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The Layered Patent System

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THE LAYERED PATENT SYSTEM

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ABSTRACT

The patent system is usually described in terms of opposites, like producers versus trolls or software versus pharma. But the reality is a far more complex set of layers, including enforcers, patentees, and technology. This study of twenty-five years of patent litigation by highly litigious non-practicing entities and randomly selected plaintiffs explores each of these layers and shows ways that each interacts with the others, using patent validity as a primary exemplar.

Data related to more than one thousand patent outcomes in more than two thousand cases leads to some surprising findings. For example, while the litigious NPEs enforced many patents from product companies and public companies, the patents enforced by random companies were more likely to come from larger and better funded companies. Additionally, the data implies that patents obtained by individuals fared worse in litigation, regardless of who enforced them. Most surprisingly, once patentee and enforcer type is considered, software patents are no longer a statistically significant predictor of invalidation.

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THE LAYERED PATENT SYSTEM

Michael Risch

INTRODUCTION

Our patent system appears divided by technology, both in theory¹ and in practice.² Or maybe it is divided by types of inventors and patentees: large, small, and individual.³ Litigants surely create division, with a variety of acronyms used to describe different types of plaintiffs.⁴ While these divisions are real, each alone does not capture the layered connections between inventors, enforcers, and technologies. Instead, head-to-head

¹ See generally DAN L. BURK & MARK A. LEMLEY, *THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT* (2009) (arguing that patent policy should differ for different industries). See also Sean B. Seymore, *Heightened Enablement in the Unpredictable Arts*, 56 UCLA L. REV. 127 (2008); Christopher Holman, *Is Lilly Written Description a Paper Tiger?: A Comprehensive Assessment of the Impact of Eli Lilly and its Progeny in the Courts and PTO*, 17 ALB. L.J. SCI. & TECH. 1 (2007) (discussing generally differing written description and enablement rules in non-mechanical arts).

² John R. Allison, Mark A. Lemley, David L. Schwartz, *Our Divided Patent System*, 82 U. CHI. L. REV. (forthcoming 2015), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2510004 (presenting data about different litigation outcomes in different industries and technologies).

³ Timo Fischer & Joachim Henkel, *Patent Trolls on Markets for Technology – An Empirical Analysis of NPEs’ Patent Acquisitions*, 41 RESEARCH POL’Y 1519 (2012) (examining source of NPE patents); Michael Risch, *Patent Troll Myths*, 42 SETON HALL L. REV. 457 (2012) (same); Naomi R. Lamoreaux et al., *Patent Alchemy: The Market for Technology in US History*, 87 Bus. Hist. Rev. 3, 5 (2013) (“The bulk of the patents came from investors who exploited their intellectual property by selling off or licensing the rights.”); B. Zorina Khan & Kenneth L. Sokoloff, *Institutions and Technological Innovation During Early Economic Growth: Evidence from the Great Inventors of the United States, 1790–1930*, 38–39 (CESifo Venice Summer Inst., CESifo Working Paper No. 1299, 2004), available at <http://ssrn.com/abstract=614044> (describing a table showing that a majority of patent holders starting in 1739 sold or licensed their patents).

⁴ 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, 258 (2006); Gwendolyn G. Ball & Jay P. Kesan, *Transaction Costs and Trolls: Strategic Behavior by Individual Inventors, Small Firms and Entrepreneurs in Patent Litigation* 14 (Univ. Ill. Law. & Econ., Working Paper No. LE09-005, 2009), available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1337166 (examining case outcomes by litigant size); 2014: *Patent Litigation Study: As Case Volume Leaps, Damages Continue General Decline*, PRICEWATERHOUSECOOPERS 1 (2014), http://www.pwc.com/en_US/us/forensic-services/publications/assets/2014-patent-litigation-study.pdf (studying litigation outcomes by plaintiff type); Michael J. Mazzeo, et al., *Do NPEs Matter? Non-Practicing Entities and Patent Litigation Outcomes*, 9 J. COMP. L. & ECON. 879 (2013) (studying litigation outcomes by plaintiff type).

comparisons present themselves in the aggregate, mere snapshots of the bigger picture. Like the proverbial elephant, one commentator feels a leg and identifies a technology problem, another feels an ear and finds a litigant problem, and a third feels the trunk and discovers a patentee problem.

This Article uses a novel dataset of twenty-five years of litigation to examine how these layers form the whole elephant. It begins with enforcement, moves to patentees, and finishes with technology. Finally, it estimates a regression to further explore the connections between different layers.

The results reveal a far more complex puzzle than any one comparison allows. One must look deeper than patent trolls versus product companies or information technology versus pharmaceuticals for explanation. Instead, the story begins with how invention is achieved, who has the resources to complete what types of inventions, and how this affects who eventually enforces patent rights.

For example, the data shows that, litigation tactics aside, who obtained the patent initially is better correlated with patent invalidation than who brought the lawsuit. It is well known that individual plaintiffs win less often than other plaintiffs. The data presented here suggests that the problem is not individuals per se, but patents obtained by individuals. Inventor company patents, however, do not fare as poorly. Plaintiffs asserting individual inventor patents fare worse, regardless of type. This is a surprising outcome that affects how we should think about individual inventors, about patent plaintiffs, and about patent quality.

Further, what appear to be technology differences may instead also be patentee and plaintiff differences. These revelations change how we look at the patent system, because most proposals focus on only one layer at a time.

The Article begins with identification of the top layer: two groups that enforce patent rights. The first group includes the ten most litigious non-practicing entities (NPEs), which many pejoratively call patent trolls. These highly litigious NPEs from the early 2000s represented the birth of calls for patent reform.⁵ Though many of them are no longer litigious because their patents expired, some are still maligned.⁶ Though most of their lawsuits

⁵ See, e.g., John Letzing, *Famed patent firm Acacia hits unwelcome milestone*, MARKETWATCH (Nov. 16, 2007), <http://www.marketwatch.com/story/famed-patent-firm-acacia-hits-unwelcome-milestone> (discussing Acacia's suits in Texas in context of reform bills to limit venue choices); John Letzing, *Speculator of mundane patents casts a long shadow*, MARKETWATCH (Sep. 7, 2007), <http://www.marketwatch.com/story/as-congress-mulls-patent-reform-holding-company-files-more-suits> (discussing Plutus IP lawsuits in context of patent reform).

⁶ See, e.g., Preston H. Heard, *Georgia Federal Court Does Not Require Internal*

were filed between 2003 and 2009, every lawsuit was identified, some dating back twenty-five years.⁷

The second group is a randomly selected group of nonNPE patent cases, roughly matched by year. These average patent plaintiffs, if there is such a thing, can be compared against the most extremely litigious NPE plaintiffs. As a result, any given patent plaintiff will generally fall on a continuum from filing a single patent in a single lawsuit to the most litigious, and may share some characteristics with either type.

The Article then examines who obtained the patents in each group. It turns out that who obtained the patents was often different from who enforced the patents. The groups had some unexpected similarities and some unexpected differences. The patents in both groups—even the litigious NPEs—were obtained in large part by product companies, companies engaged in invention to make and sell products or services. However, the NPE group included a much higher percentage of patents issued to small companies and individual inventors. This illustrates a connection between layers. There appears to be two separate tracks of patentees: large, well-funded companies versus individuals and small companies. And while both tracks are represented in each group, the litigious NPEs were much more likely to enforce the patents of smaller patentees than the average litigant.

The Article next considers an additional layer: patented technology. Using three different measures—technology class, art unit, and software—it becomes clear that the litigious NPEs assert very different technology on

Communications Of Outside Counsel To Be Listed On Privilege Log, NAT. L. REV. (Feb. 7, 2014) (discussing sham litigation allegation against Catch Curve); David Segal, *Has Patent. Will Sue.*, N.Y. TIMES BU1, BU4 (July 14, 2013), available at <http://www.nytimes.com/2013/07/14/business/has-patent-will-sue-an-alert-to-corporate-america.html> (profiling of Erich Spangenberg and IPNav); Paul Belleflamme, *What to Think of 'Patent Trolls'? The Return*, IPDIGIT (Oct. 31, 2011), <http://www.ipdigit.eu/2011/10/what-to-think-of-patent-trolls-the-return/> (debating merits of General Patent Corp. as a troll); *Microsoft Sues Acacia Over Smartphone Patents*, Reuters (Nov. 20, 2013), <http://news.yahoo.com/microsoft-sues-acacia-over-smartphone-patents-195020778--sector.html> (quoting industry lawyer: “Acacia's lawsuits are the worst kind of abusive litigation behavior, attempting to extract payment based on litigation tactics and not the value of its patents.”); Joe Mullin, *Rackspace Sues “Most Notorious Patent Troll in America,”* ARS TECHNICA (Apr. 4, 2013) <http://arstechnica.com/tech-policy/2013/04/rackspace-sues-most-notorious-patent-troll-in-america/> (claiming wrongful assertion by IPNav); Rik Myslewski, *Survey: Patent Litigation Skyrocketing, Trolls Top 10 Sueball Chuckers*, THE REGISTER (May 14, 2014), http://www.theregister.co.uk/2014/05/13/survey_patent_litigation_skyrocketing_trolls_top_10_sueball_chuckers/ (showing Ronald A. Katz Technology Licensing in top ten list for most patents involved in lawsuits).

⁷ The data set ends with cases filed on December 31, 2009.

the whole than the average patent litigant. These NPEs assert more electronics, computer, and communications patents, more software patents, and virtually no therapeutic patents. These differences might be explained in a couple of ways. Highly litigious NPEs may focus on these types of patents because they are easier to assert, more malleable, or otherwise better suited to repetitive litigation. This is the current explanation and surely apt, but it is incomplete. If there were money to be made through litigation in chemical patents, rational NPEs would pursue it. Indeed, the nonNPE group includes Monsanto, an extraordinarily litigious plaintiff that has had great success and also assigned its patents to a separate but affiliated licensing and enforcement corporation. Instead, the technology asserted by litigious NPEs is in part determined by the patentee layer. Technology inventions may be easier to develop and obtain for individuals and small companies. Because those patentees later turn to litigious NPEs to assert these patents, litigious NPEs are more likely to assert particular technologies.

Identifying the layers is an important step forward, because analysis of patents and litigation can be much more nuanced. For example, to the extent that NPEs are justified as creating a market for patents and technology,⁸ it appears that only certain types of patentees and/or technology benefits from such a market.⁹

This Article attempts to tease out the role of each layer on patent quality. Part I provides a brief overview of the divisions in the patent system and introduces reasons why focus on each particular layer may not provide sufficient policy information.

Parts II, III, and IV provide data about each layer, beginning with enforcers, moving to patentees, and ending with technology. Each part provides basic information about each layer, as well as patent validity outcome data that combines layers.

⁸ Julien Pénin, *Strategic Uses of Patents in Markets for Technology: A Story of Fabless Firms, Brokers and Trolls*, 84 J ECON. BEHAVIOR & ORGS. 633, 634 (2012) (describing benefits of patent brokers that disseminate technology). *See also*, James F. McDonough III, Note, *The Myth of the Patent Troll: An Alternative View of the Function of Patent Dealers in an Idea Economy*, 56 EMORY L.J. 189, 209-11 (2006) (describing NPEs as market makers).

⁹ Robin Feldman & Nicholson Price, *Patent Trolling: Why Bio & Pharmaceuticals Are At Risk*, 17 STAN. TECH. L. REV. 773, 788-89 (2014) (“Barriers to entry are low enough that it is easier and cheaper than ever for small companies to enter the market and create apps without substantial investment [but] the difficulty of entering the bio/pharmaceutical product market suggests that there will be fewer patents floating around that monetizers can acquire and fewer targets for them to go after.”).

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Part V presents the results of logistic regressions that illustrate the complexity of interaction between layers. It shows that no one category explains why a patent might be invalidated and that seemingly explanatory variables become less explanatory when other layers are added to the analysis.

Part VI concludes the paper by calling for reassessment the patent troll narrative based on the layered patent system.

I. THE CONVENTIONAL NARRATIVE

There is no shortage of commentary on the patent system, but most analysis is limited to dueling propositions. Articles pit productive companies versus patent trolls.¹⁰ Indeed, the troll rhetoric has driven the call for patent reform at the highest levels of government.¹¹ It is not surprising that so many studies focus on litigant identity. First, it is one of the most observable attributes of any lawsuit. Second, the plaintiff brings suit, and thus is the party most responsible for the lawsuit.¹²

But patent litigants are not solely responsible for the patents they assert. Many litigated patents were initially owned by someone else. Inventors must always apply for patents in their own names. They can, however, assign their patent to a company or another person at any time. If they do so before a deadline set by the PTO, that assignee is shown on the face of the patent, and is called an initial assignee.

Some accounts have focused on initial owners of patents in the

¹⁰ See, e.g. Markus Reitzig, et al., *On Sharks, Trolls, and Their Patent Prey—Unrealistic Damage Awards and Firms’ Strategies of “Being Infringed”*, 36 RESEARCH POL. 134, 144 (2007) (modeling litigant behavior). Only recently have empirical studies actually compared NPE outcomes directly to product company outcomes. Robin Feldman, et al., *The AIA 500 Expanded: The Effects of Patent Monetization Entities*, 17 UCLA J.L. & TECH. 1, 59–62 (2013) (summarizing outcomes of randomly selected cases); Michael Risch, *A Generation of Patent Litigation*, SAN DIEGO L. REV. (forthcoming 2015), http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2484947 (comparing detailed invalidity and infringement outcomes over 25 years); John R. Allison, Mark A. Lemley & Joshua Walker, *Patent Quality and Settlement Among Repeat Patent Litigants*, 99 GEO. L.J. 677 (2011) (analyzing outcomes of most litigated patents, many of which were NPE patents); Shawn P. Miller, *Where’s the Innovation: An Analysis of the Quantity and Qualities of Anticipated and Obvious Patents*, 18 VA. J.L. & TECH. 1, 6 (2013) (considering obviousness and anticipation of NPEs and productive companies).

¹¹ Erin Merzhon, *Obama Backs Patent Reform Effort in State of the Union*, POLITICO (Jan. 28, 2014), <http://www.politico.com/blogs/politico-live/2014/01/obama-backs-patent-reform-effort-in-state-of-the-union-182139.html>.

¹² Of course, this is a simplification. Some patent owners are defendants in declaratory relief action, and some may bring suit in order to protect licensees.

aggregate,¹³ as case studies,¹⁴ and in surveys.¹⁵ These accounts are helpful for understanding why certain patents are asserted. Were they acquired from another prior to lawsuit? Were they asserted by the companies that developed them?¹⁶ The assignee type may even forecast the technologies involved.

Still more accounts of the patent system focus on the patented technology. Commentators compare differential treatment of different technologies¹⁷ as well as differential litigation outcomes by technology.¹⁸ A few studies combine technology and NPEs.¹⁹ Further, technology may make a difference in optimal licensing rates²⁰ or litigation outcomes.²¹

¹³ Fischer & Henckel, *supra* note 3 (examining acquisitions of NPE patents); Michael Risch, *supra* note 3 (same).

¹⁴ Kristen Osenga, *Formerly Manufacturing Entities: Piercing the "Patent Troll" Rhetoric*, 47 CONN. L. REV. 435 (2014) (examining NPEs that used to create and sell products); Ashley Chuang, Note, *Fixing the Failures of Software Patent Protection: Deterring Patent Trolling by Applying Industry-Specific Patentability Standards*, 16 S. CAL. INTERDISC. L.J. 215, 221–27 (2006) (describing different NPE sources).

¹⁵ Stuart J. H. Graham, et al., *High Technology Entrepreneurs and the Patent System: Results of the 2008 Berkeley Patent Survey*, 24 BERKELEY TECH. L.J. 1255, 1274–75 (2009) (surveying source of patents held by entrepreneurial firms); Theresa Veer & Florian Jell, *Contributing to Markets for Technology? A Comparison of Patent Filing Motives of Individual Inventors, Small Companies and Universities*, 32 TECHNOVATION 513, 514 (2012) (reporting survey findings that individuals are more likely to patent in order to block others for ex post enforcement).

¹⁶ Joe Mullin, *How Operating Companies Can Stop Patent Trolls: Cut Off the Ammo*, ARS TECHNICA (July 9, 2014), <http://arstechnica.com/tech-policy/2014/07/how-operating-companies-can-stop-patent-trolls-cut-off-the-ammo/> (arguing that NPEs litigation can be diminished if no one sells patents to NPEs).

¹⁷ BURK & LEMLEY, *supra* note 1.

¹⁸ Allison, Lemley & Schwartz, *supra* note 2 (examining outcomes based on technology); Axel Haus & Steffen Juranek, *Patent Trolls, Litigation, and the Market for Innovation* 9-10 (Dep't of Bus. & Mgmt. Sci., Norweigan Sch. Of Econ., Working Paper No. 2014/24, 2014), available at <http://papers.ssrn.com/abstract=2424407> (examining case duration considering patent technology and defendant patenting intensity); Alberto Galasso & Mark Schankerman, *Patent Thickets, Courts, and the Market for Innovation*, 41 RAND J. ECON. 472, 485-486 (2010) (modeling duration by technology).

¹⁹ See, e.g., Brian J. Love, *An Empirical Study of Patent Litigation Timing: Could a Patent Term Reduction Decimate Trolls Without Harming Innovators?*, 161 PENN. L. REV. 1309, 1343 (2013) (examining patent technologies asserted by different types of plaintiffs but not including outcomes).

²⁰ Rubén Hernández-Murillo & Gerard Llobet, *Patent Licensing Revisited: Heterogeneous Firms and Product Differentiation*, 24 INT'L J. IND ORG 149, 168–69 (2006) (“Our model illustrates the different trade-offs in the choice of licensing contracts that the patentholder faces, and how they are affected by changes in the degree of differentiation in the downstream market.”).

Others look at patenting and entry rates based on legal changes affecting that technology²² or differential patenting²³ and litigation²⁴ rates by technology.

These accounts are intuitive—compelling even—but incomplete. At the very least, an important temporal aspect is lost: patent applications are often filed years before litigation, and often change hands in the meantime.²⁵ A consideration of just litigants or just initial assignees cannot explain what happened in between. Indeed, focus on litigation at the expense of the underlying patentees and their technology may miss important details about who produces different types of inventions. For example, NPE litigation in 2009 asserted patent applications filed at the birth of the world wide web in the early 1990's.

Thus, every patent case is as much about the patentee as it is about the inventor who applied for a patent, and both are informed by how technology changed during the time from application to assertion.

The nature of research and development has shifted over time. Individual and small inventors became less important in the patent system around the turn of the 20th century.²⁶ This shift coincided with the growth of large firm invention and patenting.²⁷ For much of the 20th century, assertion of acquired patents diminished as inventors joined companies and

²¹ Alan C. Marco, *The Selection Effects (and Lack Thereof) in Patent Litigation: Evidence from Trials*, 4 TOPICS ECON. ANAL. & POL'Y 1, 17 (2004) (estimating outcomes using broad technology categories); Miller, *supra* note 10, at 46–48 (estimating outcomes based on technology).

²² Iain M. Cockburn & Megan J. MacGarvie, *Entry and Patenting in the Software Industry*, 57 MGMT. SCI. 915, 915 (2011)

²³ Stuart Graham & Saurabh Vishnubhakat, *Of Smart Phone Wars and Software Patents*, 27 J. ECON. PERSP., 67, 77–79 (2013) (examining PTO allowance rates for software and non-software).

²⁴ JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK 187-93 (2008) (describing the problems associated with software patents, including high rates of litigation and claim-construction review); Shine Tu, *Patent Examiners and Litigation Outcomes*, 17 STAN. TECH. L. REV. 507, 538–41 (2014) (showing litigation rates by different technology groups).

²⁵ Love, *supra* note 19, at 1339 (showing age of patents by litigant type); Feldman, *supra* note 10, at 68 (finding more than half of patents assigned prior to suit).

²⁶ See generally Naomi R. Lamoreaux, Kenneth L. Sokoloff, and Dhanoos Sutthiphisal, *The Reorganization of Inventive Activity in the United States During the Early Twentieth Century*, in UNDERSTANDING LONG-RUN ECONOMIC GROWTH: GEOGRAPHY, INSTITUTIONS, AND THE KNOWLEDGE ECONOMY 235 (Dora L. Costa & Naomi R. Lamoreaux eds. 2011); Naomi R. Lamoreaux et al., *Patent Alchemy: The Market for Technology in US History*, 87 BUS. HIST. REV. 3, 34 n. 99 (2013).

²⁷ Lamoreaux, *Patent Alchemy*, *supra* note 26, at 34.

assigned their patents to those companies.²⁸ As corporate research grew (and inventions became more expensive), small and independent patenting and licensing shrank.²⁹

Today, companies have downsized their investments in research and development.³⁰ Indeed, many large companies have assigned some of their patents to others for licensing, rather than hold them within the firm.³¹ Furthermore, software has allowed many more small and independent inventors to obtain patents.³²

But small and independent inventors may not be best situated to commercialize or enforce their patents. Instead, NPEs may better enforce

²⁸ Michael Risch, *Licensing Acquired Patents*, 21 GEO. MASON L. REV. 979, 998 (2014) (“Thus, acquired patents may follow the ebb and flow of small and independent inventors.”).

²⁹ Robert P. Merges, *One Hundred Years of Solicitude: Intellectual Property Law, 1900–2000*, 88 CALIF. L. REV. 2187, 2216 (2000) (“As the twentieth century progressed, inventions were more and more likely to be the product of large-scale corporate R&D rather than of the lone workshop tinkerer.”); Justin E. Gray & Harold C. Wegner, Center for the Protection of Intellectual Property, Conference Materials, Top 150 “Customers”: Increasing Domination of the Patent System 3 (Nov. 23, 2009), *available at* <http://www.grayonclaims.com/storage/GrayWegnerTop300Nov23REV.pdf> (noting concentration of patents in large companies).

³⁰ John Gertner, *Like Building Refrigerators: Bell Labs and the End of Game-Changing Innovation*, TIME MAG., (Mar. 27, 2012), <http://business.time.com/2012/03/27/like-building-refrigerators-bell-labs-and-the-end-of-game-changing-innovation> (on the closing of Bell Labs: “it had become difficult, and perhaps unnecessary, for a company to capture the value of a big breakthrough. So why do it?”); Charles Duhigg & Steve Lohr, *The Patent, Used as a Sword*, N.Y. TIMES (Oct. 7, 2012), <http://www.nytimes.com/2012/10/08/technology/patent-wars-among-tech-giants-can-stifle-competition.html> (“Last year, for the first time, spending by Apple and Google on patent lawsuits and unusually big-dollar patent purchases exceeded spending on research and development of new products, according to public filings.”); Lamoreaux, *Patent Alchemy*, *supra* note 26, at 34 (“In the face of stepped-up competition, large firms began to cut their research budgets and acquire more of their technology from outside sources. In the process, their share of non-federal R&D expenditures dropped from about two-thirds in 1980 to only about one-third in 2005.”); Ashish Arora & Alfonso Gambardella, *The Market for Technology*, 1 HANDBOOK OF THE ECONOMICS OF INNOVATION 650-51 (Bronwyn H. Hall & Nathan Rosenberg eds., 2010).

³¹ Leslie A. Gordon, *‘Patent Privateers’ do Legal Legwork for Big-Time Tech Companies*, ABA JOURNAL (July 1, 2013, 2:30 AM), http://www.abajournal.com/magazine/article/small_companies_pick_up_the_cost_of_patent_privateering_litigation/.

³² See Lamoreaux, *Patent Alchemy*, *supra* note 26, at 34 (“By the end of the [twentieth] century, however, small firms and independent inventors were once again major participants in the market.”).

patents on behalf of particular inventors or even in particular technologies.³³

The goal, then, is to identify the layers and observe how the layers work together.

II. LAYER: ENFORCERS

This article expands on the data collected for two previous articles: *Patent Troll Myths*³⁴ and *A Generation of Patent Litigation*³⁵. Those studies focused on enforcers: the plaintiffs in patent cases. A brief summary of the data collected follows, and the prior articles detail collection methodologies.

A. Summary of Cases and Patent Identification

Data collection began with identification of every case involving the most litigious NPEs³⁶ of the 2000-2009 time period.³⁷ While most litigation occurred after 2000, there were many cases that predated 2000 as well. Once these cases were identified, random patent litigation roughly matched by year of lawsuit were collected. From there, the patents involved in each of the cases were identified.

An important aspect of the selection is that every case involving the studied patents in each group was identified and studied. Thus, the entire life cycle of each patent (through 2009) is part of the study. Almost by definition, in most cross-sectional studies only the patents asserted in a given year are studied and earlier cases involving the same patents are usually lost. We also recorded every outcome of every case, whether or not a ruling on the merits occurred.

We then collected additional data about the NPE and random control set of cases and patents. This included litigation data such as filing dates,

³³ Alberto Galasso, Mark Schankerman & Carlos J. Serrano, *Trading and Enforcing Patent Rights*, 44 RAND J ECON. 275, 299 (2013) (“[C]omparative advantage in patent enforcement may be more important than comparative advantage in commercialization, at least for transfers involving individually owned patents. Second, the results show that patents with larger estimated (enforcement) gains from trade are in fact those with the highest predicted likelihood of changing ownership.”); Mazzeo, *supra* note 4, at 889 (NPEs have better outcomes than individuals).

³⁴ Risch, *supra* note 3.

³⁵ Risch, *supra* note 10.

³⁶ These include Acacia Research, Plutus IP (now IP Nav), Ronald A. Katz Licensing, Catch Curve, General Patent Corp, F&G Research, Millenium, Cygnus Systems, Papst Licensing, and others.

³⁷ Further detail on the data collection process and representation in the matching set is described in Risch, *supra* note 10, at **.

duration, number of defendants,³⁸ outcomes, and appeals. It also included patent data, including priority date, number of claims, number of continuations, reexaminations, assignments, and number of references cited.

We then determined the parties that obtained each patent – the initial assignees.³⁹ Once initial assignees were identified, we collected information about them.

First, we gathered objective data available in Hoovers, Dun & Bradstreet's Million Dollar Database, and other publicly available sources. Objective data includes number of employees, revenues, and industry codes. Data was not available for all companies for all fields, and missing data was dropped from relevant analytical analysis.⁴⁰

Second, we gathered publicly available information about companies from a variety of sources, including the SEC, press releases, financial web sites, and Wharton's WRDS database. This data includes date of initial public offering, market value at the time of patent filing, and various dummy variables relating to the relationship of the company's public status and the patent.

Third, we gathered venture capital investment data using Thomson's VentureXpert database. The analysis here assumes that absence from that database indicates no venture funding for the company. This, of course, may not be true, but Thomson tracks millions of venture backed companies and virtually all of the largest venture funds, such that most venture-backed companies would appear in the database.⁴¹ However, missing venture funding information is a limitation of the data. The VentureXpert data included the number of investment rounds, the amount invested, the date of first investment, and public offering/acquisition data.

The resulting data set yielded 917 unique litigations in the litigious NPE group, which were consolidated into 752 final actions. The NPE cases involved 352 patents. In turn, the 352 patents resulted from 176 initial

³⁸ We did not collect detailed data about defendants because so many cases had multiple defendants – as many as 100 in some cases.

³⁹ Some patents may have been assigned to others shortly after their issuance, but such conveyances are not considered initial assignments here.

⁴⁰ For a variety of reasons, one would expect missing data in Dun & Bradstreet to skew available data toward operating companies.

⁴¹ There is no reason to believe that there is a selection bias, though it is theoretically possible that the types of venture capital companies that would invest in the types of assignees here are the same types that would be excluded from VentureXpert. For further discussion of VentureXpert, see Ronald J. Mann & Thomas W. Sager, *Patents, Venture Capital, and Software Startups*, 36 RESEARCH POL'Y 193, 195 (2007).

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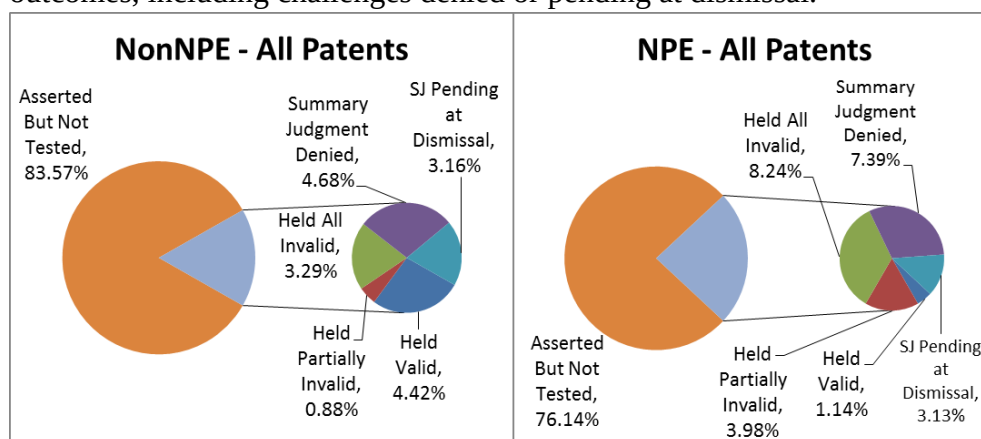
patent applications, many of which spawned multiple patents (the max was 41 patents from one application).

The nonNPE group included 1311 unique cases, which were consolidated into 1152 final actions. The cases involved 791 patents stemming from 536 applications (the max was nine from one application).

B. Enforcer Outcomes

The patent plaintiffs, standing alone, are relatively self-explanatory. The nonNPE set is comprised of a varied group, including individuals, individually owned companies, small companies, and large companies. More than 92% of the nonNPE plaintiffs were product companies, with another 5.7% as individual or individual-owned companies and the remainder distributed among the other groups. For obvious reasons, the highly litigious NPE set is more circumscribed, falling mostly into the acquired licensor, inventor owned, and IP licensing affiliate of product company groups.⁴²

The following chart highlights differences in patent quality (invalidity) outcomes based solely on the type of litigant. The chart reports all outcomes, including challenges denied or pending at dismissal.



When considered as a percentage of those patents actually adjudicated, the NPE patents performed on the whole much more poorly than nonNPE patents. When challenged, some or all of the claims were invalidated slightly more than 50% of the time, compared to 25% for nonNPEs. The summary judgment attempts to invalidate were denied at about the same rates, at around 30%. Interestingly, nonNPE group had a higher dismissal rate with summary judgment challenges pending (19% to 13%) than the

⁴² Risch, *supra* note 10, at **.

NPEs. This is contrary to a view that these litigious NPEs dismiss rather than see their patents challenged at a rate different from other plaintiffs.

The primary difference between the two groups appears to be the much higher percentage of patents found valid among nonNPEs, a phenomenon discussed in a prior paper. In the end, about 12% of the NPE patents asserted over 25 years were invalidated either partially or completely. These invalidations came in about 3% of the cases, because most cases involved multiple invalid patents. The remainder of patents and cases either went untested or survived pretrial challenge.

Finally, the primary factors that correlated with invalidation related not to NPE status or patent quality metrics (like number of claims or forward citations), but to choices litigants made such as how many defendants to sue, how often the patent was asserted, and whether to sue in a district that would lead to a transfer.⁴³ A logistic regression estimate in Part V combines these selection factors with information about patentees and technology discussed in the next two parts.

III. LAYER: PATENTEES

An analysis of the source of patents asserted by NPEs and nonNPEs shows a channeling of innovative efforts based in large part on company size and success. The NPE group asserted many more patents obtained by individuals than the nonNPE group. Further, there were some differences among companies that obtained patents. These findings reinforce a key finding of *Patent Troll Myths*: how one views these litigious NPEs should depend in large part on how one views the underlying inventive efforts.

In both groups, the final plaintiff was quite often different than the initial patentee. The nonNPE group members were more likely to hold on to their patents, though many of the nonNPE patents were assigned. A total of 531 of the nonNPE patents, or 67%, had at least one conveyance. The NPE group saw 310 conveyances, or 88% of the patents.

Among the nonNPE group, patents were assigned an average of 1.57 times after the initial assignment, with a median of 1 and standard deviation of 1.7. The litigious NPE group's patents were assigned an average of 2.77 times, with a median of 2 and standard deviation of 2.5. The maximum number of assignments was 10 for nonNPEs and 13 for NPEs.

But who were the original patentees? The following table identifies who originally obtained the patents in this study. We classified each initial assignee according to type of business. The classifications follow those of

⁴³ Risch, *supra* note 10, at**.

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prior papers,⁴⁴ classifying patent owners into a variety of different patent business models. The classifications here differ from other studies of patent plaintiffs, however, because they relate to the business of the owner *at the time of patenting*. Of course, every patent asserted by the litigious NPE group was owned either by an acquiring licensing company, an individually owned company, or an IP subsidiary of a product company at the time of assertion. But the time of patenting, however, different types of entities owned the patents.

Assignee Type	NonNPE	NPE
1 Acquired patents/Licensing	0.13%	8.24%
3 Failed Startup	0.76%	1.99%
4 Former product company	0.63%	0.00%
5 Individual Inventor Co.	3.92%	14.20%
6 Univ/Gov't/NGO	2.53%	1.14%
7 Startup – preproduct	0.00%	1.42%
8 Product company	74.21%	42.90%
9 Individual	16.06%	29.26%
10 Undetermined	0.25%	0.00%
12 IP Sub. of Product Co.	1.52%	0.85%
Total	100.00%	100.00%

The data show that product companies are the most used source of patents for both groups, but much more so for the nonNPEs (74% for nonNPEs and 43% for NPEs). Further, patents assigned to individuals and their companies were disproportionately represented in the NPE group, with a total of about 20% for nonNPEs and 43% for NPEs. The other categories are negligible, meaning that the primary division between these two groups is product companies and individuals even though product companies are well represented among the NPE group.

The non-individual entities are dominated by companies – more than 98% in each group. The remaining two percent are divided between universities and hospitals; the NPE group has a greater proportion of hospitals, while the nonNPE group has more universities. In the NPE group, about 32% of the initial company assignees were principally dedicated to licensing and enforcement, while only 2 nonNPE assignees were dedicated

⁴⁴ 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, 10 (2009) (categorizing plaintiffs according to Lemley/Myhrvold company schema); see also Michael Risch, *supra* note 3, at 495 (categorizing patent owners by same categories).

to enforcement at the time the patent issued. This is not surprising, given that licensing companies were expressly excluded from the nonNPE group.

The following table compares the companies that obtained patents asserted by each group. These comparisons are not based on the time of patenting. Instead, they consider whether the companies were ever public, ever ceased operations, ever acquired, or ever venture funded.⁴⁵

These comparisons are helpful to assess both the inventive activities of the company as well as the provenance of patents asserted in litigation.

Company Status	NonNPE	NPE
Total Companies ⁴⁶	650	248
Public	38.00%	15.32%
Public Subsidiary	13.54%	6.85%
Venture Funded	21.08%	14.92%
Defunct ⁴⁷	13.99%	10.30%
Acquired	23.08%	26.21%

The differences in funding type were relatively stark and statistically significant. The nonNPE group asserted more than twice as many patents were acquired by public or public subsidiary companies, 52% to 22%. Further, the nonNPE patents were obtained by venture funded companies about 50% more often. The percentage of companies that were defunct or acquired was not statistically significant, which is consistent with previous findings that these NPEs did not provide a special advantage to liquidating companies.⁴⁸

The market value of public companies and the amount of venture funding, sales, and employees was higher among companies obtaining patents in the nonNPE group.

⁴⁵ Overlaps in the public/public subsidiary were removed (55 in the nonNPE group and 9 in the NPE group). Overlaps in venture funded companies were not removed.

⁴⁶ All differences are statistically significant at $p=0.000$ in a t-test.

⁴⁷ About 20 patents were excluded from the calculation because current status of the initial assignee could not be determined.

⁴⁸ For extensive discussion of this issue, see Michael Risch, *supra* note 3, at 491-94.

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nonNPE*	N	Mean	Med	Min	Max	StDev
Market Value at Filing	160	\$16,132	\$3,053	\$11	\$270,847	\$37,638
Venture Funding	100	\$107	\$28	\$1	\$1,463	\$317
Sales	458	\$12,058	\$147	\$0.044	\$147,359	\$26,721
Employees	490	26,372	682	1	434,246	70,552

*all \$ in millions

NPE*	N	Mean	Med	Min	Max	StDev
Market Value at Filing	14	\$7,418	\$1,942	\$102	\$62,034	\$16,077
Venture Funding	37	\$20	\$7.5	\$0.5	\$72	\$21
Sales	78	\$3,576	\$1.5	\$0.11	\$79,029	\$12,057
Employees	149	4,674	13	4	172,438	20,575

*all \$ in millions

The comparison shows real⁴⁹ differences in every measure. The percentage of companies for which data was available was smaller among the litigious NPE group. Though highly skewed for both, companies obtaining the nonNPE patents had more employees, more sales, more venture funding, and more market value⁵⁰ at every percentile. Further, the medians show that half of the companies obtaining NPE patents remained very small, with 13 or fewer employees among those for which data was available.⁵¹

Even so, these results should not be overstated. More than 20% of the companies obtaining patents asserted by the highly litigious NPEs were public, and 15% of them were venture funded.

Nonetheless, the data supports a conclusion that the companies obtaining nonNPE patents are bigger, better funded, and more likely to be selling products than the companies obtaining patents asserted by these

⁴⁹ And significant.

⁵⁰ Interestingly, the place of incorporation does not show marked differences. More of the NPE corporations were incorporated in Delaware (28% to 34%) and in foreign countries (21% to 27%). One would have expected more corporations incorporated in Delaware among the nonNPEs given the other differences, but this did not hold true. At the very least, it implies that place of incorporation may not be a good proxy for public or venture funding.

⁵¹ Cf. Gerard N. Magliocca, *Blackberries and Barnyards: Patent Trolls and the Perils of Innovation*, 82 NOTRE DAME L. REV. 1809, 1831 (2007) (theorizing that NPEs thrive when patent acquisition costs are low); Jean O. Lanjouw & Mark Schankerman, *Protecting Intellectual Property Rights: Are Small Firms Handicapped?*, 47 J.L. AND ECON. 45 (2004) (small inventors are at a significant disadvantage in enforcement).

highly litigious NPEs. This conclusion is fortified by the higher percentage of individual inventor obtained patents in the NPE group.

Whether this conclusion holds true for all NPEs depends on the extent that these litigious NPEs found their patents from similar companies as other NPEs. This is unlikely to be true for research and development companies like InterDigital, but may hold for individual owned companies and patent licensing firms.

Finally, the effect of these differences depends on how one views the importance of invention by individuals and companies that are less well funded, sell less, and have fewer employees. As discussed in Part V, below, individual inventor patents are more likely to be invalidated, but even so, only a small fraction of them reach that point. If one believes that such entities contribute valuable inventions to society, then the litigious NPEs may be vindicating socially beneficial incentives. If one believes that such entities do not provide a social benefit through patenting, then this evidence will only bolster that view.

IV. LAYER: TECHNOLOGY

It is relatively well documented that NPEs tend to assert patents in areas different than the general litigating population.⁵² This study shows a disparity over a period of twenty-five years for highly litigious NPEs. With the assertion of different types of patents comes different problems, most notably with respect to patent defects.

People dispute the reasons why NPEs assert different types of patents, with many arguing that NPEs prefer vague software patents. However, as shown below, nonNPEs assert plenty of software patents themselves with varying degrees of success. The difference is that NPEs do not assert *other* technologies, like therapeutics.

One explanation of differential technology is the layering of the patent system. Software and other high technology patents may be more easily developed by individuals and smaller companies with fewer resources. These companies tend to be the primary patent sources for highly litigious NPEs, leading to more assertion. There is no reason, for example, why other

⁵² See, e.g., Allison, Lemley & Walker, *supra* note 44, at 16 (showing different technologies and industries of most litigated patents, many of which were asserted by NPEs); Michael Risch, *supra* note 3, at 477–78 (showing differing technology types between highly litigious NPEs and general patent pool); U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-13-465, INTELLECTUAL PROPERTY: ASSESSING FACTORS THAT AFFECT PATENT INFRINGEMENT LITIGATION COULD HELP IMPROVE PATENT QUALITY 26 (2013) (showing more software patents asserted by patent monetization entities).

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patentees with the ability to invent but not productize would stay away from patent assertions. Some have posited, for example, that universities will begin to partner with NPEs for enforcement of pharmaceutical and medical device patents,⁵³ a theory consistent with the layered patent system even if it has yet to come to fruition.

A. PTO Technology Classes

The following table lists the top USPTO technology classes for both the NPE and nonNPE set. For each group, the table shows the percentage of patents that fell within the top classes. The table also shows the percentage of patents that fall into the same classes for the *other* group for a quick comparison.

Top NonNPE Classes				Top NPE Classes			
Class		NonNPE	NPE	Class		NonNPE	NPE
514	Drug	4.17%	0.28%	379	Telephonic Comm.	2.40%	17.05%
362	Illumination	4.17%	0.28%	360	Mag. Info. Storage	0.00%	8.24%
348	Television	3.66%	6.53%	705	Fin. Bus. Meth.	1.01%	6.82%
424	Drug	3.54%	0.00%	348	Television	3.66%	6.53%
349	Liquid Crystal	2.53%	0.00%	709	Data Process. Trans.	1.89%	4.55%
379	Telephonic Comm.	2.40%	17.05%	358	Facsimile Proc.	0.25%	4.55%
210	Liquid Purif.	2.02%	0.00%	715	Display Pres.	0.38%	3.41%
340	Comm.: Electrical	1.89%	0.57%	725	Interact. Vid. Dist.	0.38%	2.84%
709	Data Process. Trans.	1.89%	4.55%	701	Locat. Data. Proc.	0.25%	2.56%
606	Surgery	1.64%	0.28%	707	DB Data Proc.	0.13%	2.56%
546	Organic Comp.	1.64%	0.00%	310	Elec. Generat.	0.25%	2.56%
435	Molecular Bio.	1.64%	0.00%	463	Games	0.13%	2.27%
345	Comp. Graphics	1.64%	0.85%	455	Telecomm.	0.63%	2.27%
	Total	32.83%	30.40%		Total	11.36%	66.19%

The table allows for a quick examination of overlap – or lack thereof. For example, Class 514 (Drug) was the top class for nonNPEs, with 4.17% of the patents, but only .28% of the NPE group patents fell in that category. Similarly, Class 379 (Telephonic Communications) was the top class for the litigious NPEs, with 17%, while 2.4% of the nonNPE patents fell into the same class, which appears in the left side as the sixth most frequent nonNPE class.

Similarly, the sixth most frequent NPE class, 358 (Facsimile

⁵³ Feldman & Price, *supra* note 9, at 793 (“Our suspicion was that these university [bio patent] holdings would provide a fertile hunting ground for monetizers.”)

Processing), is 4.55% of NPE patents, but only .25% of nonNPE patents (and not in the top 10 list for nonNPEs).

The table shows very little overlap by technology class. It also shows that most NPE classes (66%) are bunched into the top 13 classes, while only half as many (30%) of nonNPE patents are in the top 13 classes. NonNPE patents are more diverse and less focused on data processing, storage, business methods and communications.

Organization by technology class is not without problems. The primary classes can be both overly broad and unduly narrow, and often do not provide granular detail about the inventions within each class. Further, and ironically, the classes do not allow for aggregation of similar inventions into fewer coherent technology categories.

B. Technology Art Groups

In an effort to solve these dual problems, the patents here were grouped by art unit associated with their patent class.⁵⁴ The art units were then grouped into art groups. This grouping provides description about the technology, but also aggregates them.⁵⁵ The following table shows the percentage of patents in select art groups.

⁵⁴ An art unit/technology class correspondence is located here: <http://www.uspto.gov/patents/resources/classification/art/>.

⁵⁵ For an example of other reporting by art unit groups, see Dennis Crouch, *Patent Grant Rate by Technology Area*, PATENTLY-O (Aug. 11, 2014), <http://patentlyo.com/patent/2014/08/patent-grant-technology.html>.

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Technology	NonNPE	NPE
Computer Architecture, Software, & Information Security	17.57%	54.55%
Chemical and Materials Engineering	11.38%	2.56%
Optics	10.75%	3.41%
Electrical Circuits & Systems	7.21%	4.26%
Sheet Container Making, Package Making, Receptacles Shoes, Apparel, and Tool Driving or Impacting	3.92%	1.42%
Surface Transportation	3.41%	0.28%
Semiconductors/Memory	3.29%	0.57%
Printing/Measuring & Testing	2.78%	1.42%
Computer Networks	1.90%	4.55%
Amusement and Education Devices	1.77%	2.56%
Cryptography, Security	1.64%	2.27%
Electronic Commerce	1.01%	6.82%
Thermal and Combustion Technology, Motive and Fluid Power Systems	0.38%	2.56%
Cable	0.38%	2.84%
Computerized Vehicle Controls and Navigation, Radio Wave, Optical and Acoustic Wave Communication, Robotics and Nuclear Systems	0.25%	2.56%
Medical and Surgical Instruments, Treatment Devices, Surgery & Surgical Supplies	1.77%	0.00%
Organic Chemistry	1.77%	0.00%
Fermentation, Microbiology, Isolated and Recombinant Proteins/Enzymes	4.42%	0.00%
Organic Compounds: Bio-Affecting, Body Treating, Drug Delivery, Steroids, Herbicides, Pesticides, Cosmetics, and Drugs	3.41%	0.00%
Medical Instruments, Diagnostic Equipment, Treatment Devices	1.77%	0.28%

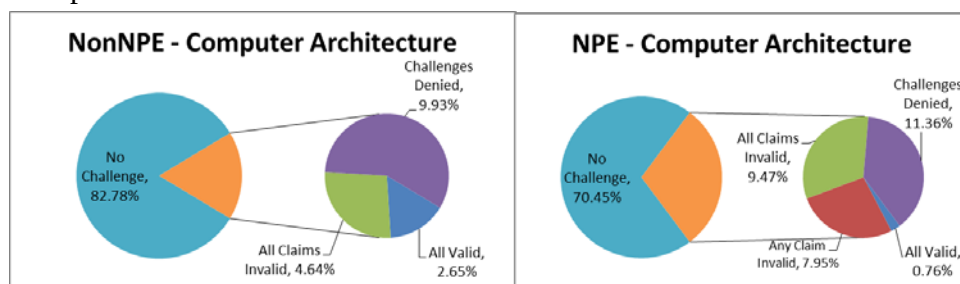
The table clarifies a few trends. Computer architecture, software, and information security is the most prevalent technology type for both groups, though the percentage is much greater – over 50% – for the NPE patents. The difference is extended when the computer networks group is added.

The data also show several areas where few and even no NPE patents were litigated. For example, the second and third most prevalent categories for the nonNPEs were chemical and materials engineering (11.38%) and optics (10.75%). These two categories totaled about 6% for the NPE group. Further, there are several categories that were completely absent from the list of litigious NPE patents, virtually all of which relate to medicine and pharmaceuticals.

The following charts shows validity outcomes for each group based on a

few selected technology categories. Because only 3% of all cases involve a patent adjudicated on the merits, the charts show percentages of patents rather than percentages of cases. For each category, the large pie chart shows the percentage of patents that were unchallenged, which was most of them. The smaller pie chart shows the outcomes of patents that were involved in some sort of challenge. This representation allows for concise reporting of both the relative outcomes among those patents that were tested and absolute outcomes among all patents in the category.

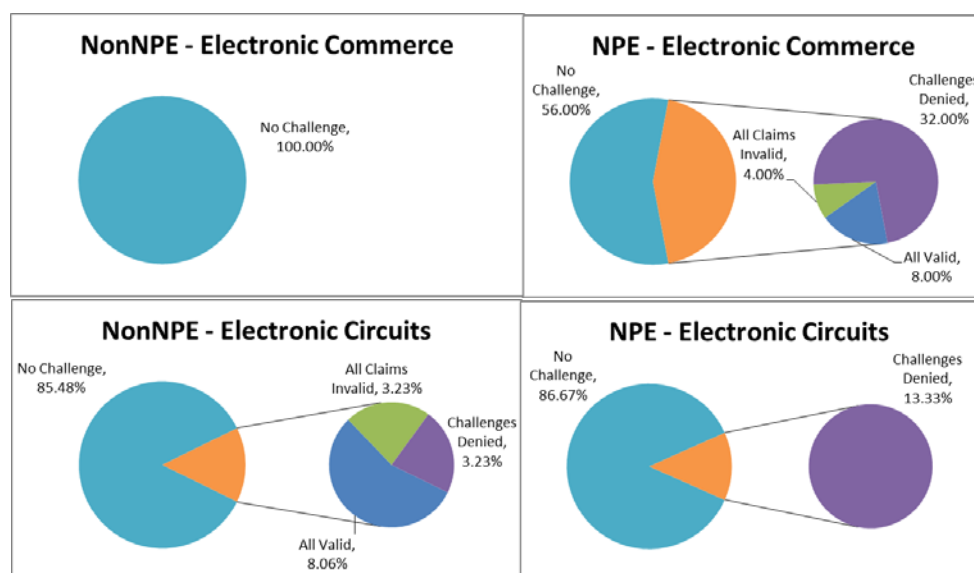
Two striking differences are apparent in the first two charts for computer architecture and software technology. First, many more of the litigious NPE patents were challenged (30% versus 18%). Second, the primary difference between the two groups appears to be that about 1/3 of the patents judged on the merits were found to have at least one claim invalid, but not all claims invalid. The two groups had patents completely invalidated at approximately equal rates (about a third of all patents subject to challenge). But the NPE group had another third of its patents with one or more (but not all) claims invalidated, whereas the nonNPE group had a greater percentage with challenges denied or held valid. This may imply that the litigious NPE group enforced more patents that had at least one extremely broad claim that was more likely to be invalidated due to prior art or some other rule relating to claim scope, such as enablement or description.⁵⁶



⁵⁶ Michael Risch, *What is a Patent Troll?*, PRAWFSBLAWG (Apr. 15, 2011), <http://prawfsblawg.blogs.com/prawfsblawg/2011/04/what-is-a-patent-troll.html> (“[T]rolls are trolls when they overreach”).

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The computer architecture and software category stands in stark contrast to electronic commerce, which is also surprising. There were no challenges of nonNPE patents, though there were only five patents in the group. The NPE e-commerce patents were some of the most challenged technology in the study, with 44% seeing a challenge (n=25). And, although heavily challenged, the challenges were almost completely unsuccessful. Less than 10% of the challenged patents were invalidated. Another 20% were found valid, and challenges were denied or pending at dismissal (but the patent was not resolved) in the remaining 70%. This is directly contrary to an expectation that these litigious NPEs asserted weak electronic commerce patents. Instead, these results imply that few of the patents were electronic commerce and, despite being general purpose software, when they were asserted they were invalidated less often than other computer patents. It should be noted that after changes in patentable subject matter jurisprudence,⁵⁷ these patents might well be invalidated today.⁵⁸



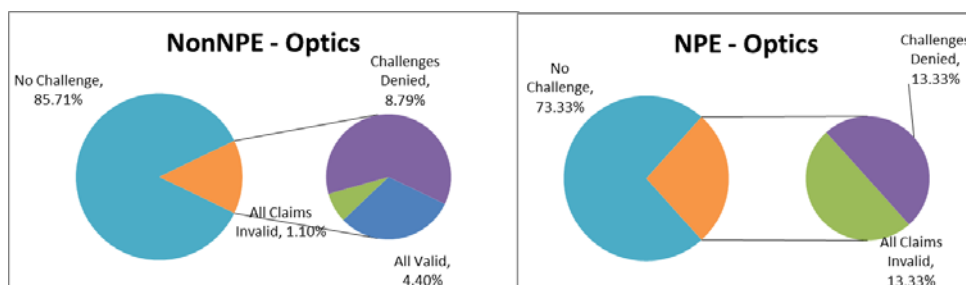
Other technologies fare better for both groups. In electric circuits, for example, fewer patents were challenged. In the nonNPE group, half the challenged patents were found valid, and another quarter had challenges denied. For the NPE group, all patents survived challenge but yielded no

⁵⁷ Alice Corp. v. CLS Bank Int'l, 573 U. S. __ (2014) (expanding scope of unpatentable abstract ideas).

⁵⁸ Timothy B. Lee, *Software Patents are Crumbling, Thanks to the Supreme Court*, Vox (Sep. 12, 2014), <http://www.vox.com/2014/9/12/6138483/software-patents-are-crumbling-thanks-to-the-supreme-court> (“[T]here have been 11 court rulings on the patentability of software since the Supreme Court’s decision — including six that were decided this month. Every single one of them has led to the patent being invalidated.”).

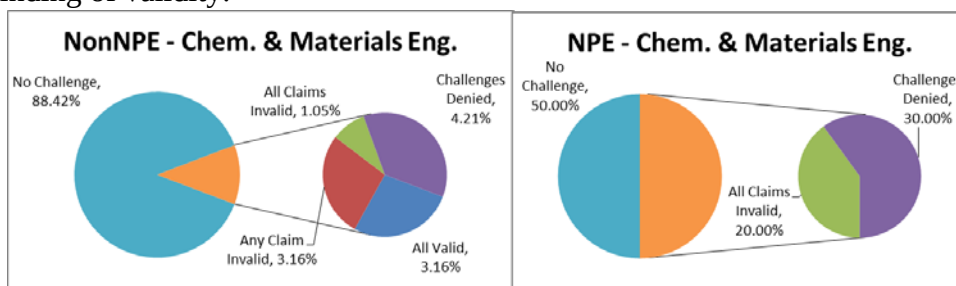
merits rulings. This is consistent with a preference for settlement among the litigious NPEs, even if the patents survived challenge.⁵⁹

Optics patents faced similar results as electric circuits. Half or more challenges were denied in both groups, but with the nonNPE patents having more found valid. As subsection C shows below, the litigious NPE optics patents included more software patents. This may explain why more of the NPE patents were challenged and more were found invalid.



These previous four categories – computer architecture, electric circuits, electronic commerce, and optics – have the largest overlap between the two groups. The groups where there is smaller, and even no, overlap provide an interesting contrast.

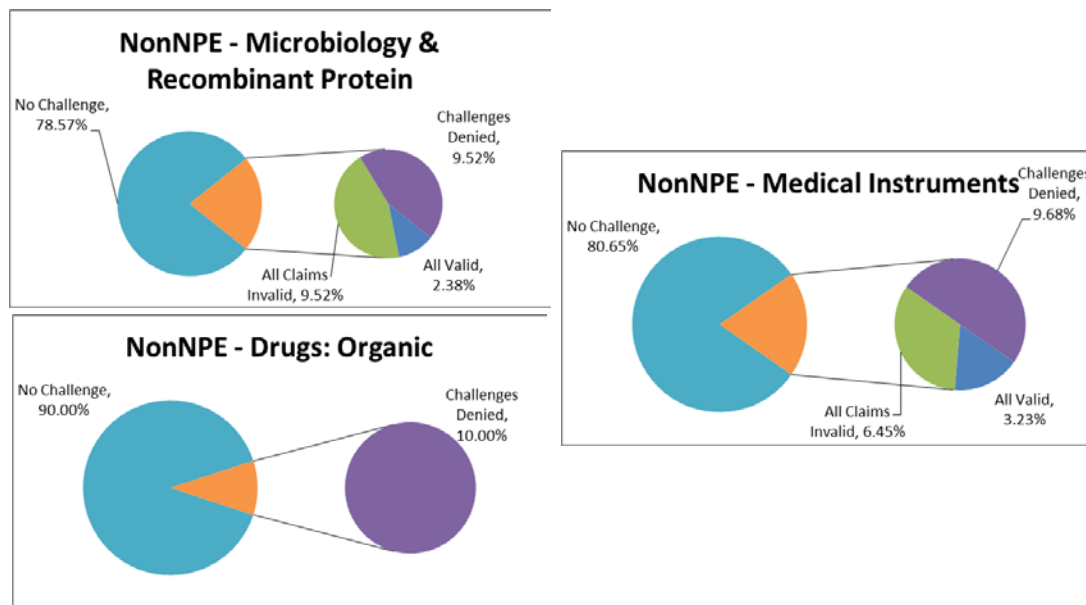
In chemical and materials engineering, patents were invalidated at about the same rate for both groups – about one-third. The primary difference was that a higher percentage of patents in the NPE group were challenged – 50%. However, the sample is small, with the total number of NPE patents in this category at 10. The results are also consistent with other findings – the litigious NPE cases terminated with challenges being denied and a pretrial dismissal, while the nonNPE cases were more likely to terminate with a finding of validity.



⁵⁹ Risch, *supra* note 10, at **.

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The final three charts all relate to the nonNPE group, because there were no NPE patents in those technologies. Pharmaceuticals appeared to fare better than medical instruments and biotechnology. Those patents were challenged less and suffered no invalidations. Indeed, the other groups were invalidated at about the same rate as computer architecture patents when challenged – between 30% and 40%. The biotechnology finding is consistent with a similar study of all cases filed in a recent period.⁶⁰



C. Software

Finally, given findings that software is related to NPE litigation,⁶¹ this study examines patents for software related inventions. Following Graham & Vishnubhakat,⁶² software patents were identified by technology class. This method may miss certain data processing, but is largely accurate has the benefit of being reproducible.⁶³ Software can be divided into two types: general purpose software, which is more like “pure” software and hardware specific software, which is software incidental to some more specific tangible invention. Software falling in each of these two groups of classes

⁶⁰ Allison, Lemley & Schwartz, *supra* note 2.

⁶¹ GAO, *supra* note 52, at 21 (software “patents were at issue in the lawsuits that accounted for about 89 percent of the increase in defendants [between 2007 and 2011].”).

⁶² Graham & Vishnubhakat, *supra* note 23, at 75 note 7.

⁶³ *Cf.* Bronwyn H. Hall & Megan MacGarvie, *The Private Value of Software Patents*, 39 RESEARCH POL’Y 994, 997–98 (2010) (describing attempts to reproducibly define software patents and type I and II errors associated with same).

do not necessarily overlap; a total of seven patents across both sets are coded for both software types.

There are significant differences between the two groups. About 10% of nonNPE patents are general software, while 30% of NPE patents are general software. The differences are less stark for hardware specific software: 25% of nonNPE patents and 30% of NPE patents. Thus, nearly 60% of NPE patents are some sort of software, as compared to 35% of the nonNPE patents.⁶⁴

The following table shows the percentage of each technology category made up of the two different software patent types. The total percentage of patents in each category is the sum of general and specific software. For example, 100% of electronic commerce patents are software based, though in the NPE group 12.5% of them are hardware specific.

	NonNPE		NPE	
	General Software	Hardware Specific	General Software	Hardware Specific
Aeronautics, Agriculture, Weaponry	0.00%	23.08%	0.00%	0.00%
Amusement and Education Devices	0.00%	7.14%	0.00%	77.78%
Body Treatment, Kinestheraphy, Exercising	0.00%	11.76%	0.00%	0.00%
Cable	100.00%	0.00%	100.00%	0.00%
Computer Architecture, Software, & Information Security	22.30%	69.06%	20.31%	38.54%
Computer Networks	100.00%	0.00%	100.00%	0.00%
Computerized Vehicle Controls and Navigation, Radio, Optical and Acoustic Wave Communication	100.00%	0.00%	100.00%	0.00%
Cryptography, Security	61.54%	38.46%	75.00%	25.00%
Digital, General, and Optical Communications, Telephony, Audio, Multiplex Communications, Cellular Telephony, Radio and Satellite	0.00%	100.00%	0.00%	100.00%
Electrical Circuits & Systems	0.00%	29.82%	0.00%	33.33%
Electronic Commerce	100.00%	0.00%	87.50%	12.50%
Medical Instruments, Diagnostic Equipment, Treatment Devices	0.00%	100.00%	0.00%	100.00%
Multiplex Communications	100.00%	0.00%	100.00%	0.00%
Optics	0.00%	22.35%	0.00%	66.67%
Printing/Measuring & Testing	4.55%	72.73%	20.00%	0.00%
Refrigeration, Vaporization, Ventilation, and Combustion	0.00%	0.00%	0.00%	50.00%

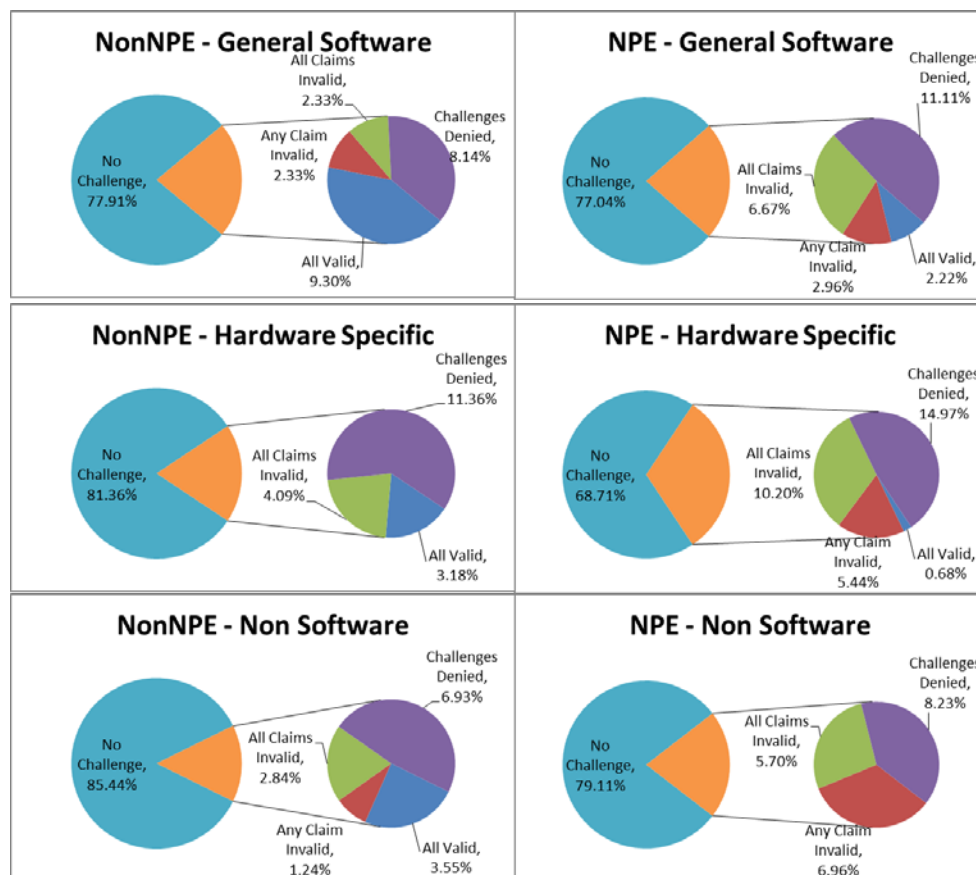
⁶⁴ Accord, GAO** at 21-22 (finding that monetization plaintiffs brought had roughly double the number of software patents in lawsuits).

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Semiconductors/Memory	0.00%	50.00%	0.00%	100.00%
Television and TV Recording, Video Distribution, Image Analysis, (Fax, Printing, Printing Network, Scanners), Speech, (Fax, Disk Drive), Computer Graphics, Display	100.00%	0.00%	0.00%	0.00%
Video Compression/Recording	0.00%	100.00%	0.00%	0.00%

The table shows that software patents are not limited to electronic commerce and computer networks; they appear in a variety of different categories. At the same time, not every patent is software based, even in the computer architecture category. There were many categories with no software patents, and some of the categories in the table, like optics, have more non-software patents than one might expect.

The following charts consider patent validity for software. Each chart shows the percentage of patents in each group that were tested on the merits, and then shows percentages of each type of holding in a separate pie chart that shows the relative findings on the merits.



In one sense, the charts are not surprising. Among the nonNPE group,

nonsoftware patents were challenged less often and invalidated less often than software patents.

In another sense, the results are somewhat surprising. General software patents appear to perform better than hardware specific software patents for both groups. Further, software patents survive challenge among both groups about half the time.⁶⁵ Indeed, among nonNPEs, a large portion of the challenged general software patents were found valid. More surprising, nonsoftware patents fared worse than software patents, at least among the NPEs. Though nonsoftware patents were challenged less often, the challenges were successful about two-thirds of the time, as compared to half for each category of software. Even in the nonNPE group, a greater percentage of software patents survived challenge or were found valid than non-software patents.

These findings are inconsistent with a narrative that software patents are worse than other patents. However, the results are consistent with a layered approach to the patent system. It is not enough to simply compare software patents to nonsoftware patents; examination by technology group and even patentee and plaintiff type is also necessary. For example, the results imply that NPEs may be better at selecting software patents than nonsoftware patents – at least in terms of quality. The invalidity outcomes also show why patentable subject matter rulings are so important to defendants—general software patents were harder to invalidate when tested on other patentability criteria.

Furthermore, the results show that attempts to curb patent trolls by making software more difficult to patent⁶⁶ may have unintended consequences against non-targeted patent owners.

D. Policy Implications

The policy implications of the technology findings are twofold. The first is well-known – broad patent reform intended to curb litigious NPEs might create a risk to the entire patent system if nonNPEs are asserting different types of patents. Further, there is *some* overlap between the two groups, which means reforms targeted at specific types of patents will affect nonNPEs that hold similar patents. Of course, if one believes that every patent in a particular category is problematic, then focus on that technology

⁶⁵ Allison, Lemley & Schwartz, *supra* note 2 (finding software patents fared much more poorly when tested than other patent technology).

⁶⁶ See, e.g., Chuang, *supra* note 14, at 245–47 (suggesting stricter limitations on software patents to limit patent troll activity).

may be preferable to focus on types of patent owners.

A second implication that is merely anecdotal in most studies is that different patent classes will create different reasons for invalidation. For example, while about 55% of the NPE patents were in the computer architecture category, virtually all of the NPE invalidations—whether for anticipation, obviousness, written description, or definiteness—fell in that category.⁶⁷ In contrast, reasons for invalidation were spread much more evenly among the nonNPE patents because the technology was spread more evenly.

The takeaways here are ambiguous. On the one hand, one could argue that NPEs simply assert invalid patents more often. On the other hand, it could be that the types of patents that NPEs assert are broad data processing patents, which are in all cases more likely to be invalidated, even if hardware specific.

Third, despite protestations that litigious NPEs might begin asserting therapeutic patents,⁶⁸ evidence of such assertions had not materialized among highly litigious NPEs as of 2009. One reason may be that the therapeutic technology and patentee layers simply do not overlap with NPE enforcement layers, even among universities.

V. MODELING THE LAYERS

The data collected can shed some light on patent quality by enforcer, patentee, and technology type.⁶⁹ It can also help show how the repetitive assertion of patents affects invalidation.

The data allows for a regression to test whether patent invalidity findings are correlated with patent characteristics (such as the number of claims), with technology characteristics (such as software), with plaintiff characteristics (such as licensing companies), with initial patentee characteristics (such as public companies), or with litigation selection choices (such as number of defendants).

The method involves a stepped regression that adds and removes variables and observes changes in the estimates, if any. Prior analysis found that once selection effects were included in the model, status as an NPE did not affect the likelihood of a patent being invalidated.⁷⁰ While NPEs were more likely to sue more defendants, assert patents more often, and assert

⁶⁷ *But see* Miller, *supra* note 10, at 49–50 (finding that NPE patents are more likely to be invalidated for obviousness or anticipation, regardless of technology).

⁶⁸ Feldman & Price, *supra* note 9.

⁶⁹ The data does not allow for regression testing by entity size.

⁷⁰ Risch, *supra* note 10, at **.

more patents in each case, invalidations were more likely when any plaintiff did so, not just NPEs.

The regression here adds new information. Other studies have found that technology areas can make a difference in litigation,⁷¹ but those studies typically examine differences only among patents for which a court issues a ruling one way or the other. The data in this study extends the analysis by including *all* of a patent's lifetime assertions, including the times when it was not invalidated or even tested on the merits.

Including every patent assertion rather than just those with a judicial ruling allows for a better assessment of the likelihood of a particular patent to be invalidated in any given case; it may be, for example, that computer architecture patents are invalidated more often because they are asserted more often or against more defendants. Or, a particular type of patent may be invalidated less often because it is asserted by a party that does not like to go to judgment. These effects can only be disambiguated if every patent assertion is considered. Without including every assertion, the data may be biased toward only those patents or litigations most likely to lead to a ruling on the merits. Thus, each data point is a case-patent pair – the outcome of patent validity in a given case.⁷²

The following are variables are included in each of the four regression estimates:

-*Claim Invalid*: This is the dependent variable equal to 1 if any claim in the patent was invalidated in that case, and 0 if no claims in the patent were invalidated in that case.

-*Patentee is Public*: 1 if the initial assignee is publicly traded or an affiliate of a public company

-*Reexam-Added*: 1 if claims were added to the patent in reexamination, 0 otherwise.

-*Log backward citations*: The logarithm of the number of patents and other references cited by the patent at issue.

-*Log adjusted forward citations*: The logarithm of the number of patents that cite to the studied patent, normalized by yearly cohort.

-*Log pendency*: The logarithm of the number of days between the very earliest priority date of the patent and its issuance.

-*Number continuations*: The number of times a continuation application was filed to obtain the patent; how removed from the original filing are the claims?

⁷¹ See, e.g., Allison, Lemley & Schwartz, *supra* note 2, for a recent example.

⁷² Errors were clustered by patent number and by case number with similar results.

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- Log claimcount*: The logarithm of the number of claims in the patent.
- Log prioritytosuit*: The logarithm of the number of days between the earliest patent application date and the lawsuit; a larger difference reduces the amount of prior art available and makes it harder to invalidate.
- Year filed*: The year the case was filed.
- Number of inventors*: how many inventors on a patent.
- Reexamined*: The number of times the patent has been reexamined. Either the patentee seeking to enforce or threatened defendants could seek reexamination.
- Stayed*: 1 if the case was ever stayed, 0 otherwise. Cases are often stayed pending reexamination by aggressive defendants, though there were a few bankruptcy stays.
- Xfer/Consolidation*: 1 if the case was ever transferred or consolidated. This too can imply an active defendant or a high activity patent.
- NumDefs*: The number of defendants in a case. The more defendants, the more likely one will challenge the patent.
- Dec. Relief*: Whether the case was solely a declaratory relief action by a defendant.
- Prior Assertions*: The number of times the patent has been asserted as of the case filing date, including the current case. Cases filed on the same day have the same number assigned.
- Total Assertions*: The number of times the patent was asserted in all cases in the set.
- NumPatentsCase*: The number of patents in the same case as the studied patent.

Each of the first three regressions tests one of the layers.

- (1) Regression 1 includes the factor variable *Plaintiff Type*, which categorizes the enforcer by business model. The base level is Product Company, so any coefficients represent a change from a product company plaintiff to some other type.
- (2) Regression 2 includes the factor variable *Initial Assignee Type*, which categorizes the initial assignee by business model. Product Company plaintiffs are also the base level for this variable.
- (3) Regression 3 includes the factor variable *Technology Group*, which categorizes the patented technology.
- (4) Regression 4 includes all three of the previous factors: *Plaintiff Type*, *Initial Assignee Type*, and *Technology Group*.

For brevity, the results omit several technology groups with statistically insignificant results. It also omits variables with no invalidation. For example, no patent asserted by an IP affiliate was found invalid in the entire

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dataset, eliminating about 200 case-patent pairs. Similarly, no patent in the organic drug category was found invalid, eliminating about 250 pairs.

	(1) claim invalid	(2) claim invalid	(3) claim invalid	(4) claim invalid
<i>Plaintiff Type</i>				
Licensing (Acquired)	3.927** (0.004)			2.117 (0.207)
Failed Startup	54.19*** (0.000)			3.183 (0.370)
Inventor Owned Co.	1.041 (0.937)			0.353 (0.218)
<i>Initial Assignee Type</i>				
Failed Startup		19.66*** (0.000)		17.24*** (0.000)
Inventor Owned Co.		1.888 (0.316)		1.454 (0.638)
Govt or NGO		3.068 (0.206)		3.009 (0.301)
Startup – preproduct		3.141 (0.362)		2.197 (0.658)
Individual		5.466*** (0.000)		3.477** (0.007)
IP Affiliate of Product Co.		0.203 (0.173)		0.508 (0.641)
<i>Technology Group</i>				
Microbiology, