate.[196] "Small entities" are defined by the PTO as individual inventors, nonprofits, and business entities with fewer than 500 employees, and they are entitled to pay about half of the fees that normal entities pay.[197] I extracted information about the number of maintenance payments made as well as the size of the owner, based on the PTO's definition, of each patent. I used this information to create a new variable reflecting whether or not the entity status of a patent owner had changed from small to large, large to small, or both. Finally, I used information from LexisNexis regarding whether a reexamination certificate had been issued[198] to identify patents in which ex parte reexamination proceedings had been completed.[199]

3. Data Available at the PTO Website.—In contrast to intrinsic information about each patent, the extrinsic information described above is not readily ascertainable from the PTO website. To determine whether a patent is in force requires an examination of the history of fees paid in the patent and an analysis of how the fees match up with the schedule of payments owed.[200] Patent reexamination data can be found on the PTO website,

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195. *See USPTO Bulk Downloads: Patent Maintenance Fees*, GOOGLE, http://www.google.com/googlebooks/uspto-patents-maintenance-fees.html (providing access to the PTO's database of patent-grant maintenance-fee events).

196. *Id.*

197. *See supra* note 141 and accompanying text; *see also* 13 C.F.R. § 121.802 (2011) (describing an entity eligible for reduced patent fees as one in which the number of employees, including affiliates, does not exceed 500 persons); 37 C.F.R. § 1.27(a)–(b) (2011) (defining small entities as individual inventors, nonprofit organizations of specified types, and business entities under a specified size, and stating that small entities are entitled to pay reduced fees).

198. These data are in the REEXAM-LITIGATE segment of the LexisNexis patents database and are generated based on the *Official Gazette* notices that the PTO publishes when reexamination of the patent has been completed. *See* 37 C.F.R. § 1.570(f) (2011) (prescribing publication in the *Official Gazette* of the notice of issuance of each ex parte reexamination certificate).

199. Publication of the certificate means that reexamination proceedings have been concluded, with the claims either affirmed, changed, or canceled—even if due to the patentee's nonresponsiveness to the reexamination proceedings. *See id.* § 1.550(d) ("If the patent owner fails to file a timely and appropriate response to any Office action or any written statement of an interview required under § 1.560(b), the prosecution in the *ex parte* reexamination proceeding will be a terminated prosecution, and the Director will proceed to issue and publish a certificate concluding the reexamination proceeding under § 1.570 in accordance with the last action of the Office."). Inter partes reexamination procedures were not available for the studied patents due to their age. *See supra* note 159 and accompanying text.

200. Whether a particular patent is in force can be determined by using the PTO's Public Patent Application Information Retrieval (PAIR) online portal. *Patent Application Information Retrieval*, U.S. PAT. & TRADEMARK OFF., http://portal.uspto.gov/external/portal/pair. It requires accessing the "Fees" tab of a designated patent, *id.*, as the application number and the PTO's maintenance fee schedule must also be known. If the patent term has been extended, it is even more difficult to know without reviewing the "file history" the patent how long the patent will be in force. *Id.*

but only in a patent-by-patent,[201] cumbersome way.[202] Determining the current owner of a patent—if any transfers have been recorded—also takes some work, though it is relatively straightforward.[203] However, due to the multiple ways a company can be referred to,[204] and the "games" companies play in order to hide their patent holding, determining what patents a company owns is a difficult task.[205] Because there is no requirement to record patent transfers, it is impossible to identify with absolute certainty a company's complete patent holdings—or who owns a patent—from the public record.

B. Coding Litigations

In order to detect the patents most likely to be litigated, I focused my analysis on the differences between litigated and unlitigated patents. However, I also considered the differences among litigated patents. Different parties litigate their patents for different reasons;[206] it may also be the case that the patents they litigate also differ from each other in measurable ways. If this is the case, a more segmented approach may provide more precise results. Such results might also help inventors, particularly companies, focus on threats posed by individual inventor patents separately from competitor patents against which the company may enjoy greater protection.

To test the differences between litigated patents, I coded each litigated patent according to who litigated it.[207] Scholars have used a variety of methods to classify patentees and patent plaintiffs; there is no single

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201. E-mail from PTO official to author (Mar. 21, 2011, 8:53 AM) (indicating that the agency does not have "plans for creating a consolidated listing of patents for which reexams have been requested").

202. E-mail from PTO official to author (Apr. 12, 2011, 12:05 PM) (noting the difficulty inherent in figuring out whether a patent reexamination was performed ex parte or inter partes: "[T]he relevant data likely exist within the Patent Application Location and Monitoring (PALM) records but are unavailable via the PAIR website. . . . [To access them,] you might have to file a Freedom of Information Act (FOIA) request.").

203. The easiest way is to go to the PTO assignments database and search for the patent. *Change Ownership*, U.S. PAT. & TRADEMARK OFF., http://www.uspto.gov/patents/process/changeownership.jsp. However, as described above, patentees who have not recorded their assignments cannot be determined solely from the record, even through this process. *See supra* section III(A)(1).

204. *See* Hall et al., *supra* note 83, 425 n.22 ("[T]he same firm may appear in different patent documents under various, slightly different names, one assignee may be a subsidiary of the other, etc.").

205. *See* FED. TRADE COMM'N, *supra* note 21, at 130 ("Testimony suggested that parties often fail to report assignments to the PTO or list 'shell companies' as assignees, 'making it as difficult as possible, apparently, to trace back to the true assignee of the patent.'" (footnotes omitted)).

206. *See* Colleen V. Chien, *Of Trolls, Davids, Goliaths, and Kings: Narratives and Evidence in the Litigation of High-Tech Patents*, 87 N.C. L. REV. 1571, 1577–90 (2009) [hereinafter Chien, *Of Trolls*] (discussing the different types of patent disputes and what motivates them).

