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EXTREME VALUE OR TROLLS ON TOP? THE CHARACTERISTICS OF THE MOST-LITIGATED PATENTS*

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INTRODUCTION

Patent reform has become, perhaps improbably, one of the most contentious issues facing Congress and the courts over the past six years. The fights range across a number of major issues, which not only separate patent owners from patent defendants and those who believe in innovation incentives from those who believe in market competition, but also divide patent owners themselves along both industry and technology lines. Advocates on both sides paint seemingly irreconcilable pictures of the patent system, either as a stable system with clearly defined legal rights essential to innovation or as a system rampant with litigation abuse by "patent trolls" who use the legal system to divert money from innovative companies.[1]

Far too much of this debate is based on anecdote and assumption, not real data. Pharmaceutical patent owners assume that most of the world works the way their industry does; so, too, do information technology (IT) companies. Patent trolls are variously portrayed as responsible for the majority of all patent lawsuits, for no more than two percent, or as mythical creatures that do not actually exist.[2]

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[1] On these two views of the world, see DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 3-6 (2009).

[2] *See, e.g.*, *Patent Trolls: Fact or Fiction: Hearing Before the Subcomm. on Courts, the Internet, and Intell. Prop. of the H. Comm. on the Judiciary*, 109th Cong. 14-18 (2006) (statement of Dean Kamen, President, Deka Research & Development Corporation) [hereinafter *Kamen Testimony*], *available at* http://frwebgate.access.gpo.gov/cgibin/getdoc.cgi?dbname=109_house_hearings&docid=f:28201.pdf (questioning whether patent trolls even exist); Jennifer Kahaulelio Gregory, *The Troll Next Door*, 6 J. MARSHALL REV. INTELL. PROP. L. 292, 305-09 (2007) (arguing that the term "patent troll" obscures real problems in the patent system); Mark A. Lemley & Carl Shapiro, *Patent*

The opening of the Stanford IP Litigation Clearinghouse in December 2008[3] allows us to collect data that give a unique perspective on many of these debates. Using this data, we identify the patents litigated most frequently between 2000 and 2007 and compare those patents to a control set of patents that have been litigated only once in that period. The results are startling. The most-litigated patents are far more likely to be software and telecommunications patents, not mechanical or other types of patents. They are significantly different from once-litigated patents in ways that signal their value up front. And they are disproportionately owned by nonpracticing entities (i.e., "trolls"). The results do not answer all of the policy questions; we offer only one important piece of a larger mosaic. But our findings have significant implications for debates over patent reform, since we show both that the most-litigated patents are the most valuable ones[4] and

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Holdup and Royalty Stacking, 85 TEX. L. REV. 1991, 2009 (2007) (asserting that nonpracticing entities account for thirty to forty percent of suits in the computer and electronics industries); Marc Morgan, *Stop Looking Under the Bridge for Imaginary Creatures: A Comment Examining Who Really Deserves the Title* Patent Troll, 17 FED. CIR. B.J. 165, 166 (2007) ("In reality only two percent of all patent litigation is linked to so-called *trolling*." (footnote omitted)).

[3] Press Release, Stanford Law Sch., Stanford Law School Launches Intellectual Property Litigation Clearinghouse (Dec. 8, 2008), *available at* http://www.law.stanford.edu/program/centers/iplc/#press_releases. The website of the Stanford IP Litigation Clearinghouse (IPLC) is located at http://lexmachina.stanford.edu.

[4] When we speak of value, we refer to *private* value, or value to the owner. We also refer only to the fact of value and not to any quantitative measure of value. We defend the litigation-value connection extensively in our prior work. *See* John R. Allison et al., *Valuable Patents*, 92 GEO. L.J. 435, 440-43 (2004) (explaining the intuitive litigation-value connection and its strong empirical support); *see also* John R. Allison & Thomas W. Sager, Commentary, *Valuable Patents Redux: On the Enduring Merit of Using Patent Characteristics to Identify Valuable Patents*, 85 TEX. L. REV. 1769, 1794 (2007) (defending the value-litigation connection). The economics literature supports this connection as well. *See, e.g.*, Dietmar Harhoff et al., *Citations, Family Size, Opposition and the Value of Patent Rights*, 32 RES. POL'Y 1343, 1345 (2003) (finding that "patents which are upheld against opposition . . . are particularly valuable"); Jean O. Lanjouw & Mark Schankerman, *Characteristics of Patent Litigation: A Window on Competition*, 32 RAND J. ECON. 129, 140 (2001) [hereinafter Lanjouw & Schankerman, *Characteristics*] (finding that litigation correlates with patent value and that "the number of claims is another . . . indicator of the 'bits of information' contained in a patent, and therefore its value"); Stuart J.H. Graham et al., *Post-Issue Patent "Quality Control": A Comparative Study of U.S. Patent Re-examinations and European Patent Oppositions* 6-22 (Nat'l Bureau of Econ. Research, Working Paper No. 8807, 2002) (comparing USPTO and EPO opposition mechanisms and finding that the most valuable patents were challenged in both systems); Dietmar Harhoff & Markus Reitzig, *Determinants of Opposition Against EPO Patent Grants—The Case of Biotechnology and Pharmaceuticals* 4 (Ctr. for Econ. Policy Research, Discussion Paper No. 3645, 2002) (confirming that "patents with above-average values are more likely to be attacked"); Jean O. Lanjouw & Mark Schankerman, *Enforcing Intellectual Property Rights* 5 (Nat'l Bureau of Econ. Research, Working Paper No. 8656,

that they are most commonly in the hands of companies other than the ones building new products.

In Part I we describe our study. In Part II we report our results. Part III discusses the implications of our findings.

I. STUDY DESIGN

Only about 1.5% of all patents are ever litigated in court.[5] The majority of patents are worth no more than a few thousand dollars;[6] litigated patents are almost by definition extreme outliers, since the parties are willing to spend millions of dollars per side in legal fees in order to litigate them.[7] In prior work, two of the authors demonstrated that litigated patents have significantly different characteristics than other patents.[8] They include more claims, cite more prior art,

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2001) ("[M]ore valuable patents . . . are much more likely to be involved in suits."); *cf.* Jean O. Lanjouw & Josh Lerner, *The Enforcement of Intellectual Property Rights: A Survey of the Empirical Literature*, 49/50 ANNALES D'ECONOMIE ET DE STATISTIQUE 223 (1998) (surveying the literature on the issue). This Article both strengthens that conclusion and demonstrates for the first time a strong relationship between the number of times a patent is enforced and the determinants of value. It also allows us to refute a hypothesis that we addressed but could not resolve in our prior work: that litigated patents are valuable, but not the *most* valuable patents. Litigation, on this account, is evidence of weakness in a patent. Perhaps competitors quietly take licenses to the *truly* valuable patents, and the ones they fight about are akin to an "upper-middle class" of potentially valuable but less-than-perfect patents.

[5] Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1507 (2001).

[6] *See, e.g.*, Jonathan A. Barney, *A Study of Patent Mortality Rates: Using Statistical Survival Analysis to Rate and Value Patent Assets*, 30 AIPLA Q.J. 317, 329 (2002) ("A relatively large number of patents appear to be worth little or nothing while a relatively small number appear to be worth a great deal."); Jean O. Lanjouw et al., *How to Count Patents and Value Intellectual Property: The Uses of Patent Renewal and Application Data*, 46 J. INDUS. ECON. 405, 412 & n.3 (1998) (noting a variety of studies finding "that most patents are of very little value"); Kimberly A. Moore, *Worthless Patents*, 20 BERKELEY TECH. L.J. 1521, 1526 (2005) (documenting the failure of most patentees to pay maintenance fees costing only a few thousand dollars); Thomas Ewing, Book Review, 43 SANTA CLARA L. REV. 631, 633 (2003) ("Some of the authors simply recount patent procurement and litigation statistics ad nauseum and do not seem to understand that some patents really do have no value whatsoever since no one would ever practice the disclosed technology, as claimed."). Maintenance fees are due in increasing amounts at 3.5 years, 7.5 years, and 11.5 years after the patent issues. 35 U.S.C. § 41(b) (2006). The fees are $830 at 3.5 years, $1,900 at 7.5 years, and $2,910 at 11.5 years. *Id.* Those fees are halved for small entities. *Id.* § 41(h)(1).

[7] *See* AM. INTELL. PROP. LAW ASS'N, REPORT OF THE ECONOMIC SURVEY, at I-91 (2007) (reporting that the median cost of high-stakes patent lawsuits is five million dollars per side in legal fees through trial).

[8] Allison et al., *supra* note 4; *see also* Allison & Sager, *supra* note 4, at 1794 (defending the statistical power of the results in the earlier study).

are cited more often by later patents, file more continuation applications, and come from larger "families" of patents.[9] They are also concentrated in certain industries. For example, semiconductor patents are particularly unlikely to be litigated because the industry is concentrated and cross-licenses are common.[10] Many of these characteristics are within the control of the patent applicant, and most are known by the time the patent issues. Allison et al. suggest that these characteristics are evidence of the private value of patents.[11]

That prior work depended significantly on a randomly selected sample of cases actually litigated. The development of the Stanford IP Litigation Clearinghouse in December 2008 opened up a second alternative. The Clearinghouse collects every patent-infringement lawsuit filed since January 1, 2000, in searchable format, and links those suits to the patents in suit.[12] Using that database, we identified every patent that has been litigated eight or more times between 2000 and 2007 (including cases still pending). We identified 106 such patents.[13] For purposes of our study, we also identified a randomly selected control set of 106 patents that have been litigated only once during this time period. This allows us to extend the work that Allison et al. did in 2004, comparing the "ordinary" litigated patents (already outliers, as we have seen) to the most-litigated patents. If Allison et al. are correct, we would expect those most-litigated patents to exhibit even more evidence of private value, and perhaps even more of an industry skew.

To test these hypotheses, we collected a variety of data about both the patents and the patent lawsuits.[14] For each litigated patent, we col-

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[9] Allison et al., *supra* note 4, at 438.

[10] *Id.* at 468-69.

[11] *Id.* at 460.

[12] Due to increased availability of electronic filings in federal court, the ability to identify patents in suit has improved markedly, particularly since 2003. Moreover, electronic access varies by district, potentially making this patent data set underinclusive for certain districts despite manual collection of cases from those districts. Nevertheless, the patents identified represent the best, most representative data set available.

[13] For purposes of this analysis, we include declaratory-judgment actions as well as actions filed by the patent owner. Until 2007, the rules for declaratory judgment required a clear threat of suit by the patent owner. *See* Teva Pharm. USA, Inc. v. Pfizer, Inc., 395 F.3d 1324, 1333 (Fed. Cir. 2005) (requiring reasonable apprehension of imminent suit), *abrogated by* MedImmune, Inc. v. Genentech, Inc., 549 U.S. 118 (2007) (permitting a declaratory judgment action so long as there is an actual controversy between the parties). We count only separate lawsuits; many patent lawsuits are filed against multiple defendants in a single proceeding.

[14] We do not address the outcomes of those lawsuits in this Article; that is the subject of a companion piece by the authors, tentatively entitled *Patent Quality and Risk Aversion Among Repeat Patent Litigants.*

lected information about small-entity status (i.e., whether the patent owner at issue is an individual, university, or small business, as opposed to a large business); whether the patent is assigned before litigation; the number of continuation applications filed leading to issuance of the patent; the raw and adjusted number of "forward citations" (citations to the patent by later patents); the number of "prior art references" the patent makes to U.S. patents, foreign patents, and nonpatent prior art; and the number of claims in each patent.

We also categorized each patent into both an industry and a technology in order to ascertain whether significant differences existed in the technology and industry areas.[15] We did not use the Patent and Trademark Office (PTO) classification system because our prior work has found that it is badly flawed.[16] Instead, we did our own categorization. In our description of technology and industry areas for inventions that we actually encountered in our data sets, we attempted to define the areas in a comprehensive way, and our definitions are thus broad enough to include specific inventions not actually found in our data sets.[17]

A. *Technology Areas*

(1) Software: An invention in which data processing is a sufficiently critical element that at least one claim element in the patent consists of data processing—the actual manipulation of data—

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[15] We did not attempt to create a comprehensive typology of such areas, but for obvious reasons only identified and defined those technology and industry areas we actually encountered in the population of the 106 most-asserted patents and the sample of 106 once-litigated patents. Although the size of our data sets is sufficient for sound statistical analysis, the relatively small numbers of observations necessarily results in our having encountered fewer technology and industry areas than we would have encountered in a much larger patent data set. The technology categories are not necessarily mutually exclusive because modern inventions so often involve multiple technologies.

Our industry categories are also not all mutually exclusive, reflecting the reality of modern industry crossovers. For example, a software-implemented telecommunications process or product rightly belongs in both a computer and a communications industry category. There are, however, fewer inventions belonging in more than one *industry* category than there are inventions belonging in more than one *technology* area because mixes of technologies in inventions are more common than industry crossovers.

[16] John R. Allison & Mark A. Lemley, *Who's Patenting What? An Empirical Exploration of Patent Prosecution*, 53 VAND. L. REV. 2099, 2114 (2000).

[17] Although we report descriptive statistics and bivariate comparisons for all of our technology and industry areas, we defined a few technology and industry areas encountered in the data set that we ultimately did not subject to statistical testing because the number of observations for such areas was so small as to render statistical analysis meaningless. We did this to create definitions of categories that could also be used in data sets other than the ones we used in this study.

regardless of whether the code carrying out that data processing is on a magnetic storage medium or embedded in a chip. The latter is often called "firmware."[18] This category includes the two software patent subsets described below.

(2) Pure software: An invention consisting only of data processing; all claim elements in the patent consist of data processing. However, we include in this definition a patent on data processing in which there is a trivial nondata processing element such as a generic input, output, or storage element clearly not intended to represent any novel technical advance. This category is a subset of software.

(3) Software business method: Also a subset of software patent, this category includes software patents that cover methods for conducting business transactions. Business-method patents are notoriously difficult to define, with possible definitions varying greatly in scope. For this study, we used a narrow definition limited to those patents the claims of which obviously covered only such things as automated generation of customer proposals, advertising, and the use of online catalogs.

(4) Mechanical: A process, machine, or product that consists solely of the use of mechanical parts, sometimes combined with heat, hydraulics, pneumatics, or other power sources; or an invention in which the above is a critical part. Some inventions classified as mechanical will also be in one or more other classifications, such as electronics. While many different types of inventions fit into this category, it is not a catchall "other" category.

(5) Electronics: A process, machine, or product in which the invention or a critical part thereof makes use of traditional electronic circuitry or involves electric-energy storage. An invention in this classification may also be included in other classifications, such as chemistry, mechanics, or optics.

(6) Optics (other than imaging): A process, machine, or product in which the invention or a critical part thereof employs light waves. Optics technology will sometimes also be classified in one or more other areas, such as electronics or chemistry.

(7) Imaging: A process, machine, or product in which the invention or a critical part thereof involves the creation or processing of images for various purposes. The imaging may be analog or digital.

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[18] The difficulty in defining a software patent, and the detailed reasoning that supports our definition, can be found in Arti K. Rai, John R. Allison & Bhaven N. Sampat, *University Software Ownership and Litigation: A First Examination*, 87 N.C. L. REV. 101, 111-15 (2009).

The majority of imaging patents have medical uses, but some serve other purposes such as security or meteorology.

(8) Biotechnology: A process involving advanced genetic techniques intended to construct new microbial, plant, or animal strains; a product created from such a process; or the way such a process or product is used in biotechnology research. Although there are a number of different genetic-engineering techniques, for several reasons we decided not to disaggregate these techniques into separate technology areas.

(9) Chemistry: A process consisting of chemical reactions, a product resulting from such a process, an invention of which a chemical process or product is a critical part, or an invention consisting of a purportedly novel use of chemical substances. Closely related inventions such as those on novel metal alloys and nonmetallic amalgams are also included. An invention in the field of chemistry may be included in one or more other classifications, such as electronics or optics.

B. *Industry Areas*

(1) Computer: This industry encompasses both software and computer-hardware inventions, including not only hardware products but also machines and processes for making computer hardware. As discussed below, some but not all inventions in the semiconductor industry are also included in the computer industry category.

(2) Semiconductor: The semiconductor industry category includes inventions of any kind intended to advance the state of the art in researching, designing, or fabricating semiconductor chips. Despite the fact that many semiconductor devices are intended to be computer components, not all are so intended, and we thus do not automatically include semiconductor patents in the computer industry category. There are situations in which a patent appropriately belongs in both the computer and semiconductor industry categories, such as a patent on a software or computer-hardware invention specifically for use in semiconductor device fabrication, but this is not an automatic industry crossover.

(3) Electronics: This is a somewhat narrower version of the electronics *technology* category. This industry category includes many patents that involve the use of electronics technology, but inventions of which electronics technology forms a part are not always legitimately viewed as being within the electronics *industry*. An example might be an electro-mechanical process (covered by both the mechanical and

electronics technology areas) for creating a packaging system for integrated circuits and printed circuit boards.[19] Although reasonable minds could differ, it seems most logical to include such an invention in the computer and semiconductor industries for which the packaging is intended, not in the electrical industry.

(4) Medical: This industry category includes inventions of any kind used for research on, or for the diagnosis or treatment of, diseases or other abnormal conditions in humans or animals. Patents on processes and products for *pharmaceutical* purposes are not included in the medical industry category.

(5) Pharmaceutical: The pharmaceutical industry category includes patents on drugs for treating diseases or other abnormal conditions in humans or animals, as well as processes for producing or using such drugs.

(6) Biotechnology: In this instance, we concluded that the biotechnology *technology* area, which we define broadly, should also be an *industry* category.

(7) Chemical: The chemical industry category includes inventions of all kinds that deal primarily with the making, transportation, and use of chemical substances, *except for pharmaceutical drugs*. It is both narrower and broader than the chemistry *technology* area. It is narrower in the sense that it does not include patents on inventions using chemical techniques to produce nonchemical products that more logically belong in another industry. For example, a patent including an element covering the use of chemical techniques in semiconductor fabrication would not be included in the chemical industry category. The industry category is broader than the chemistry *technology* category, as it includes inventions not employing chemistry techniques but that nevertheless are intended for use by chemical companies, such as a mechanical invention relating to the handling of chemicals.

(8) Communications: The communications industry category includes patents on inventions of all kinds intended to advance the state of the art in communications.

(9) Transportation: This category includes patents on any type of invention related to vehicles of any type, or to the provision of transportation services.

(10) Energy and utility services: This category includes patents on inventions of any kind associated with power generation, transporta-

[19] U.S. Patent No. 5,551,216 (filed July 20, 1995) (issued Sept. 3, 1996).

tion, or consumption. Also included are inventions related to the delivery of public utility services.

(11) Financial: This category includes processes and products associated with providing financial services of various kinds. Such patents usually employ software and, if so, are also included in the computer industry category.

(12) Consumer goods and services: This category includes patents on products and services of all kinds intended for personal consumer purposes. Also included are patents on methods for marketing, buying, or delivering personal consumer goods or services, which often will be software implemented and thus will also fall within the *computer* industry category.

(13) Construction: The construction industry category includes inventions of all kinds related to the erection or maintenance of structures, or to excavation.

C. *Entity Status*

Finally, we investigated the nature of the patent plaintiff. Following Lemley and Myhrvold,[20] we categorized each patent owner into one of the twelve different "entity status" categories listed in Table 1.

Table 1: Entity-Status Classes

Entity Class	Description
1	Acquired patents
2	University heritage or tie
3	Failed startup
4	Corporate heritage
5	Individual-inventor-started company
6	University/Government/NGO
7	Startup, pre-product
8	Product company
9	Individual
10	Undetermined
11	Industry consortium
12	IP subsidiary of product company

[20] Mark Lemley and Nathan Myhrvold are currently working on an article, tentatively entitled *The Complex Ecology of Patent Plaintiffs*, employing this method.

Of the twelve entity classes, only one (Class 8) involves enforcement by a patent owner that actually makes products. The remainder are different types of "nonpracticing entities,"[21] sometimes called "patent trolls" for the prototypical practice of hiding under a bridge they did not build and demanding a toll from surprised passersby. Rather than take a position on what, if any, nonpracticing entities should be considered "trolls," we classify each patent owner and let the reader decide. We do, however, report the results for practicing versus nonpracticing entities (i.e., Class 8 versus other classes) as well as the results for each class.

D. *Statistical Analysis*

We tested each of the results reported here for statistical significance. We report the results in the tables in most cases. But, unless otherwise noted, the reader should assume that we report only results with a confidence level greater than 99% (i.e., a *p*-value of less than 0.01).[22]

In addition to descriptive statistics and bivariate comparisons of individual variables between the two data sets,[23] we also checked our results using logistic regression to determine which differences between the two data sets remained significant after accounting for interactions (correlations) among the variables within each set. Logistic regression is one form of multiple regression, which is used when there are multiple predictor (or explanatory) variables and only one dependent variable (here, either a singly or multiply litigated patent).

We conducted two logistic regressions, one including the key patent characteristics and *technology* areas, the other including those same patent characteristics and *industry* areas.

The patent characteristics included in each regression, some of which are obviously categorical variables and some of which are obviously continuous variables, were as follows: (1) whether ownership of the patent had been assigned after issuance and before the first litigation of that patent; (2) whether the patent was initially issued to a

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[21] After a diligent search, we could not identify the entity status of a few patent owners. We have classified those entities as 10 (Undetermined) and have excluded them from our entity-status analyses.

[22] In social science research, a confidence level of 95% (*p*-value of 0.05) is typically treated as sufficient to show statistical significance. Thus, a confidence level of 99% (*p*-value of 0.01) shows a far greater degree of confidence that the differences are not due to random chance.

[23] We used accepted statistical techniques to adjust many of the variables to normalize skewed distributions before making bivariate statistical comparisons.

small or large entity; (3) the number of U.S. nonprovisional applications leading to the particular patent; (4) the number of forward citations, adjusted for patent age; (5) the subset of forward citations consisting of self-citations, also adjusted for patent age; (6) the number of claims; (7) the number of references to prior U.S. patents; (8) the number of references to prior foreign patents; and (9) the number of references to nonpatent prior art (i.e., "other publications").

In the regression with technology areas, we included all of those listed in the descriptive and bivariate statistics, except that we used the total number of software patents and did not break the software category into subsets. In the regression with industry areas, we included all of those listed in the descriptive and bivariate statistics.

II. RESULTS

A. *The Characteristics of the Most-Litigated Patents*

We begin by investigating the characteristics of the most-litigated patents and comparing them to the control set of patents that were litigated only once. The results are dramatic. The most-litigated patents differ fundamentally in virtually every respect from even the once-litigated patents. We report these results in Tables 2 and 3.

Table 2 shows that the most-litigated patents made extraordinary use of patent continuations.[24] Litigated patents in the control set had an average of two priority applications—the original application and one continuation or divisional. Moreover, fully half of the patents in the control set filed no continuation applications at all.[25] By contrast, the most-litigated patents had an average of 4.3 applications each, and the median patent in this set had 3 applications.

[24] For a discussion of patent continuations, see Mark A. Lemley & Kimberly A. Moore, *Ending Abuse of Patent Continuations*, 84 B.U. L. REV. 63 (2004).

[25] This explains the otherwise odd result that the median number of applications filed is 1.5—exactly half of the patents had one application, and half had more than one.

Table 2: Continuation Applications and Forward Citations

	Number of Non-provisional U.S. Apps. in Chain	Total Number of Forward Citations	Adjusted Total Number of Forward Citations	Total Number of Self-Citations	Adjusted Number of Self-Citations
		Most-Litigated Patents			
Mean	4.32	32.25	-0.33	1.27	2.24
Median	3.00	15.50	-0.17	0.00	0.00
Standard Deviation	4.85	42.42	1.02	5.29	11.20
		Once-Litigated Patents			
Mean	2.01	14.07	-0.77	1.33	1.00
Median	1.50	6.00	-0.14	0.00	0.00
Standard Deviation	1.40	23.18	1.74	2.74	1.71
		Bivariate Comparison (one sample *t*-test with log transformation)			
p-value	0.0001	0.0001	0.0001	0.0173	0.0001
Significant?	Yes	Yes	Yes	Yes	Yes

Table 2 also shows differences in forward citations (i.e., citations received by subsequent patents referring back to the patent in question as prior art), which economists have often identified as a measure of patent value.[26] The results here are more complicated. As Hall, Jaffe, and Trajtenberg have shown, just counting forward citations can be misleading because the older a patent is the more time others will have had to cite it.[27] The results also need to be adjusted because citation patterns have changed over time. The base results in Table 2 show that the

[26] A number of studies have used forward citations as evidence of patent value. *See, e.g.*, Bronwyn H. Hall, Adam Jaffe & Manuel Trajtenberg, *Market Value and Patent Citations*, 36 RAND J. ECON. 16, 29-30 (2005) (finding that an extra citation per patent increases a firm's market value by three percent); Dietmar Harhoff et al., *Citation Frequency and the Value of Patented Inventions*, 81 REV. ECON. & STAT. 511, 515 (1999) (concluding from surveys in the United States and Germany that patents renewed to full term are more frequently cited than those that lapse and that citation frequency increases with economic value for full-term patents); Manuel Trajtenberg, *A Penny for Your Quotes: Patent Citations and the Value of Innovations*, 21 RAND J. ECON. 172, 172 (1990) (demonstrating the use of patent counts weighted by citations as evidence of patent value); *cf.* Lanjouw & Schankerman, *Characteristics*, *supra* note 4, at 130 (finding that citations received predicted litigation when those citations were made by competitors).

[27] Hall, Jaffee & Trajtenberg, *supra* note 26, at 30-31.

most-litigated patents are cited more than twice as often as the control-set patents. After adjusting the number of forward citations received by patents to account for their different ages, the differences between the two data sets are significant to an exceptional degree.[28] Table 2 also shows significant differences in "self-citations," a subset of forward citations that has been found to be an independent value indicator apart from the set of overall forward citations of which they are a part.[29]

The differences are even more dramatic when it comes to prior art references (sometimes referred to as "backward citations"). These

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[28] The method of adjustment to account for the different ages of patents involves placing each patent in the data set into a cohort of other patents in the data set that were issued during the same year. Thus, each cohort is one year, although cohorts of more than one year could be used if necessary even though that would decrease precision somewhat. The number of forward citations received by each patent is divided by the average number of forward citations received by other patents in the same cohort. This gives us the adjusted number of forward citations for that patent in the data set. The process is repeated for every other patent in the same cohort and then repeated for each patent in the other year cohorts. To obtain the adjusted number of forward citations for an entire data set, we then averaged the quantity of adjusted number of forward citations received by all patents in the set. The method is from Bronwyn H. Hall, Adam B. Jaffe & Manuel Trajtenberg, *The NBER Patent-Citations Data File: Lessons, Insights, and Methodological Tools*, *in* PATENTS, CITATIONS, & INNOVATIONS: A WINDOW ON THE KNOWLEDGE ECONOMY 403, 434-37 (Adam B. Jaffe & Manuel Trajtenberg eds., 2002).

Because of the unusual skew in forward citations, the means for untransformed forward citations look nearly identical even though the differences in the distributions are both dramatic and highly significant. As a result, we also report in Table 2 the log-transformed value for adjusted forward citations, which makes the differences quite clear.

[29] Self-citations are references to the patent as prior art in subsequent patents issued to the same inventor or assignee. Self-citations have been identified as an independent indicator of private patent value apart from overall forward citations of which the self-citations are a part. *See, e.g.*, Hall et al., *supra* note 26, at 31-33 (finding self-citation to be a highly significant indicator of market value). The apparent reason is that self-citations provide evidence that the patent owner is building a portfolio of patents on related technologies, and a portfolio of patents often has a value that is greater than the sum of its parts. *See, e.g.*, Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios*, 154 U. PA. L. REV. 1, 5-6 (2005). Because there can be multiple inventors on a patent, and because ownership of a patent can sometimes change after issuance, there is occasionally difficulty in identifying a particular forward citation as a self-citation. Thus, we used the following decision rule for identifying self-citations: a forward citation is a self-citation if either (a) the *owners* of the main patent and the forward citation are the same, or (b) the owners are different, the *inventors* in the main patent and the forward citation are the same, *and* there are no co-inventors (i.e., no other inventors). To apply this decision rule, we had to examine the front pages of each of the 3419 patents that constituted forward citations to patents in our two data sets. Economists do not examine individual forward citations and thus use a blunter test to identify self-citations—a forward citation is a self-citation when the assignee (owner) of the patent is the same in the instant patent and the forward citation. *See, e.g.*, Hall et al., *supra* note 28, at 424. This approach clearly does not capture any nuance, but it has the advantage of being automatizable.

are references to prior U.S. and foreign patents as well as printed publications and claims. Table 3 presents these results. The most-litigated patents have more than 50% more claims than the control set—39.3 on average compared with 24.5 for once-litigated patents. The number of claims is sometimes associated with patent value, though two of the authors have elsewhere noted the complexity of the claim count/value relationship.[30] Much more significant is the difference in prior art citations.[31] The most-litigated patents cite nearly three times as many U.S. and foreign patents as other litigated patents and nearly *ten* times as many nonpatent prior art references as other litigated patents. This is particularly notable given that litigated patents themselves cite much more prior art than unlitigated patents.[32]

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[30] Allison et al., *supra* note 4, at 449 n.58 (noting that the number of claims in a patent can depend on a number of factors correlated to value); *see also* John R. Allison & Emerson H. Tiller, *The Business Method Patent Myth*, 18 BERKELEY TECH. L.J. 987, 1052-56 (2003) (reviewing the literature on numbers of claims as an indicator of patent value); Lanjouw & Schankerman, *Characteristics*, *supra* note 4, at 140-42 (discussing patent claims as an underutilized indicator of patent value); Kimberly A. Moore, *Xenophobia in American Courts*, 97 NW. U. L. REV. 1497, 1544 (2003) (noting that, while the number of claims has been shown to be an indicator of private value, the reason is *not* that more claims cause the patent to have greater breadth (or scope) as economists have asserted, as it is the generality of claim language that creates breadth); *cf.* John R. Allison & Mark A. Lemley, *The Growing Complexity of the United States Patent System*, 82 B.U. L. REV. 77, 104 (2002) [hereinafter Allison & Lemley, *Growing Complexity*] ("[T]he number of claims could also reflect resource constraints, drafting style, uncertainty about the law or the significance of an invention, or a host of other factors that are not necessarily driven by patent value.").

[31] *See, e.g.*, Allison & Tiller, *supra* note 30, at 1036-39 (arguing that there is a correlation between the number of prior art references and patent value); Allison et al., *supra* note 4, at 453 (finding a statistically significant relationship between prior art references and litigation); Harhoff et al., *supra* note 4, at 1360 (finding a relationship between prior art references cited and other measures of patent value). *But see* Lanjouw & Schankerman, *Characteristics*, *supra* note 4, at 41 ("[A] litigated patent is likely to cite *fewer* prior patents per claim than a randomly selected patent."). The theory behind the relationship of prior art references and value is that the more citations that are considered during prosecution by the examiner, the less likely it is that some prior art exists that will invalidate the patent. The more prior art considered, in other words, the more likely a patent is to survive subsequent litigation. *See, e.g.*, John R. Allison & Mark A. Lemley, *Empirical Evidence on the Validity of Litigated Patents*, 26 AIPLA Q.J. 185, 232-34 (1998) (showing that courts are more likely to invalidate patents on the basis of uncited prior art than on prior art cited to the PTO); Moore, *supra* note 30, at 1538 ("Patents that include more citations or more diverse citations are more likely to be valid."). Because lawyers know this, the value relationship may reflect not only the strength of patents that cite a lot of prior art, but also efforts by applicants to "bulletproof" patents they expect to litigate by citing a great deal of art.

[32] Allison et al., *supra* note 4, at 453-55. Because many of the patents in this sample were issued before January 1, 2001, when the PTO began identifying examiner-added prior art on the face of the patent, we were unable to determine whether it was

All of these differences are significant at extraordinarily high confidence levels.

Table 3: Number of Claims and References

	Number of Claims	Number of References to U.S. Patents	Number of References to Foreign Patents	Number of Nonpatent References (Printed Publications)
		Most-Litigated Patents		
Mean	39.29	61.46	9.00	52.68
Median	22.50	12.00	1.00	4.00
Standard Deviation	44.69	109.31	18.61	110.71
		Once-Litigated Patents		
Mean	24.46	23.13	3.59	5.61
Median	19.00	12.50	0.00	0.00
Standard Deviation	23.62	30.79	7.70	16.21
		Bivariate Comparison (one sample *t*-test with log transformation)		
p-value	0.0002	0.0149	0.0052	$1.33E^{-10}$
Significant?	Yes	Yes	Yes	Yes

B. *The Technologies and Industries of the Most-Litigated Patents*

We also find dramatic differences between most-litigated and once-litigated patents when it comes to the technologies they employ and the industries with which they are associated. Prior work has found that significant numbers of patents issue in a wide variety of technology areas and industries, including mechanics, biotechnology, semiconductors, and computer-related inventions,[33] though this diversity of technologies is a relatively recent phenomenon.[34] In our 2004

the applicant or the examiner that provided most of this art. However, other work has shown that virtually all nonpatent prior art (over ninety percent) is provided by applicants, not examiners. *See* Mark Lemley & Bhaven N. Sampat, *Examiner Characteristics and the Patent Grant Rate* 10 (John M. Olin Program in Law & Econ., Working Paper No. 369, 2009). Thus, it is quite likely that the disparity in nonpatent prior art citations is a result of applicant submissions, not examiner diligence.

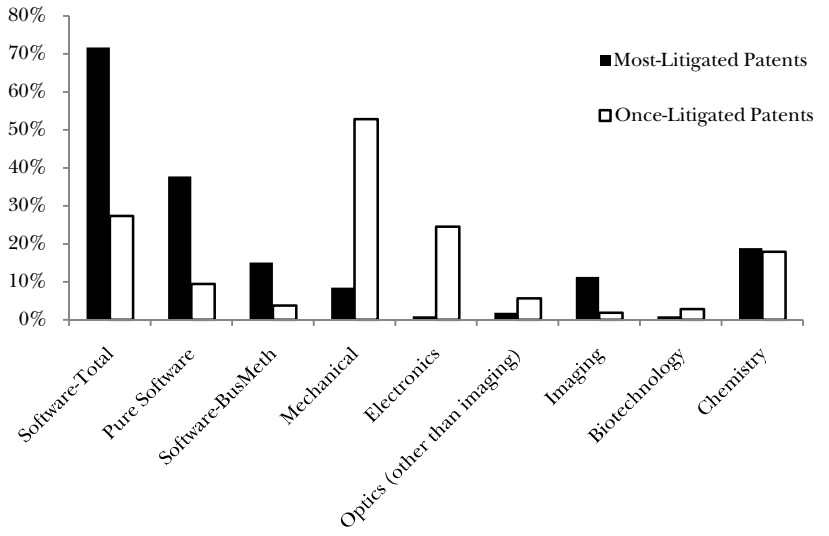
[33] *See, e.g.*, Allison & Lemley, *supra* note 16, at 2113-15, 2148 tbl.1 (showing the distribution of studied patents among fourteen technology categories).

[34] *See, e.g.*, Allison & Lemley, *Growing Complexity*, *supra* note 30, at 93 & tbl.1, 94 (documenting the growing diversity of patented technologies).

study, we found that patents were disproportionately more likely to be litigated in some industries than in others, and that semiconductor patents in particular were unlikely to be litigated.[35]

We find even more significant differences in technology and industry areas between most-litigated and once-litigated patents. We report two sets of results: one by industry area and one by technology area. As noted above, the two frequently diverge—a software invention may be used in any number of industries, some traditionally considered computer-related but others entirely divorced from it, such as automobiles or bioinformatics. The results, reported as proportions of the 106 patents in each data set involving the identified technology or industry area,[36] are presented in Tables 4 and 5 and Figures 1 and 2.

Figure 1: Technology Areas



[35] Allison et al., *supra* note 4, at 472.

[36] A reminder—inventions can involve more than one industry or technology class, so the proportions exceed 100%. We simply compared proportions between the most-litigated and once-litigated data sets.

Table 4: Technology-Areas Data

	Most-Litigated Patents	Once-Litigated Patents	Bivariate Comparison (one sample *t*-test with log transformation)	
			p-value	Significant?
Software Total	0.72	0.27	$1.07341E^{-10}$	Yes
Pure Software	0.38	0.09	$1.21E^{-06}$	Yes
SoftwareBusMeth	0.15	0.04	0.004809	Yes
Mechanical	0.08	0.53	$2.54E^{-12}$	Yes
Electronics	0.01	0.25	$2.6E^{-07}$	Yes
Optics (other than imaging)	0.02	0.06	0.149394	No
Imaging	0.11	0.02	0.005684	Yes
Biotechnology	0.01	0.03	0.312702	No
Chemistry	0.19	0.18	0.859304	No

The most-litigated patents are overwhelmingly likely to be software patents. Nearly three-fourths of the most-litigated patents are software patents, compared with just over one-fourth of the once-litigated patents. Similarly, software-implemented business-method patents are overrepresented in the most-litigated patents group (they comprise 15% of the most-litigated patents versus 4% of the least-litigated). And imaging patents are much more heavily represented in the most-litigated category (11% versus 2%) as well. By contrast, mechanical and electronics patents make up the bulk of the once-litigated-patent cases, but they are only of minor significance in the most-litigated-patent set. Mechanical inventions make up only 8% of the most-litigated patents, but 53% of the once-litigated patents; electronics inventions make up only 1% of the most-litigated patents but fully 25% of the once-litigated patents. Other industries, notably biotechnology and chemistry, do not show significant differences between the two data sets.

We see similar variance when we move from the technology areas to the industries. Figure 2 and Table 5 present the results by industry. The computer industry is once again dominant in the most-litigated-patent set; 72% of the most-litigated patents are in the computer industry, compared with 34% of the once-litigated patents. Telecommunications is similar; 34% of the most-litigated patents are in the communications industry, compared with 8% of the once-litigated patents. By contrast, a variety of more traditional industries, including electronics, medical, chemical, energy, consumer goods and services, and construction are all significantly more likely to show up in the once-litigated-patent set than in the most-litigated set.

Figure 2: Industry Areas

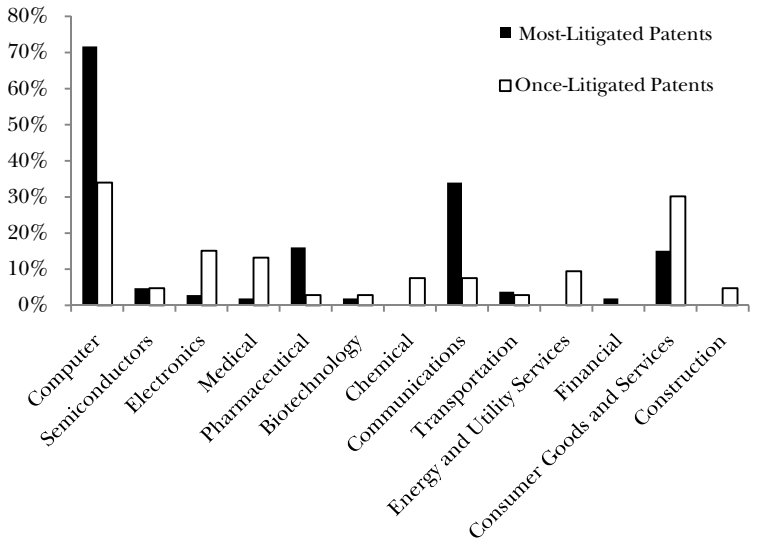


Table 5: Industry-Areas Data

	Most-Litigated Patents	Once-Litigated Patents	Bivariate Comparison (one sample *t*-test with log transofrmation)	
			p-value	Significant?
Computer	0.72	0.34	$3.73E^{-08}$	Yes
Semiconductors	0.05	0.05	1	No
Electronics	0.03	0.15	0.001773	Yes
Medical	0.02	0.13	0.001808	Yes
Pharmaceutical	0.16	0.03	0.001004	Yes
Biotechnology	0.02	0.03	0.650849	No
Chemical	0.00	0.03	0.003935	Yes
Communications	0.34	0.08	$2.12E^{-06}$	Yes
Transportation	0.04	0.03	0.700709	No
Energy and Utility Services	0.00	0.09	0.001197	Yes
Financial	0.02	0.00	0.155337	No
Consumer Goods and Services	0.15	0.30	0.008647	Yes
Construction	0.00	0.05	0.023641	Yes

In short, the most-litigated patents are disproportionately IT patents—software, software-implemented business methods, computer industry, and telecommunications. Notably absent from this list is the semiconductor industry; consistent with what Allison et al. found in 2004, semiconductor inventions are a relatively minor percentage of both data sets.[37] Also surprising is the pharmaceutical industry, which has a significant share of the most-litigated patents but perhaps less of a share than one might expect given their power in the patent-reform debate.

C. *The Owners of the Most-Litigated Patents*

Finally, we collect a variety of information regarding the owners of the patents in both the most-litigated and the once-litigated sets. To begin, we must separate the initial owner of the patent from the owner when the lawsuit is filed because one of our findings is that more than one-third of the litigated patents across both data sets were sold to another owner after issue and before the first lawsuit was filed.[38]

Small entities start out owning more once-litigated than most-litigated patents: 57 of 106 once-litigated patents were originally assigned to small entities, compared to 40 of the most-litigated patents. While one might conclude that small entities are more likely to be occasional users of the patent system, two problems complicate this conclusion. First, a large number of the most-litigated patents are owned by a single entity—Ronald S. Katz Technology Licensing LLP.[39] While that company is most probably a "small entity," defined as a company employing fewer than 500 people, the patents were not filed with small-entity status. To avoid skewing the data in either direction by treating Katz patents either as large- or small-entity patents, we have excluded them from the small-entity analysis entirely. That means that the small-entity numbers are a larger share of the most-litigated patents than the raw numbers suggest. Small entities owned 53.8% of the once-litigated patents and 46.5% of the most-litigated patents.[40]

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[37] Allison et al., *supra* note 4, at 472.

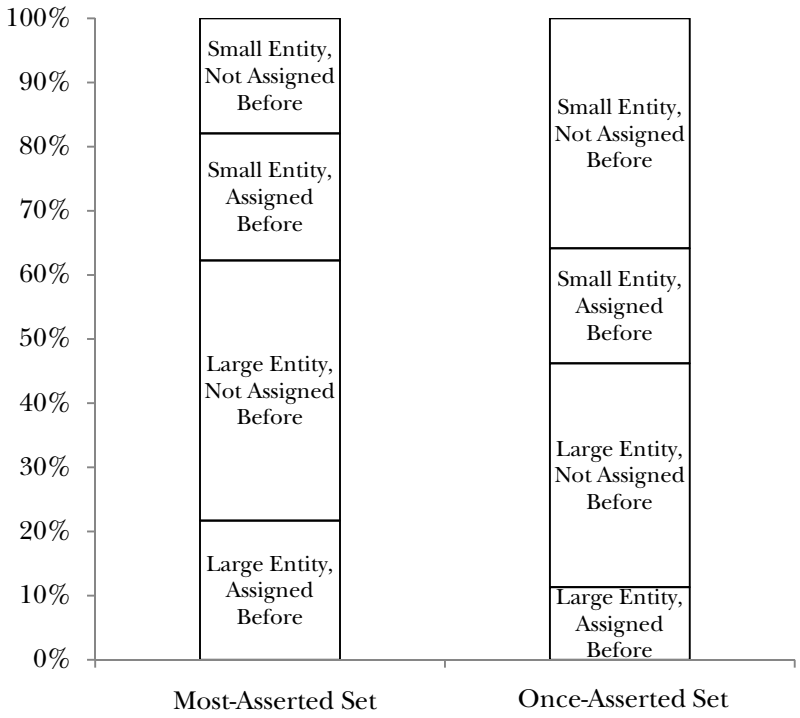
[38] We found that 44 of the 106 most-litigated patents and 31 of the 106 once-litigated patents were sold before litigation. The difference was not statistically significant, however, so we rely only on the aggregate numbers.

[39] Katz had 20 of the top 106 most-litigated patents issued in his name. In fact, his impact on the most-litigated patents is even greater, because at litigation he owned still other patents acquired after issue.

[40] *Cf.* Gwendolyn G. Ball & Jay P. Kesan, *Transaction Costs and Trolls: Strategic Behavior by Individual Inventors, Small Firms, and Entrepreneurs in Patent Litigation* 14 (Univ. Ill. Law & Econ.

That is not the end of the story, however, because the owner of the patent at issue is not always the owner of the patent when the suit is filed. Indeed, we find that 44 of the 106 most-litigated patents and 31 of the 106 once-litigated patents are assigned to another entity before the first lawsuit is filed.[41] In Table 6 and Figure 3, we relate the entity size at issue to the likelihood of assignment before litigation.

Figure 3: Entity-Assignment Matrix
Excluding Patents Originally Issued to Katz



Paper Series, Research Paper Series No. LE09-005, 2009), *available at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1337166 (finding that small firms are frequent patent litigants).

[41] This is consistent with Judge Kimberly Moore's finding that assignments of litigated patents are quite common. *See* Kimberly A. Moore, *Populism and Patents*, 82 N.Y.U. L. REV. 69, 92-93 (2007); *see also* Carlos J. Serrano, *The Dynamics of the Transfer and Renewal of Patents* 3 (Nat'l Bureau of Econ. Research, Working Paper No. 13938, 2008) (finding that the likelihood that a patent will be transferred increases with indicia of value).

Table 6: Entity-Assignment Matrix Data

	Most-Asserted Set		Once-Asserted Set	
	Large-Entity Owner	**Small-Entity Owner**	**Large-Entity Owner**	**Small-Entity Owner**
Assigned Before Litigation	23	21	12	19
Not Assigned Before Litigation	43	19	37	38

Notably, once assignments are taken into account, it seems that small entities that keep rather than sell their patents tend to litigate less often than either large entities or purchasers of small-entity patents. The fact that assigned patents are more likely to be the most-litigated patents is also consistent with the idea that the most-litigated patents are also the most valuable, since they are more likely to have been sold.[42]

Next, we evaluate the nature of the patent owners in both sets. One of the biggest policy debates in patent reform has been over the nature and extent of "patent trolls." As noted in Part I, we divide the patent plaintiffs in our data sets into twelve different categories. We present the results of that categorization in Table 7 and Figure 4.

[42] An alternative explanation, however, is that once a company pays money to buy a patent, it is more likely to enforce that patent since it wants a return on its investment. Similarly, the correlation between value and assignment may reflect the nature of the acquiring entities, at least for a given subset of cases. An entity purchasing third-party patents to assert will presumably do precisely that. Moreover, at least some patent holders may create special-purpose entities immediately prior to, and for, litigation. On the other hand, one must assume that an acquirer will evaluate the likely value of patents before buying them and will not knowingly purchase patents that are either of highly dubious validity or of such narrow scope as to be of little use.

Figure 4: Entity Status

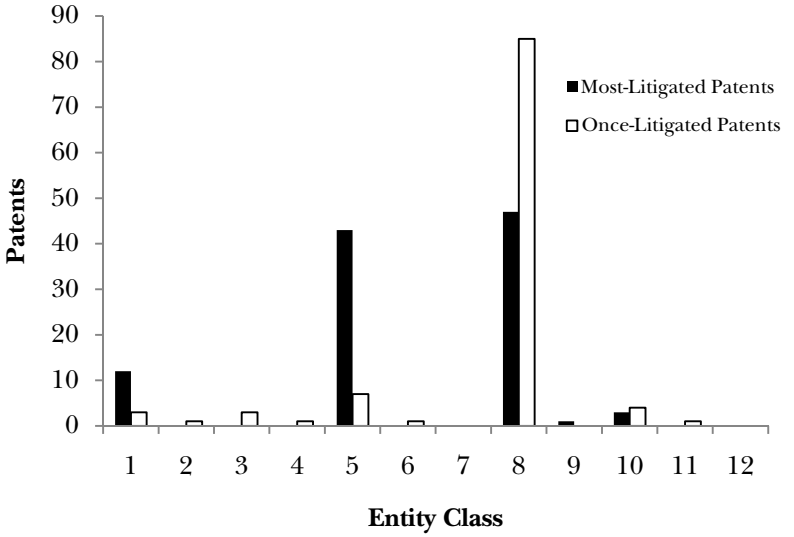


Table 7: Entity-Status Data

Entity Classes	Most-Litigated Patents	Once-Litigated Patents
Entity Class 1 (Acquired patents)	12	3
Entity Class 2 (University heritage or tie)	0	1
Entity Class 3 (Failed startup)	0	3
Entity Class 4 (Corporate heritage)	0	1
Entity Class 5 (Individual-inventor-started company)	43	7
Entity Class 6 (University/Government/NGO)	0	1
Entity Class 7 (Startup, pre-product)	0	0
Entity Class 8 (Product company)	47	85
Entity Class 9 (Individual)	1	0
Entity Class 10 (Undetermined)	3	4
Entity Class 11 (Industry consortium)	0	1
Entity Class 12 (IP subsidiary of product company)	0	0
Total	106	106

The differences are dramatic. Once the few entities whose status we could not determine (three of the most-litigated patents and four of the once-litigated patents) are excluded, traditional product companies—those that are participants in the market in which they are enforcing the patent—represent 83.3% of the once-litigated patents but only 45.6% of the most-litigated patents. If one views all nonpracticing entities as patent trolls, a view with which we do not necessarily agree,[43] trolls hold a significant share of the most important patents, but a much smaller share of "ordinary" once-litigated patents.[44] The most-litigated patents, despite being small in number compared to the total number of patents issued, are disproportionately important to the patent system because of the volume of litigation they generate. Nonetheless, it is worth keeping in mind that the 2987 infringement suits filed on the 106 most-litigated patents still represent only about 14% of the patent suits filed from 2000 through 2007.[45]

Nonpracticing entities in the most-litigated-patent set fall almost entirely into only two classes: licensing companies in the business of buying up and enforcing patents ("trolls" by virtually anyone's definition) and companies started by an inventor that do not make products. Licensing companies account for 11.7% of the most-litigated-patent suits, and inventor companies account for 41.7% of those suits. Only one patentee in this group—an individual litigant—falls into any other category. By contrast, the ecology of once-litigated patents is somewhat more diverse; that data set includes suits by universities, university spin-outs, failed start-ups, companies that once sold products but no longer do, and industry consortia. None represents a large percentage of the set of once-litigated patents.

The disparity is even greater than these data suggest. Each patent in the control set has been litigated only once, meaning that each patent has an equal effect on the overall distribution. By contrast, the most-litigated patents include some patents litigated eight times and others litigated ninety-seven times.[46] Weighting entity status by the

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[43] *See* Mark A. Lemley, *Are Universities Patent Trolls?*, 18 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 611, 612 (2008) (arguing that universities, although nonpracticing patent owners, are not necessarily patent trolls).

[44] The differences we report are statistically significant at a 95% or greater confidence level for class 1, and at a 99% confidence level for classes 5 and 8.

[45] *See* Stanford IP Litigation Clearinghouse, http://lexmachina.stanford.edu (last visited Oct. 15, 2009) (reporting that 13,793 total patent suits were filed between 2003 and 2007 inclusive). A list of the most-litigated patents and the number of suits in the database is attached as the Appendix.

[46] *See infra* Appendix.

number of lawsuits gives us a somewhat different story, one depicted in Table 8 and Figure 5.

Figure 5: Number of Lawsuits in Most-Litigated Patents, by Entity Class

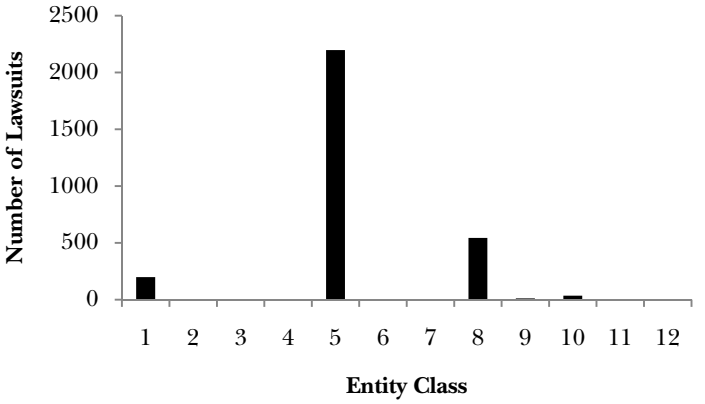

Table 8: Most-Litigated Patents by Status

Entity Classes	Most-Litigated Patents	Number of Suits in Most-Litigated Patents
Entity Class 1 (Acquired patents)	11	199
Entity Class 2 (University heritage or tie)	0	0
Entity Class 3 (Failed startup)	0	0
Entity Class 4 (Corporate heritage)	0	0
Entity Class 5 (Individual-inventor-started company)	41	2198
Entity Class 6 (University/Government/NGO)	0	0
Entity Class 7 (Startup, pre-product)	0	0
Entity Class 8 (Product company)	51	544
Entity Class 9 (Individual)	0	11
Entity Class 10 (Undetermined)	3	35
Entity Class 11 (Industry consortium)	0	0
Entity Class 12 (IP subsidiary of product company)	0	0
Total	106	2987

Once we take account of the number of suits, the share of suits by product companies falls to 18.4%—showing that more than 80% of the most-litigated-patent suits are filed by NPEs.[47] Most are filed by inventor-owned or inventor-developed companies, which account for 74.4% of the most-litigated-patent lawsuits. Further, the share of suits filed by licensing shops actually falls to 6.7% of all suits. Nonpracticing entities are a small share of once-litigated patents, but they thus represent an overwhelming share of the suits filed on the most-litigated patents.

D. *The Katz Effect*

It is worth mentioning the outsized role played here by one patent plaintiff, Ronald Katz. He owns a large percentage of the most-litigated patents, including most of the top thirty patents. Roughly 60% (1789 of 2987) of the patent-lawsuit combinations in the most-litigated set are Katz-related lawsuits. There is no question that Katz is an outlier. We considered removing his suits from our results but decided against it, as the most-litigated patents are all outliers in some sense and removing Katz would skew our data. Katz is a product of the current patent system, and the Katzes of the world should be considered in evaluating the effects of that system.

E. *Logistic Regression*

In both the technology-area and industry-area regressions, we found three continuous variables to be significant or highly significant despite the existence of substantial correlations among many variables: (1) the number of U.S. nonprovisional applications leading to the particular patent;[48] (2) the number of references to prior U.S. patents;[49] and (3) the number of references to nonpatent prior art (i.e., "printed publications").[50] In the technology-area logistic regression, we found a high degree of significance for the software ($p = 0.0024$) and mechanical ($p = 0.0004$) areas. In the industry-area logistic regression, we found exceptionally high levels of significance for the computer ($p < 0.0001$) and pharmaceutical ($p < 0.0001$) areas.[51]

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[47] This may overstate the role played by NPEs, however, because many of those suits involve more than one patent in our data set.

[48] Technology-area regression $p = 0.0303$; industry-area regression $p = 0.0359$.

[49] Technology-area regression $p = 0.0223$; industry-area regression $p = 0.0061$.

[50] Technology-area regression $p = 0.0282$; industry-area regression $p = 0.0062$.

[51] The full results of the logistic regressions are available from the authors on request.

Given the large number of correlated variables in patent data,[52] it is quite meaningful that we found significance in the three continuous variables in both regressions. The more interactions there are among variables, the more difficult it is to tease out predictive power in a multiple regression.

In addition to the unavoidable correlations among many patent characteristics, the very nature of the question we are asking places some limitations on the logistic regressions. First, the nature of our inquiry into the most-litigated patents necessarily means that we have a relatively small number of observations. Data sets of 106 observations each are large enough for statistical analysis, but when combined with the fact of unavoidable interactions among many variables, larger data sets would allow for stronger results. With larger numbers of observations, we would almost certainly find significance with more variables in the regressions. There is, however, no way to make them larger. We are intentionally looking at "upper-outlier patents." Moreover, when we divide the patents in our data sets into technology and industry areas, we necessarily reduce the number of observations even further. This fact makes it even more remarkable that significance in the regressions was found in two technology areas and two industry areas.

In addition, the number of interactions among variables was increased by the fact that, as in our previous studies, we did not treat technology or industry areas as necessarily being mutually exclusive. This reflects the reality of modern inventions: any attempt to assign many patented inventions to a single technology or industry area is completely unrealistic and unjustifiable. However, the fact that a single patent may belong in more than one technology or industry area does further increase the number of interactions among these variables.

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[52] Many patent characteristics are necessarily correlated rather highly, such as the number of claims, various types of prior art references, number of U.S. applications leading to a particular patent, and number of forward citations. This correlation has a common cause: applicants for certain patents perceive in advance that the patents likely will have value to them, that they will be important, and even that they are more likely to be litigated, and this perception often leads the applicants to make such patents stronger and broader by drafting more claims, finding and citing more prior art, and actively crafting the patent using continuation applications. Their actions, in turn, tend to create private value for the patents. Applicants do not have the same degree of control over the number of forward citations as they do over other patent metrics, except for self-citations in their own later patents (which, as previously explained, is itself an independent indicator of value). However, these are patents that the owners are more likely to assert through litigation or licensing, and they get more attention, leading to more forward citations by others in later patents. As a consequence, the number of forward citations is also correlated with the internal patent characteristics noted above.

In the end, because of the very nature of the questions we ask and the unavoidable interactions in our data, our results may be portrayed less accurately by the logistic regressions than by the descriptive statistics and bivariate comparisons. We have accordingly emphasized those conclusions in the Part that follows.

III. IMPLICATIONS

In this Part, we draw a number of possible implications from the data. Notably, there are different ways to understand our data, and, depending on one's predisposition, the data might point to different policy conclusions. We seek to identify some of the most likely implications in this Part.

A. *Extreme Value?*

The first thing that stands out is the powerful evidence that the most-litigated patents have different, clearly identifiable characteristics that distinguish them from once-litigated patents (and distinguish them even more from ordinary, nonlitigated patents). Notably, the characteristics that distinguish the most-litigated patents from other patents are also the ones that researchers have long used to identify the most-valuable patents: more claims, more prior art citations, more forward citations, a higher likelihood of assignment between issue and litigation, and larger numbers of continuation applications. A reasonable conclusion, therefore, is that the most-litigated patents are also the most-valuable patents. Allison et al. drew this conclusion for the general class of litigated patents (i.e., patents that had been litigated at least once).[53] Our data seem to strengthen that conclusion substantially. While one might question whether litigation was actually an indicator of value in all cases, the fact that more litigation is strongly correlated with the indicia of value suggests that the intuitive relationship between value and litigation is indeed the right one.[54]

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[53] Allison et al., *supra* note 4, at 439-43.

[54] This is not to suggest, however, that the objective measures of value accurately capture all, or even most, of the value of patents; they are necessarily imperfect indicators of that value. *See* David E. Adelman & Kathryn L. DeAngelis, *Patent Metrics: The Mismeasure of Innovation in the Biotech Patent Debate*, 85 TEX. L. REV. 1677, 1680 (2007) ("[T]he misuse of patent metrics has both fostered dire predictions and created unrealistic expectations about the capacity of patent data to guide policy."). But the fact that they are not perfect predictors does not render them worthless. *See* Allison & Sager, *supra* note 4, at 1794 (concluding that, despite some imperfections, patent characteristics can be useful in identifying valuable patents).

The fact that the most-litigated patents are disproportionately owned by nonpracticing entities, coupled with our suggestion that the most-litigated patents are the most valuable ones, might lead one to conclude that nonpracticing entities produce the most important patents and therefore are owed more respect than the current patent system (and certainly patent reformers) gives them. This reasoning might also support a subsidiary conclusion that continuation applications are necessary to support the most important patents.[55]

We acknowledge that these are possible implications of our results. But there are reasons to be cautious in drawing these conclusions. The value we identify in this Article is not social value but private value.[56] Our results suggest that having more claims, more prior art citations, and more continuation applications leads to stronger patents, and a first-order assessment might suggest that stronger patents are good. But that does not mean that those patents are necessarily better for society or even valid. It may simply mean that those patents are optimized for litigation, because they are better protected against the vagaries of claim construction[57] and against validity challenges based on uncited prior art.[58] And because of the well-known constraints under which the PTO operates, it may even be that the PTO is worse at assessing larger, more complex patents in the limited time that examiners can devote to those patents.[59]

Whether the most-litigated patents represent the most important inventions or just the most valuable rights to exclude, the fact that the patents that are likely to generate the most litigation have common

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[55] *But see* Lemley & Moore, *supra* note 24, at 71-83 (arguing that continuations are mostly unnecessary and do more harm than good).

[56] On the difference, see Allison et al., *supra* note 4, at 439-40.

[57] Burk and Lemley argue that modern claim construction can systematically disadvantage patentees since even one error in claim drafting or one lost claim-construction fight may result in a finding of either invalidity or noninfringement. Dan L. Burk & Mark A. Lemley, *Fence Posts or Sign Posts? Rethinking Patent Claim Construction*, 157 U. PA. L. REV. 1743, 1763 (2009). Drafting more claims hedges against this risk by giving the patentee multiple shots at an error-free claim. Continuations also hedge against this risk by allowing patentees to rewrite their claims after the fact.

[58] *See* Allison & Lemley, *supra* note 31, at 231-34 (finding that it is much harder to invalidate patents based on art that was cited to the PTO, leading to the possibility of "bulletproofing" a patent application by including as much prior art as possible). Relatedly, a sea of citations may actually *diminish* the PTO's ability to analyze invalidity with respect to the most salient prior art included therein, since examiners operate under severe time constraints and are not given more time to examine applications just because they include more prior art.

[59] We test this hypothesis in an upcoming companion paper that investigates the outcomes of the most-litigated-patent cases. *See supra* note 14 and accompanying text.

characteristics, identifiable before or during patent prosecution, has important implications for reforming the patent-prosecution process. One of us argued in 2001 that it would not be cost-effective for the PTO to achieve 100% accuracy in granting or denying every patent.[60] Nonetheless, it would surely be desirable to improve the accuracy of PTO decisions in both directions if it could be done without substantial additional expense.[61] And if we have good information on which patents are likely to turn out to be important, at least in the sense that their validity is going to matter, we can use that information to focus more attention on those applications during the prosecution process. Patent reformers have, for example, proposed post-grant opposition,[62] a tiered review or "gold-plating" system,[63] and outside peer review of patents.[64] Each of those proposals, to be workable, requires the selection of certain patents or applications on which to focus additional attention. The

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[60] Lemley, *supra* note 5, at 1508-10.

[61] *See, e.g.*, Joseph Farrell & Carl Shapiro, *How Strong Are Weak Patents?*, 98 AM. ECON. REV. 1347, 1362 (2008) (noting that "weak" patents of questionable validity are very costly to society and urging a "targeted application of resources" to improve the patent review process); Joseph Farrell & Robert P. Merges, *Incentives to Challenge and Defend Patents: Why Litigation Won't Reliably Fix Patent Office Errors and Why Administrative Patent Review Might Help*, 19 BERKELEY TECH. L.J. 943, 960-64 (2004) (arguing that litigation does not efficiently correct PTO mistakes and urging better funding and improved processes for patent review).

[62] *See, e.g.*, Mark D. Janis, *Rethinking Reexamination: Toward a Viable Administrative Revocation System for U.S. Patent Law*, 11 HARV. J.L. & TECH. 1, 118-21 (1997) (recommending the adoption of a post-grant opposition mechanism incorporating lessons learned from U.S. and European experience); Robert P. Merges, *As Many as Six Impossible Patents Before Breakfast: Property Rights for Business Concepts and Patent System Reform*, 14 BERKELEY TECH. L.J. 577, 614 (1999) (advocating a "coherent, efficient opposition procedure"); Craig Allen Nard, *Certainty, Fence Building, and the Useful Arts*, 74 IND. L.J. 759, 764 (1999) (proposing "the implementation of a post-grant opposition proceeding"); J.H. Reichman, *From Free Riders to Fair Followers: Global Competition Under the TRIPS Agreement*, 29 N.Y.U. J. INT'L L. & POL. 11, 31 (1997) ("A national opposition system seems uniformly advisable."); John R. Thomas, *Collusion and Collective Action in the Patent System: A Proposal for Patent Bounties*, 2001 U. ILL. L. REV. 305, 326-30 ("The general acknowledgment of the wisdom of oppositions is striking.")

[63] *See* Doug Lichtman & Mark A. Lemley, *Rethinking Patent Law's Presumption of Validity*, 60 STAN. L. REV. 45, 61-63 (2007) (arguing in support of an additional, optional "gold-plated" patent-review process); Mark Lemley, Doug Lichtman & Bhaven Sampat, *What to Do About Bad Patents*, REG., Winter 2005-2006, at 10, 10-12 (advocating for a two-tiered patent review system). While one might view applicant bulletproofing as a form of "gold plating," the latter term refers to a proposal that the PTO devote additional resources to examine certain applications and award a patent that has correspondingly higher deference.

[64] *See* Beth Simone Noveck, *"Peer to Patent": Collective Intelligence, Open Review, and Patent Reform*, 20 HARV. J.L. & TECH. 123, 143-51 (2006) (supporting an open peer-review framework for patent reviews).

value data may give us a means to select applications for additional review. It could also be systematized within the PTO, for example by replacing the "one size fits all" allocation of examiner time with a complexity-weighting system that gives examiners more time and more credit for evaluating the most complex (and most valuable) applications. Moreover, the ability to identify the most valuable patents in advance may allow companies to focus their attention on smaller sets of patents with which they should be concerned when they invent in the same or a related area. It may also provide investors with more relevant information when deciding whether to help fund a start-up, take a security interest in a patent for a loan, or make some other investment decision.[65]

The data also suggest substantial variation by technology area and industry area in how patent litigation works. That itself should come as no surprise; Burk and Lemley have documented the many ways in which both patent law and innovation incentives are industry specific, and the congressional debates over patent reform have pitted different industries against each other on issue after issue.[66] But the disproportionate representation of software, telecommunications, and business-method patents among the most-litigated patents might suggest that it is appropriate to pay more attention to patents in those technologies and industries, both in court and at the PTO, just as the importance of patents with multiple claims and prior art citations suggests that those patents are more important than the average patent. Here too we urge caution, however: While the most-litigated patents are disproportionately IT patents, there are unquestionably pharmaceutical patents whose value exceeds that of any patent in the IT industry. The regulated nature of the biomedical industries may be limiting the number of lawsuits in the pharmaceutical and biotechnology industries.

B. *Trolls on Top?*

The other important difference evident from this data is the prevalence of nonpracticing entities in the most-litigated patents. Patent reform debates have, perhaps unfortunately, focused a great deal of attention on "patent trolls." There is substantial disagreement as to whether trolls exist and how significant a role they play in patent liti-

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[65] *See* Allison & Sager, *supra* note 4, at 1787-88 (describing how prospective investors may sift through a set of patents looking for ones of value).

[66] *See* BURK & LEMLEY, *supra* note 1, at 49-66 (documenting industry differences in innovation and patenting); *see also* Josh Lerner, *The Litigation of Financial Innovations* 2 (Nat'l Bureau of Econ. Research, Working Paper No. 14324, 2008) (finding that financial-services patents are litigated 27 to 39 times more than ordinary patents).

gation.[67] Our data shed significant light on this question, though readers may disagree on how to interpret that data.

Nonpracticing entities are clearly an important phenomenon in the modern patent system. While they account for only about 16% of the once-litigated patents, they represent over 80% of the suits filed involving the most-litigated patents and own more than 50% of the most-litigated patents themselves.[68] Clearly, then, the role of nonpracticing entities in the modern patent system cannot be dismissed and should not be diminished.

Whether this represents a flood of patent trolls depends critically on how one defines the term "patent troll." If a patent troll is anyone who sues to enforce a patent that she does not practice, trolls are indeed rampant among the most-litigated patents. But if we limit the definition to companies enforcing patents that cover inventions they did not themselves develop, the number of patent trolls drops dramatically, to 12% of the patents and 7% of the lawsuits. And even if the reader decides that trolls are rampant, that fact informs policy debates over patent reform but does not itself tell us whether to celebrate or deplore the role of patent trolls.

One of the authors has argued that we should not focus so much attention on labeling particular plaintiffs as trolls or not, but instead on making sure that the patent rules provide patentees of all types fair compensation but not opportunities for holdup.[69] Even if we are not to create troll-specific rules, however, our findings here are important because they suggest that the remedy rules that do depend on the plaintiff's status, such as entitlement to injunctive relief[70] and lost-profits damages,[71] are critically important and need to be evaluated in

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[67] *See supra* note 2 and accompanying text.

[68] Colleen Chien studied the percentage of all suits filed by trolls. In defining only a subset of nonpracticing entities as trolls and excluding lawsuits by individuals, she found that while 17% of suits were filed by trolls, those suits accounted for 28% of the defendants in patent cases—a share that has continued to rise over time. 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, 1608-11 (2009).

[69] *See* Lemley, *supra* note 43, at 630-31 (arguing that identifying trolls is not as important as preventing abuses of the patent system by any plaintiff).

[70] *See* eBay Inc. v. MercExchange L.L.C., 547 U.S. 388, 393-94 (2006) (requiring proof of irreparable injury before granting injunctions in patent cases).

[71] *See, e.g.*, BIC Leisure Prods., Inc. v. Windsurfing Int'l, Inc., 1 F.3d 1214, 1219, 1223 (Fed. Cir. 1993) (reversing an award of lost profits because the patentee and the infringer did not compete); *cf.* Del Mar Avionics, Inc. v. Quinton Instrument Co., 836 F.2d 1320, 1326 (Fed. Cir. 1987) (describing the "general rule" that patentees producing the patented item are entitled to lost-profits damages); John E. Dubiansky, *An*

the context of a world in which many of the most significant patent lawsuits are not those filed by practicing entities against competitors.

APPENDIX: THE MOST-LITIGATED PATENTS[72]

Patent Number	Assignee/ Applicant Name	Earliest Case Title	Plaintiff	Entity Class
5132992	Paul Yurt & Browne H. Lee	*Acacia Media Tech. Co. v. New Destiny Internet*	Acacia Media Tech. Co.	1
6144702	Greenwich Information Techs., LLC	*Acacia Media Tech. Co. v. New Destiny Internet*	Acacia Media Tech. Co.	1
5734961	Genese	*Antor Media Corp. v. Audiogalaxy, Inc.*	Antor Media Corp.	10
4924257	Jain Kanti	*Anvik Corp. v. Nikon Precision, Inc.*	Anvik Corp.	8
5285236	Jain Kanti	*Anvik Corp. v. Nikon Precision, Inc.*	Anvik Corp.	8
5291240	Anvik Corp.	*Anvik Corp. v. Nikon Precision, Inc.*	Anvik Corp.	8
5721606	Jain Kanti	*Anvik Corp. v. Nikon Precision, Inc.*	Anvik Corp.	8
5897986	Anvik Corp.	*Anvik Corp. v. Nikon Precision, Inc.*	Anvik Corp.	8
6748318	Arrival Star, Inc.	*Arrival Star, Inc. v. Nistevo Corp.*	Arrival Star, Inc.	1
6904359	Arrival Star, Inc.	*Arrival Star, Inc. v. Pilot Air Freight Corp.*	Arrival Star, Inc.	1
5738872	Hoechst Marion Roussel, Inc.	*Aventis Pharm. v. Barr Labs.*	Aventis Pharm.	8
5855912	Hoechst Marion Roussel, Inc.	*Aventis Pharm. v. Barr Labs.*	Aventis Pharm.	8
6037353	Hoechst Marion Roussel, Inc.	*Aventis Pharm. v. Barr Labs.*	Aventis Pharm.	8
6113942	Aventis Pharm., Inc.	*Aventis Pharm. v. Barr Labs.*	Aventis Pharm.	8
6187791	Merrell Pharm., Inc.	*Aventis Pharm. v. Barr Labs.*	Aventis Pharm.	8
6399632	Merrell Pharm., Inc.	*Aventis Pharm. v. Barr Labs.*	Aventis Pharm.	8
6482516	Banner Pharmacaps, Inc.	*Banner Pharmacaps, Inc. v. Perrigo Co.*	Banner Pharmacaps, Inc.	8
6044362	Alan R. Neely	*BCE Emergis Tech. v. EDOCS, Inc.*	BCE Emergis Tech.	8
6374229	Billingnetwork.com, Inc.	*Billingnetwork.com v. Advanced Healthcare*	Billingnetwork.com	8
5951643	NCR Corp.	*Boardman Molded Prods., Inc. v. Mats, Inc.*	Boardman Molded Prods., Inc.	8

Analysis for the Valuation of Venture Capital-Funded Startup Firm Patents, 12 B.U. J. SCI. & TECH. L. 170, 177 (2006) ("In the licensing context, however, the patent owner is not engaged in an enterprise which utilizes the patent. Consequentially, the owner has no profits to have lost, and is only eligible to receive a reasonable royalty.").

[72] The count here is based on the number of lawsuits in which the patent could be verified using IPLC data. Because some lawsuits, including some of Katz's lawsuits, involve more than one patent, the actual number of cases filed by the plaintiffs identified here is smaller than simply adding the number of suits for each patent would suggest.

Patent Number	Assignee/ Applicant Name	Earliest Case Title	Plaintiff	Entity Class
6151601	NCR Corp.	*Boardman Molded Prods., Inc. v. Mats, Inc.*	Boardman Molded Prods., Inc.	8
6169997	NCR Corp.	*Boardman Molded Prods., Inc. v. Mats, Inc.*	Boardman Molded Prods., Inc.	8
6480855	NCR Corp.	*Boardman Molded Prods., Inc. v. Mats, Inc.*	Boardman Molded Prods., Inc.	8
6502096	NCR Corp.	*Boardman Molded Prods., Inc. v. Mats, Inc.*	Boardman Molded Prods., Inc.	8
5933630	Acceleration Software Int'l Corp.	*Computer Acceleration Corp. v. Microsoft Corp.*	Computer Acceleration Corp.	1
5883964	Cygnus Telecomms. Tech., LLC	*Cygnus Telecomms. Tech. v. Int'l Telec Ltd.*	Cygnus Telecomms. Tech.	1
6035027	Cygnus Telecomms. Tech., LLC	*Cygnus Telecomms. Tech. v. Int'l Telec Ltd.*	Cygnus Telecomms. Tech.	1
5910988	CSP Holdings, Inc.	*Datatreasury Corp. v. First Data Corp.*	Datatreasury Corp.	1
6032137	CSP Holdings, LLC	*Datatreasury Corp. v. First Data Corp.*	Datatreasury Corp.	1
4975950	Stephen A. Lentz	*Digital Dev. Corp. v. Asus Computer Int'l*	Digital Dev. Corp.	10
5121345	Stephen A. Lentz	*Digital Dev. Corp. v. Asus Computer Int'l*	Digital Dev. Corp.	10
6295530	Jonathan M. Bradshaw	*East Mfg. Corp. v. Titan Trailers, Inc.*	East Mfg. Corp.	8
6961737	Ablaise Ltd.	*East Mfg. Corp. v. Titan Trailers, Inc.*	East Mfg. Corp.	8
7075673	EON-Net, LP	*Eon-Net, LP v. Flagstar Bancorp*	Eon-Net, LP	5
6683697	Millenium, LP	*Eon-Net, LP v. Black Hound New York*	Eon-Net, LP	5
5313229	Federico G. Gilligan & Fernando D. Falcon	*F & G Research, Inc. v. Kye Int'l*	F & G Research, Inc.	5
4787722	Fresnel Techs., Inc.	*Fresnel Techs. v. Rokonet Indus.*	Fresnel Techs.	8
RE35534	Fresnel Techs., Inc.	*Fresnel Techs. v. Rokonet Indus.*	Fresnel Techs.	8
6294196	Hoffmann-La Roche, Inc.	*Hoffman-La Roche, Inc. v. Gate Pharm.*	Hoffman-La Roche, Inc.	8
6298862	Laughlin Prods., Inc.	*In re Laughlin Prods., Inc., Patent Litig.*	Laughlin Prods., Inc.	5
6464703	Elektromedizin GmbH	*In re Katz Interactive Call Processing Patent Litig.*	Ronald A. Katz Tech. Licensing, LP	5
4663318	Bonnie Davis	*In re '318 Patent Infringement Litig.*	Barr Labs.	8
5922333	Laughlin Prods., Inc.	*Laughlin Prods., Inc. v. TRB Group*	Laughlin Prods., Inc.	5
7040022	Great Neck Saw Mfrs., Inc.	*Laughlin Prods., Inc. v. Binder*	Laughlin Prods., Inc.	5

Patent Number	Assignee/ Applicant Name	Earliest Case Title	Plaintiff	Entity Class
5425085	Rates Tech. Inc.	*Laughlin Prods., Inc. v. Bariana*	Laughlin Prods., Inc.	5
6474343	Laughlin Prods., Inc.	*Laughlin Prods., Inc. v. ETS, Inc.*	Laughlin Prods., Inc.	5
5258855	System X, LP	*Millennium, LP v. Hyland Software, Inc.*	Millennium, LP	5
5369508	System X, LP	*Millennium, LP v. Hyland Software, Inc.*	Millennium, LP	5
5625465	Int'l Patent Holdings Ltd.	*Millennium, LP v. Hyland Software, Inc.*	Millennium, LP	5
5768416	Millennium, LP	*Millennium, LP v. Hyland Software, Inc.*	Millennium, LP	5
6094505	Millennium, LP	*Millennium, LP v. Hyland Software, Inc.*	Millennium, LP	5
RE39247	Monsanto Tech., LLC	*Monsanto Co. v. SUGGS*	Monsanto Co.	8
5352605	Monsanto Co.	*Monsanto Co. v. McFarling*	Monsanto Co.	8
5699526	NCR Corp.	*NCR Corp. v. Microstrategy Inc.*	NCR Corp.	8
6026403	NCR Corp.	*NCR Corp. v. Microstrategy Inc.*	NCR Corp.	8
5137342	Oakley, Inc.	*Oakley, Inc. v. Pacific Sunwear*	Oakley, Inc.	8
5367627	Clear with Computers, Inc.	*Orion IP, LLC v. Staples, Inc.*	Orion IP, LLC	1
5615342	Clear with Computers, Inc.	*Orion IP, LLC v. Staples, Inc.*	Orion IP, LLC	1
5053407	Daiichi Pharm. Co., Ltd.	*Ortho-McNeil Pharm. v. Mylan Labs.*	Ortho-McNeil Pharm.	8
5991791	NCR Corp.	*Overstock.com v. NCR*	Overstock.com	8
6253203	NCR Corp.	*Overstock.com v. NCR*	Overstock.com	8
6777095	Parker-Hannifin Corp.	*Parker-Hannifin Corp. v. Zippertubing (Japan) Ltd.*	Parker-Hannifin Corp.	8
5809336	Patriot Scientific Corp.	*Patriot Scientific Corp. v. Sony Corp. of Am.*	Patriot Scientific Corp.	8
6298341	RareDomains.com, LLC	*RareDomains.com, LLC v. Verio, Inc.*	RareDomains.com, LLC	8
5519769	Rates Tech., Inc.	*Rates Tech., Inc. v. Tech. Arts, Inc.*	Rates Tech., Inc.	1
5243627	AT&T Bell Labs.	*Rembrandt Techs., LP v. Comcast Corp.*	Rembrandt Techs., LP	1
6570967	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Alltel Corp.*	Ronald A. Katz Tech. Licensing, LP	5
5109404	First Data Res., Inc.	*Ronald A. Katz Tech. Licensing, LP v. Ahold USA Inc.*	Ronald A. Katz Tech. Licensing, LP	5
4792968	FDR Interactive Techs.	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
4930150	First Data Res., Inc.	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5

Patent Number	Assignee/ Applicant Name	Earliest Case Title	Plaintiff	Entity Class
5251252	First Data Res., Inc.	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
5255309	First Data Res., Inc.	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
5259023	First Data Res., Inc.	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
5351285	First Data Res., Inc.	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
5561707	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
5684863	Ronald A. Katz, Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
5787156	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
5828734	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
5835576	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
5898762	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
5917893	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
5974120	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
6035021	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
6044135	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
6148065	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
6292547	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
6335965	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
6424703	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5

Patent Number	Assignee/ Applicant Name	Earliest Case Title	Plaintiff	Entity Class
6434223	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
6512415	Ronald A. Katz Tech. Licensing LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
6678360	Ronald A. Katz Tech. Licensing, LP	*Ronald A. Katz Tech. Licensing, LP v. Citibank*	Ronald A. Katz Tech. Licensing, LP	5
5048075	First Data Res., Inc.	*Ronald A. Katz Tech. Licensing, LP, v. Am. Airlines, Inc.*	Ronald A. Katz Tech. Licensing, LP,	5
5338874	Tanaka Kikinzoku Kogyo K.K.	*Sanofi-Aventis U.S., LLC v. Sandoz, Inc.*	Sanofi-Aventis U.S., LLC	8
6495721	Teva Pharm. Indus., Ltd.	*Teva Pharm. Indus. Ltd. v. Torrent Pharm. Ltd.*	Teva Pharm. Indus. Ltd.	8
6500987	Teva Pharm. Indus. Ltd.	*Teva Pharm. Indus. Ltd. v. Torrent Pharm. Ltd.*	Teva Pharm. Indus. Ltd.	8
6600073	Teva Pharm. Indus. Ltd.	*Teva Pharm. Indus. Ltd. v. Torrent Pharm. Ltd.*	Teva Pharm. Indus. Ltd.	8
6897340	Teva Pharm. Indus. Ltd.	*Teva Pharm. Indus. Ltd. v. Torrent Pharm. Ltd.*	Teva Pharm. Indus. Ltd.	8
4777354	Barry Thomas	*Thomas v. Adelphia Commc'ns Corp.*	Barry Thomas	9
RE35616	Tillotson Corp.	*Tillotson Corp. v. High Five Prods.*	Tillotson Corp.	8
6766304	Trading Techs. Int'l, Inc.	*Trading Tech. Int'l v. eSpeed, Inc.*	Trading Tech. Int'l	8
6772132	Trading Techs. Int'l, Inc.	*Trading Tech. Int'l v. eSpeed, Inc.*	Trading Tech. Int'l	8
5091171	Ruey J. Yu & Eugene J. Van Scott	*Tristrata Tech. v. Mary Kay, Inc.*	Tristrata Tech.	8
5128984	First Data Res., Inc.	*Verizon CA, Inc. v. Ronald A. Katz Tech.*	Verizon CA, Inc.	5
5815551	Ronald A. Katz Tech. Licensing, LP	*Verizon CA, Inc. v. Ronald A. Katz Tech.*	Verizon CA, Inc.	5
6349134	Ronald A. Katz Tech. Licensing, LP	*Verizon CA, Inc. v. Ronald A. Katz Tech.*	Verizon CA, Inc.	5
6054482	Godecke Aktiengesellschaft	*Warner-Lambert Co. v. Purepac Pharm.*	Warner-Lambert Co.	8