Our Divided Patent System[1]

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Abstract

In this comprehensive new study, we evaluate all substantive decisions rendered by any court in every patent case filed in 2008 and 2009—decisions made between 2009 and 2013. We assess the outcome of litigation by technology and industry. We relate the outcomes of those cases to a host of variables, including variables related to the parties, the patents, and the courts in which those cases were litigated.

We find dramatic differences in the outcomes of patent litigation by both technology and industry. For example, owners of patents in the pharmaceutical industry fare much better in dispositive litigation rulings than do owners of patents in the computer & electronics industry*, and chemistry patents have much greater success in litigation than their software or biotech*

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counterparts. Our results provide an important window into both patent litigation and the industry-specific battles over patent reform. And they suggest that the traditional narrative of industry-specific patent disputes, which pits the IT industries against the life sciences, is incomplete.

We nominally have a unitary patent system. With rare exceptions, the patent statute doesn't treat different technologies or different industries differently. Indeed, by treaty patents are to be made available without discrimination by technology.[2]

Despite its unitary nature, different industries have increasingly experienced very different patent systems in practice. Prior evidence suggests that both the process and ease of obtaining patents differ substantially by industry and technology.[3] And a decade of experience with legislative patent reform has made it clear that many of the large players in the pharmaceutical and computer industries have diametrically opposed views of whether and how the patent system is promoting innovation. The users of the patent system, then, don't seem to view it as unitary.

[2] TRIPs art. 27(1).

[3] *See, e.g.,* John R. Allison & Mark A. Lemley, *The Growing Complexity of the Patent System*, 82 **B.U. L. Rev.** 77 (2002) (finding that patent applicants in different industries experience a very different prosecution process); Mark A. Lemley & Bhaven Sampat, *Is the Patent Office a Rubber Stamp?*, 58 **Emory L.J.** 181 (2008) (finding very different grant rates in different technology classes).

We offer empirical evidence that is consistent with this sharp division by technology and industry. Building on our comprehensive new study of patent litigation outcomes,[4] in this paper we examine how our results differ by both industry and technology.

The differences by technology are dramatic. Of the lawsuits that reach a merits decision, patents in the chemical field are found valid and infringed more than half the time, while software patents are found valid and infringed in less than one case in seven. Biotechnology[5] patents fare even worse in litigation than software patent owner, winning only 8% of the cases that reach a merits ruling. We see a similar result when we sort, not by the nature of the patented technology but by the industry of the patent owner, with a similar sharp divide between the pharmaceutical, computer and electronics, and biotechnology industries.

In Part I, we discuss the prior work that has been done on the industry-specific nature of the patent system. In Part II, we explain our data set and methodology. We present our results in Part III and discuss some implications in Part IV.

I. Cracks in the Unitary Patent System

Patent law was first enacted in 1790. Inventions in 1790 tended to be machines or simple mechanical devices. The dominance of machines persisted for most of the country's history. As Rob Merges puts it, "a hundred years ago, if you put technology in a bag and shook

[4] John R. Allison, Mark A. Lemley, & David L. Schwartz, *Understanding the Realities of Modern Patent Litigation*, 92 **Tex. L. Rev.** 1769 (2014) (hereafter *Understanding the Realities*).

[5] Here we refer to "biotechnology" *as a technology*. We also use the term biotechnology to refer to an *industry.* We later discuss the difference in some detail, and whenever we use the term "biotechnology" we will make our usage of the term clear.

it, it would make some noise."[6] As late as the 1970s, the majority of all patents issued in the United States were mechanical inventions.[7]

But the nature of inventions has been changing rapidly. While chemical inventions have been around for some time, in the last forty years software and electronics patents have grown dramatically, to the point where they have eclipsed mechanical inventions and now account for a majority of all patents.[8] That shift is also reflected in patents that reach a final ruling in litigation; as we explain below, roughly half of the lawsuits in our data set involved software or electronics technologies, with chemical and biotech patents accounting for another 20% of the patents.[9]

The nature of mechanical, software, and chemical inventions differs, and so does their relationship to the patent system.[10] Jim Bessen & Michael Meurer have gone so far as to argue that the patent system works in the pharmaceutical and chemical industries but serves as a drag on innovation elsewhere.[11] And many have suggested that we should abolish certain

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[6] Robert P. Merges, *As Many as Six Impossible Patents Before Breakfast: Business Method Concepts and Patent System Reform*, 14 **Berkeley Tech. L.J.** 577, 585 (1999).

[7] John R. Allison & Mark A. Lemley, *The Growing Complexity of the Patent System*, 82 **B.U. L. Rev.** 77 (2002).

[8] Mark A. Lemley & Bhaven Sampat, *Is the Patent Office a Rubber Stamp?*, 58 **Emory L.J.** 181 (2008) (finding that roughly half of the patent applications filed in 2001 were in the information technology (IT) industries); *cf.* Allison & Lemley, *supra* note __ (finding a dramatic growth in software and other IT patents between the 1970s and the 1990s).

[9] *See infra* Table 1.

[10] For detailed discussion, see, e.g., Dan L. Burk & Mark A. Lemley, **The Patent Crisis and How the Courts Can Solve It** (2009); Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 **Va. L. Rev.** 1575 (2003).

[11] James Bessen & Michael Meurer, **Patent Failure: How Judges, Lawyers, and Bureaucrats Put Innovation at Risk** (2008). Bessen & Meurer's primary empirical evidence for their claim is based upon an event study. Basically, they studied market movements in stock prices of publicly traded companies after the filing of a patent infringement lawsuit. Others have criticized their methodology and

types of patents (generally software or business methods) altogether.[12] But others who haven't gone that far nonetheless recognize that different industries and technologies have different needs and characteristics.[13] The patent system has responded to those differences,

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questioned their findings. *See* Glynn S. Lunney, Jr., On the Continuing Misuse of Event Studies: The Example of Bessen and Meurer, 16 **J. Intell. Prop. L.** 35, 37, 49–56 (2008); David L. Schwartz & Jay P. Kesan, *Analyzing the Role of Non-Practicing Entities in the Patent System*, 99 **Cornell L. Rev.** 425, 447-448 (2014) (characterizing as "facially implausible" Bessen & Meurer's estimate that each NPE lawsuit, on average, caused each defendant to drop in market capitalization between $122 million and $140.6 million). Another researcher reports data suggesting that stock market losses upon case filings are recovered at case disposition. *See* Ron D. Katznelson*, Questionable Science Will Misguide Patent Policy*, (Oct. 27,2013) (unpublished manuscript), available at http://j.mp/Junk-Science. Despite these concerns, others besides Bessen and Meurer, including one of the authors, have offered some evidence that patents are more important for innovation in the life science technologies than in technologies like software. *See, e.g.,* Burk & Lemley, **Patent Crisis**, *supra* note __, ch. 4-5; Mark A. Lemley, *Software Patents and the Return of Functional Claiming*, 2013 **Wis. L. Rev.** 905 (collecting evidence).

[12] *See, e.g.,* League for Programming Freedom, *Software Patents: Is This the Future of Programming?,* DR. DOBB'S J., Nov. 1990, at 56, 56; Brian J. Love, *Why Patentable Subject Matter Matters for Software,* 81 GEO. WASH. L. REV. ARGUENDO 1 (2012) http://www.gwlr.org/wp-content/uploads/2012/09/Love_Arguendo_81_1.pdf (arguing that while 101 exclusion is problematic, it is "virtually the only defensive mechanism left"); Alan Newell, *Response: The Models Are Broken, The Models Are Broken!*, 47 U. PITT. L. REV. 1023, 1025 (1986); Pamela Samuelson, Benson *Revisited: The Case Against Patent Protection for Algorithms and Other Computer Program-Related Inventions*, 39 EMORY L.J. 1025, 1135–36 (1990); Joshua D. Sarnoff, *Patent-Eligible Inventions After* Bilski*: History and Theory,* 63 HASTINGS L.J. 53, 119–20 (2011). *But see* Donald S. Chisum, *The Patentability of Algorithms*, 47 U. PITT. L. REV. 959, 1014–15 (1986); Mark A. Lemley et al., *Life After* Bilski*,* 63 STAN. L. REV. 1315, 1326–27 (2011); Robert P. Merges, *Software and Patent Scope: A Report from the Middle Innings*, 85 TEX. L. REV. 1627, 1656–57 (2007); Michael Risch, *Everything Is Patentable*, 75 TENN. L. REV. 591, 622 (2008).

In *Bilski v. Kappos*, 130 S.Ct. 3218 (2010), four Justices would have drawn a similar line banning the patenting of business methods. *Id*. at 3232 (Stevens, J., concurring). *See also* John R. Thomas, *The Patenting of the Liberal Professions,* 40 B.C. L. REV. 1139, 1145–47 (1999); Peter S. Menell, *Forty Years of Wandering in the Wilderness and No Closer to the Promised Land:* Bilski*'s Superficial Textualism and the Missed Opportunity to Return Patent Law to Its Technology Mooring*, 63 STAN. L. REV. 1289, 1312–13 (2011). *But see* John R. Allison & Emerson H. Tiller, *The Business Method Patent Myth*, 18 BERKELEY TECH. L.J. 987 (2003) (presenting empirical evidence that software-implemented business method patents issued through the end of the 1990's were of a quality not inferior to other types of patents); John R. Allison & Starling D. Hunter, *On the Feasibility of Reforming Patent Quality One Technology at a Time: The Case of Business Methods*, 21 BERKELEY TECH. L.J. 729 (2006) (presenting empirical evidence that, although the PTO's program to add a second-level review to applications for certain software-implemented business method patents seemed to have improved the quality of patents issued after having gone through the extra examination, the practice of singling out one class of applications or patents for markedly different treatment will ultimately prove to be futile and counterproductive).

[13] Burk & Lemley, **Patent Crisis**, *supra* note __, at ch. 4-5.

not by creating industry or technology-specific patent statutes, but by varying in places the application of the unitary patent statute to respond to the characteristics and needs of each industry.[14] A number of scholars have thought about the various ways in which the patent system treats different industries and technologies differently.[15] And there has been some empirical work focused on other questions that touch on industry- or technology-specific differences.[16]

II. Data and Methodology

[14] *Id.*; *see also* Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 **Berkeley Tech. L.J.** 1155 (2002).

[15] *See, e.g.,* Bessen & Meurer, **Patent Failure**, *supra* note __; Burk & Lemley, **Patent Crisis**, *supra* note __; Burk & Lemley, *Policy Levers, supra* note __; Burk & Lemley, *Technology-Specific*, *supra* note __; Stephen M. Maurer & Suzanne Scotchmer, *Procuring Knowledge, in Intellectual Property and Entrepreneurship* 1, 2 (Gary D. Libecap ed. 2004); James Bessen & Michael Meurer, *Lessons for Patent Policy From Empirical Research on Patent Litigation*, 9 **Lewis & Clark L. Rev.** 1 (2005); Richard C. Levin et al., *Appropriating the Returns from Industrial Research and Development*, 1987 **Brookings Papers on Economic Activity** 783, 794-95; Edwin Mansfield, *Patents and Innovation: An Empirical Study*, 32 **Mgmt. Sci.** 173, 176-77 (1986) (examining the extent to which various firms and industries rely on the patent system to protect their innovations); See also Michael W. Carroll, *One for All: The Problem of Uniformity Cost in Intellectual Property Law*, 55 **Am. U. L. Rev.** 845 (2006); Wesley M. Cohen et al., *Protecting Their Intellectual Assets: Appropriability Conditions and Why U.S. Manufacturing Firms Patent (or Not)* (Nat'l Bureau of Econ. Res., Working Paper No. W7552, 2000); Mark Schankerman, *How Valuable Is Patent Protection? Estimates by Technology Field*, 29 **RAND J. Econ.** 77, 79 (1998); Gideon Parchomovsky & R. Polk Wagner, *Patent Portfolios* 154 **U. Pa. L. Rev.** 1 (2005); Amir A. Naini, *Convergent Technologies and Divergent Patent Validity Doctrines: Obviousness and Disclosure Analyses in Software and Biotechnology*, **J. Pat. & Trademark Ofc. Soc'y** 541 (2004).

[16] *See, e.g.,* 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, 261 (2006); 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 (2009); Colleen V. Chien, *Predicting Patent Litigation*, 90 **Tex. L. Rev.** 283 (2011); Paul M. Janicke & LiLan Ren, *Who Wins Patent Infringement Cases?*, 34 AIPLA Q.J. 1, 10 (2006); John R. Allison, Mark A. Lemley & Joshua Walker, *Extreme Value or Trolls on Top? The Characteristics of the Most-Litigated Patents*, 158 U. PA. L. REV. 1, 3 & n.3 (2009).

In this Part, we explain in detail the techniques we used to locate and collect the data.[17] We describe the data sources and provide information about the coders. And we describe our process of selecting data for inclusion in the data set.[18]

A. Data Collection

Electronic filing requirements mean that the online filing tool of the federal courts, Public Access to Court Electronic Records (PACER), has a nearly complete collection of litigation documents from patent cases.[19] Some scholars have taken advantage of PACER data to analyze district court decisions.[20] But the raw data provided by the Administrative Office of the United States Courts is notoriously error-prone,[21] and it does a poor job of classifying outcomes.[22]

We used the Lex Machina database as our data source.[23] Lex Machina provides convenient access to cleaned and verified PACER data for district court patent litigation, which permitted us to evaluate all patent lawsuits. Lex Machina data offer three primary benefits. First, it

[17] We plan to release the dataset to the public after the completion of our third and final article on this project, considering entity status (i.e., operating companies v. non-practicing entities).

[18] Portions of this section are adapted from our prior paper to the extent this paper reflects the same methodology. *See* Allison et al., *Understanding the Realities*, *supra* note __.

19. For a discussion of PACER coding and its shortcomings, see generally Matthew Sag, *Empirical Studies of Copyright Litigation: Nature of Suit Coding* (Loyola Univ. Chi. Sch. of Law, Pub. Law & Legal Theory Research Paper No. 2013-017), a*vailable at* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2330256.

20. *See, e.g.*, 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, 261 (2006) (examining the online docket reports available through the PACER system).

21. *See id*. at 261 tbl.1 (finding a substantial percentage of cases misclassified as patent cases); Kimberly A. Moore, *Judges, Juries, and Patent Cases—An Empirical Peek Inside the Black Box*, 99 MICH. L. REV. 365, 381 (2000) (eliminating some cases misclassified as patent trials from the data set).

22. *See* Kesan & Ball, *supra* note 20, at 265 (explaining that the Administrative Office of the District Courts' categories for case disposition are "rather ambiguous").

23. LEX MACHINA, http://www.lexmachina.com.

includes all lawsuits, even those without a decision available on Westlaw or Lexis, so we do not over-count appellate decisions.[24] Second, Lex Machina has cleaned and evaluated the PACER data, eliminating many of the errors in the raw data.[25] Finally, Lex Machina has indexed the cases to identify summary judgment rulings, trial events, and appeals.[26]

Our study covers all patent lawsuits filed in a federal district court between January 1, 2008 and December 31, 2009. We selected 2008 and 2009 for several reasons. First, those years are sufficiently recent to provide a snapshot of current patent litigation. Second, because the cases were initiated several years ago, the overwhelming majority of those cases were finally resolved or settled before our project began.[27] Lex Machina graciously provided us with a list of 2008 and 2009 lawsuits that contained at least one ruling on summary judgment or trial. Lex Machina furnished us a second list of 2008 and 2009 lawsuits, the second list including cases with an appeal but without a summary judgment ruling or trial. The second list allowed us to capture cases in which the parties stipulated to judgment based upon a claim construction decision with the goal of placing the case in condition for appeal. Both lists provided by Lex Machina included basic information about each lawsuit, including the judicial district in which

24. *See Features*, LEX MACHINA, https://lexmachina.com/features/ ("[V]iew all patent case outcomes for a specific judge or district, displayed in easy-to-read charts and graphs supported by interactive case lists.").

25. *See How It Works*, LEX MACHINA, https://lexmachina.com/features/how-it-works/ ("Lex Machina cleans, codes, and tags all data . . . .").

26. *See id.* ("We identify all asserted patents, findings, and outcomes, including any damages awarded. We also build a detailed timeline linking all the briefs, motions, orders, opinions, and other filings for every case.").

27. We conducted the coding in the late summer and fall of 2013. By February 2014, it appears that only 2%–3% of 2008 and 2009 cases were still open. *See* Dennis Crouch, *Pendency of Patent Infringement Litigation*, PATENTLY-O (Feb. 17, 2014), http://patentlyo.com/patent/2014/ 02/pendency-infringement-litigation.html; *see also* Kesan & Ball, *supra* note 20, at 246 (defending the decision to study cases by year filed rather than by year terminated).

the case was filed, the identity of the district court judge, and the filing date of the lawsuit.

From the cases provided by Lex Machina, we excluded lawsuits that did not include a complaint for infringement of a utility patent, or declaratory relief of noninfringement or invalidity of a utility patent. Thus, we excluded inventorship and licensing disputes, malpractice actions, and allegations of design or plant patent infringement. After removing these lawsuits, we reviewed the docket report in detail, reading all relevant orders, opinions, motions, verdicts, appellate rulings, and other necessary court documents to code the litigation outcomes.

Because many of the dockets were extremely complicated—it was not uncommon for a patent case to have over 500 docket entries—we felt that student coders would be ill-suited to the task. Coding of outcomes, especially in patent cases, is notoriously difficult and time consuming, requiring deep knowledge of patent law and litigation, and the motivation to devote long hours to the task. Consequently, Lemley and Schwartz each personally coded the litigation-outcome information for approximately half of the lawsuits. Both Lemley and Schwartz are experienced patent litigators who understand how to read a docket and appreciate complex litigation rulings. The hand coding was extremely time intensive; it took several hundred hours in the aggregate. To permit an evaluation of the reliability and consistency of the coding, Lemley and Schwartz also overlapped in their coding of approximately ten percent of the lawsuits.[28]

28. Lemley and Schwartz both initially coded approximately 5% of the cases. Thereafter, they compared results and fine-tuned the codebook. For coding of the remaining cases, Lemley and Schwartz overlapped in 10% of the initial list of cases provided by Lex Machina. Some of the cases provided by Lex Machina turned out to not have relevant merits decisions. After a manual review of the dockets, the 10% overlap resulted in 30 patent–cases with duplicate coding. To increase the amount of overlap and permit the use of statistical tests to report inter-coder reliability, Schwartz additionally coded another random 15% overlap with Lemley, for an additional 46 patent–cases with duplicate coding. We chose

Our study uses a patent–case combination as the unit of analysis. For each case, we coded the outcome separately for each asserted patent. For instance, if the jury returned a verdict on two patents, then we recorded separately what occurred for each patent.[29] For each patent, we also obtained a variety of patent demographic information and various facts about the lawsuit in question. We reported those findings in our companion paper, and we detail the information we collected there.[30]

For each patent in a lawsuit, the coders reviewed and captured all rulings on summary judgment relating to a patent law issue. This includes rulings on motions of summary judgment of noninfringement, infringement, validity, invalidity, inequitable conduct, and no inequitable conduct. We excluded rulings on issues that were not patent-specific, such as laches. We also excluded summary judgment rulings on patent law issues if the court did not reach the merits

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"Cohen's Kappa" (*kappa*) as the measure of inter-coder reliability. Mark A. Hall & Ronald F. Wright, *Systematic Content Analysis Of Judicial Opinions*, 96 CALIF. L. REV. 63, 113–14 (2008) (stating that the best practice for evaluating coding reliability is to report an agreement coefficient, such as *kappa*). *Kappa* ranges from 0 to 1, with numbers near 1 indicating a higher degree of reliability. *See id.* (explaining that a 0 indicates "agreement entirely by chance" and a 1 indicates "perfect agreement"). For the basic definitive and interim winners in cases, *kappa* was 0.9534, equating to near perfect agreement. For grants of motions for summary judgment of invalidity and non-infringement, *kappa* was 0.9793, which also equates to near perfect agreement for times in which we both identified motions. However, one of us found 1 additional motion for summary judgment of invalidity (40 v. 39). For motions for summary judgment of non-infringement, we each identified motions that the other did not (42 motions were found by both authors; one found 43 motions, while the other identified 44 motions). We revisited the overlapping case dockets again to understand these additional rulings, and we found that the additionally identified rulings should be included. We corrected all known disagreements in the data set. We believe that these differences in coding are due to the complexity of the dockets, and we do not believe that they are biased in one direction or another. We do believe, however, that the reliability information suggests that we slightly undercounted the numbers of merits rulings, although we cannot be sure whether the actual number should have more denials or grants.

29. Occasionally, the court ruled differently on different claims of a patent. For instance, claim 1 may be infringed and not invalid, but claim 2 was not infringed and anticipated. In these cases, we would create a new record for each group of claims that had a different substantive outcome.

30 *See* Allison et al., *Understanding the Realities, supra* note __, at __.

of the issue—such as denials of summary judgment motions because they were premature. The coders also reviewed and recorded all trial outcomes, whether there was a jury or bench trial, and decisions on post-verdict JMOL motions. Finally, we recorded whether an appeal was lodged, and how the appeal was resolved. The resolution data includes whether the ruling on the patent was affirmed or reversed on appeal, or whether an appeal is pending or was dismissed (typically because the case settled). When the underlying trial or appellate court opinion lacked sufficient detail to ascertain the basis for the ruling, we read the underlying briefing by the parties.

We coded merits decisions at a low level of granularity. For invalidity, we coded whether the ruling was based on utility, patentable subject matter, section 102 prior art, obviousness, indefiniteness, written description, enablement, and best mode. We also coded various bases for section 102 invalidity. For infringement, we captured literal infringement, the doctrine of equivalents, and various types of indirect infringement. And we coded unenforceability, as well as the basis for the unenforceability argument. In addition to the separate coding of issues for summary judgment and trial, we also recorded the final resolution for each patent on the issues of infringement, validity, and enforceability.

Notably, we coded the issues litigated to decision, whether or not that decision resulted in a trial outcome or a grant of summary judgment. Thus, if an accused infringer argued that the patent was invalid for lack of patentable subject matter, anticipation, and obviousness, and the court denied the first two arguments but granted the third, each of those three rulings shows

up in our data set.[31] To understand how the final resolution variables were coded, one should understand that denial of summary judgment does not result in a final resolution. Instead, denial of summary judgment means that there is an unresolved disputed issue of material fact.[32] Consequently, denials of summary judgment alone would not result in a final ruling in either direction. If, however, the issue had been resolved at trial, then the final ruling was coded as the trial resolution. If summary judgment had been granted on an issue, then the summary judgment ruling was coded as the final resolution in our coding.[33] We coded decisions that finally ruled for a party on an issue as definitive wins, and decisions that ruled for a party but kept the issue alive (largely denial of summary judgment but also remands on appeal) as interim wins.

B. Technology and Industry Classifications

The heart of this paper is our comparison of outcomes across the industry and technology categories of the asserted patents. Our technology categories refer to the nature of the invention itself, while our industry categories focus on the owner of the patents and the industry in which the technology is put to use. In one instance, biotechnology, we use the same

[31] To be clear, while we included merits rulings on each issue, we did *not* include the issue if the court denied the motion as moot. For instance, if the court granted summary judgment of anticipation on the merits and simultaneously denied summary judgment of obviousness as moot, we included anticipation but not obviousness.

32. *See* FED. R. CIV. P. 56.

33. Of course, if the Federal Circuit reversed a ruling relating to a patent on appeal, we updated the final-resolution coding to reflect the appellate decision. If the ruling was reversed on appeal, we retained the original decision in our summary judgment coding because we wanted to capture summary judgment win rates at the trial court. [Insert data on how much, if at all, this matters.]

term to describe both technology and industry; a patent on a gene sequence used in gene therapy is both a biotech technology and is used in the biotech industry. But the two are not identical.[34] In this and many other categories there is substantial but not complete overlap between industry and technology categories. Some patents that cover software technology are employed in traditional software industries like computers and electronics, but software as a technology also shows up in a wide array of other industries, from transportation/automotive to consumer goods, industrial goods, energy, medical devices/methods, and others.

While the U.S. PTO has a technology classification scheme, it was not created for the purpose of defining technologies at a conceptual level and possesses other serious shortcomings that have been discussed in connection with prior research published by two of the current authors.[35] We wanted a series of broad categories that would capture inventions of different types. As a result, one of us (Allison) evaluated each of the patents in our study by hand and categorized them into one of six different technology areas and one of eleven different industry categories.

1. Technology areas

When determining the technology area to which an invention should be assigned, we placed emphasis on the claims, sometimes aided by the written description and drawings to

[34] A substantial majority of patents covering biotechnology techniques, i.e., biotech as a technology, were assigned either to the medical industry because the patented technology's covered use was for medical diagnostics and other medical techniques, or to the pharmaceutical industry because the technology produced a covered pharmaceutical drug.

[35] *See, e.g.,* John R. Allison, Mark A. Lemley, Kimberly A. Moore, & Derek Trunkey, *Valuable Patents*, 92 **Geo. L.J.** 435 (2004) (discussing these shortcomings). When a researcher works with an extremely large data set such that it is not feasible to study each patent in depth as was done here, reliance on PTO classifications or International Patent Classifications (IPCs) may be an unavoidable shortcut.

explain ambiguous claim terms. When further required to interpret a term in the claims, we occasionally consulted technical dictionaries, encyclopedias, and the Internet, although we rarely had to resort to such extrinsic sources. We first assigned each patent in our data set to a single, primary technology area. In the case of approximately one-third of the patents, we also identified one (or, rarely, two or more) "secondary" technology areas. This was done when another technology area clearly formed an additional but integral part of the claims. When both primary and secondary technology areas are included, the 949 patent-case pairs had a total of 1,244 tech areas for an average of 1.31 tech areas per patent-case pair. The six primary technology areas are thus mutually exclusive, while the primary-plus-secondary areas are not.

The technology areas are defined as follows:

(1) Mechanical: An invention in which the claims cover the use of mechanical parts, either solely or predominantly, sometimes combined with heat, hydraulics, pneumatics, or other power sources or power transfer techniques.

(2) Electronics: An invention in which the claims cover the use of traditional electronic circuitry or the storage or transmission of electric energy.

(3) Chemistry: An invention in which the claims cover chemical reactions, chemical compounds with specific elements and proportions, and chemical processes specifying specific elements and amounts or proportions. Closely related inventions such as those on purportedly novel metal alloys and nonmetallic composites are also included when the claims cover the specific components and proportions of such amalgams. This technology area includes "small-molecule" chemistry; DNA, antibodies, and other large molecules are included in the biotechnology category instead. Although many of the chemistry technology patents were

assigned to the pharmaceutical industry category, they are also found in other industry categories such as semiconductors.

(4) Biotechnology: An invention in which the claims cover processes 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.[36]

(5) Software: An invention in which the claims cover data processing—the actual manipulation of data (and not merely transmission, receipt, or storage of data), regardless of whether the code carrying out such data processing is on a magnetic storage medium, embedded in a chip ("firmware"), or resident in flash memory.

(6) Optics: An invention in which the claims cover the use of light waves or light energy.

We also assigned certain patents in the "primary" software classification to one of that technology's subsets, namely, software business methods. As we defined it, the software business method category includes software patents that cover models, methods, and techniques 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

[36] We also employ the term "biotechnology" to describe an industry because the term seems to us to be the most accurate one in each case. As used here, to describe a technology, we are only concerned with scientific technique, and not with how the results of the scientific technique are ultimately employed. The scientific techniques of biotechnology can be employed in different industries. Many of the patents assigned to biotech as a technology category find their way into the pharmaceutical industry category, which is discussed below. This occurs when the result employing the scientific techniques of biotechnology (the technology) is a therapeutic drug. When the technology of biotech produces a means for diagnosing a disease or disease propensity, the patent is properly assigned to a "medical" industry category. When a patent with a technology classification of biotechnology represents an advance in the science of biotechnology itself, its proper industry home is biotechnology.

narrow definition limited to those patents the claims of which obviously covered only such things as automated generation of customer proposals, advertising, financial techniques, the use of online catalogs. We do not include computer-controlled manufacturing methods in the business method category because they are not customarily viewed as being within the definition of a business method patent, although a very broad definition could plausibly contain them. Because the business method category is a subset of software generally, it cannot be included in multiple regressions that also include the broader software category. We did, however, run some regressions including software business method and software non-business method patents as mutually exclusive categories that substitute for the broader software category.[37]

2. Industry Categories.

Unlike technology areas, the industry categories focused more attention on the business use of the patent than on the nature of the technology itself. Although we paid attention to the

[37] We used logistic regression (or logit) models, because each of our dependent variables (specific outcomes) is binary (or "dummy"—"yes" or "no"). Although multivariate regression assumes that all variables are independent of one another, this assumption does not hold when applied to studies of patent infringement litigation. There are several reasons for this: (1) many cases involve the assertion of multiple patents, and decisions about these patents are made by the same judge and jury; (2) it is common to find in a data set that the same patent has been litigated in more than one separate lawsuit against different defendants, and even though the decision makers may be different, the same patent has the same attributes in each case; and (3) some cases will be consolidated, with the same decision maker deciding certain issues—usually only pretrial summary judgments, but sometimes trial decisions as well. Allison & Lemley, *supra* note **, at 245; Allison et al., *Patent Quality*, *supra* note **, at 678–79; Kesan & Ball, *supra* note **, at 261. To account for the lack of complete independence among observations, we clustered on the standard errors of the unique patent numbers.

claim language in assigning a patent to one of eleven mutually exclusive industry categories, we found it necessary to focus more attention to the written description and to extrinsic evidence, especially the Internet.

(1) Computer and Other Electronics: This industry encompasses inventions of all kinds that purport to advance the state of the art in computing or computer device manufacturing, or to enhance users' experiences in employing computing technology. The category includes software and computer hardware inventions that seek to serve the aforementioned purposes. Also included are inventions predominated by the use of traditional electronic circuitry when those inventions purport to advance the art in that technology or enhance users' experiences in employing electronics technology. In contrast with our prior studies, here we combine the computer and traditional electronics industries because we find fewer and fewer patents covering traditional electronics without also including significant data processing elements. Traditional electronics inventions without data processing elements do continue to exist, but their frequency and importance is rapidly declining—the industries clearly have been merging for quite some time.

(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. Technologies employed in semiconductor industry inventions may include software, chemistry, optics, and mechanical.

(3) 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. The technologies found in pharmaceutical industry inventions are overwhelmingly chemistry or biotechnology.

(4) Medical Devices, Methods, & Other Medical: This industry category includes non-pharmaceutical, non-biotechnology 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 this category. All of the different technology fields are represented in the medical industry category.

(5) Biotechnology: This category includes those inventions that are in the biotechnology technology category that do not relate to the production of pharmaceutical compositions or medical diagnostics or treatment, but that instead purport to advance the science of biotechnology itself.

(6) Communications: The communications industry category includes inventions of all kinds intended to advance the state of the art in communications. Technologies represented in the communications industry include software, electronics, optics, and mechanics.

(7) Transportation (including automotive): This category includes patents on any type of invention related to the production of automobiles or vehicles of any other kind intended for transporting people or cargo, and inventions related to the provision of transportation services. Several different technology areas are represented in this industry category.

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

(9) Energy: This category includes inventions of any kind associated with power generation, transportation, or consumption.

(10) Goods & Services for Industrial & Business Uses: This category includes patents on products and services of all kinds intended for industrial and business purposes—i.e. goods and services for wholesale uses that are not in another, more specific category. Many software-implemented business method inventions are included in this category.

(11) Goods & Services for Consumer Uses: This category includes patents on products and services of all kinds intended for personal consumer purposes—i.e. goods and services for retail uses that are not in another, more specific category. Many software-implemented business method inventions are included in this category.

C. Potential Limitations

Our data set and the implications that can be drawn therefrom are subject to several limitations. For brevity, we discuss two important limitations here.

First, our data set is limited to lawsuits filed in 2008 and 2009. Thus, it is only a snapshot of the larger flow of litigation. The exact beginning and ending points of our dataset—January 1, 2008 and December 31, 2009— are artificial cutoffs. Obviously which suits were brought just inside and outside the time period may be due, in part, to chance. It is sufficiently recent, in our opinion, that the results are generally applicable today. However, there have been several legal changes in the interim that may make lawsuits today different from those in our data set. The most salient changes are the passage of the America Invents Act in 2011;[38] the Federal Circuit's en banc *Therasense*[39] decision in 2011; and three Supreme Court cases involving the doctrine of

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

39. Therasense, Inc. v. Becton, Dickinson & Co., 649 F.3d 1276 (Fed. Cir. 2011) (en banc).

patentable subject matter in 2010,[40] 2012,[41] and 2013.[42] The Federal Circuit issued several opinions involving patent damages, which may have affected litigant behavior and settlement.[43] These law changes may influence what issues litigants press, and separately, which cases reach the stage of a ruling on the merits. Accordingly, the cases filed today in 2014 may differ from those we studied. And some of the 2008 and 2009 cases in our dataset were decided under Supreme Court and Federal Circuit opinions issued after the case was filed. These subsequent legal changes may have been unforeseeable to the patent owners when they originally elected to initiate lawsuits, when the Patent Office originally examined the underlying patent applications, and when the patent attorneys drafted the applications.[44]

Second and perhaps more importantly, our data set only contains patents that were subject to a ruling on summary judgment, a trial, or an appeal. To be sure, we have the population of cases that resulted in a ruling on a dispositive motion or trial. For these cases, we report statistical results on the outcomes. However, most lawsuits settle,[45] and as our data confirms, most lawsuits settle before any ruling on the merits. Cases that settled before any substantive patent ruling are completely absent from our data set. Moreover, many disputes

40. Bilski v. Kappos, 130 S. Ct. 3218 (2010).

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

42. Ass'n for Molecular Pathology v. Myriad Genetics, Inc., 133 S. Ct. 2107 (2013).

43. *See, e.g.*, Uniloc USA, Inc. v. Microsoft Corp., 632 F.3d 1292, 1315 (Fed. Cir. 2011) (prohibiting the use of the 25% rule of thumb for calculating reasonable royalties); ResQNet.com, Inc. v. Lansa, Inc., 594 F.3d 860, 873 (Fed. Cir. 2010) (vacating the district court's damages award because the reasonable royalty determination relied on speculative evidence).

44 See David L. Schwartz, *Retroactivity at the Federal Circuit,* 89 **Ind. L. J**. 1548 (2014) (arguing that many Federal Circuit opinions have weak prospective effect on future patents, but strong retroactive effect on existing patents.)

45. Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 NW. U. L. REV. 1495, 1501 (2001) ("The overwhelming majority of [patent] lawsuits settle or are abandoned before trial."); Kesan & Ball, *supra* note 20 at 271-73 (finding that the vast majority of cases settle).

do not result in litigation.[46] Obviously, our data set lacks unlitigated disputes about patents. The upshot is that our data and results are not generalizable to the cases or disputes that settled without any substantive ruling. Thus, while our data sheds light on who wins and loses patent cases and dispositive motions, it cannot tell us who *would* win cases that were filed but settled without a judgment.[47]

We do not even have a sense of which direction the bias, if any, would point if one were interested in all litigated cases. On the one hand, it may be that the cases that are settled before a merits ruling are mainly strong cases in which the parties overlapped in their expectations on success. If this is true, then the defendant win rates we observe in our data set would be higher than the win rate if all cases were litigated to judgment. On the other hand, it could be that the cases that settled before a merits ruling consist disproportionately of meritless cases that were resolved via cost-of-defense settlements.[48] If this alternative hypothesis was true, then our estimates of defendant win rates from the cases that reached the merits phase would be lower than the defendant win rate if all filed cases went to judgment.

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46. *See id.* at 1507 (estimating that only 1.5% of patents were litigated).

[47] Litigation and settlement incentives are extremely hard to quantify or observe. The incentives are likely influenced by many factors, including the venue of the litigation. *See Understanding Realities, supra* note 4 *at 1793,* Table 3A (reporting diversity in case outcomes in patent litigation in 8 distinct busy patent districts). In our previous work, we provided a comparison between filed lawsuits by district and our dataset of adjudicated patents. *Id.* at 1778-81.

48. Such claims may be common. *See* Mark A. Lemley & A. Douglas Melamed, *Missing the Forest for the Trolls*, 113 COLUM. L. REV. 2117, 2163 (2013) (stating that patent trolls pursue a large number of cases, many of which a practicing entity would probably not bring, but that these cases are more likely to settle quickly). Moreover, prior research has shown that patent owners who assert their patents a large number of times lose more frequently than owners who assert patents less frequently. *See* John R. Allison, Mark A. Lemley, & Joshua W. Walker, *Patent Quality and Settlement Among Repeat Patent Litigants*, 99 GEORGETOWN LAW JOURNAL 677 (2011).

Because almost all of the settlements are confidential,[49] we cannot assess the direction of the bias.

Third, the size of our dataset is relatively modest, with fewer than 1,000 patent observations. This is not a sample; we report the full population of merits decisions for the 2008 and 2009 lawsuits. However, once the dataset is broken down by technology and further still by patent law doctrine, the number of observations in each category becomes much smaller, making statistical significance harder to find. For each of these reasons, we urge readers to interpret our results with these limitations in mind.

III. Results

A. Descriptive Statistics by Technology and Industry

Consistent with past evidence of the growing diversity of patent litigation, we find that mechanical patents no longer dominate over other technology types in litigation that reaches a merits decision. As Table 1 demonstrates, software, not mechanical, patents are the single largest category of decided cases, accounting for more than a third of all outcomes in our data set. Just over a quarter of outcomes are mechanical, and just over 20% are chemical or biotechnological. More than 45% of cases are software and electronics cases.

Table 1
Patent Decisions by Technology Area

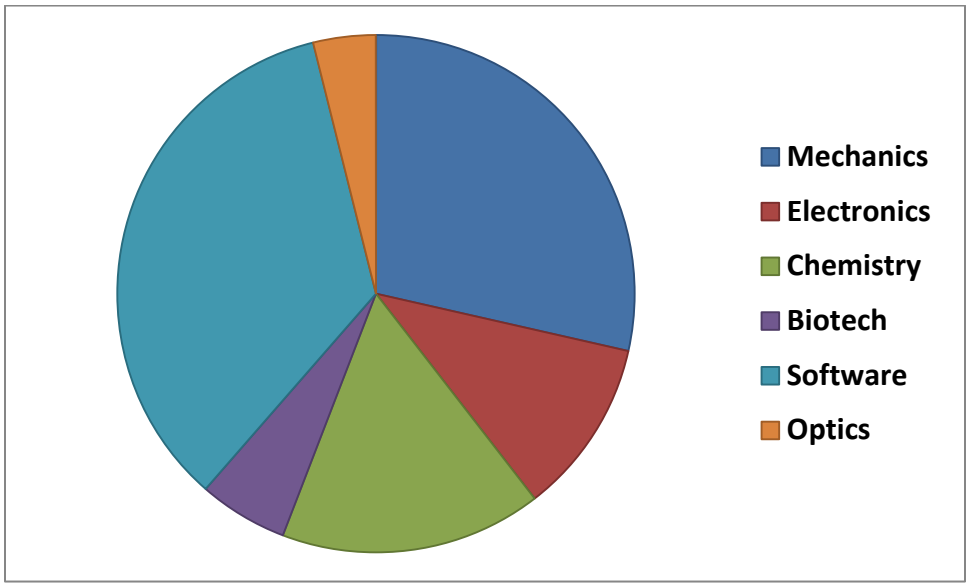
Technology	Freq.	Percent
Mechanics	271	28.56

49. *See* Scott A. Moss, *Illuminating Secrecy: A New Economic Analysis of Confidential Settlements*, 105 MICH. L. REV. 867, 869 (2007) ("*Public* settlements are the exception, common in only a few types of cases . . . .").

Electronics	104	10.96
Chemistry	155	16.33
Biotech	53	5.58
Software	329	34.67
Optics	37	3.9
Total	949	100

Figure 1

Patent Decisions by Technology Area



Because many of the complaints about software patents are directed to a particular subset of those patents that cover business methods, we also ran an alternative specification in which we separated patents covering business methods from other, more traditional software patents.[50] In this alternative specification, 65 of the software patents were software business method patents and 264 were not business method patents.

[50] As observed *infra* in our technology area definitions, all of the litigated patents covering business methods were within the primary software classification.

The industry results tell a similar story. No one industry dominates in our data set of merits decisions.[51] . The computer, communications, and electronics patents have a slightly smaller footprint in industry than they did in technology, accounting for just under 30% of case outcomes, still larger than any other industry cluster. That suggests that adjudicated software patents in particular are distributed across a number of different industries. Many show up in the consumer goods and industrial goods categories, though virtually all the industries include at least some software patents. Medical devices and pharmaceuticals both account for a sizeable share of litigated patent outcomes.

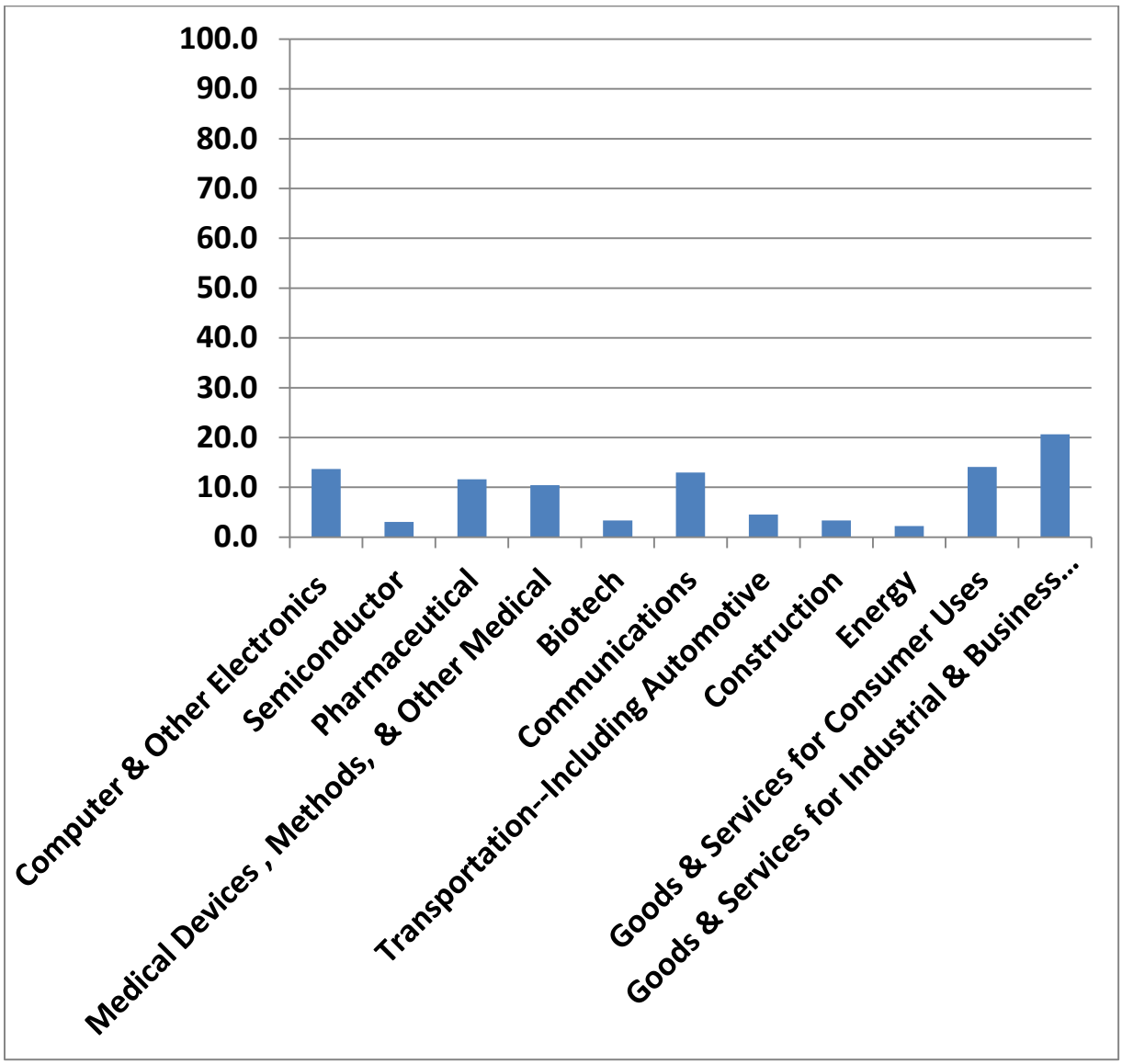
Table 2
Patent Decisions by Industry

Industry	Freq.	Percent
Computer & Other Electronics	130	13.7
Semiconductor	29	3.1
Pharmaceutical	110	11.6
Medical Devices , Methods, & Other Medical	99	10.4
Biotech	32	3.4
Communications	123	13
Transportation--Including Automotive	43	4.5
Construction	32	3.4
Energy	21	2.2
Goods & Services for Consumer Uses	134	14.1

[51] Our unit of observation is the resolution of a claim over a particular patent in a particular case (the patent-case pair). Some cases include multiple patents, and when that is true each patent outcome is given a separate entry in our data. Similarly, some patents are litigated in multiple cases, and when that is true each is given a separate entry. For simplicity we sometimes refer to resolution of "cases" or "disputes," but unless we say otherwise each unit of observation in our study is a patent-case pair.

Goods & Services for Industrial & Business Uses	196	20.7
Total	949	100

Figure 2
Patent Decisions by Industry



B. Outcomes by Technology Area

We find dramatic differences in how patent owners in different industries and technologies fare in the cases that reach a definitive result in litigation.[52] Our statistics on definitive results exclude cases in which there was a summary judgment denial, followed by a settlement before trial.[53] A we reported in our companion paper, patentees overall won just 26% of cases that went to a definitive outcome.[54] But that overall percentage conceals remarkable variation by technology area. Chemical patents (many of which are owned by pharmaceutical companies) won a majority of their cases that went to final decision (62 of 119, or 52.1%). By contrast, software patents prevailed in only 29 out of 222 cases, or 13.1%. That difference is consistent with the received wisdom in the literature that patents are stronger and more valuable in disciplines like chemistry than in software.[55] However, for reasons previously

[52] A Pearson chi-square test for significances in outcome differences shows that we can easily reject the hypothesis that there is no difference by technology area (p=0.000).

[53] Presumably many of these excluded cases involve a monetary payment to the patentee. This selection issue should be taken into account when considering the statistic that accused infringers win approximately three quarters of the patents that end with a definitive ruling. Patentees often get paid even without a definitive ruling, particularly if they have managed to avoid losing pre-trial.

[54] Allison et al., *supra* note __, at __.

[55] *See, e.g.,* Bessen & Meurer, *supra* note __, at __ (arguing that the patent system is beneficial to society only in the life sciences and not elsewhere).

discussed, data on win rates cannot necessarily be extrapolated to make inferences about all patents or even all litigated patents.

When we broke out business method and non-business method patents, we found that business method patents actually fared slightly better than other sorts of software patents. Patent owners won 17.0% of the business method cases that went to a final decision, compared with only 12.0% of the non-business method cases.[56] This suggests that the low win rate for software patents cannot be attributed solely to business method patents

More remarkable are the findings for biotechnology patents, which had the lowest patentee win rate of any technology area. Only 3 out of 37, or 8.1%, of biotech patentees that took a case to a final decision prevailed. Most policy advocates lump chemistry and biotechnology patents together, arguing that we need strong patent protection in those areas (even if not elsewhere) because of the cost and uncertainty associated with biomedical inventions. But our data suggest that the biotech patents that reach a merits ruling overwhelmingly lose.[57]

Table 3
Definitive Win Rate by Technology Area

Notably, prior work by two of the authors found that software patents were quite unlikely to prevail. John R. Allison et al., *Patent Quality and Settlement Among Repeat Patent Litigants*, 99 **Geo. L.J.** 677 (2011). But that study was limited because it focused on the most-litigated patents—those that had been litigated 8 or more times during the 2000-2009 period. Our paper provides the first evidence that those software patents that reach the stage of a merits ruling more generally disproportionately lose in court.

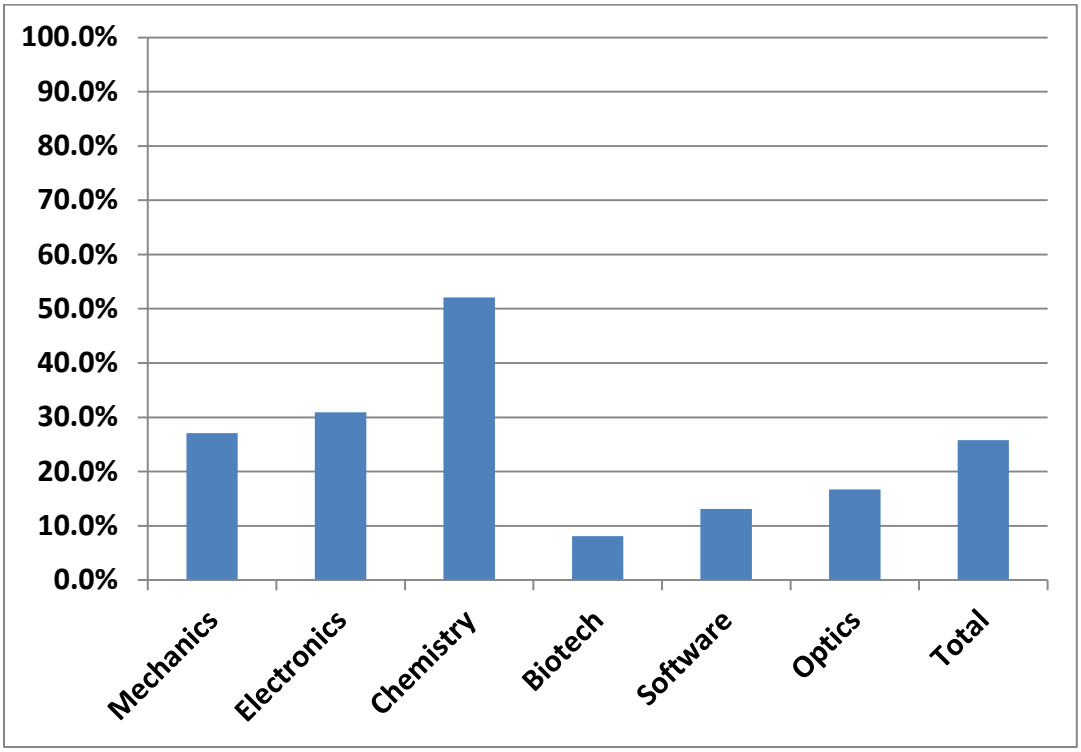
[56] The differences among the seven technology areas are statistically significant (p=0.000).

[57] 7 of the invalidated biotech patents were part of the *Myriad* lawsuit, decided by the U.S. Supreme Court in *Association for Molecular Pathology v. Myriad Genetics*, 569 U.S. 12 (2013). The *Myriad* lawsuit is the only lawsuit in our dataset that the Supreme Court reviewed on either validity or infringement. The Federal Circuit had found some of these 7 patents valid, a decision reversed by the Supreme Court.

Patent Owner Definitive Winner	Mechanics	Electronics	Chemistry	Biotech	Software	Optics	Total
Freq.	45	21	62	3	29	4	164
%	27.1%	30.9%	52.1%	8.1%	13.1%	16.7%	25.8%
Total	166	68	119	37	222	24	636

Pearson chi2(5) = 69.9983 Pr = 0.000[58]

Figure 3
Definitive Win Rate by Technology Area



We can gain further insight by breaking down the results by both stage of litigation and reason for patentee loss. Table 4 shows that our results are driven by a combination of differences in invalidity findings and noninfringement findings, with different technologies

[58] As explained in the introduction to our technology area definitions, we also ran an alternative specification in which we allowed patents to be coded in a secondary as well as a primary technology area. That increased the number of technology area observations substantially, from 636 definitive merits outcomes to 777. But it did not have a large effect on the results, with one exception: the patentee win rate in electronics dropped from 30.9% to 20.9%, likely as a result of having some software patents (which fared poorly as a class) receive a secondary classification as electronic patents.

faring better on one front than another. While roughly 43% of patents that went to a final judgment on validity were invalidated, the technology-specific numbers ranged from a low of 21.4% for optics and 25.6% for chemistry to a high of 80% for biotechnology. Interestingly, mechanical patents were invalidated more often than not (52.2% of the time). Software was only slightly above the average; software patents were invalidated 45.3% of the time. When we broke out software into business method and non-business method categories, we find that business method patents are more likely than non-business method patents to be invalidated (56.4% invalid for business methods compared with 41.4% for non-business method patents).

Table 4
Invalidity Rate by Technology Area[59]

Invalidity-All Grounds-Any stage	Mechanics	Electronics	Chemistry	Biotech	Software	Optics	Total
Freq	60	22	23	12	68	3	188
%	52.20%	38.60%	25.60%	80.00%	45.30%	21.40%	42.60%
Total	115	57	90	15	150	14	441

Pearson chi2(5) = 26.9771 Pr = 0.000

Figure 4
Invalidity Rate by Technology

[59] Validity and invalidity decisions conditioned on a final determination of a validity dispute.

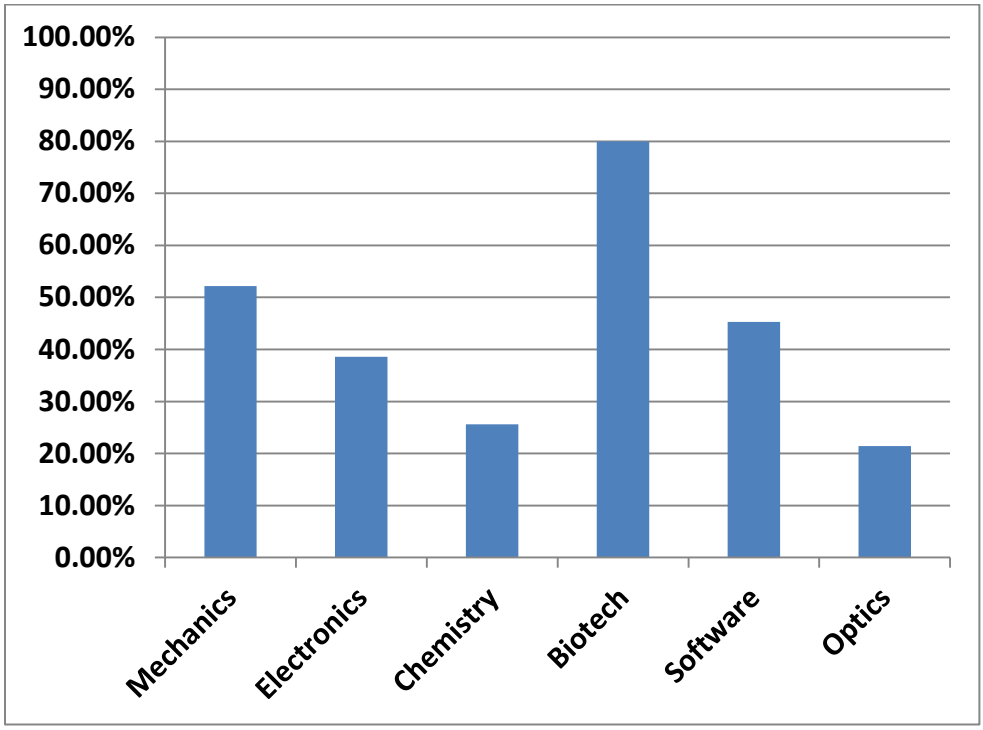


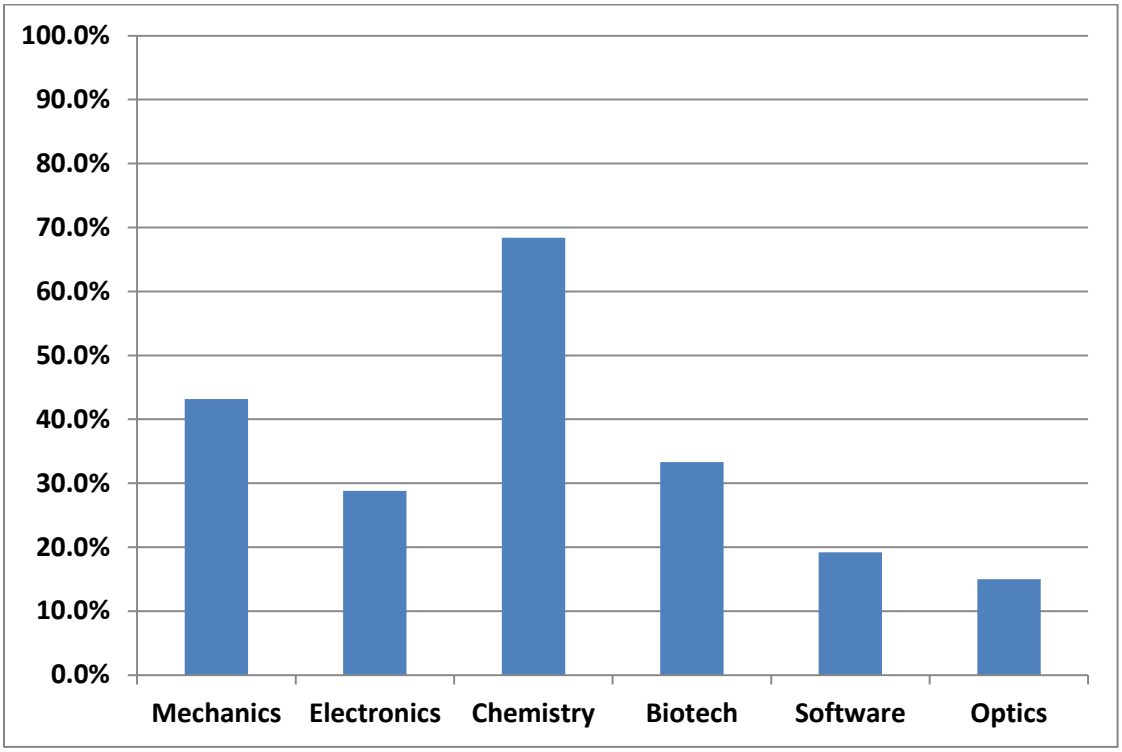
Table 5
Infringement Rate by Technology Area[60]

Direct Infringement (Literal + DOE)- Any stage	Mechanics	Electronics	Chemistry	Biotech	Software	Optics	Total
Freq	64	17	67	9	37	3	197
%	43.2%	28.8%	68.4%	33.3%	19.2%	15.0%	36.1%
Total	148	59	98	27	193	20	545

Pearson chi2(5) = 76.7483 Pr = 0.000

Figure 5
Infringement Rate by Technology

[60] Infringement decisions conditioned on a final determination of an infringement dispute.



The infringement numbers tell a different story. Optics patents may be the least likely to be invalid in our data set, but they are also the least likely to be infringed (only 3 of 20 cases that resolved infringement, or 15%, found infringement). Software patents fare only slightly better, with only 37 out of 193 cases that resolved an infringement dispute (or 19.2%) finding infringement. [Breaking that into business method and non-business method patents reveals that 28.6% of business method patents and 17.0% of non-business method patents are found infringed.] By contrast, chemical patents won infringement disputes more than two-thirds of the time (67 out of 98 times, or 68.4%). The chemistry result is not surprising, since many chemical cases involve suits against generic drug manufacturers who have to copy the basic technology in order to be eligible for expedited FDA approval. In some of these lawsuits, the generic defendant apparently did not contest infringement, instead stipulating on the issue.

The percentages do not tell the whole story, however, because some types of arguments are made more often in some industries than others. For instance, while litigated biotech patents faced a higher invalidity rate (80%) than noninfringement rate (66.7%), there were more noninfringement decisions than invalidity decisions in biotech, meaning that when a biotech patentee lost it was more likely to lose on noninfringement grounds (18 cases) than on invalidity grounds (12 cases). To account for this, in Table 5 we show the number of results of each type by area of technology.[61] Table 5 demonstrates that across all technologies, the chance of a patent being held not infringed were significantly higher than the chance of it being held invalid.[62] That was true in every technology, but the result was particularly striking in the optics and software industries, where more than two-thirds of all the cases we observed included a finding of noninfringement. Overall, there were almost twice as many noninfringement rulings (348) as invalidity rulings (188).

Table 6
Number of Wins on Each Issue by Technology

Case Outcomes	Mechanics	Electronics	Chemistry	Biotech	Software	Optics	Total
Patent Owner Loss on Invalidity	60	22	23	12	68	3	188
Patent Owner Loss on Noninfringement	84	42	31	18	156	17	348
Patent Owner Win	45	21	62	3	29	4	164
Total Cases	166	68	119	37	222	24	636

[61] Note that in Table 5 the percentages do not necessarily add to 100% because in some cases a patent claim was held both invalid and not infringed.

[62] *See* Roger Ford, *Patent Invalidity Versus Noninfringement*, 99 **Cornell L. Rev.** 71 (2013) (arguing that parties are motivated to litigate too many infringement issues and not enough validity issues).

The differences are not evident at trial, or on summary judgment of noninfringement; in neither case are the technology differences statistically significant. Where we do see significant differences is in the willingness of courts to grant summary judgment of invalidity. As Table 6 illustrates, they are more likely to do so when confronted with biotech and software patents. (That is particularly true of business method patents; 43.9% of summary judgment motions of invalidity for business method patents were granted, compared to 34.2% of non-business method software patents. But grant rates in both categories were above average).

Table 7
Win Rate on Summary Judgment of Invalidity by Technology[63]

SJ Invalidity-All	Mechanics	Electronics	Chemistry	Biotech	Software	Optics	Total
Freq	34	14	12	11	57	3	131
%	27.6%	28.6%	21.1%	50.0%	36.8%	15.0%	30.8%
Total	123	49	57	22	155	20	426

Pearson chi2(5) = 11.9839 Pr = 0.035

[63] Note that the summary judgment wins are not strictly comparable to the definitive wins reported above. A defendant that wins summary judgment of invalidity has won the case and is a definitive winner for purposes of Table 3. A patentee who defeats a motion for summary judgment of invalidity on one ground has defeated summary judgment on that issue, but has not won the case, and so will show up as a winner in this table but not in Table 3.

Those differences extend to the grounds of invalidity. In Table 7, we present the results for several common invalidity arguments.[64]

Table 8
Win Rates on Particular Invalidity Arguments by Technology

Invalidity-102 Prior Art-All--Any stage	Mechanics	Electronics	Chemistry	Biotech	Software	Optics	Total
Freq	22	6	9	2	31	2	72
%	37.9%	18.2%	19.1%	33.3%	40.3%	20.0%	31.2%
Total	58	33	47	6	77	10	231

Pearson chi2(5) = 25.6518 Pr = 0.000

Invalidity-103-Obviousness--Any Stage	Mechanics	Electronics	Chemistry	Biotech	Software	Optics	Total
Freq	37	11	6	2	16	0	72
%	46.3%	30.6%	9.7%	50.0%	30.2%	0.0%	29.9%
Total	80	36	62	4	53	6	241

Pearson chi2(5) = 25.6518 Pr = 0.000

Invaldity-112-Indefiniteness--Any Stage	Mechanics	Electronics	Chemistry	Biotech	Software	Optics	Total
Freq	0	7	1	0	22	1	31
%	0.0%	31.8%	3.0%	0.0%	24.4%	12.5%	17.7%
Total	19	22	33	3	90	8	175

[64] Note that unlike Table 6, the results in Table 7 are from arguments in all procedural postures, not just summary judgment.

Pearson chi2(5) = 15.5658 Pr = 0.008

Invalidity-112-Inadequate Disclosure-Any stage	Mechanics	Electronics	Chemistry	Biotech	Software	Optics	Total
Freq	11	3	8	3	5	0	30
%	26.8%	10.0%	18.2%	75.0%	16.7%	0.0%	18.2%
Total	41	30	44	4	30	16	165

Pearson chi2(5) = 15.6934 Pr = 0.008

The technology differences were statistically significant for all of these grounds for invalidity (though barely above the 95% confidence threshold for 102 prior art). Among the most notable differences are in the grounds for invalidity in section 112.[65] Indefiniteness arguments under section 112(b) were never successful in the mechanical or biotechnology areas and succeeded only 3% of the time in chemical patents. By contrast, indefiniteness claims prevailed nearly a quarter of the time in software patent cases (including 1/3 of business method cases) and nearly a third of the time in electronics cases. The comparison of success rates for indefiniteness validity challenges in our set of adjudicated patents is consistent with the arguments of some scholars that patents are simply less clear in the information technology industries than in other industries.[66] And it may result in part from a specific set of definiteness rules that applies only to software claims written in means-plus-function format.[67] By contrast,

[65] 35 U.S.C. §112.

[66] Bessen & Meurer, *supra* note __; Mark A. Lemley, *Software Patents and the Return of Functional Claiming*, 2013 **Wis. L. Rev.** 905.

[67] *See, e.g., Aristocrat Techs. Austl. PTY Ltd. v. Int'l Game Tech*., 521 F.3d 1328, 1336–38 (Fed. Cir. 2008) (holding that an algorithm must be disclosed in order for a patent to be upheld); *Function Media, LLC v. Google Inc.*, 708 F.3d 1310, 1318 (Fed. Cir. 2013); *ePlus, Inc. v. Lawson Software, Inc.*, 700 F.3d 509, 518–19 (Fed. Cir. 2012); *Ergo Licensing, LLC v. CareFusion 303, Inc.*, 673 F.3d 1361, 1362, 1365 (Fed. Cir. 2012); *Noah Sys., Inc. v. Intuit Inc.*, 675 F.3d 1302, 1312–13 (Fed. Cir. 2012); *In re Aoyama*, 656 F.3d 1293, 1294, 1297–98 (Fed. Cir. 2011) (means-plus-function software patent claim invalid as indefinite for failure to disclose the corresponding algorithm performing that function); *Typhoon Touch Techs., Inc.*

arguments based on enablement and written description—that is, arguments about whether the scope of the patent claims were properly supported by the disclosure in the patent – show a very different pattern. One third of mechanical patent decisions and three-quarters of biotechnology patent decisions on these grounds resulted in invalidity, far more than in software and electronics. We caution, however, that some of these data points, such as those for biotechnology, are quite small, which means that a few cases can significantly affect the outcome. But despite the small number of cases in some of these fields, these technology differences are statistically significant (p=0.008 for indefiniteness and p=0.008 for disclosure).[68]

Interestingly, when we divided software patents into business method and non-business method categories, we found that business method patents were less likely to be invalidated on grounds of 102 prior art (33.3% for business methods compared with 43.4% for other software) and obviousness (16.7% for business methods compared with 34.1% for other software).

In prior work based on the same data set, we studied a variety of different patent characteristics, including whether the inventors were domestic or foreign, the number of claims, the prior art references cited, the number of other patents that cite this one, and a variety of litigation characteristics, including how old the patent was when the suit was filed,

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v. Dell, Inc., 659 F.3d 1376, 1384–86 (Fed. Cir. 2011) (means-plus-function software claims required disclosure of corresponding structure performing that function in the specification, but that structure did not need to be described in the form of software code); *WMS Gaming, Inc. v. Int'l Game Tech.*, 184 F.3d 1339, 1349 (Fed. Cir. 1999) ("the disclosed structure is not the general purpose computer, but rather the special purpose computer programmed to perform the disclosed algorithm."). The *Aristocrat* line of cases were developed during the time frame of our dataset. That may have resulted in considerable uncertainty about the doctrine. All of the patents in our dataset were drafted before the *Aristocrat* line of cases existed, which may explain why so many adjudicated patents in software failed on this issue.

[68] Statistical significance here does not mean that there is a discernible difference between each of the categories; it merely means that we can reject the hypotheses that the distribution of results across all categories is due to chance.

how many defendants were sued, and how many other patents were asserted in the same case.[69] For this paper, we ran a multivariate regression that incorporated each of those variables in addition to the technology categories we just described. The full results are presented in Appendix A.[70] Compared to chemical patents—our "comparison dummy"—we

[69] Allison et al., *supra* note __, at __.

[70] Appendix A includes both primary and secondary technology categories; chemistry is the excluded dummy variable. We also ran alternative specifications excluding optics and software, and re-ran each of the three specifications using only primary technology categories as well as primary and secondary technology categories. The results were internally consistent. The full specifications are available upon request.

In addition to addressing the problem caused by lack of complete independence among our observations, *supra* note 33, we also had to contend with the fact that when running multiple tests from the same data set, there is the problem that we might obtain one or more findings of statistical significance by pure chance. Of the various techniques that have been proposed for correcting this problem, we decided that the use of bootstrapping would best serve our needs. To correct for any possible false significance findings (false discovery rate) resulting from doing multiple tests from the same data set, we used a bootstrapping procedure when running the logistic regressions on the various merits decisions. This procedure consisted of first resampling the original data to construct fifty samples with the original size. Thus, we had 949 observations, and from that we took a random sample of 949 fifty different times (1,244 different times when primary plus secondary technology areas were combined). Each random sample from the original 949 observations is clearly *not* identical to the original 949 observation sample because of the randomness of the samples—randomness will miss some of the observations and duplicate others.

We then ran the logistic regression on the first random sample and generated a coefficient, standard error, and *p*-value. Random sample 1 was then added to the original data set of 949 observations. Then, random sample 2 was taken, another logistic regression was run on this second sample, and a second coefficient was generated, along with a standard error and *p*-value. Random sample 2 was then added back into the set consisting of the original 949 observations plus the first random sample. This process was repeated a total of fifty times. Finally, we averaged the fifty coefficients and derived a final standard error and *p*-value. Note that we clustered on the standard errors of the unique patent numbers when running each of the fifty logistic regressions. Also, the combination of bootstrapping and standard-error clustering was employed for each regression model—there was a separate regression model for each of the merits outcomes. We were required to do separate logits on each merits outcome, and could not combine all of these outcomes into a single multinomial regression model because the different outcomes possible for each patent were not independent of one another. *See generally* Joseph P. Romano et al., *Control of the False Discovery Rate Under Dependence Using the Bootstrap and Subsampling*, 17 TEST 417 (2008) (discussing the merits of the bootstrap method to control for a false discovery rate while testing *s* null hypotheses simultaneously).

find that mechanical, biotechnology, and software patents litigated to judgment are significantly less likely to succeed overall even when we factor in each of these variables about the patents and the lawsuits. The result is highly significant ($p<0.001$ in each case). Patents in each of those three technology areas were significantly more likely to be held invalid than chemical patents ($p<0.001$ in mechanical and biotechnology, $p<0.01$ in software). And patents in the biotechnology and software areas (but not mechanics) were significantly less likely to be found infringed than chemical patents ($p<0.001$).

It bears repeating that multivariate regression analysis assumes that all variables are independent of one another, but that this assumption does not hold when one studies patent infringement litigation. There are several reasons for this: (1) many cases involve the assertion of multiple patents, and decisions about these patents are made by the same judge and jury; (2) it is common to find in a data set that the same patent has been litigated in more than one separate lawsuit against different defendants, and even though the decision makers may be different, the same patent has the same attributes in each case; and (3) some cases will be consolidated, with the same decision maker deciding certain issues—usually only pretrial summary judgments, but sometimes trial decisions as well. To account for the lack of complete independence among observations, we clustered on the standard errors of the unique patent numbers.

We ran a second regression that included both technology areas and the district in which the lawsuit was filed. We present the results in Appendix B. Our prior paper had found that patentees were more likely to prevail in some districts than others. While that remained true after controlling for technology, the technology differences remain highly significant even

after controlling for district. Compared to chemical patents and controlling for districts, patents in the mechanical, biotechnology, optics, and software industries were less likely to prevail overall ($p<0.001$ for mechanical, biotechnology, and software patents and $p<0.01$ for optics). Mechanical and software patents were more likely to be invalidated than chemical patents ($p<0.001$), and mechanical, electronics, optics, and software patents were less likely to be found infringed ($p<0.001$ for electronics, optics, and software and $p<0.01$ for mechanics).

We also ran an alternate specification in which we distinguished business method software patents from software patents that were actually directed to technology. In that specification, reported in Appendix C, we incorporate both patent and lawsuit characteristics and a somewhat truncated set of district dummies representing the top 13 districts.[71] Some of the districts remain significant – the Eastern District of Texas is significantly more likely to rule for patentees ($p<0.01$), while the Northern District of Texas is more likely to rule against them ($p<0.001$). The technology areas are all significant. Relative to chemical patents (the excluded variable) and taking account of both patent and lawsuit characteristics and district, every other type of technology is significantly less likely to have a patentee win. For software, business method, and mechanical patents this result is highly significant ($p<0.001$). It is significant at the 99% confidence level in biotechnology and at the 95% confidence level for electronics and optics.

C. Outcomes by Industry

In the previous section we focused on the technology at issue in the patent. In this section we look at the outcomes by industry. As we explained in Part II, technology and

[71] We could not include the full set of districts because of limits on the degrees of freedom.

industry, while often overlapping, are not the same. Some software patents are owned by companies in the business of making and selling software, but not all; software patents are also deployed in the electronics, telecommunications, automotive, and a variety of other industries. Similarly, while chemical patents share the same type of technology, it is useful to distinguish pharmaceutical industry patents from other types of chemical patents because of the special rules and incentives that exist in the pharmaceutical industry.[72] For the same reason, medical devices may have different characteristics than other kinds of mechanical devices. Accordingly, in this section we ignore the nature of the technology claimed and focus on the industry in which the patent is deployed.

As with technology area, we find significant differences in overall outcomes by industry. Table 8 reports the overall patentee win rate by industry. As with technology, biotechnology industry patent owners fared the poorest, winning only 8.3% of the cases definitively resolved in our data set. Patentees also fared poorly in communications (14.8% win rate), consumer goods (15.1% win rate), construction (15% win rate), and computer and electronics (17.1% win rate). By contrast, patentees won a majority of cases in the pharmaceutical industry (51.6%) and a significant number in the energy industry (40%). These differences are highly significant (p=0.000).

Table 9
Overall Patentee Win Rate by Industry

Patent Owner Definitive Winner	Computer & Other Electronics	Semiconductor	Pharmaceutical	Medical Devices & Methods	Biotech	Communications

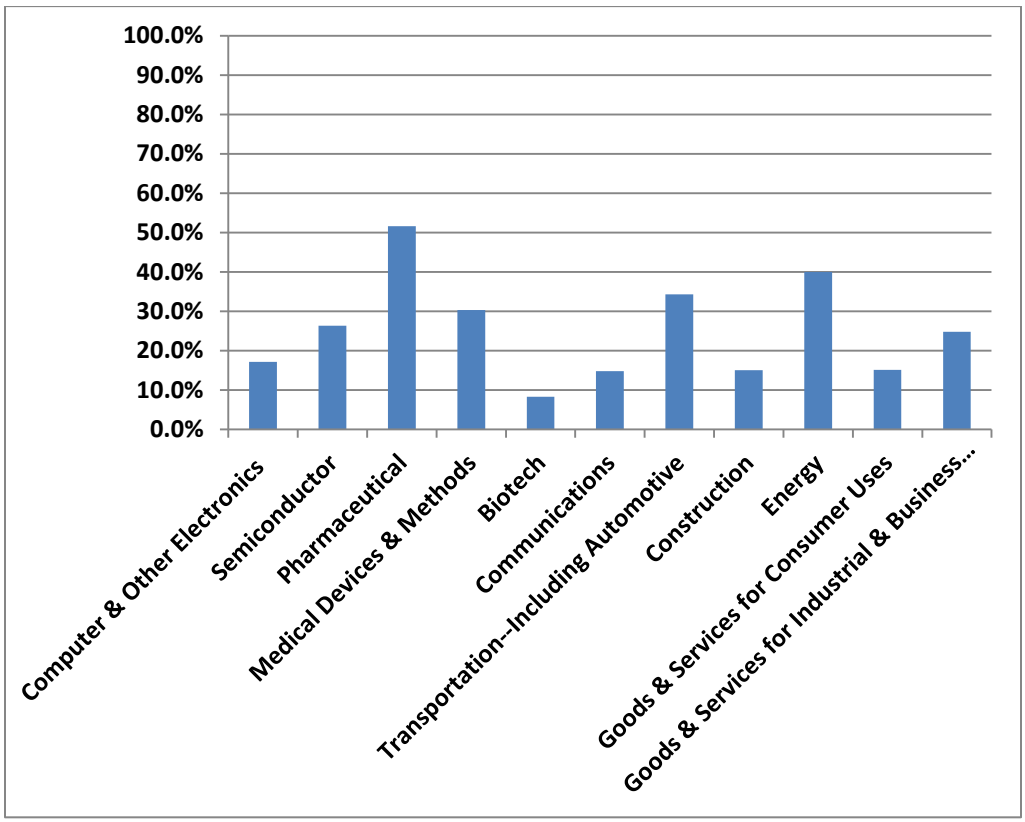
[72] For a discussion of those rules, see 1 Herbert Hovenkamp et al., **IP and Antitrust** §15.2c.

Freq	14	5	49	20	2	12
%	17.1%	26.3%	51.6%	30.3%	8.3%	14.8%
Total	82	19	95	66	24	81

Patent Owner Definitive Winner	**Transportation --Including Automotive**	**Construction**	**Energy**	**Goods & Services for Consumer Uses**	**Goods & Services for Industrial & Business Uses**	**Total**
Freq	12	3	6	13	28	164
%	34.3%	15.0%	40.0%	15.1%	24.8%	25.8%
Total	35	20	15	86	113	636

Pearson chi2(10) = 55.1966 Pr = 0.000

Figure 6
Patentee Win Rate by Industry



Tables 10 and 11 break down the results by industry for the accused infringer's success rate on invalidity and the patent owner's success rate on infringement.

Table 10
Invalidity Rate by Industry

Invalidity-All--Any stage	Computer & Other Electronics	Semiconductor	Pharmaceutical	Medical Devices & Methods	Biotech	Communications
Freq	22	3	19	25	8	29
%	46.8%	21.4%	25.7%	53.2%	72.7%	43.3%
Total	47	14	74	47	11	67

Invalidity-All--Any stage	Transportation--Including Automotive	Construction	Energy	Goods & Services for Consumer Uses	Goods & Services for Industrial & Business Uses	Total
Freq	13	8	2	23	36	188
%	59.1%	80.0%	11.8%	47.9%	42.9%	42.6%
Total	22	10	17	48	84	441

Pearson chi2(10) = 33.1555 Pr = 0.000

Table 11
Findings of Infringement by Industry

Direct Infringement (Literal + DOE)-Any stage	Computer & Other Electronics	Semiconductor	Pharmaceutical	Medical Devices & Methods	Biotech	Communications
Freq	21	4	51	15	8	10
%	26.3%	22.2%	68.0%	29.4%	36.4%	16.7%
Total	80	18	75	51	22	60

Direct Infringement (Literal + DOE)-Any stage	Transportation--Including Automotive	Construction	Energy	Goods & Services for Consumer Uses	Goods & Services for Industrial & Business Uses	Total
Freq	15	12	8	13	40	197
%	53.6%	52.2%	47.1%	18.1%	40.4%	36.1%
Total	28	23	17	72	99	545

Pearson chi2(10) = 66.8513 Pr = 0.000

Figure 7
Invalidity Rulings by Industry[73]

[73] Validity and invalidity decisions conditioned on a final determination of a validity dispute.

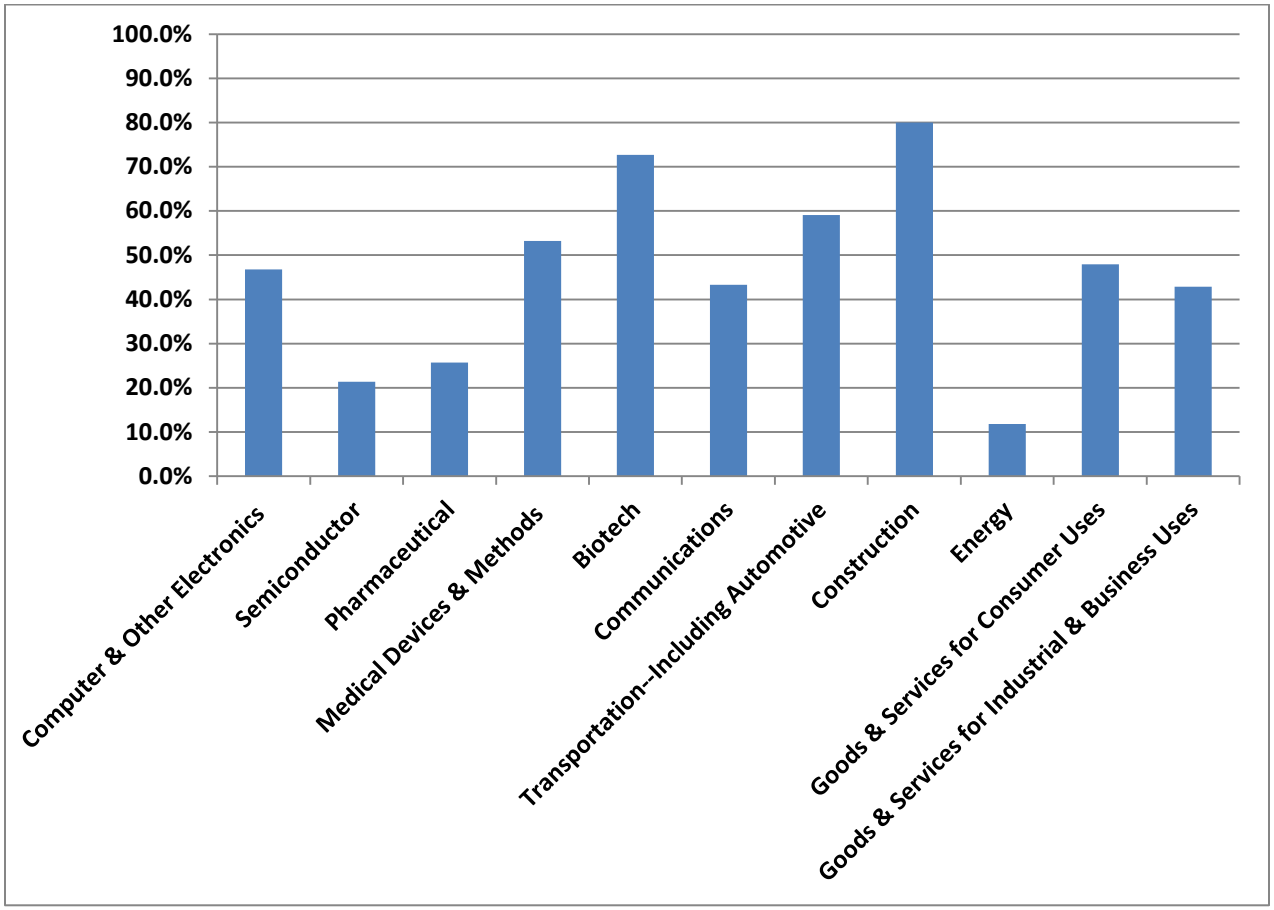
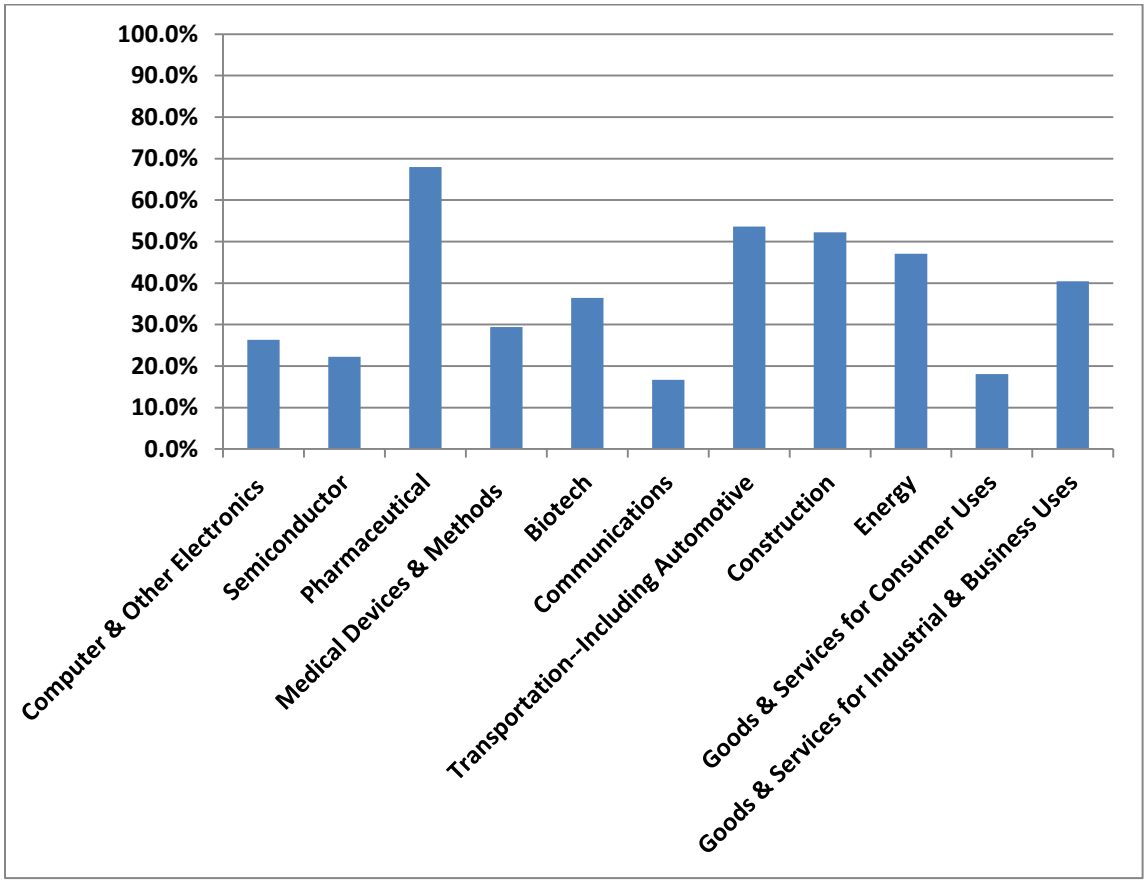


Figure 8
Infringement Findings by Industry[74]

[74] Infringement decisions conditioned on a final determination of an infringement dispute.