207. There were a handful of patents that were litigated by different entities over their lives. In most cases, the entity type was consistent; however, in the few that were not, I relied upon the first litigating entity.

approach.[208] Because one of my objectives was to test the differences among litigated patents, I placed patents into one of three major categories: litigated by a practicing entity, litigated by an individual, and litigated by a PAE.[209] The choice of these categories yielded enough data in each individual category to enable reliable statistical analyses to be performed. The majority of litigated patents, about 73%, were asserted by practicing-company plaintiffs, 18% were asserted by individuals, and 9% were asserted by PAEs.[210]

C. Analyses Performed

I applied standard statistical techniques to address each of three questions: first, how do litigated patents differ from unlitigated patents with respect to the patents' acquired traits; second, do the differences between litigated and unlitigated patents enable higher risk patents to be identified before they are actually litigated; and third, what are the differences between patents that are litigated by different kinds of plaintiffs?

First, I generated descriptive statistics to describe the acquired characteristics of patents developed over their lifetimes.[211] I compared litigated and unlitigated patents along these dimensions; the results are reported in Figure 2. I used standard statistical approaches to see whether the differences I observed were the result of chance or represented statistically significant differences. I used bivariate techniques to test whether or not a particular characteristic of a patent, in isolation, was correlated with the litigation of that patent,[212] and I performed logistic regression analyses to take

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208. *See, e.g.*, Chien, *Of Trolls*, *supra* note 206, at 1599 tbl.2 (categorizing cases by such factors as the size of the companies involved and whether those companies were publicly or privately owned); Ball & Kesan, *supra* note 60, at 31 tbl.2, 32 tbl.3 (dividing patent litigants into a number of classes, including "small firm," "medium firm," "large firm," and "licensing firm").

209. I performed my analysis on the first named plaintiff in each patent infringement suit and the first named defendant in each declaratory judgment suit. I determined the posture of the suit by reading the complaints in DocketX and PACER. I placed each litigated patent into one of three categories as follows: First, I classified the patent as litigated by a PAE either (i) if it was asserted by a company that had no Internet presence other than in association with litigation or the asserted patent, or (ii) if it was asserted by a company or subsidiary focused on the litigation or licensing of patents. Second, if the patent was litigated by an individual suing in his or her own name, I classified it as an individual-entity-litigated patent. Finally, companies that, based on their descriptions, made or sold goods or services were classified as practicing companies. I assumed that foreign entities, which comprised a small percentage of the sample, were practicing entities. In my sample, there were a handful of patents that were asserted by more than one entity over its lifetime; however, the asserters all belonged to the same category. I excluded from the analysis a single patent that did not fit into any of these categories because it was litigated by a university.

210. In a sample of high-tech patent litigations taken from a later period, 2000–2008, 5% were initiated by individuals, 17% by PAEs, 1% by nonprofits, and the remainder by practicing companies. Chien, *Of Trolls*, *supra* note 206, at 1600 tbl.3. The difference in nonpracticing-entity share is likely attributable to the growth in the troll phenomenon described earlier.

211. My dataset included 2,636 litigated and unlitigated patents.

212. I treated whether or not a patent was litigated as the dependent variable and the characteristics of each patent as the independent variables. For my bivariate comparisons, I performed two types of tests: *t*-test for continuous independent variables**,** and *chi*-squared test for independent binary variables. Because several of the continuous-variable values were distributed

into account the interaction between variables.[213] In my regression models, as illustrated in Table 1, I included the intrinsic and acquired traits of patents, both separately and together.

Table 1. Patent Traits Studied[214]

Intrinsic Traits	
Claims	The number of claims in the patent
Issued to Small-Entity Owner[Ŧ]	Whether the issue fee was paid by a small entity
Foreign Counterparts	The number of foreign-counterpart patents
Family Members	The number of patents, including "parent" and "child" patents (continuation, continuation-in-part, and divisional patents) in the patent's family
Acquired Traits	
Recorded Assignments	The number of recorded reassignments in the patent
Recorded Transfer[Ŧ]	Whether the patent was reassigned, excluding merger and acquisition and intracompany or organization reassignments
Owner Size Change[Ŧ]	Change in owner size from small entity to large entity or vice versa
Maintenance Fees	Number of maintenance fees paid
Ex Parte Reexamined[Ŧ]	Ex parte reexamination certificate issued
Collateralized[Ŧ]	Security interest in the patent recorded
Adjusted Forward Cites	The number of cites to a patent made by subsequent patents without common investorship in the patent

[Ŧ] Binary variable

Logistic regression analysis is appropriate for determining the relationship between a yes-or-no outcome (such as whether or not a patent is litigated) and a set of diverse factors that may be expressed in numerical (continuous), binary (dichotomous), or categorical terms.[215] Throughout the

substantially non-normally, I transformed them using a log transformation before subjecting them to statistical analysis. I used Microsoft Excel to perform the bivariate comparisons. For an overview and description of statistical approaches for testing for significance, see HARRY FRANK & STEVEN C. ALTHOEN, STATISTICS: CONCEPTS AND APPLICATIONS 363–68 (1994).

213. I included both intrinsic and acquired variables in the regression. *See infra* Appendix A. I used the open-source statistics program R and the proprietary program SPSS to perform the logistic regressions.

214. Over the lifetime of each patent as well as prior to the time of first litigation. *See infra* Figure 2 (showing the differences between litigated and unlitigated patents developed over their lifetimes); Figure 3 (showing these differences as developed prior to the time of litigation).

215. For further information on logistical regression analysis, see generally SCOTT MENARD, APPLIED LOGISTIC REGRESSION ANALYSIS (1995).

Article, I report the full results of the analyses I performed.[216] In regression, relationships between independent variables can impact model results, exaggerating or suppressing the significance of certain variables. This problem is known as multicollinearity.[217] I performed multicollinearity-diagnostic tests to ensure that my results were not distorted.[218]

To test the predictive relevance of the characteristics studied, I constructed a time-series model. This model, depicted in Figure 3, explored the extent to which the difference between litigated and unlitigated patents developed before, rather than after, the litigation.[219] In contrast to my descriptive model, which tracked differences between litigated and unlitigated patents developed over the lifetime of a patent, my time-series model included a snapshot of each litigated patent and its matched counterparts prior to the time of the litigated patent's first litigation. To enable a comparison across patents despite having patents of different ages in the sample, I adjusted the number of forward citations and assignments by time.[220] To determine the relative importance of each set of characteristics, I considered three models: one based on the intrinsic characteristics of the patents, one based on the acquired characteristics of the patents, and one based on the patent's intrinsic and acquired characteristics. The results of this analysis are shown in Figure 4. Finally, I analyzed the differences between litigated patents based on who litigated them. The results of this analysis are reported in Figure 5.

IV. Results and Discussion

A. The Acquired Traits of Litigated Patents—Descriptive Results

Patents destined for litigation start out with certain traits that set them apart from the vast majority[221] of patents that do not end up in litigation. In this study, I asked whether additional differences between litigated and unlitigated patents developed after the patent issued. This subpart, and in particular Figure 2, reports the descriptive results of my comparison of litigated and unlitigated patents based on the characteristics they developed over their lifetimes. While my focus was on studying the relationship between the acquired traits of the patents and litigation, my regression models included both intrinsic and acquired traits.

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216. *See infra* Appendix A (reporting coefficients, standard errors, and significance at the .05, .01, and .001 levels).

217. MENARD, *supra* note 215, at 65 (defining multicollinearity as "a problem that arises when independent variables are correlated with one another").

218. While Variance Inflation Factor (VIF) values exceeding 10 (or 2.5) are generally seen as cause for concern, among the studied variables the VIF values were all below 1.5.

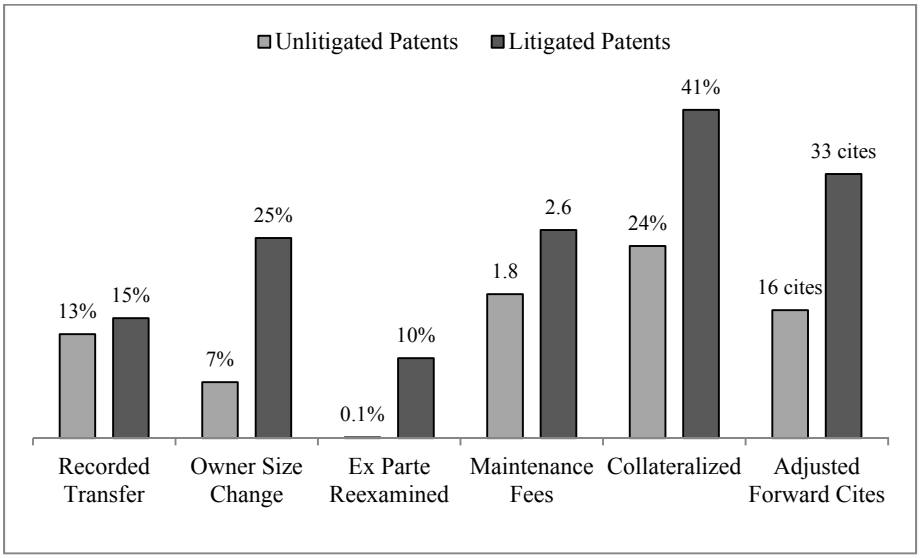
219. I constructed the time-series model using the variables listed in Table 1.

220. Because all of the patents in this study issued in the same year, I did not need to control for variances in the overall number of patents issued per year.

221. *See supra* note 29 and accompanying text.

The results are dramatic—in every way I considered, litigated patents differed significantly post-issue from unlitigated patents. Litigated patents are more likely to be transferred and nearly four times as likely as unlitigated patents to experience a change in owner size. They are a hundredfold more likely to experience ex parte reexamination than are unlitigated patents.[222] They are maintained more times, on average, than are unlitigated patents. They are more often collateralized and are cited twice as many times.

Figure 2. Descriptive Statistics—The Acquired Characteristics of Litigated and Unlitigated Patents over their Lifetimes



Each of the observed differences in acquired characteristics between litigated and unlitigated patents was statistically significant.[223] These traits had an impact on the likelihood of litigation when considered in isolation as well as when considered together with all of the intrinsic and acquired

222. Inter partes reexamination was not available for any of the patents in this sample. *See supra* note 159 and accompanying text.

223. These differences were statistically significant based on both bivariate and regression methods. For the bivariate tests I performed in each category (one-tailed *t*-test for the continuous variables and *chi*-squared test for the binary variables), all the observed differences were significant to at least the .01 level. The regression results based on patent characteristics can be found in Appendix A, *infra*.

traits.[224] The differences were also robust, holding up in virtually every category across all of the technology categories I studied.[225]

These results amplify and deepen our understanding of litigated patents. Previous studies have shown that patent owners give patents destined for litigation more time and attention during prosecution.[226] My results show that this differential treatment continues even after patents leave the PTO. These findings—that the patents worth investing in and citing to are also the patents worth fighting about—are not necessarily surprising. However, they do identify additional clues that can be used to predict what patents may end up in litigation. Broadly defined, these types of traits fall into two categories: traits that reflect the value of the patent and traits that reflect ownership of the patent.

For example, patent owners pay more maintenance fees on patents destined for litigation.[227] They are more likely to strengthen and defend patents that end up in litigation by pursuing and completing ex parte reexamination of them.[228] These investments in the patent indicate that the patent owner feels that the patent is worth preserving and potentially strengthening. Litigated patents are also more frequently cited by subsequent patents, a measure of their economic value.[229]

Other events in a patent's life arguably have as much to do with its owner as they do with the patent itself. Litigated patents were nearly twice as likely to have been used as collateral as were unlitigated patents. A company's decision to use a patent as collateral says something about the company—that it is in financial need and willing to put its patent assets at risk. If a portion of a company's patent portfolio, rather than the entire portfolio, is used as collateral, it may also say something about the collateralized patents—that they are regarded as more valuable than others in the company's portfolio or, potentially, that they are anticipated to be the subject of litigation.[230]

Litigated patents are also more likely to be transferred than unlitigated patents. However, the observed difference in transfer rates was slight (15% versus 13%, respectively), likely for a number of reasons. Patents may be

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224. The intrinsic variables I included in the regression were the log-transformed number of claims, the log-transformed number of prior art citations, whether or not the initial owner of the patent was an individual or small entity, and the log-transformed number of jurisdictions in which the patent's protection was sought.

225. Except for one out of the fifty industry-characteristic comparisons, litigated mechanical patents were transferred at a rate of 14%, as compared to a transfer rate of 15% among unlitigated mechanical patents.

226. *See supra* note 138 and accompanying text.

227. *See supra* Figure 2.

228. *See supra* Figure 2.

229. *See supra* Figure 2.

230. *See* CHESBROUGH, *supra* note 51, at 68–69 (describing the bank practices of taking patents as collateral to cover the costs of litigating those same patents and of using patent reassignments to secure lines of credit).

traded for many reasons besides use of the patent in litigation. Many, perhaps most, trades are for the purpose of transferring technology, rather than the legal right of exclusion, and they accompany the transfer of a business unit, company, or general know-how.[231] Patents may also be bought for defensive reasons to keep the patents from being asserted or for signaling purposes to deter others from suing.[232] Even when patents are bought for assertion purposes, the buyer's strategy may be focused on licensing, rather than on litigation.[233] More cynically, when companies buy patents for the purpose of litigating them, they may hide or decline to record these transactions.[234]

The owners of patents destined for litigation were four times more likely to change size—whether the patent changed hands or not[235]—over the lifetime of the patent than owners of patents that were not litigated.[236] How to interpret this finding is not entirely clear. The owner's size change could be triggered by its growth, for example, from a small start-up into a midsize company. Or it could represent the transfer of the patent from a PTO-defined small entity[237] to a large entity, or vice versa. Of litigated patents that experienced a size change, the majority reflected the patent owner going "up" in status, from a small to a large entity, rather than the reverse.[238] Thus, it could be that for the same reason that patents issued to small and individual inventors are more likely to be litigated, patents that experience a boost in owner size are also more likely to be litigated. Further analysis is warranted.

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231. *See supra* note 117 and accompanying text; *see also* CHESBROUGH, *supra* note 51, at 66–69 (listing common reasons, unrelated to litigation, why companies reassign patents).

232. This is the business model of defensive-patent aggregators like RPX. *See supra* note 64 and accompanying text; *see also* Erick Schonfeld, *Is RPX's "Defensive Patent Aggregation" Simply Patent Extortion by Another Name?*, TECHCRUNCH (Nov. 24, 2008) http://techcrunch.com/2008/11/24/is-rpxs-defensive-patent-aggregation-simply-patent-extortion-by-another-name/ (describing RPX's model of buying patents and licenses and offering its clients protection from being sued over them).

233. *See* Myhrvold, *supra* note 64, at 41, 46, 49 (describing how Intellectual Ventures licenses patent bundles to practicing companies and claiming that the company had never sued to defend its intellectual property). *But see* Nathan Vardi, *Intellectual Ventures Launches Its Fourth Lawsuit Targeting Dell and HP*, FORBES (July 12, 2011), http://www.forbes.com/sites/nathanvardi/2011/07/12/intellectual-ventures-launches-its-fourth-lawsuit-targeting-dell-and-hp/ (describing how Intellectual Ventures began bringing patent infringement claims in December 2010 after failed attempts to negotiate licensing agreements with large, practicing companies such as Hynix Semiconductor and Elpida).

234. *See* Chien, *Arms Race*, *supra* note 15, at 319 (describing the practice of assigning patents to shell companies and subsidiaries in order to hide the transactions from others); *see also* FED. TRADE COMM'N, *supra* note 21, at 130 (suggesting that parties fail to report assignments or list shell companies as assignees in order to make it difficult to determine the identity of the true assignee).

235. *See supra* note 135 and accompanying text.

236. *See supra* Figure 2.

237. *See supra* note 197 and accompanying text.

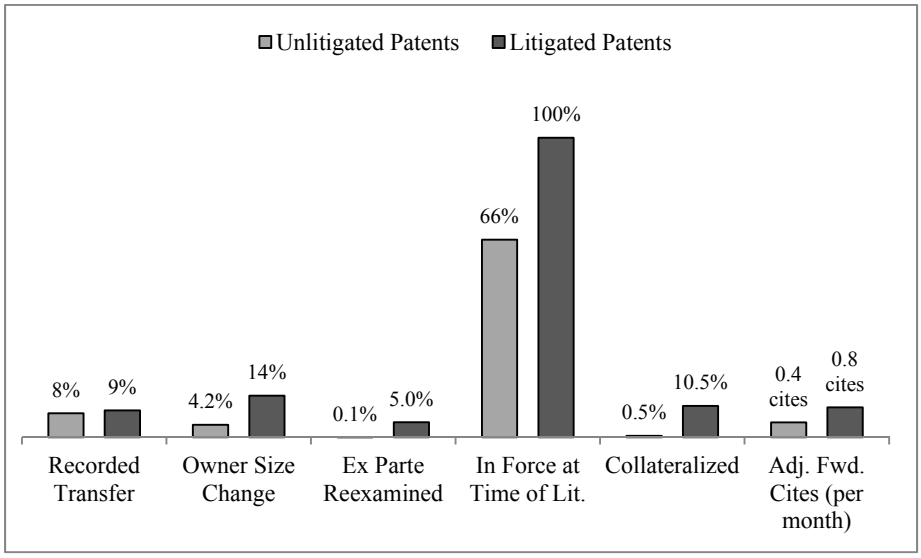
238. One hundred seventy-two patents fit this category; 72% of these had owners that changed from small- to large-entity status.

B. Predicting Patent Litigation

Despite these results, the characteristics that distinguish litigated from unlitigated patents by the end of their lives do not necessarily predict *ex ante* whether a patent will be litigated.[239] The decision to litigate may influence the likelihood of a patent developing a certain trait, rather than the other way around.

For example, reexamination in some cases may be prompted by litigation rather than predate it. In addition, when someone buys a patent in order to litigate it, the recordation of this purchase may take place after the litigation is initiated. Perhaps the litigation of a patent makes it better known and therefore more likely to be cited.[240] Endogeneity effects, as they are known, can prevent factors that are correlated with an outcome from having any predictive value.[241] In order to remove the impact of litigation on each patent, I developed a time-series model. Rather than using the traits of patents developed over the patent's life, I used the traits of each litigated patent (and its unlitigated counterparts) developed prior to the litigation of the patent.

Figure 3. Characteristics of Patents Developed Prior to Litigation



239. As suggested by the well-known maxim, "correlation does not imply causation."

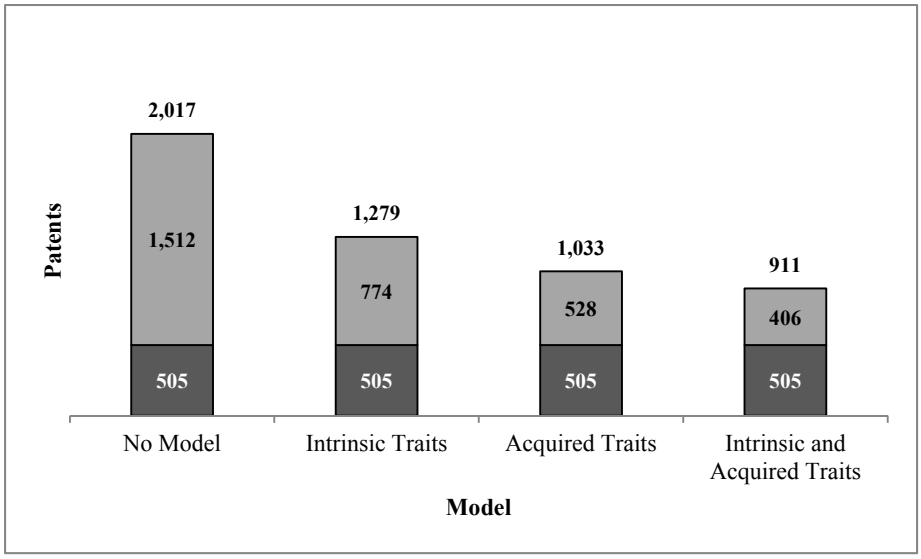
240. *See* Lanjouw & Schankerman, *supra* note 91, at 140 (hypothesizing that a publicity effect increases the citations of a patent for a few years after its litigation and suggesting it might be due to awareness of the patent).

241. *See* ABA SECTION OF ANTITRUST LAW, ECONOMETRICS 297 (2005) (explaining how endogenous variables lead to bias and inconsistency unless instrumental variables are used).

The results were surprisingly robust: in each dimension, the differences between litigated and unlitigated patents were observable prior to the litigated patent's first litigation. These differences were statistically significant in nearly every category.[242]

In addition, consideration of the acquired characteristics had a measurable payoff. Including them in the analysis resulted in a more precise profile of litigated patents than did an analysis based only on the patents' intrinsic characteristics. I estimated the improvement by comparing the predictive accuracy of three time-series models: one that included just the intrinsic traits of patents, one that included their acquired traits, and one that included both sets of traits, all developed prior to litigation. Figure 4 presents this comparison.

Figure 4. Predicted Versus Actually Litigated Patents (Based on a ~75% Observation Rate)[243]



To enable comparison across models, I designed an analysis that would ensure that each model correctly predicted about 75% of the patents actually litigated,[244] with a corresponding false negative or "miss" rate of around

242. *See infra* Appendix A (showing that, with the exception of whether the patent was in force—a product of its maintenance fee payments—the differences in characteristics acquired over the lifetime of the patents were also observable with respect to characteristics developed prior to the patent's litigation).

243. Each model calibrated in order to represent a 76.5% observation rate, indicating a false-negative rate of 23.5% across models. Cut values for Intrinsic Traits Model = 0.217, Acquired Traits Model = 0.324, Intrinsic and Acquired Traits Model = 0.305.

244. The actual rate was 505 correctly identified out of 650 litigated patents, or 76.5%.

25%. What varied, then, among the models was the number of false positives each model identified; in other words, the number of patents predicted to be litigated but not actually litigated.

The results varied widely. The baseline was represented by "no model"—as if the patents were selected at random.[245] The number of false positives was 1,512 patents. Using a model based on the intrinsic traits of patents resulted in an improvement over this baseline, identifying 774 false positives. However, a model based on the acquired traits of patents was more precise, generating 528 false positives, or about 250 fewer than the false positives generated based on the "intrinsic traits" model. The model that included both intrinsic and acquired characteristics was the most precise, generating only 406 false positives.

These results suggest that litigation-bound patents can be identified ahead of time. The differences between litigated and unlitigated patents, therefore, would seem to have not only descriptive but also predictive power. In the example presented here, the number of patents predicted to be litigated was reduced from 2,017 to 911 patents. This suggests that a company seeking to clear its rights could focus on fewer high-risk patents identified by the model and ignore others.

While I leave for future research the development of more refined predictive models, the ability to rank patent-litigation risk, even at a low grade of resolution, has a number of potential applications. For example, patent-litigation-risk indices could be developed for particular technological fields by predicting the number of patents with certain probabilities of suit in that field. For example, knowing that a particular technological field is higher risk because most of the patents are issued to small entities and the field has higher than average collateralization and reexamination rates could be useful to a company deciding whether to pursue research in it or another field. A litigation-prediction model could also be used to inform decision making regarding how to allocate risk-management resources to activities like joining a patent pool, defensive-patent buying or patenting, or allocating resources for litigation.

Litigation-risk ranking also presents a way to sort through a large number of patents without having to read through every patent in a portfolio or technology area. Risk ranking, in combination with other techniques for winnowing down the number of relevant patents (for example, through matching a company's technology area with that of a potential legal adversary), could be used to reduce the "impossible" task of clearance to a more manageable level. Outside of litigation contexts, the ranking methods described here have other potential applications. When evaluating a large patent portfolio, the criteria described in this Article can provide an intuitive

245. To get 76.5% of the litigated patents using this technique, 2,017 patents (2,636 × 76.5%) needed to be selected, 1,512 of them being false negatives.

way to determine the relative strength of individual patents as well as a way to determine how multiple patent portfolios stack up against each other. Doing so could be relevant in cross-licensing, purchasing, and management contexts—for example, when a company is deciding which patents to maintain or abandon, which to sell, and which to donate. Using criteria that are objective and transparent can allay doubts about whether selected patents are really "representative" of the entire portfolio.

At the industry level, the rankings assigned to individual patents could be used by those interested in minimizing risk in general. By knowing *ex ante* which patents pose the greatest threats, a nonprofit or other group could better prioritize its efforts on removing these threats through defensive-patent purchasing, post-grant review, or reexamination, for example. Insurance companies could also use litigation-risk ranking to develop a sense of the general level of risk in an industry, which could then be translated into a company-specific policy.

From the starting point presented here, there are a number of directions that follow-up research could take to improve the resolution of the ranking approach described here that, while promising, do not provide a "commercial grade" solution to outstanding patent-clearance problems.[246] Perhaps the most obvious refinement would be to explicitly take into account industry and technology effects. PAE litigation mostly involves high-tech patents.[247] Pharmaceutical patent litigation is triggered by the listing of the patent in the FDA's Orange Book,[248] and pharmaceutical patents are among the most frequently litigated.[249] These industry-specific dynamics influence the weights that should be allocated to the different characteristics and also potentially skew the results presented here. In addition, a larger dataset may allow for the inclusion of more fine-grained differences, relating, for example, to the reissuance of a patent, to the various types of reexamination, or to who initiated the reexamination. Other variables, both intrinsic and acquired, could also be developed, relating, for example, to the number of words in a claim, the Standard Industrial Classification (SIC) code of the patentee or

246. Reducing, for example, the field of relevant patents in the smartphone space from 250,000 to 125,000 would be unlikely to significantly reduce the perceived risk to companies posed by the patents.

247. *See* Chien, *Of Trolls*, *supra* note 206, at 1580 (asserting that nonpracticing entities have focused on high-tech patents); *Product Categorization*, PATENTFREEDOM, https://www.patentfreedom.com/research-pc.html (last modified Jan. 1, 2011) (reporting that by number of patents asserted, by number of nonpracticing entities involved, and by number of individual litigations, nonpracticing entities are most active in litigating high-tech patents).

248. *See* Julie Dohm, Comment, *Expanding the Scope of the Hatch-Waxman Act's Patent Carve-Out Exception to the Identical Drug Labeling Requirement: Closing the Patent Litigation Loophole*, 156 U. PA. L. REV. 151, 154–56 (2007) (describing the requirement of listing a patent in the Orange Book as well as the Orange Book's paragraph IV provision for contesting a patent's validity).

249. *See* BESSEN & MEURER, *supra* note 10, at 23, 33 tbl.2 (reporting data showing that firms in the chemical and pharmaceuticals industries have the highest number of expected suits per year).

owner,[250] the tenure of the patent attorney writing the patent, or the location of the transfer of the patent.

Unlike previous studies that have used litigated patents as a proxy for other types of patents, in this study I use previously litigated patents to identify patents that are at risk of being litigated in the future. In this way, the present work avoids the selection-bias problems that make it difficult to apply findings about litigated patents to patents in general. However, litigated patents represent a subset of two other groupings of patents with relevance to patent risk: potentially infringed patents and potentially asserted patents. Of these two groups, potentially infringed patents are of less concern from a defensive perspective because of the pervasive nonenforcement that others have described.[251] However, potentially-asserted, yet unlitigated, patents represent potentially costly threats to companies, albeit ones that avoid the expense and disruption associated with litigation.[252]

According to the Priest–Klein hypothesis, parties that litigate their disputes to trial rather than settle them will have roughly equal win rates when their respective gains or losses are equal;[253] however, asymmetric stakes in the underlying dispute may upset this balance. According to studies of patent litigation, asymmetries between the costs or stakes of litigation can also explain why parties decide to litigate.[254] A natural extension of the present work would be to match the present data to these theories by focusing not only on whether a patent is litigated, but also on what type of party litigates it, for how long, and against whom. The dynamics of litigation vary considerably depending on whether a suit represents, for example, a battle between well-resourced competitors (what I and others have called a "sport of kings" lawsuit) or an individual inventor seeking remuneration or an injunction (more of a "David v. Goliath" matchup).[255] A guide published by the Federal Judicial Center on patent-case management characterizes competitor-versus-competitor disputes over core technology as "[d]ifficult to settle absent a counterclaim or other significant risk to the patent owner or

250. For an overview of the SIC system, see *Standard Industrial Classification (SIC) System*, U.S. CENSUS BUREAU, http://www.census.gov/epcd/www/sic.html.

251. *See supra* notes 47–53 and accompanying text. However, from an offensive perspective, as well as from a social perspective, potentially infringed patents represent potentially duplicated efforts and technology-transfer opportunities.

252. As one extension of this work, it would be useful to attempt to determine whether the "false positives" identified in the models had in fact been the subject of assertion attempts or licenses. I thank Mark Lemley for making this point to me.

253. George L. Priest & Benjamin Klein, *The Selection of Disputes for Litigation*, 13 J. LEGAL STUD. 1, 4–5 (1984).

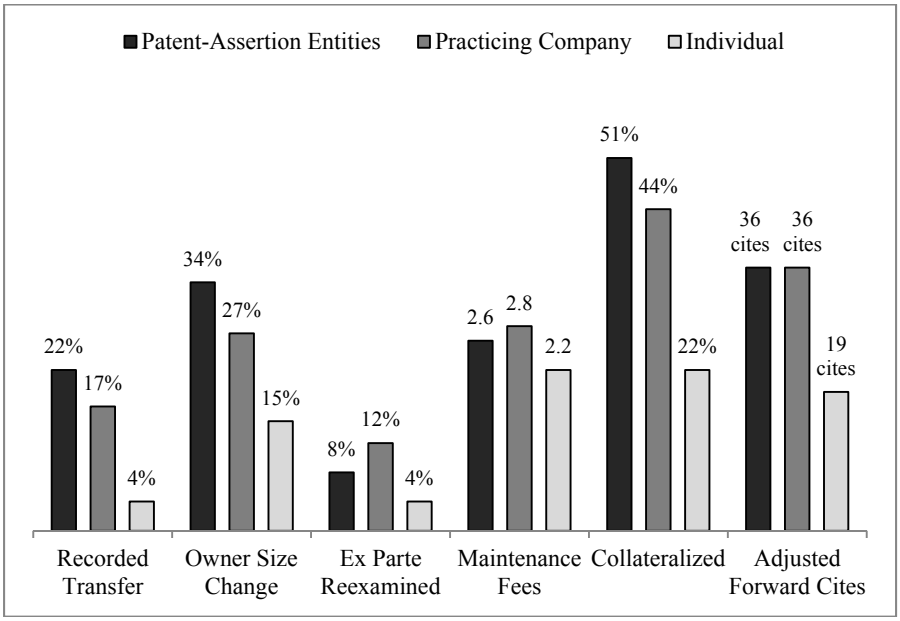
254. *Cf.* Chien, *Arms Race*, *supra* note 15, at 335–36 ("The results [of my study] suggest that asymmetries between practicing companies are being exploited even in large company suits. . . . [T]hey provide empirical evidence that large companies are exploiting asymmetries in the patent system by targeting companies whose businesses differ, in some cases significantly, from their own.").

255. *See* Chien, *Of Trolls*, *supra* note 206, 1599 tbl.2 (developing a taxonomy of patent suits based on plaintiff and defendant size and the narratives associated with each pairing).

strategic opportunity available from business agreement."[256] In contrast, licensing-company-versus-start-up suits are described as most likely to be settled "very early in the litigation or just after [a critical] event [for the start-up]."[257]

As part of the present analysis, I compared the acquired characteristics of patents litigated by different types of patent holders. Patents litigated by individuals came in last in every category that I considered. On average, they were less mobile, less likely to reflect additional investment, and less likely to be cited than patents litigated by practicing companies or nonpracticing PAEs.

Figure 5. Differences Between Litigated Patents (Traits Developed over the Patent's Lifetime)[258]



These differences imply that greater precision in prediction could be obtained by focusing, for example, on patents litigated by individuals. Jay Kesan and Gwendolyn Ball have found that when small parties sue large defendants, they are more likely than any other type of plaintiff to litigate

256. PETER S. MENELL ET AL., FED. JUDICIAL CTR., PATENT CASE MANAGEMENT JUDICIAL GUIDE 2-45 tbl.2.7 (2009).

257. *Id.*

258. The differences in every category were significant at the .001 level. Averages calculated on the basis of 59 PAE-litigated patents, 490 practicing company-litigated patents, and 117 individual-litigated patents. I used ANOVA to test for the bivariate significance of the observed differences with respect to the continuous variables and *chi*-squared test to test for the significance of the observed differences for the binary variables (individual versus nonindividual).

their disputes to a judgment.[259] In my previous work, I have found that cases brought by individual inventors against large companies, so-called David-versus-Goliath suits, take longer than any other type of suit to resolve.[260]

Different risk-management techniques may be applied to threats posed by different types of patentees—for example, cross-licensing in the case of a competitor or settlement in the case of a PAE. Companies may have a good awareness of their competitor's research and patenting activities and use clearance to identify the relevant patents of less obvious stakeholders.

C. Policy Implications

When the findings of this study are combined with earlier work, they result in a more quantitatively precise profile of litigated patents. They also present a more robust story of patent litigation. Across industries, the likelihood of a patent being litigated depends on at least two things: the patent and the patent owner.[261] All other things being equal, valuable patents are more likely to be litigated. But the economic value of the patent is only part of the story. Who holds the patent also matters, as does the owner's propensity to, for example, collateralize the patent or transfer it to someone who is willing to litigate it.

Figure 6. The Characteristics of Litigated Patents

Patent Traits	Patent-Owner Traits
Litigation-bound patents have more: • claims • backward citations • foreign counterparts • patent family members • adjusted forward citations • maintenance fees	*The owners of litigation-bound patents are more likely to:* • be originally small entity • be originally domestic • transfer their patents • change size • securitize their patents • reexamine their patents

These insights have implications for patent clearance and risk management. The risk associated with an individual patent depends not only on the patent itself and its traits, but also on the patent owner and the owner's willingness to litigate the patent, as represented by a host of factors. A patent issued to a large company has a much lower risk of being litigated than that same patent when issued to a small entity or individual owner. When a patent is transferred or the size of its owner changes, its risk profile is impacted.

259. Ball & Kesan, *supra* note 60, at 20.
260. Chien, *Of Trolls*, *supra* note 206, at 1605 & tbl.6.
261. *See supra* Figure 5.

The findings here have implications for patent policy. The concept of "patent notice" is usually conceived of in terms of the metes and bounds of a patent's claims.[262] Indeed, the conventional yardstick of patent notice is how well the public can tell what is and what is not covered by the patent.[263] But the risk a patent poses to follow-on innovators is not only determined by the patent's document and claims—as understood in light of the specification—but also is influenced by who owns the patent and what is done with it.

These basic facts are not readily ascertainable based on the patent record. Although the only patents that could be asserted are patents that have not lapsed, it is impossible to search only among in-force patents at the PTO website, and even finding out whether a particular patent is still in force is a laborious process.[264]

Patentees are not required to record their transfers, nor are they required to specify the nature or the purpose of their transfers.[265] Even when they do register changes in ownership, they are not required to specify the corporate entity that owns the asset, making the seemingly simple task of identifying the patents of a particular company extremely difficult.[266] As the FTC has put it, "PTO records provide poor notice regarding current ownership of patents."[267] But if patents provide the right to exclude, the public is entitled to know who might do the excluding. Under the current system of recordation, accused infringers may have to wait until litigation to identify "the real party in interest."[268]

Other potential clues to the use of patents are obscured by loose recording rules and outdated technology classifications. Patentees do not have to record loans taken out on their patents at the PTO.[269] The lack of readily identifiable technological classes makes it more likely that companies

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262. *See, e.g.*, Burke, Inc. v. Bruno Indep. Living Aids, Inc., 183 F.3d 1334, 1340 (Fed. Cir. 1999) ("[T]he public is entitled to be apprised of what is and is not protected by a particular patent . . . ." (citing Markman v. Westview Instruments, Inc., 517 U.S. 370, 371 (1996))); Corning Glass Works v. Sumitomo Elec. U.S.A., Inc., 868 F.2d 1251, 1257 (Fed. Cir. 1989) ("A claim in a patent provides the metes and bounds of the right which the patent confers on the patentee to exclude others from making, using, or selling the protected invention.").

263. *See* BESSEN & MEURER, *supra* note 10, at 46, 147 (arguing that an "ideal patent system features rights that are defined as clearly as the fence around a piece of land" and articulating a theory of "notice failure" by which the patent system has failed to inform the public of the boundaries of patents).

264. *See supra* notes 200–03 and accompanying text.

265. *See supra* section III(A)(1).

266. *Cf.* AVANCEPT LLC, A STUDY OF: THE INTELLECTUAL VENTURES PORTFOLIO IN THE UNITED STATES: PATENTS & APPLICATIONS 15 (2d ed. 2010) (stating that Intellectual Ventures has over 1,000 known shell companies that it uses to hold its patent portfolio and declaring that "[w]e do not believe that we have found all of the shell companies").

267. FED. TRADE COMM'N, *supra* note 21, at 130.

268. FED. R. CIV. P. 17 ("An action must be prosecuted in the name of the real party in interest.").

269. *See supra* note 167 and accompanying text.

will, despite their best efforts, fail to identify the relevant patents in the first place.

These forms of "commercial patent notice failure"[270] have received little attention thus far but represent areas of potential improvement. The quality of any analysis based on patent data is crucially dependent on the quality of the underlying data. If ignoring patents is no longer an option, neither is paying attention to all of them. The ability to sift through them can be improved if the patent system facilitates rather than frustrates doing so.

V. Conclusion

Patent litigation is a disruptive and costly enterprise. The inability to anticipate patent litigation has made it practically uninsurable and driven companies to rapidly accumulate patents in order to ward off suits. This Article has demonstrated that the uncertainty about which patents are going to be asserted can be reduced through identification of the riskiest patents ahead of time. It shows that whether a patent is going to be litigated depends on the economic value of the patent, the characteristics of the owner of the patent, and her propensity to litigate. It leaves for future exploration the development of higher-resolution predictive models. It also highlights the need for greater policy attention to ensuring that the public has notice of who owns and what happens to a patent.

270. They are the subject of a work in progress tentatively entitled *Rethinking Patent Notice*.

Appendix A. The Effect of Various Patent Characteristics on the Likelihood of Litigation (Multivariate Logistic Regression)

	Lifetime Model (Characteristics Acquired over Patent Life)			**Time-Series Model (Characteristics Acquired Prior to Litigation)**		
Variables in the Equation	Intrinsic Variables Only	Acquired Variables Only	Intrinsic and Acquired Variables	Intrinsic Variables	Acquired Variables	Intrinsic and Acquired Variables
Nagelkerke R Square	.209	.330	.400	.209	.376	.459
Intrinsic Variables						
Claims (Log)	1.349*** (.061)	—	1.158* (.068)	1.349*** (.061)	—	1.242*** (.068)
Issued to Small-Entity Owner[T]	2.948*** (.107)	—	3.204*** (.123)	2.948*** (.107)	—	3.136*** (.122)
Foreign Counterparts (Log)	1.100 (.059)	—	1.018* (.065)	1.100 (.059)	—	1.043 (.066)
Family Members (Log)	4.383*** (.106)	—	2.479*** (.119)	4.383*** (.106)	—	2.972*** (.120)
Acquired Variables	—			—		
Recorded Assignments (Log)	—	.283*** (.140)	.404*** (.147)	—	.197*** (.142)	.303*** (.146)
Recorded Transfer[T]	—	2.052 (.197)	1.624* (.208)	—	2.406*** (.224)	1.969** (.235)
Owner Size Change[T]	—	2.843*** (.145)	1.792*** (.159)	—	2.247*** (.192)	1.452* (.200)
Ex Parte Reexamined[T]	—	79.000*** (.747)	46.575*** (.761)	—	63.669*** (1.039)	35.501*** (1.058)
Maintenance Fees[&]/In Force Prior to First Litigation[T]	—	1.991*** (.059)	2.162*** (.064)	—	7.8E+08 (1507.8)	7.6E+08 (1465)
Adjusted Forward Cites (Log)	—	1.520*** (.050)	1.417*** (.053)	—	1.418*** (.046)	1.46*** (.050)
Securitized[T]	—	1.71*** (.171)	1.443* (.179)	—	2.502*** (.190)	2.092*** (.202)

N = 2.636. Displayed: Exp(B) (Standard Error)

[T] Binary variable

[&] Categorical variable (Variables not otherwise designated are continuous variables.)

*** Significant at the .001 level

** Significant at the .01 level

* Significant at the .05 level

Note: Logit coefficients obtained using Robust Standard Errors. Standard errors in parentheses.