Both invalidity and infringement show significant differences by industry. Patentees won on infringement only 18.1% of the time in consumer goods and 16.7% of the time in communications. Computer and electronics and semiconductor cases were also significantly less likely than average to result in a patentee win on infringement. By contrast, patentees won a majority of the infringement disputes in the transportation and construction industries and over two-thirds of the infringement disputes in the pharmaceutical industry. The last result is not too surprising, given that many pharmaceutical patent cases are filed against generics who

copy the technology in order to take advantage of the regulatory benefits of selling a bioequivalent drug.[75]

The invalidity results tell a rather different story. Patentees lost a majority of invalidity disputes in the transportation and medical device industries, nearly three-quarters of the validity disputes in the biotech industry,[76] and a whopping 80% of the invalidity claims in construction. By contrast, patentees fared far better in energy, semiconductors, and pharmaceuticals, where a quarter or less of invalidity challenges succeeded.

As with the technology results, we cannot simply add up the percentages to get a full picture of outcomes, because in many industries courts resolved far fewer disputes of one type than another. For instance, while the percentage of biotech industry patents that was invalidated was higher than the percentage of biotech industry patents held noninfringed, there were actually more findings of noninfringement than invalidity in that industry, simply because there were more motions filed. The same is true of the communications industry.

As for the procedural posture of the cases, our results are not driven by industry differences in trial outcomes or summary judgments of noninfringement; in neither case were our results statistically significant. What is significant are the industry-specific differences in rulings on summary judgment of invalidity, as we see in Table 12. While just over 30% of invalidity summary judgment motions were granted across our entire data set, industry differences range from a motion success rate of 0% in the energy industry (none of the 17

[75] *See, e.g.,* Christopher A. Cotropia & Mark A. Lemley, *Copying in Patent Law*, 87 **N.C. L. Rev.** 1421 (2009) (finding more copying among pharmaceutical patents than other industries).

[76] Recall from our previous discussion that there is a biotech technology area, and also a biotech industry category. The latter consists of those biotech patents that purported to advance the state of the art in biotech research. A substantial majority of the patents from the biotech technology area, however, were placed in the medical and pharmaceutical industry categories.

motions filed prevailed) to the biotech industry, where a majority of filed invalidity motions prevailed.

Table 12
Win Rate on Summary Judgment of Invalidity by Industry

SJ Invalidity-All Grounds	Computer & Other Electronics	Semiconductor	Pharmaceutical	Medical Devices & Methods	Biotech	Communications
Freq	15	3	5	12	9	24
%	28.8%	27.3%	17.9%	25.5%	56.3%	39.3%
Total	52	11	28	47	16	61

SJ Invalidity-All Grounds	Transportation--Including Automotive	Construction	Energy	Goods & Services for Consumer Uses	Goods & Services for Industrial & Business Uses	Total
Freq	10	1	0	19	33	131
%	40.0%	7.7%	0.0%	33.3%	33.3%	30.8%
Total	25	13	17	57	99	426

Pearson chi2(10) = 22.2267 Pr = 0.014

As with technology areas, the grounds for invalidity in our dataset differed significantly by industry. While there was no significant difference in rulings based on prior art under section 102,[77] and the differences in findings of invalidity based on inadequate disclosure (enablement or written description) were significant but modest, findings of obviousness and indefiniteness differed significantly by industry. While less than 30% of obviousness challenges were successful, the win rate for those arguments ranged from a high of 77.8% in construction and 54.2% in consumer goods to 0% in semiconductors, energy, and biotechnology. The cross-

[77] 35 U.S.C. § 102.

industry differences were highly significant (p=0.000), though we caution that the small numbers in some of these categories counsel caution in drawing broad conclusions. The fact that the only two biotechnology obviousness challenges failed, for example, does not mean that future challenges always will.

Indefiniteness arguments were primarily successful in the computer and electronics, communications, and industrial goods industries. In other industries, by contrast, notably pharmaceutical and energy, indefiniteness arguments never succeeded.

Table 13
Grounds for Invalidity by Industry

Invalidity-102 Prior Art-All--Any stage	Computer & Other Electronics	Semiconductor	Pharmaceutical	Medical Devices & Methods	Biotech	Communications
Freq	11	1	7	5	0	13
%	39.3%	14.3%	17.1%	20.8%	0.0%	44.8%
Total	28	7	41	24	2	29

Invalidity-102 Prior Art-All--Any stage	Transportation--Including Automotive	Construction	Energy	Goods & Services for Consumer Uses	Goods & Services for Industrial & Business Uses	Total
Freq	7	5	2	8	13	72
%	50.0%	50.0%	16.7%	34.8%	31.7%	31.2%
Total	14	10	12	23	41	231

Pearson chi2(10) = 15.4983 Pr = 0.115

Invaldity-103-Obviousness--Any Stage	Computer & Other Electronics	Semiconductor	Pharmaceutical	Medical Devices & Methods	Biotech	Communications
Freq	7	0	8	16	0	8
%	28.0%	0.0%	14.3%	44.4%	0.0%	36.4%
Total	25	8	56	36	2	22

Invaldity-103-Obviousness--Any Stage	Transportation--Including Automotive	Construction	Energy	Goods & Services for Consumer Uses	Goods & Services for Industrial & Business Uses	Total
Freq	5	7	0	13	8	72
%	33.3%	77.8%	0.0%	54.2%	23.5%	29.9%
Total	15	9	10	24	34	241

Pearson chi2(10) = 36.5050 Pr = 0.000

Invalidity-112-Inadequate Disclosure-Any stage	Computer & Other Electronics	Semiconductor	Pharmaceutical	Medical Devices & Methods	Biotech	Communications
Freq	1	1	7	3	1	4
%	20.0%	25.0%	21.2%	12.0%	50.0%	28.6%
Total	5	4	33	25	2	14

Invalidity-112-Inadequate Disclosure-Any stage	Transportation--Including Automotive	Construction	Energy	Goods & Services for Consumer Uses	Goods & Services for Industrial & Business Uses	Total
Freq	1	4	0	3	5	30
%	50.0%	100.0%	0.0%	27.3%	21.7%	22.2%
Total	2	4	12	11	23	135

Pearson chi2(10) = 24.4367 Pr = 0.007

As we did with technology areas, we ran multivariate regressions that incorporated the characteristics of patents and lawsuits alongside the industry variables. We present the results in Appendix C. Controlling for patent and lawsuit characteristics, patent owners in the pharmaceutical ($p<0.001$), medical devices/methods ($p<0.01$), and transportation/automotive ($p<0.05$) industries were significantly more likely to than in the consumer goods industry (the omitted variable used as a "comparison dummy" against which to compare the other industries). Pharmaceutical and transportation/automotive industry patents were more likely to be found infringed ($p<0.001$), but transportation patents were also more likely to be held invalid for lack of adequate disclosure ($p<0.001$).

We find similar results when we control for districts. We present the results in Appendix D. Compared to patentees in consumer goods, patentees were more likely to win overall in the pharmaceutical ($p<0.001$), transportation, medical devices (both $p<0.01$) and semiconductor ($p<0.05$) industries. Pharmaceutical patents were more likely to be found infringed ($p<0.001$) than those in consumer goods. Energy patents were significantly less likely to be held invalid than consumer goods patents, both overall and on the basis of prior art ($p<0.001$).

Finally, we ran an omnibus regression in which we combined the patent, lawsuit, and district variables along with industry characteristics. In this omnibus specification, we included only three important districts (the Eastern District of Texas, the District of Delaware, and the Northern District of California).[78] We present the results in Appendix F. Not surprisingly, the

[78] We did not have sufficient degrees of freedom to run a regression including the full set of district dummies.

inclusion of so many variables reduced the significance of some results. Nonetheless, the number of asserted patents in the Eastern District of Texas remained significantly associated with an overall patentee win rate ($p<0.001$ for both variables).[79] Pharmaceutical industry patents were significantly more likely to win overall ($p<0.01$) than consumer goods patents (the comparison dummy), as were transportation/automotive patents ($p<0.05$). Pharmaceutical and energy industry patents were less likely to be held invalid ($p<0.05$) than those in the consumer goods industry and pharmaceutical, transportation, and energy patents were more likely to be infringed ($p<0.001$ than pharmaceuticals and $p<0.01$ for transportation and energy) than consumer goods.

IV. Implications

The outcomes of litigation in our dataset vary significantly by the type of patented technology and the industry in which the parties operate. Across both invalidity and infringement, and regardless whether we look at industry or technology, chemical and pharmaceutical patents fare better than virtually any other type of patent. With these notable exceptions, patentees lose the large majority of cases that are litigated to judgment. What can

[79] Notably, many judges in the Eastern District of Texas require parties to seek permission before filing a summary judgment motion. That may artificially reduce the number of summary judgments in the Eastern District of Texas and, because summary judgment grants disproportionately favor defendants compared to jury trials, contribute to the greater patentee win rate in that district. On the other hand, the judges in the Eastern District of Texas may have denied summary judgment in these cases even if filed, as denying permission to file may signal the judges' view on the merits of these motions.

In recent work, one of the authors found that filing in the Eastern District of Texas was not statistically significant. Mark A. Lemley, Jennifer Urban, & Su Li, *Does Familiarity Breed Contempt Among Judges Deciding Patent Cases?*, 66 **Stan. L. Rev.** 1121 (2014). But that study differed from our present one in several respects. First, it included only final determinations made by a judge, and did not include either jury trials or denials of summary judgment motions. Second, it included a different set of control variables, including individual judge fixed effects.

explain these provocative results? In this section we leave the comfortable world of hard data for the more exciting, but also more treacherous, world of speculation.

While our dataset is limited to litigated patents that reached rulings on summary judgment, trials, or appeals, it is *possible* that these patents are representative of all patents or all litigated patents. To be clear, we have no strong evidence that the patents in our dataset are representative of the general population of patents, or even representative of the population of litigated patents that do not result in a final ruling. But if the patents in our dataset are indeed representative of all patents, then our results may help explain at a high level the alleged differences between industries in the political and public policy arguments they commonly make. Even if the results are not representative of all litigated patents, they are still significant for those policy arguments, as much of the current debate over patent reform centers on allegations of patent litigation abuse.

When pharmaceutical and medical device patent owners insist that patents are strong and valuable while software companies insist that patents are overclaimed and often invalid, they may both be right. Chemistry and pharmaceutical patents in our dataset are significantly more likely to be valid and infringed than software and electronics patents, only one in eight of which (in the case of software) ultimately prevail. Somewhat surprisingly, the invalidity rate of software patents is close to that of the average patent that reaches an invalidity ruling.[80] The vast majority of software patent losses are on non-infringement. Patents in the medical device & methods industry also do quite well; communications industry patents do poorly. So if our

[80] The relatively low invalidity rate may be tied to the relatively high non-infringement rate for software. Courts and litigants may prefer to resolve disputes on non-infringement rather than invalidity. *See* Roger A. Ford, *Patent Invalidity Versus Noninfringement,* 99 **Cornell L. Rev.** 71 (2013).

results are generalizable to all litigated patents, it is understandable both that companies in both the computer and communications industries complain about a flood of suits on weak patents while pharmaceutical companies deny that such a problem exists.

And if our results are generalizable to patents more generally, we might find some comfort in our results. If we do indeed have a patent system divided by industry and technology, perhaps patent litigation is helping to render that divide the right one. The pharmaceutical and medical device/methods industries, which in theory rely on strong patent protection, seem to be getting effective protection in the courts. Meanwhile, computer industry and software technology patents, which many argue are particularly problematic,[81] overwhelmingly lose in court. Perhaps this is an example of the patent system accommodating the industry-specific differences in the desirability of patents, sorting the arguably socially valuable patents from the arguably problematic ones.[82]

There is, however, another possible explanation for our findings: that the patents litigated to summary judgment, trial, or appellate decision are not representative of all patents, or even all litigated patents. In other words, there is a potential *selection story.* If this explanation is true, then our results are still interesting, although they have less profound implications. In this alternate story, our findings tell us mainly about a subset of all patent

[81] *See, e.g.,* Lemley, *Functional Claiming*, *supra* note __, at __ (discussing this evidence).

[82] The differences we observe may also reflect variations in the concreteness of patent law doctrines by technologies. For instance, chemical patents in our dataset were found obvious in only 9.7% of patents and found indefinite in only 3.0% of patents. These relatively low rates may support the view that the patent law was stable for chemical inventions. Higher rates in other technologies may be due to more legal uncertainty. In these uncertain fields, patent prosecutors may be unsure how to properly claim inventions, and patent litigators may be uncertain how courts will react to claims and prior art. Uncertainty may also encourage more aggressive claiming in both prosecution and litigation, since those broader claims might turn out to be valid.

litigation. While our findings are from only a small subset of all lawsuits, since there is no feasible way to study outcomes of those cases that were filed but settled before judgment,[83] they are an important subset. The lawsuits in our dataset require substantial of judicial resources, they develop into our body of precedent, and parties in other cases presumably consider them when evaluating settlement. Second and more interesting, the results signify that the filtering of patents through the prosecution, litigation, and licensing systems, leaves a small and technologically uneven group of patents that reach judgment. It would mean that the filtering process itself is technology specific. That in itself is interesting.

To put in perspective our dataset relative to the universe of patents, it is typically estimated that only a small fraction, on the range of 1-2%, of issued patents are ever litigated. An unknown percentage of patents are licensed outside of litigation, although we suspect that the percentage is relatively small.[84] Most patents likely expire unlitigated, unlicensed, and uninfringed by others.[85] For those patents involved in litigation, most settle by some mutual agreement between the parties. As we discussed in Section II.C above, our dataset includes less than 10% of the filed lawsuits in the years of our study. And almost half of our dataset

[83] We cannot measure outcomes in settled cases because the terms of settlement agreements are almost always confidential. In any event, a settlement does not have a meaningful outcome on a specific issue like definiteness or infringement, reflecting instead the collective judgment of the parties both of the possible outcomes on the merits and the cost and uncertainty to reach that decision.

[84] *See, e.g.,* Mark A. Lemley, *Rational Ignorance at the Patent Office*, 94 **Nw. U. L. Rev.** 1495 (2001) (estimating that no more than 5% of patents are licensed for a royalty without litigation). Jay Walker, founder of Priceline.com and currently chairman of Walker Digital, has recently expressed the view that the patent licensing system in the U.S. is broken, leading to litigation in many cases. Jay Walker, *Fixing the Licensing System*, Patently-O Blog, (http://patentlyo.com/patent/2014/07/walker-licensing-system.html). *See also* Mark A. Lemley, *Ignoring Patents*, 2008 **Mich. St. L. Rev.** 18 (arguing that licensing disputes are often driven to litigation because targets ignore patent claims unless forced to confront them by a lawsuit).

[85] *See, e.g.,* Lemley, *Rational Ignorance*, *supra* note __; Kimberly A. Moore, *Worthless Patents*, 20 **Berkeley Tech. L.J.** 1521 (2005) (both finding that a large number of patents lapse for failure to pay even a modest maintenance fee, suggesting they are unlikely to be valuable).

comprises lawsuits with a summary judgment denial, followed by a settlement. Thus, the dataset used for the dispositive rulings analyses maybe closer to only 5% of the filed lawsuits and well under .1% of all patents. Thus, almost nineteen in twenty litigated patents are missing from our dataset, in addition to all unlitigated patents.

The law and economics literature on litigation selection effects contends that the cases that are tried, as opposed to settled, are the closest cases. More specifically, Priest and Klein suggested the tried cases should have a fifty percent plaintiff win rate.[86] Subsequent law and economics literature provides a more nuanced set of factors that affect settlement and adjudication of disputes. This more recent literature argues that deviations from the fifty percent win rate can be caused by a variety of factors, including asymmetric stakes, costs, and risk profiles; agency costs; endowment effects; and other complicating factors.[87] Our results, including the win rate data from each of summary judgment, trial, and appeal, are inconsistent with the strong Priest-Klein fifty percent hypotheses. The selection stories that we propound below can be viewed as engaging with the law and economics literature that offers factors to explain deviations from the fifty percent win rate. More particularly, we translate these factors into various incentives found in patent litigation, which an emphasis on differences along

[86] George L. Priest & Benjamin Klein, *The Selection of Disputes for Litigation*, 13 **J. Legal Stud.** 1, 16–17 (1984). Others have criticized the relevance of the strong Priest-Klein theory to patent litigation. *See e.g.,* Jason Rantanen, *Why Priest-Klein Cannot Apply to Individual Issues in Patent Cases,* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2132810 (working paper 2012); David L. Schwartz, *Pre-Markman Reversal Rates,* 43 **Loy. L.A. L. Rev.** 1073, 1101-07 (2010).

[87] See, e.g., Kevin M. Clermont, *Litigation Realities Redux*, 84 **Notre Dame L. Rev.** 1919, 1951–56 (2009); Kevin M. Clermont & Theodore Eisenberg, *Litigation Realities*, 88 **Cornell L. Rev.** 119, 137–40 (2002; Daniel Kessler, Thomas Meites & Geoffrey Miller, *Explaining Deviations from the Fifty-Percent Rule: A Multimodal Approach to the Selection of Cases for Litigation*, 25 **J. Legal Stud.** 233, 237, 242–48 (1996).

technology and industry lines. Or our selection stories may be further evidence that the Priest-Klein fifty percent theory itself is inaccurate.[88]

Turning now to the selection story, if the patents that reach a filed lawsuit differ by industry or technology, this could partially or fully explain our results. Similarly, if the litigated patents that settle before reaching trial or summary judgment differ by industry or technology, this also could explain our findings. Below we set forth several potential selection stories, which are areas for future research. The stories below are not intended to be an exhaustive list of potential selection stories.

One selection story relates to the particulars of pharmaceutical industry patent litigation. Generic drug litigation occurs under the Hatch-Waxman Act, which separates these cases from other garden variety patent infringement litigation. Before filing the lawsuit, the branded drug patentee has an FDA granted monopoly. The status quo is no competition, and there can be no direct infringement until the FDA approves the generic's drug application, which in turn usually cannot happen until pending litigation is resolved.[89]

Pharmaceutical industry patent cases also routinely involve drugs with large market shares, prices, or profits. The costs of litigation to the branded manufacturer typically are small relative to the drug profits.[90] These facts might push the branded companies to refuse to settle strong cases because they will win anyway. In fact, however, brand owners may have even

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[88] Steve Shavell, for instance, has argued that Priest and Klein are wrong and that any plaintiff win rate is possible. Steven Shavell, *Any Frequency of Plaintiff Victory at Trial Is Possible*, 25 **J. Legal Stud.** 493 (1996).

[89] For a discussion of these rules, see, e.g., C. Scott Hemphill & Mark A. Lemley, *Earning Exclusivity: Generic Drug Incentives and the Hatch-Waxman Act*, 77 **Antitrust L.J.** 947 (2011).

[90] Several pharmaceutical patent litigators told us that the branded manufacturer typically spends more money on litigation in a given case than its generic counterpart. We have not been able to verify this claim or locate empirical support for it.

stronger incentives than other patent owners to settle their case. Because pharmaceutical patent owners will face no generic competition unless they lose the patent case, they have often paid their generic challengers to drop their challenges,[91] in effect splitting the monopoly profits with the generic rather than taking that the risk that the patent will be held invalid. Thus, unlike patentees in the other industries, branded drug companies (the patent owners) sometimes offer to pay money to a generic, which is commonly known as a reverse payment. Such reverse payment settlements were extremely common during the period of our dataset, though recent antitrust scrutiny may make them less likely in the future.[92]

These different incentives make the direct comparison to "regular" patent litigation difficult. That said, it is not obvious that the selection story explains our results. The willingness of brand owners to use reverse payments to settle disputes might suggest that only particularly weak invalidity challenges (valid patents) go to judgment, because only in those cases is the patentee willing to take a chance on a court outcome. But it could suggest the opposite – that generics lured by the promise of a reverse payment will refuse to settle only their strongest challenges.[93] The ANDA process itself may encourage weak drug challenges, with little downside risk to the generic except for paying its own lawyers.[94] The most we can say about the selection story as an explanation for our pharmaceutical industry results is that patent

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[91] The Federal Trade Commission collects such all pharmaceutical patent settlements and reports on them annually. During the period before *Actavis*, there were dozens of such reverse-payment settlements each year. *See, e.g.,* 1 **Herbert Hovenkamp et al., IP and Antitrust** §15.2c1 (2013 Supp.).

[92] *See, e.g.,* FTC v. Actavis Inc., 133 S.Ct. 2223 (2013) (holding that reverse payments are not presumptively illegal but still may violate the antitrust laws under a Rule of Reason analysis).

[93] A generic that manages to enter before the expiration of a patent, either by settling or by invalidating the patent, is entitled to 180 days of "generic exclusivity" during which no other generic can enter the market. This generic exclusivity period is often more lucrative to the generic than the entire period of open competition that follows. *See, e.g.,* Hemphill & Lemley, *supra* note __.

[94] *See id*.

litigation in the pharmaceutical industry has a variety of incentives that are distinct from other patent litigation, which may result in a different mix of patents surviving until adjudication.

Unlike pharmaceutical litigation, computer industry patent litigation, the majority of which involves software patents, is more similar to patent litigation in other technologies. However, there are several potential selection stories that may cause different lawsuits to reach a merits ruling in software as compared to other technologies. The first relates to non-practicing entities ("NPEs"), —generally companies that do not make and sell products— because there likely are more NPE lawsuits in the software field than in the mechanical, chemical, or other technology fields. Using the current data set augmented by data on the types of entities that own the patent, we plan in future work to study how, if at all, the entity status of the patent holder relates to outcomes. The settlement incentives in NPE litigation differ from those in competitor litigation. NPEs have fewer available settlement options than operating companies do.[95] Importantly, they typically cannot settle by means of cross licenses or other business deals. Separately, NPEs are unlikely to be entitled to injunctive relief if they prevail. Both of these affect settlement. Because NPEs are only interested in a monetary payment, they may be more likely to settle cases than companies whose incentives are asymmetric. The evidence that exists is mixed on differences between NPE and non-NPE settlement rates.[96]

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[95] Lemley & Melamed, *Missing the Forest for the Trolls*, *supra* note 48.

[96] *Compare* Allison et al., *Patent Quality*, *supra* note __ (finding that, of the most litigated patents, the NPE settlement rate was not statistically different from the non-NPE settlement rate) with Michael Risch, *A Generation of Patent Litigation* (working paper 2014) (finding that the most litigious non-practicing entities have a higher settlement rate than a matched set of once litigated patents). Notably, both the Allison et al. and Risch studies over-sampled repeat litigants (the focus of those studies) and therefore are not strictly representative of the population as a whole.

Moreover, most NPEs have fewer reputational concerns than operating companies.[97] One might expect NPEs unconstrained by these concerns to assert weaker patents. Pointing in the other direction, NPEs' primary assets are patents. It would be extremely bad for business if their patents are adjudicated invalid or not infringed. Their entire revenue stream for that patent may disappear, and they lack a commercial product to profit from. For this reason, some have speculated that NPEs may be more risk averse than a similarly situated practicing entity.[98] There are other differences as well, including that the large defendants in the computer industry cases may have more resources to litigate than smaller plaintiffs, which is the opposite of the resource allocation in pharmaceutical cases. There may be more defendants in the average software case, which likely increases the possibility that at least one accused infringer maintains the case through summary judgment. These could affect which software patents reach adjudication.

A second potential selection story relates to the products offered in the computer and electronics industry, which differ from those in some other industries. Products like smartphones involve numerous subcomponents, each of which may be covered by one or more patents. In other industries, particularly in pharmaceuticals, the ratio of patents to products is almost certainly much smaller. When the patented invention purportedly covers but a small component of the product, it may be easier to design around. Designing around, even after litigation has commenced, curtails ongoing damages. Curtailing damages reduces the potential liability and increases the ratio of attorneys' fees to recovery for a patent holder. This may

[97] Lemley & Melamed, *supra* note __.

[98] There is conflicting evidence on settlement rates. Allison et al., *Patent Quality*, *supra* note __; Risch, *supra* note __.

encourage patent holders and accused infringers to settle all cases, as the transaction costs may overwhelm the amount in dispute. Indeed, evidence suggests that some plaintiffs in those industries intentionally aim to obtain a cost-of-litigation defense.[99] Those cases should rationally settle regardless of their merit, making it hard to know how their existence affects selection among software patents.[100] There may be differences in litigation strategies by industry, with patent owners being more willing to take weak cases to judgment in the computer and electronics industry.

A related phenomenon is the rise of contingent fee representation, primarily in the computer and communications industries. The fact that a plaintiff is being represented on a contingent fee basis strongly influences settlement incentives.[101] It also reduces the plaintiff's upfront transaction costs (fees and often expenses) relative to the amount in dispute and relative to the upfront expense the defendant must incur. Settlement strategy is based on a combination of the perceived merits of the case (validity and infringement), damages, and the cost of defense. Contingent fee representation may affect the type of cases that go to judgment. Again, however, it is hard to tell what that effect would be. In theory, contingent-fee lawyers may be more likely to seek early settlement, which generates revenue for them with a minimum of work, while in theory hourly billing lawyers may be more willing to continue

[99] Colleen V. Chien, *Patent Assertion Entities,* *http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2187314* (reporting results of an RPX survey of 78 companies that found that in the majority of NPE lawsuits (defined broadly), the legal costs exceed the settlement amount). Lemley and Melamed refer to these as "bottom feeder" plaintiffs. Lemley & Melamed, *supra* note __. We are not aware of a comparable survey of legal costs and settlement amounts of practicing entity litigation.

[100] If there are a large number of computer & electronics industry lawsuits that both settle for nuisance value and are weak patents (either likely invalid or not infringed), then our estimates of the patentee success rate may be higher than the success rate of all litigated software patents.

[101] David L. Schwartz, *The Rise of Contingent Fee Representatives in Patent Litigation*, 64 **Ala. L. Rev. 335** (2012)**.**

to litigate regardless of the merits or benefits to the client, as that approach generates extra revenue for the lawyers.[102] And the asymmetry between plaintiffs and defendants early-stage litigation costs may encourage the bottom-feeder litigation model in cases. These factors certainly have an effect on which cases are selected for final judgment. But again, it is hard to tell what that effect will be. We might expect plaintiffs represented by contingent-fee lawyers to bring more (and weaker) cases than other plaintiffs. Or because the contingent lawyers screen cases before accepting to handle them on a contingent basis, the lawsuits brought may be stronger than other plaintiffs' lawsuits. Plaintiffs represented on a contingency may be more likely to settle those cases.

Investigating these potential selection stories in great detail is beyond the scope of this Article. Importantly, we do not have the technology and industry classifications for all of the 2008 and 2009 lawsuits that were filed and settled before a dispositive motion or trial. Our dataset does, however, include patent holder interim wins. We recorded a patent owner interim win when summary judgment was denied and there was no further resolution of the dispute on the merits. These cases included settled cases as well as cases that were still pending as of the time of our coding (summer of 2013). Within patentee interim wins, we also included accused infringer victories that were vacated and remanded by the Federal Circuit. Although interim wins do not permit us to fully evaluate the selection stories, they shed light on selection between the patents that reach a summary judgment ruling and those that reach a definitive ruling.

[102] To be sure, these broad generalizations are tempered by legal ethic rules that require lawyers put their clients' interests first.

The distribution of interim and dispositive resolutions varies by technology and industry. As shown in Table 14 below, pharmaceutical patent trials are almost all bench trials, while software, biotech, and mechanical technologies are nearly all jury trials. Litigants may view whether a jury or judge will decide the case as a factor in settlement. In pharmaceutical patents, over three quarters of the definitive winners came at trial, as opposed to summary judgment. Biotech patents, on the other hand, were conclusively resolved on summary judgment 86.5% of the time. And over half of the pharmaceutical trials occur without the court having previously considered a summary judgment motion. In other words, there was no previous motion to resolve the case on the papers. The lack of summary judgment rulings may be related to bench trials. Courts may be less willing to consider summary judgment in cases without a jury trial demand. That said, the lack of summary judgment rulings in these cases may affect which cases reach trial. The software, biotech, and mechanical procedural dispositions appear quite different.[103]

[103] In Table 14, the total number of trials does not exactly match the number of trials with definitive winners. This is because the results of one patent software trial and three mechanical software patent trials were reversed on appeal. If a trial's results were vacated on appeal, we did not include it as a definitive win

Table 14
Trial and Disposition Rates for Certain Technologies and Industries

Jury Trials	Pharmaceuticals	Software	Mechanical	Biotech
Freq	3	63	74	5
%	4.1%	94.0%	94.9%	100%
Total Trials (Jury and Non-Jury)	71	67	78	5

Definitive Rulings at Trial (not summary judgment)	Pharmaceuticals	Software	Mechanical	Biotech
Freq	74	66	75	5
%	77.9%	29.7%	45.2%	13.5%
Total Definitive Rulings (including SJ)	95	222	166	37

Trials without a prior summary judgment ruling	Pharmaceuticals	Software	Mechanical	Biotech
Freq	42	18	22	1
%	56.8%	27.3%	29.3%	20.0%
Total	74	66	75	5

Patentee interim wins differ by industry and technology. Many of these cases involve settlements,[104] which often (though not always) result in money being paid to the patent

[104] Our data in its present form does not permit us to cleanly distinguish between those interim wins with a subsequent settlement and those interim wins that are still pending. When originally coding, we did not record whether the case settled, but only whether Lex Machina indicated that the case was pending at the district court. To give a sense of distribution between likely settlements and pending

holder. In Table 15 below, we count patentee interim wins as patentee wins. Of course, if these interim winner patents had gone to full adjudication, they would not have all prevailed. But using this metric, the win rate gap shrinks, although not entirely, between pharmaceutical, software, biotech, and mechanical patents.

Table 15
Win Rates including Interim Wins as Patentee Wins

Win Rate	Pharmaceuticals	Software	Mechanical	Biotech
Patent Owner Interim Wins	14	100	97	14
Definitive Patent Owner Wins	49	29	45	3
Total (Patent Owner Interim + Definitive Wins)	63	129	142	17
%	57.8%	40.1%	54.0%	33.3%
Total (Patent Owner Interim + All Definitive)	109	322	263	51

In sum, patentee interim wins seem to vary by technology and industry. We believe that substantially more work must be completed to understand and assess the selection stories.

cases, we note that almost 90% of the patentee interim wins in our dataset involve cases that have a termination date, per Lex Machina, at the trial court. These likely involve settlements.

Even beyond selection characteristics by technology or industry, there are several other potential concerns. For instance, we cannot rule out the possibility that experienced lawyers are aware of the likelihood of winning on various issues, including the likelihood based upon technology or industry. The lawyers may adjust which cases they settle, and even which patents they assert, based upon their knowledge of win rates on summary judgment and trial.

Separately, we also cannot measure whether the media or general academic discourse influenced any of the judicial rulings. In other contexts, there is evidence that extralegal factors may influence judicial decision-making.[105] Software patents have been loudly criticized in the press and by many academics. Judges may be influenced by the dialog, whether via personal contacts at meetings discussing software patents or indirectly through exposure to newspaper op-eds.

Moving beyond the computer/electronics and pharmaceutical industries, there is one technology and industry that is a startling anomaly: biotechnology. Most of the scholarly discussions about the industry-specific nature of the patent system put biotechnology with pharmaceuticals and medical devices as industries that rely heavily on strong patent protection.[106] The economic characteristics of the biotechnology industry bear some similarity to the pharmaceutical industry; both require substantial investment over a period of years

[105] See e.g., Mark A. Lemley & Shawn P. Miller, *If You Can't Beat 'Em, Join 'Em? How Sitting by Designation Affects Judicial Behavior,* http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2449349 (working paper 2014) (finding that district court judges who sit by designation at the Federal Circuit are reversed less frequently thereafter than other judges).

[106] *See, e.g.,* Burk & Lemley, **Patent Crisis**, *supra* note __, at __; Orton Huang et al., Biotechnology Patents and Start-ups ¶ 1 (2003) ("[P]atents are absolutely essential to the success of traditional biotech startups.").

before bringing a product to market.[107] Scholars have worried that the excessive fragmentation of biotechnology patents will lead to an anticommons in which no one can make products because they would have to clear too many rights.[108] But the proposed solutions to the anticommons problem have generally involved consolidating the patent rights in fewer hands, either through broader patents,[109] some sort of specific exemption,[110] or through a patent pool.[111] They have not involved arguing against biotechnology patents altogether.

Our data suggest that biotech companies have been decidedly unsuccessful when they take their patents to judgment, winning only 8% of their adjudications. Of the litigated patents in our dataset, biotech patents are much more likely to be invalidated than any other type of patent, and they are less likely than average to be infringed.[112] As a further robustness check, we transformed the unit of analysis for biotech from a per-patent analysis to a per-lawsuit analysis. This transformation was intended to evaluate whether biotech patent owners were "winning" cases on at least one patent, even if unsuccessful on other patents. Our results on a

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[107] Burk & Lemley, **Patent Crisis**, *supra* note __, at __.

[108] *See, e.g.,* Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research,* 280 **Science** 698, 698 (1998). For an articulation of the idea of the anticommons, see Michael A. Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 **Harv. L. Rev.** 621, 624 (1998). For other discussion of the characteristics of biotechnology inventions, see, e.g., Rebecca S. Eisenberg, *Proprietary Rights and the Norms of Science in Biotechnology Research*, 97 **Yale L.J.** 177 (1987); Arti K. Rai, *Regulating Scientific Research: Intellectual Property Rights and the Norms of Science*, 94 **Nw. U. L. Rev.** 77 (1999).

[109] Burk & Lemley, **Patent Crisis**, *supra* note __, at ch. 13.

[110] *See, e.g.,* Maureen A. O'Rourke, *Toward a Doctrine of Fair Use in Patent Law*, 100 **Colum. L. Rev.** 1177, 1236-39 (2000); Janice M. Mueller, *No "Dilettante Affair": Rethinking the Experimental Use Exception to Patent Infringement for Biomedical Research Tools*, 76 **Wash. L. Rev.** 1, 5 & n.23 (2001).

[111] *See, e.g.,* Michael A. Carrier, *Resolving the Patent-Antitrust Paradox Through Tripartite Innovation*, 56 **Vand. L. Rev.** 1047, 1105 (2003) ("cross-licenses and patent pools are reasonably necessary to circumvent bottlenecks in the semiconductor and biotechnology industries").

[112] *See supra* Tables 3-5 and accompanying text. This is true whether it is biotechnology industry patents or biotechnology as a technology that is at issue.

per-lawsuit basis show a similar trend to the per-patent analysis: 3 patentee definitive victories, 13 accused infringer definitive victories,[113] and 6 lawsuits that settled with at least one patent still alive.[114] Perhaps selection effects can explain these results too, though the mechanism for such a result is not obvious to us.

If our results can be generalized to all biotechnology patents, they are both surprising and potentially worrisome. If it is right that biotechnology needs strong patent protection, then it appears it is not receiving it, at least not in the patent litigation system. Litigation is, of course, only the tip of the iceberg, and it is possible that biotechnology patent owners can comfortably rely on strong licenses to provide them with effective protection even though the patents that reached judgment in our dataset were largely unsuccessful. But at the end of the day, the willingness of companies to pay for a patent license is based on the ability of the patentee to credibly threaten to enforce the patent in litigation if the licensee doesn't pay up. If that threat isn't credible, it should be hard for biotechnology patentees to effectively demand licenses outside the litigation system. This disconnect between the observable data and the apparent views of the industry makes us cautious, and we believe further research is needed. For example, we do not know whether the unsuccessful biotech patents disproportionately

[113] For the per-lawsuit analysis, we defined a patentee definitive victory as a lawsuit in which at least one patent was finally adjudicated as valid and infringed. We defined an accused infringer definitive victory as a lawsuit in which all patents were finally adjudicated as invalid and/or not infringed.

[114] In reviewing our biotech results, we noticed that there are two separate lawsuits involving the same parties, same patents, and same judge (*Illumina v. Affymetrix*): The court consolidated the lawsuits and ruled on summary judgment in both cases together, We included these as separate observations, and it would lower the number of accused infringer definitive wins by 1 if we omitted one of the lawsuits.

relied upon functional claiming. We also believe that more detailed case studies of the 2008 and 2009 biotech cases[115] or empirical study of additional years of litigation would be fruitful.

As an aside, our data on the biotechnology industry may explain why scholars have had a hard time empirically validating the anticommons theory.[116] There are a lot of patents in the biotechnology space, and many efforts (especially whole-genome testing) require collection of many different rights. But if researchers simply ignore the existence of those patents, either

[115] For those who are interested, the 2008-2009 biotech cases in our sample are: 3:08-cv-00845 INOVA Diagnostics, Inc. v. Euro-Diagnostica AB et al; 3:08-cv-04909-SI, Genentech, Inc. et al v. Sanofi-Aventis Deutschland GMBH et al; 8:08-cv-01349-MRP-SS, Billups-Rothenberg Inc. v. Associated Regional and University Pathologists, Inc. et al; 5:08-cv-05568-RMW, The Central Institute for Experimental Animals -v- The Jackson Laboratory; 5:08-cv-05590-JF, Medimmune, LLC v. PDL Biopharma, Inc.; 5:09-cv-00006-GTS-ATB, OptiGen, LLC v. International Genetics, Inc. et al; 3:09-cv-00277-bbc, Illumina, Inc. v. Affymetrix, Inc.; 4:09-cv-00686-ERW, Monsanto Company et al v. E.I. Dupont De Nemours and Company et al; 1:09-cv-04515-RWS, Association For Molecular Pathology et al v. United States Patent and Trademark Office et al; 3:09-cv-01311-GPC-JMA, AntiCancer, Inc. v. Fujifilm Medical Systems U.S.A., Inc. et al; 4:09-cv-11340-FDS, Abbott GmbH & Co., KG et al v. Centocor Ortho Biotech, Inc.; 2:09-cv-00242, Ambato Media, LLC v. Clarion Co., Ltd et al; 1:09-cv-00627-SLR, LadaTech LLC v. Illumina Inc.; 1:09-cv-05879, PSN Illinois, LLC v. GenScript Corporation; 3:09-cv-02319-BEN-NLS, Gen-Probe Incorporated v. Becton Dickinson and Company; 3:09-cv-04919-SI, Sanofi-Aventis Deutschland GMBH v. Genentech, Inc. et al; 3:09-cv-00665-bbc, Illumina, Inc. v. Affymetrix, Inc.; 2:09-cv-05675-SD, Teva Pharmaceuticals USA, Inc. v. Amgen Inc.; 4:09-cv-11362, Bayer Healthcare, LLC, v. Centocor Ortho Biotech Inc.; 4:09-cv-40002, Abbott Laboratories et al. v Bayer Healthcare, LLC; 1:08-cv-11132, E8 Pharmaceuticals LLC et al v. Affymetrix, Inc.; 1:09-cv-10112, Teva Pharmaceuticals USA, Inc. et al v. Sandoz Inc. et al.

[116] Several scholars have challenged the anticommons story in biotechnology, pointing out that there is little evidence that anticommons problems have actually impeded innovation. John P. Walsh, Charlene Cho & Wesley M. Cohen, *View from the Bench: Patents and Material Transfers*, 309 **Science** 2002, 2002-03 (2005) (finding "little empirical basis for claims that restricted access to IP is currently impeding biomedical research"); David E. Adelman, *A Fallacy of the Commons in Biotech Patent Policy*, 20 **Berkeley Tech. L.J.** 985 (2005); Christopher M. Holman, *Trends in Human Gene Patent Litigation*, 322 **Science** 198, 198-99 (2008) ("Human gene patent litigation invariably has involved an alleged infringer engaged in substantial commercial activities focused specifically on the single gene that is the subject of the asserted patent, the antithesis of a patent thicket scenario."). But see Fiona Murray & Scott Stern, *Do Formal Intellectual Property Rights Hinder Free Flow of Scientific Knowledge? An Empirical Test of the Anti-Commons Hypothesis*, 63 **J. Econ. Behav. & Org.** 648, 648 (2007) (finding that issuance of a patent reduces citations to the corresponding academic paper, suggesting an anticommons effect); Heidi L. Williams, *Intellectual Property Rights and Innovation: Evidence From the Human Genome*, http://www.nber.org/papers/w16213 (working paper 2010) (finding that granting IP rights to gene sequences reduced subsequent work using those sequences by 20-30%).

through ignorance or because they believe they will not be sued and lose, they may avoid in practice anticommons problems that should be debilitating in theory.[117]

The biotechnology puzzle calls for further investigation. It may be that the biotechnology industry is suffering from a lack of strong patent protection. If so, that should be evident in the economic and venture capital data if others recognize this shortcoming. Alternatively, it may be that the biotechnology industry is doing just fine, even if patent rights aren't sufficiently strong in the industry. If so, that should cause us to rethink the dominant narrative about the need for strong patents in that industry, and perhaps about the relationship between strong patent enforcement and innovation more generally. After all, biotechnology has been one of the poster children for the need for strong patents. Finally, it is possible that our data are outliers, and that there is something about the biotechnology patents enforced in the late 2000s that made them systematically weaker than other biotechnology patents. Eight *Myriad* patents, seven of which were invalidated by the Supreme Court, are within our dataset and may themselves partially explain the results. Furthermore, the Federal Circuit tightened the patentability standards for biotech patents from 2008 until now.[118] The litigated patents in our dataset may have been valid when issued, but invalid when adjudicated. Investigating how the biotechnology industry is using patents is beyond the scope of this paper, but our data provide a road map for future work in this area.

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[117] Indeed, the seminal Walsh et al. paper did not find that there were no significant overlaps in rights, but found instead that academic researchers simply paid no attention to those rights. Walsh et al., *supra* note __, at __. *See generally* Mark A. Lemley, *Ignoring Patents*, 2008 **Mich. St. L. Rev.** 19 (finding that inventors and companies ignore the existence of patent rights in industries in which there are too many of them).

[118] For instance, the courts expanded the written description requirement in *Ariad v. Lilly,* 598 F.3d. 1336 (Fed. Cir. 2010) (en banc)*;* reduced the patent eligibility of DNA in *Myriad*, 569 U.S. ___ (2013); and increased the likelihood of finding a patent obvious in *In re Kubin*, 561 F.3d 1351 (Fed. Cir. 2009).

Our results are interesting and in some cases quite surprising. Litigation is a complex phenomenon, and some of our results may be due to selection effects. But even if they cannot be generalized, our results suggest that the selection mechanisms for biotech and pharmaceutical industry patents differ from each other and from electronics patents for unknown reasons. And they are important in their own right for lawyers and clients who bring patent lawsuits.

V. Conclusion

Our patent system is divided. Different technologies and different industries experience the patent system very differently. We find evidence that those differences are present in patent litigation – both to overall outcomes and to the application of specific legal doctrines. Software, communications, and – surprisingly – biotechnology patent owners fare very poorly in court decisions, winning less than one case in five and, in biotechnology, less than one case in ten. These differences are dramatic, and they may have important implications for both patent theory and patent policy.

Appendix A

Full Regression Specification by Technology Area Including Patent and Lawsuit Characteristics

Top row = Coefficient; * = p<.10, ** = p<.05, *** = p<.01; Bottom row = Std. error	Patent Owner Definitive Winner	SJ Invalidity-All	SJ Noninfringement Plus Stip. Jgmt of Noninfringement	Patent Owner-Trial Winner	Invalidity-All--Any stage
Foreign Origin of Patent	0.374	-0.696*	0.0699	0.253	-1.050***
	-0.232	-0.304	-0.209	-0.325	-0.26
Adjusted Number of Citations Received	0.0598	0.0726	-0.0118	0.0187	0.0487
	-0.0823	-0.102	-0.0991	-0.116	-0.0917
Total Prior Art References	-0.00207**	0.0000359	0.00124	0.00151	0.000911
	-0.00078	-0.00082	-0.00076	-0.00193	-0.000719
Number of Claims	0.00258	-0.00741	-0.00531	-0.00682	-0.00598
	-0.0048	-0.00568	-0.00503	-0.00596	-0.00742
Age of Patent at Current Litigation Filing	-0.0293	0.0572*	0.0041	0.0269	-0.00745
	-0.0239	-0.0238	-0.0194	-0.0263	-0.0288
Number of Defendants	0.0503*	-0.0283	-0.0142	-0.00502	-0.0215
	-0.0196	-0.0227	-0.0179	-0.024	-0.0219
Number of Asserted Patents	0.129**	0.0181	0.0378	-0.1	-0.064
	-0.0404	-0.0596	-0.0421	-0.0608	-0.055
Mechanical (Primary + Secondary)	-0.998***	0.351	0.0884	0.169	1.164***
	-0.209	-0.274	-0.245	-0.339	-0.268
Electronics (Primary + Secondary)	-0.442	-0.0897	0.015	0.0045	-0.106
	-0.269	-0.269	-0.197	-0.351	-0.243
Biotech (Primary + Secondary)	-2.579***	1.185	0.451	0.121	2.444***
	-0.565	-0.663	-0.455	-0.709	-0.672
Optics (Primary + Secondary)	-0.402	-0.948	0.00466	0.318	-0.113
	-0.59	-0.514	-0.28	-0.544	-0.597
Software (Primary + Secondary)	-1.844***	0.721*	0.0697	0.00548	0.738**
	-0.226	-0.303	-0.25	-0.376	-0.286
Comparison Dummy = Chemistry					
N	636	425	508	290	441

r2_p	0.153	0.0555	0.0128	0.0233	0.0997
ll	-307.4	-247.9	-341.7	-189.8	-270.9
chi2	223.3	42.84	7.165	8.873	53.7
p	4.81E-41	0.0000241	0.847	0.714	3.09E-07

Top row = Coefficient; * = p<.10, ** = p<.05, *** = p<.01; Bottom row = Std. error	**Invalidity-102 Prior Art-All--Any stage**	**Invaldiity-103-Obviousness--Any Stage**	**Invalidity-112-Indefiniteness--Any Stage**	**Invalidity-112-Inadequate Disclosure-Any stage**	**Direct Infringement (Literal + DOE)-Any stage**
Foreign Origin of Patent	-0.757	-1.078	-0.515	-0.377	0.224
	-0.584	-0.707	-0.706	-1.09	-0.224
Adjusted Number of Citations Received	-0.0448	-0.121	0.192	0.61	0.199*
	-0.177	-0.143	-0.166	-0.326	-0.0976
Total Prior Art References	-0.00077	0.0019	-0.0029	0.00495	-0.00096
	-0.00173	-0.00115	-0.00266	-0.00269	-0.000969
Number of Claims	0.00674	0.00233	-0.0392	0.0134	0.00367
	-0.00836	-0.00792	-0.022	-0.0156	-0.0043
Age of Patent at Current Litigation Filing	0.0106	-0.0171	0.0541	0.0935	-0.0533*
	-0.0314	-0.0325	-0.0558	-0.0869	-0.021
Number of Defendants	-0.0192	0.0154	-0.0766	-0.206	0.0228
	-0.0505	-0.0488	-0.0974	-0.172	-0.0293
Number of Asserted Patents	0.0763	-0.0817	-0.158	-0.123	0.181***
	-0.0831	-0.0895	-0.164	-0.176	-0.0446
Mechanical (Primary + Secondary)	1.156*	1.585***	0.741	1.2	-0.307
	-0.462	-0.409	-0.813	-1.211	-0.311
Electronics (Primary + Secondary)	-0.639	0.412	1.621*	0.326	-1.074***
	-0.605	-0.535	-0.809	-1.208	-0.282
Biotech (Primary + Secondary)	0.889	1.042	0	2.288	-0.314
	-1.082	-0.912	0	-1.745	-0.63
Optics (Primary + Secondary)	-0.181	0.571	-0.383	0	-0.794
	-0.792	-0.863	-1.256	0	-0.509
Software (Primary + Secondary)	1.292**	0.719	1.15	0.93	-1.450***
	-0.406	-0.441	-0.646	-1.241	-0.274
Comparison Dummy = Chemistry					
N	231	241	172	119	545

r2_p	0.0925	0.135	0.198	0.269	0.159
ll	-130.1	-127.1	-65.11	-49.12	-300
chi2	20.45	35.49	26.55	13.18	109
p	0.0591	0.000392	0.00538	0.282	9.27E-18

Top row = Coefficient; * = p<.10, ** = p<.05, *** = p<.01; Bottom row = Std. error	**Invaldity-103-Obviousness--Any Stage**	**Invaldity-112-Indefiniteness--Any Stage**	**Invalidity-112-Inadequate Disclosure-Any stage**	**Direct Infringement (Literal + DOE)-Any stage**
Foreign Origin of Patent	-1.078	-0.515	-0.377	0.224
	-0.707	-0.706	-1.09	-0.224
Adjusted Number of Citations Received	-0.121	0.192	0.61	0.199*
	-0.143	-0.166	-0.326	-0.0976
Total Prior Art References	0.0019	-0.0029	0.00495	-0.00096
	-0.00115	-0.00266	-0.00269	-0.000969
Number of Claims	0.00233	-0.0392	0.0134	0.00367
	-0.00792	-0.022	-0.0156	-0.0043
Age of Patent at Current Litigation Filing (T)	-0.0171	0.0541	0.0935	-0.0533*
	-0.0325	-0.0558	-0.0869	-0.021
Number of Defendants	0.0154	-0.0766	-0.206	0.0228
	-0.0488	-0.0974	-0.172	-0.0293
Number of Asserted Patents (W)	-0.0817	-0.158	-0.123	0.181***
	-0.0895	-0.164	-0.176	-0.0446
Mechanical (Primary+Secondary)	1.585***	0.741	1.2	-0.307
	-0.409	-0.813	-1.211	-0.311
Electronics (Primary + Secondary)	0.412	1.621*	0.326	-1.074***
	-0.535	-0.809	-1.208	-0.282
Biotech (Primary + Secondary)	1.042	0	2.288	-0.314
	-0.912	0	-1.745	-0.63
Optics (Primary + Secondary)	0.571	-0.383	0	-0.794
	-0.863	-1.256	0	-0.509
Software (Primary + Secondary)	0.719	1.15	0.93	-1.450***
	-0.441	-0.646	-1.241	-0.274
Comparison Dummy = Chemistry				
N	241	172	119	545
r2_p	0.135	0.198	0.269	0.159
ll	-127.1	-65.11	-49.12	-300
chi2	35.49	26.55	13.18	109
P	0.000392	0.00538	0.282	9.27E-18

Appendix B
Full Regression Specification by Technology Area Including Districts

Top row = Coefficient; * = p<.10, ** = p<.05, *** = p<.01; Bottom row = Std. error	Patent Owner Definitive Winner	SJ Invalidity-All	SJ Noninfringement Plus Stip. Jgmt of Noninfringement	Patent Owner-Trial Winner	Invalidity-All--Any stage	Invalidity-102 Prior Art-All--Any stage
TX ED	1.495***	-1.345**	-0.631*	-0.221	-1.330**	-1.366*
	-0.418	-0.433	-0.299	-0.395	-0.421	-0.562
DE D	0.236	-0.828*	0.277	0.415	-0.176	-0.605
	-0.473	-0.339	-0.317	-0.444	-0.383	-0.544
CA ND	0.0664	-0.138	0.108	1.460*	0.665	0.484
	-0.58	-0.376	-0.406	-0.616	-0.404	-0.713
CA CD	-1.298*	0.539	0.134	0.658	0.326	1.056
	-0.633	-0.429	-0.34	-0.482	-0.634	-1.164
CA SD	-0.0538	-1.348*	-0.251	-0.438	0.0921	0.416
	-0.536	-0.685	-0.413	-0.71	-0.615	-0.715
NY SD	1.627***	-0.607	0.0811	1.285	-1.488	-0.635
	-0.436	-0.425	-0.462	-0.802	-2.704	-0.875
IL ND	-1.241*	0.655	-0.778	-0.899	-0.0516	1.178
	-0.533	-0.536	-0.409	-0.747	-0.63	-0.924
WI WD	0.883	-1.073	0.698	0	-1.792*	0
	-0.509	-0.556	-0.688	0	-0.858	0
NJ D	-0.992	0.329	-0.0621	-1.093	1.032	-0.972
	-0.81	-0.468	-0.716	-1.053	-0.643	-0.645
MA D	0	-1.585*	-0.33	-0.0758	0.295	0.374
	0	-0.733	-0.639	-0.636	-0.75	-0.896
VA ED	0.586	-1.416*	0.176	0.105	0.139	-1.02
	-0.815	-0.658	-0.488	-0.874	-0.876	-0.558
OH ND	0.108	0	0	0	-2.636***	0
	-0.748	0	0	0	-0.684	0
TX SD	1.206*	-1.972**	1.949***	0.385	-1.532**	-0.992
	-0.547	-0.67	-0.558	-0.768	-0.577	-0.675
All Other Districts (multi-collinearity too high)	0	0	0	0	0	0
	0	0	0	0	0	0
Mechanical (Primary)	-0.910***	0.466	-0.0325	0.473	1.253***	0.708
	-0.253	-0.422	-0.264	-0.568	-0.343	-0.439

Electronics (Primary)	-0.769	0.481	0.186	-0.123	0.477	-0.716
	-0.454	-0.437	-0.362	-0.662	-0.411	-0.909
Biotech (Primary)	-2.867***	1.652***	0.552	0.243	3.115	-0.196
	-0.591	-0.479	-0.363	-1.034	-2.83	-1.086
Optics (Primary)	-1.704**	-0.482	-0.273	0.568	-0.0967	-0.547
	-0.622	-0.815	-0.616	-0.589	-0.841	-1.25
Software (Primary)	-2.132***	1.043*	0.265	0.261	1.135***	0.928**
	-0.354	-0.412	-0.314	-0.539	-0.338	-0.34
Comparison Dummy = Chemistry						
N	620	417	500	281	441	221
r2_p	0.174	0.104	0.0323	0.0571	0.145	0.12
ll	-296	-232.6	-328.2	-178.2	-257.3	-122.8
chi2	.	149.2	67.34	28.9	85.78	.
p	.	3.50E-23	6.16E-08	0.0246	8.19E-11	.

Top row = Coefficient; * = p<.10, ** = p<.05, *** = p<.01; Bottom row = Std. error	**Invaldity-103-Obviousness--Any Stage**	**Invaldity-112-Indefiniteness--Any Stage**	**Invalidity-112-Inadequate Disclosure-Any stage**	**Direct Infringement (Literal + DOE)-Any stage**
TX ED	-0.426	-1.670**	0	0.898**
	-0.82	-0.582	0	-0.288
DE D	-0.48	0.0911	2.716***	-0.055
	-0.663	-0.373	-0.69	-0.348
CA ND	0.645	-0.119	1.778	-1.242*
	-0.883	-0.44	-0.984	-0.532
CA CD	0.166	0.611	0	-1.132
	-0.65	-0.622	0	-0.679
CA SD	1.01	0	3.565***	0.347
	-0.763	0	-0.806	-0.348
NY SD	0	0	0	1.354*
	0	0	0	-0.657
IL ND	1.137	-0.696	4.097**	-0.178
	-0.701	-0.941	-1.25	-0.603
WI WD	-1.385	0	0	-0.403
	-0.776	0	0	-0.525
NJ D	0.872	0	5.261***	-1.418
	-1.269	0	-1.548	-0.735

MA D	2.382	0	3.367***	-0.462
	-1.263	0	-0.934	-0.564
VA ED	-0.879	-0.407	0	-0.172
	-0.94	-1.307	0	-0.706
OH ND	0	0	0	-0.938
	0	0	0	-0.732
TX SD	0	-2.199***	0	1.061
	0	-0.475	0	-0.601
All Other Districts	0	0	0	0
(multi-collinearity too high)	0	0	0	0
Mechanical (Primary)	1.858	0	0.734	-0.791**
	-0.981	0	-0.953	-0.302
Electronics (Primary)	0.919	2.765***	-0.204	-1.441***
	-0.656	-0.406	-1.878	-0.431
Biotech (Primary)	0.709	0	2.604*	-1.106
	-0.903	0	-1.084	-0.67
Optics (Primary)	0	1.456	0	-2.607***
	0	-1.246	0	-0.693
Software (Primary)	1.301	2.163**	1.76	-2.209***
	-0.948	-0.76	-1.23	-0.36
Comparison Dummy = Chemistry				
N	206	119	82	545
r2_p	0.133	0.137	0.243	0.179
Ll	-115.6	-58.91	-39.33	-292.8
chi2	.	.	.	291.9
P	.	.	.	2.18E-51

Appendix C

Full Regression Specification by Technology with Restricted District Dummies

Top row = Coefficient; * = p<.10, ** = p<.05, *** = p<.01; Bottom row = Std. error	Patent Owner Definitive Winner	SJ Invalidity-All	SJ Noninfringement Plus Stip. Jgmt of Noninfringement	Patent Owner-Trial Winner	Invalidity-All--Any stage
Foreign Origin of Patent	0.536*	-0.823*	0.149	0.437	-1.122***
	-0.221	-0.345	-0.246	-0.429	-0.257
Adjusted Number of Citations Received	0.0332	0.0716	-0.0262	0.0733	0.0467
	-0.0949	-0.0887	-0.0664	-0.134	-0.0978
Total Prior Art References	-0.00213**	-0.00013	0.00130*	0.00162	0.000657
	-0.000704	-0.000765	-0.000658	-0.00129	-0.000662
Number of Claims	0.00242	-0.00968	-0.0056	-0.0111	-0.00563
	-0.00496	-0.00682	-0.0058	-0.00613	-0.00756
Age of Patent at Current Litigation Filing	-0.0372*	0.0847*	0.00968	0.0306	0.0112
	-0.0161	-0.0349	-0.0192	-0.0398	-0.0327
Number of Defendants	0.0212	-0.0149	-0.00759	0.0189	0.0346
	-0.0292	-0.0228	-0.0236	-0.0283	-0.0298
Number of Asserted Patents	0.0259	0.0725	0.0471	-0.127*	0.0131
	-0.0447	-0.0692	-0.0529	-0.0601	-0.0721
TX ED	1.357**	-1.247**	-0.633	-0.251	-1.463***
	-0.428	-0.457	-0.397	-0.513	-0.418
DE D	0.176	-0.724	0.277	0.44	-0.09
	-0.4	-0.501	-0.324	-0.42	-0.455
CA ND	0.134	0.00265	0.21	1.278	0.595
	-0.487	-0.331	-0.358	-0.697	-0.601
CA CD	-1.330*	0.842	0.253	0.866	0.339
	-0.579	-0.658	-0.325	-0.567	-0.615
CA SD	-0.0448	-1.352	-0.218	-0.37	0.0233
	-0.585	-0.905	-0.413	-0.465	-0.611
NY SD	1.377	-0.752	-0.103	1.820*	-1.115
	-0.785	-0.829	-0.719	-0.748	-0.691
IL ND	-1.598***	1.169	-0.734	-1.052	0.571
	-0.485	-0.863	-0.386	-0.725	-0.62
WI WD	1	-1.101	0.817	0	-1.968**
	-0.642	-0.8	-0.627	0	-0.739
NJ D	-0.929	0.488	-0.203	-1.507	1.11
	-0.653	-0.577	-0.796	-1.073	-0.802

MA D	0	-1.273	-0.196	-0.316	0.601
	0	-0.997	-0.609	-0.814	-1.057
VA ED	0.742	-1.747*	0.199	-0.0501	-0.122
	-0.771	-0.743	-0.595	-0.856	-0.932
OH ND	0.0382	0	0	0	-2.626***
	-0.676	0	0	0	-0.704
TX SD	0.972	-1.733**	2.014**	0.36	-1.300*
	-0.911	-0.613	-0.628	-0.87	-0.596
All Other Districts (multi-collinearity too high)	0	0	0	0	0
	0	0	0	0	0
Mechanical (Primary)	-0.884***	0.301	0.00617	0.5	1.370**
	-0.227	-0.523	-0.404	-0.464	-0.448
Electronics (Primary)	-0.846*	0.446	0.167	-0.0494	0.413
	-0.367	-0.586	-0.56	-0.572	-0.435
Biotech (Primary)	-2.937**	1.41	0.519	0.433	2.392**
	-1.056	-0.791	-0.651	-1.347	-0.901
Software BM (Subset of Primary)	-2.034***	1.311*	0.633	0.318	1.457***
	-0.564	-0.644	-0.568	-0.695	-0.339
Software NBM (Subset of Primary)	-2.135***	0.767	0.277	0.11	0.977*
	-0.362	-0.6	-0.498	-0.497	-0.409
Optics (Primary)	-1.365*	-0.872	-0.307	0.496	-0.472
	-0.64	-0.742	-0.776	-1.037	-0.914
Comparison Dummy = Chemistry					
N	620	416	500	281	441
r2_p	0.193	0.139	0.0441	0.0872	0.179
ll	-289	-223.1	-324.2	-172.5	-246.9
chi2	.	5533	58.03	131.7	.
p	.	0	0.000194	7.56E-17	.

Top row = Coefficient; * = p<.10, ** = p<.05, *** = p<.01; Bottom row = Std. error	**Invalidity-102 Prior Art-All--Any stage**	**Invaldity-103-Obviousness--Any Stage**	**Invaldity-112-Indefiniteness--Any Stage**	**Invalidity-112-Inadequate Disclosure-Any stage**	**Direct Infringement (Literal + DOE)-Any stage**
Foreign Origin of Patent	-0.969	-1.515*	-0.789	1.222	0.204
	-0.528	-0.641	-2.196	-7.491	-0.306
Adjusted Number of Citations Received	-0.0675	-0.142	0.402	0.38	0.164
	-0.121	-0.334	-0.241	-11.14	-0.0903
Total Prior Art References	-0.000555	0.00158	-0.00149	0.00432	-0.000961
	-0.00116	-0.00228	-0.00248	-0.0531	-0.000883
Number of Claims	0.00523	-0.00225	-0.0389	0.0156	0.00283
	-0.00819	-0.00771	-0.0408	-0.339	-0.00464

Age of Patent at Current Litigation Filing	0.0736	0.0134	0.133	0.0376	-0.0559*
	-0.0499	-0.0506	-0.142	-0.67	-0.0272
Number of Defendants	0.0515	0.102*	-0.0797	0.011	0.00616
	-0.0546	-0.0419	-0.0912	-3.914	-0.0236
Number of Asserted Patents	0.246*	0.0587	-0.0711	0.959***	0.0891
	-0.108	-0.13	-0.205	-0.0905	-0.059
TX ED	-1.747***	-0.932	-1.361	0	0.730*
	-0.526	-0.912	-1.442	0	-0.351
DE D	-1.18	-0.239	0.925	1.191	-0.189
	-0.83	-0.779	-1.724	-2.86	-0.364
CA ND	0.642	0.58	-0.161	2.926	-1.364*
	-0.732	-1.017	-0.69	-7.651	-0.562
CA CD	0.992	0.0913	-0.0888	0	-1.156
	-1.472	-1.305	-15.19	0	-0.675
CA SD	0.243	0.904	0	3.025	0.178
	-1.157	-0.679	0	-12.88	-0.626
NY SD	-0.278	0	0	0	0.895
	-0.718	0	0	0	-0.767
IL ND	1.86	1.823*	-0.456	2.377	-0.204
	-1.065	-0.908	-2.573	-30.45	-0.518
WI WD	0	-1.664	0	0	-0.425
	0	-1.178	0	0	-0.579
NJ D	-0.483	1.674*	0	5.128***	-1.307
	-1.086	-0.696	0	-1.288	-0.747
MA D	0.921	3.114***	0	4.09	-0.314
	-1.394	-0.763	0	-10.76	-0.691
VA ED	-1.917*	-1.254	-1.406	0	-0.211
	-0.803	-1.154	-13.85	0	-0.724
OH ND	0	0	0	0	-0.93
	0	0	0	0	-0.645
TX SD	-1.057	0	-1.841	0	0.665
	-0.863	0	-6.365	0	-0.653
All Other Districts (multi-collinearity too high)	0	0	0	0	0
	0	0	0	0	0
Mechanical (Primary)	0.598	2.171***	0	1.18	-0.743
	-1.061	-0.313	0	-5.6	-0.421
Electronics (Primary)	-0.986	0.727	5.089	-0.554	-1.517**
	-1.015	-0.895	-8.308	-20.83	-0.586
Biotech (Primary)	-0.524	-0.0987	0	2.139	-1.059
	-1.292	-0.864	0	-3.821	-0.666
Software BM (Subset of Primary)	0.718	0.477	4.158	0	-1.895***
	-0.487	-0.736	-13.92	0	-0.541
Software NBM	0.739	1.316*	3.441	-0.301	-2.175***

(Subset of Primary)	-0.672	-0.668	-8.901	-28.45	-0.47
Optics (Primary)	-1.632	0	3.504	0	-2.386**
	-1.101	0	-9.249	0	-0.833
Comparison Dummy = Chemistry					
N	221	206	119	80	545
r2_p	0.167	0.193	0.288	0.413	0.202
ll	-116.1	-107.5	-48.58	-29.17	-284.6
chi2	.	.	.	.	.
p	.	.	.	.	.

Appendix D

Full Regression Specification by Industry Including Patent and Lawsuit Characteristics

Top row = Coefficient; * = p<.10, ** = p<.05, *** = p<.01; Bottom row = Std. error	Patent Owner Definitive Winner	SJ Invalidity-All	SJ Noninfringement Plus Stip. Jgmt of Noninfringement	Patent Owner-Trial Winner	Invalidity-All--Any stage	Invalidity-102 Prior Art-All--Any stage
Foreign Origin of Patent	0.379	-0.628	-0.0197	0.185	-1.004**	-0.728
	-0.237	-0.452	-0.26	-0.493	-0.323	-0.67
Adjusted Number of Citations Received	0.0603	0.0829	-0.0312	0.0372	0.032	-0.0912
	-0.0876	-0.114	-0.0868	-0.155	-0.0854	-0.16
Total Prior Art References	-0.00231**	0.000139	0.00124	0.00152	0.00111	-0.00056
	-0.0008	-0.00046	-0.000791	-0.00168	-0.00086	-0.00171
Number of Claims	0.00281	-0.00909	-0.00516	-0.00742	-0.00501	0.00781
	-0.00393	-0.00617	-0.005	-0.00744	-0.00491	-0.00611
Age of Patent at Current Litigation Filing	-0.0221	0.0395	0.00657	0.0217	-0.0057	0.0275
	-0.0219	-0.0297	-0.0214	-0.022	-0.0277	-0.0393
Number of Defendants	0.0431	-0.0291	-0.0102	-0.0036	-0.0224	-0.0205
	-0.0228	-0.0196	-0.0186	-0.035	-0.0267	-0.0531
Number of Asserted Patents	0.171***	-0.0138	0.0537	-0.0761	-0.0294	0.0466
	-0.0475	-0.0642	-0.0456	-0.0652	-0.045	-0.115
Computer & Other Electronics	-0.0564	-0.198	-0.393	-1.253*	-0.0171	0.273
	-0.439	-0.457	-0.388	-0.544	-0.416	-0.69
Semiconductor	0.591	-0.277	-0.457	-1.268	-1.315	-1.323
	-0.796	-0.714	-0.571	-0.971	-0.671	-1.064
Pharmaceutical	1.511***	-0.473	-0.0225	-1.006	-0.789	-0.819
	-0.341	-0.615	-0.425	-0.549	-0.489	-0.819
Medical Devices, Methods, & Other Medical	0.936**	-0.358	0.0297	-0.902	0.365	-0.615
	-0.361	-0.406	-0.36	-0.583	-0.644	-0.552
Biotech (industry)	-1.118	1.085	-0.251	-0.153	1.269	0
	-0.735	-0.679	-0.588	-0.984	-0.894	0
Communication	-0.403	0.434	-0.424	-0.828	0.0141	0.568
	-0.404	-0.357	-0.349	-0.522	-0.555	-0.621
Transportation-Including Automotive	1.047*	0.312	-0.266	-1.241	0.514	0.729
	-0.478	-0.508	-0.6	-0.839	-0.591	-0.817
Construction	0.12	-1.825**	0.0935	-0.692	1.274	0.714

	-0.646	-0.678	-0.631	-0.762	-0.891	-0.802
Energy	0.8	0	0.0377	-0.85	-1.800*	-0.604
	-0.727	0	-0.694	-0.628	-0.82	-0.742
Goods & Services for Industrial & Business Uses	0.328	0.125	-0.196	-0.589	-0.045	-0.0647
	-0.339	-0.374	-0.338	-0.388	-0.446	-0.708
Comparison Dummy = Consumer Goods & Services						
N	636	408	508	290	441	229
r2_p	0.123	0.0518	0.0162	0.0454	0.0976	0.0739
ll	-318.5	-242.8	-340.5	-185.5	-271.5	-132
chi2	100.8	38.56	10.19	14.73	205.6	40.75
p	6.21E-14	0.00126	0.896	0.615	2.17E-34	0.000604

Top row = Coefficient; * = p<.10, ** = p<.05, *** = p<.01; Bottom row = Std. error	**Invalidity-103-Obviousness--Any Stage**	**Invalidity-112-Indefiniteness--Any Stage**	**Invalidity-112-Inadequate Disclosure-Any stage**	**Direct Infringement (Literal + DOE)-Any stage**
Foreign Origin of Patent	-1.015*	0.231	1.227*	0.373
	-0.496	-0.929	-0.552	-0.312
Adjusted Number of Citations Received	-0.182	0.308	0.013	0.185*
	-0.164	-0.243	-0.0855	-0.0765
Total Prior Art References	0.00223*	-0.00235	0.0032	-0.00137
	-0.00112	-0.00207	-0.0032	-0.000936
Number of Claims	0.00243	-0.0303	0.0176	0.00409
	-0.00872	-0.0207	-0.0201	-0.00419
Age of Patent at Current Litigation Filing	-0.0108	0.0499	0.0905	-0.0508
	-0.0366	-0.0762	-0.0565	-0.0276
Number of Defendants	0.0293	-0.0368	-0.0598	0.0267
	-0.0509	-0.0576	-0.1	-0.0275
Number of Asserted Patents	0.00649	-0.103	-0.530*	0.186**
	-0.0941	-0.184	-0.257	-0.0603
Computer & Other Electronics	-1.124	2.178	-1.08	0.23
	-0.901	-8.694	-2.086	-0.478
Semiconductor	0	3.058	1.934	-0.0454
	0	-8.681	-3.117	-0.66
Pharmaceutical	-1.652	0	1.442	1.839***
	-0.853	0	-1.243	-0.48
Medical Devices, Methods, & Other Medical	-0.106	1.511	-1.103*	0.526
	-0.69	-9.008	-0.489	-0.465

Biotech (industry)	0	0	1.386	0.51
	0	0	-1.384	-0.705
Communication	-0.894	1.383	1.027	-0.603
	-0.824	-8.675	-0.553	-0.547
Transportation-Including Automotive	-0.622	0	0.891***	1.641***
	-0.757	0	-0.24	-0.47
Construction	1.14	0	0	1.519*
	-0.946	0	0	-0.643
Energy	0	0	0	0.791
	0	0	0	-0.791
Goods & Services for Industrial & Business Uses	-1.261	1.193	-0.0941	0.723
	-0.71	-8.361	-1.584	-0.4
Comparison Dummy = Consumer Goods & Services Uses				
N	221	133	119	545
r2_p	0.143	0.15	0.248	0.148
ll	-119.5	-60.34	-46.99	-303.7
chi2	40.9	21.94	.	87.19
p	0.000185	0.0382	.	1.98E-11

Appendix E

Full Regression Specification by Industry Including District Dummies

Top row = Coefficient; * = p<.10, ** = p<.05, *** = p<.01; Bottom row = Std. error	Patent Owner Definitive Winner	SJ Invalidity-All	SJ Noninfringement Plus Stip. Jgmt of Noninfringement	Patent Owner-Trial Winner	Invalidity-All--Any stage	Invalidity-102 Prior Art-All--Any stage
Foreign Origin of Patent	0.379	-0.628	-0.0197	0.185	-1.004**	-0.728
	-0.237	-0.452	-0.26	-0.493	-0.323	-0.67
Adjusted Number of Citations Received	0.0603	0.0829	-0.0312	0.0372	0.032	-0.0912
	-0.0876	-0.114	-0.0868	-0.155	-0.0854	-0.16
Total Prior Art References	-0.00231**	0.000139	0.00124	0.00152	0.00111	-0.00056
	-0.0008	-0.00046	-0.000791	-0.00168	-0.00086	-0.00171
Number of Claims	0.00281	-0.00909	-0.00516	-0.00742	-0.00501	0.00781
	-0.00393	-0.00617	-0.005	-0.00744	-0.00491	-0.00611
Age of Patent at Current Litigation Filing	-0.0221	0.0395	0.00657	0.0217	-0.0057	0.0275
	-0.0219	-0.0297	-0.0214	-0.022	-0.0277	-0.0393
Number of Defendants	0.0431	-0.0291	-0.0102	-0.0036	-0.0224	-0.0205
	-0.0228	-0.0196	-0.0186	-0.035	-0.0267	-0.0531
Number of Asserted Patents	0.171***	-0.0138	0.0537	-0.0761	-0.0294	0.0466
	-0.0475	-0.0642	-0.0456	-0.0652	-0.045	-0.115
Computer & Other Electronics	-0.0564	-0.198	-0.393	-1.253*	-0.0171	0.273
	-0.439	-0.457	-0.388	-0.544	-0.416	-0.69
Semiconductor	0.591	-0.277	-0.457	-1.268	-1.315	-1.323
	-0.796	-0.714	-0.571	-0.971	-0.671	-1.064
Pharmaceutical	1.511***	-0.473	-0.0225	-1.006	-0.789	-0.819
	-0.341	-0.615	-0.425	-0.549	-0.489	-0.819
Medical Devices, Methods, & Other Medical	0.936**	-0.358	0.0297	-0.902	0.365	-0.615
	-0.361	-0.406	-0.36	-0.583	-0.644	-0.552
Biotech (industry)	-1.118	1.085	-0.251	-0.153	1.269	0
	-0.735	-0.679	-0.588	-0.984	-0.894	0
Communication	-0.403	0.434	-0.424	-0.828	0.0141	0.568
	-0.404	-0.357	-0.349	-0.522	-0.555	-0.621
Transportation-Including Automotive	1.047*	0.312	-0.266	-1.241	0.514	0.729
	-0.478	-0.508	-0.6	-0.839	-0.591	-0.817
Construction	0.12	-1.825**	0.0935	-0.692	1.274	0.714
	-0.646	-0.678	-0.631	-0.762	-0.891	-0.802
Energy	0.8	0	0.0377	-0.85	-1.800*	-0.604

	-0.727	0	-0.694	-0.628	-0.82	-0.742
Goods & Services for Industrial & Business Uses	0.328	0.125	-0.196	-0.589	-0.045	-0.0647
	-0.339	-0.374	-0.338	-0.388	-0.446	-0.708
Comparison Dummy = Consumer Goods & Services Uses						
N	636	408	508	290	441	229
r2_p	0.123	0.0518	0.0162	0.0454	0.0976	0.0739
ll	-318.5	-242.8	-340.5	-185.5	-271.5	-132
chi2	100.8	38.56	10.19	14.73	205.6	40.75
p	6.21E-14	0.00126	0.896	0.615	2.17E-34	0.000604

Top row = Coefficient; * = p<.10, ** = p<.05, *** = p<.01; Bottom row = Std. error	**Invalidity-103-Obviousness--Any Stage**	**Invalidity-112-Indefiniteness--Any Stage**	**Invalidity-112-Inadequate Disclosure-Any stage**	**Direct Infringement (Literal + DOE)-Any stage**
Foreign Origin of Patent	-1.015*	0.231	1.227*	0.373
	-0.496	-0.929	-0.552	-0.312
Adjusted Number of Citations Received	-0.182	0.308	0.013	0.185*
	-0.164	-0.243	-0.0855	-0.0765
Total Prior Art References	0.00223*	-0.00235	0.0032	-0.00137
	-0.00112	-0.00207	-0.0032	-0.000936
Number of Claims	0.00243	-0.0303	0.0176	0.00409
	-0.00872	-0.0207	-0.0201	-0.00419
Age of Patent at Current Litigation Filing	-0.0108	0.0499	0.0905	-0.0508
	-0.0366	-0.0762	-0.0565	-0.0276
Number of Defendants	0.0293	-0.0368	-0.0598	0.0267
	-0.0509	-0.0576	-0.1	-0.0275
Number of Asserted Patents	0.00649	-0.103	-0.530*	0.186**
	-0.0941	-0.184	-0.257	-0.0603
Computer & Other Electronics	-1.124	2.178	-1.08	0.23
	-0.901	-8.694	-2.086	-0.478
Semiconductor	0	3.058	1.934	-0.0454
	0	-8.681	-3.117	-0.66
Pharmaceutical	-1.652	0	1.442	1.839***
	-0.853	0	-1.243	-0.48
Medical Devices, Methods, & Other Medical	-0.106	1.511	-1.103*	0.526
	-0.69	-9.008	-0.489	-0.465
Biotech (industry)	0	0	1.386	0.51
	0	0	-1.384	-0.705

Communication	-0.894	1.383	1.027	-0.603
	-0.824	-8.675	-0.553	-0.547
Transportation-Including Automotive	-0.622	0	0.891***	1.641***
	-0.757	0	-0.24	-0.47
Construction	1.14	0	0	1.519*
	-0.946	0	0	-0.643
Energy	0	0	0	0.791
	0	0	0	-0.791
Goods & Services for Industrial & Business Uses	-1.261	1.193	-0.0941	0.723
	-0.71	-8.361	-1.584	-0.4
Comparison Dummy = Consumer Goods & Services Uses				
N	221	133	119	545
r2_p	0.143	0.15	0.248	0.148
ll	-119.5	-60.34	-46.99	-303.7
chi2	40.9	21.94	.	87.19
p	0.000185	0.0382	.	1.98E-11

Appendix F

Full Industry Specification with Truncated District Variables

Top row = Coefficient; * = p<.10, ** = p<.05, *** = p<.01; Bottom row = Std. error	Patent Owner Definitive Winner	SJ Invalidity-All	SJ Noninfringement Plus Stip. Jgmt of Noninfringement	Patent Owner-Trial Winner	Invalidity-All--Any stage
Foreign Origin of Patent	0.385	-0.492	-0.0339	0.178	-0.976***
	-0.241	-0.409	-0.243	-0.378	-0.295
Adjusted Number of Citations Received	0.0559	0.0616	-0.0477	0.0368	0.012
	-0.106	-0.121	-0.0961	-0.153	-0.0986
Total Prior Art References	-0.00235**	0.000118	0.00126	0.00136	0.00115*
	-0.00089	-0.00092	-0.000979	-0.00134	-0.00057
Number of Claims	0.00181	-0.00796	-0.00528	-0.00607	-0.0044
	-0.00594	-0.00815	-0.0054	-0.00733	-0.006
Age of Patent at Current Litigation Filing	-0.017	0.046	0.00723	0.0259	-0.0043
	-0.0266	-0.026	-0.0251	-0.0334	-0.0262
Number of Defendants	0.0136	-0.0105	0.000912	0.00499	0.024
	-0.0232	-0.0298	-0.0213	-0.0251	-0.0304
Number of Asserted Patents	0.158***	0.0103	0.0603	-0.0457	-0.0222
	-0.0389	-0.0545	-0.0478	-0.06	-0.0534
TX ED	1.440***	-0.884	-0.539	-0.273	-1.310**
	-0.312	-0.5	-0.379	-0.395	-0.459
DE D	0.262	-0.612	0.273	0.312	0.123
	-0.383	-0.435	-0.273	-0.375	-0.294
CA ND	0.0574	0.471	0.38	1.415**	0.526
	-0.444	-0.475	-0.331	-0.543	-0.448
All Other Districts (multi-collinearity too high)	0	0	0	0	0
	0	0	0	0	0
Computer & Other Electronics	-0.427	-0.137	-0.338	-1.321*	0.141
	-0.57	-0.476	-0.393	-0.578	-0.503
Semiconductor	0.673	-0.18	-0.596	-1.331	-1.455
	-0.735	-0.846	-0.79	-0.859	-0.761
Pharmaceutical	1.459**	-0.663	-0.153	-1.117	-0.916*
	-0.466	-0.633	-0.456	-0.575	-0.396
Medical Devices, Methods, & Other Medical	0.922	-0.479	-0.0566	-1.147*	0.149
	-0.493	-0.394	-0.41	-0.561	-0.404
Biotech (industry)	-0.812	0.8	-0.375	-0.585	0.758
	-0.789	-0.593	-0.531	-0.942	-0.824
Communication	-0.508	0.474	-0.462	-0.972*	-0.0401

	-0.514	-0.43	-0.401	-0.493	-0.306
Transportation-Including Automotive	1.195*	0.25	-0.326	-1.198	0.313
	-0.491	-0.476	-0.554	-0.681	-0.452
Construction	0.159	-1.950**	0.0868	-0.678	1.196
	-0.76	-0.593	-0.688	-0.658	-0.928
Energy	1.002	0	0.205	-0.722	-1.818*
	-0.574	0	-0.697	-0.869	-0.713
Goods & Services for Industrial & Business Uses	0.174	0.131	-0.18	-0.537	-0.0728
	-0.409	-0.367	-0.335	-0.45	-0.408
Comparison Dummy = Consumer Goods & Services Uses					
N	636	408	508	290	441
r2_p	0.153	0.0699	0.0244	0.0655	0.132
ll	-307.3	-238.2	-337.6	-181.6	-261.3
chi2	247.4	63.83	18.03	32.85	356.9
p	3.85E-41	9.45E-07	0.586	0.035	1.68E-63

Top row = Coefficient; * = p<.10, ** = p<.05, *** = p<.01; Bottom row = Std. error	**Invalidity-102 Prior Art-All--Any stage**	**Invaldity-103-Obviousness--Any Stage**	**Invaldity-112-Indefiniteness--Any Stage**	**Invalidity-112-Inadequate Disclosure-Any stage**	**Direct Infringement (Literal + DOE)-Any stage**
Foreign Origin of Patent	-0.65	-1.125*	0.229	1.052	0.422
	-0.614	-0.504	-1.317	-0.685	-0.311
Adjusted Number of Citations Received	-0.113	-0.212	0.294	-0.0269	0.208*
	-0.0898	-0.161	-0.336	-1.024	-0.0959
Total Prior Art References	-0.00036	0.00221	-0.00192	0.00282	-0.00151
	-0.00123	-0.00146	-0.00436	-0.00524	-0.00121
Number of Claims	0.00971	0.00347	-0.0339	0.0237**	0.00366
	-0.0115	-0.00958	-0.0206	-0.00759	-0.00557
Age of Patent at Current Litigation Filing	0.0187	-0.00975	0.0508	0.0701***	-0.0526*
	-0.0609	-0.0413	-0.0693	-0.0111	-0.0241
Number of Defendants	0.0245	0.0615	-0.00691	0.0714	0.00428
	-0.0452	-0.0364	-0.0615	-0.684	-0.0253
Number of Asserted Patents	0.106	0.0187	-0.0873	-0.511***	0.154***
	-0.113	-0.0913	-0.162	-0.14	-0.0417
TX ED	-1.376*	-0.819	-0.629	0	0.816*
	-0.644	-0.616	-1.271	0	-0.345
DE D	-0.506	0.199	0.759	0.547***	-0.0335
	-0.678	-0.477	-1.208	-0.0244	-0.301
CA ND	0.687	-0.176	0.421	0.0457	-1.408*
	-0.854	-0.918	-1.021	-3.62	-0.672

All Other Districts (multi-collinearity too high)	0	0	0	0	0
	0	0	0	0	0
Computer & Other Electronics	0.417	-0.955	2.348	-1.515***	0.2
	-0.867	-0.659	-7.003	-0.403	-0.556
Semiconductor	-1.499	0	2.697	1.856	0.343
	-1.291	0	-6.969	-1.491	-0.788
Pharmaceutical	-0.701	-1.759***	0	1.388***	1.865***
	-1.007	-0.526	0	-0.292	-0.529
Medical Devices, Methods, & Other Medical	-1.201	-0.0672	1.39	-1.293	0.868
	-1.192	-0.678	-6.721	-2.704	-0.516
Biotech (industry)	0	0	0	1.537	0.853
	0	0	0	-1.054	-0.683
Communication	0.0426	-1.047	1.393	1.338	-0.453
	-0.74	-0.721	-6.527	-2.713	-0.531
Transportation-Including Automotive	0.42	-0.73	0	1.108*	1.657**
	-0.527	-0.829	0	-0.454	-0.604
Construction	0.464	1.088	0	0	1.798**
	-1.01	-0.966	0	0	-0.63
Energy	-0.963	0	0	0	0.81
	-1.028	0	0	0	-0.769
Goods & Services for Industrial &Business Uses	-0.19	-1.376**	1.24	0.0115	0.669
	-0.569	-0.506	-6.665	-2.353	-0.46
Comparison Dummy = Consumer Goods & Services Uses					
N	229	221	133	108	545
r2_p	0.108	0.153	0.165	0.26	0.176
ll	-127.1	-118.1	-59.26	-44.12	-293.8
chi2	64.25	101.5	.	.	205.3
p	8.08E-07	4.62E-14	.	.	9.89E-33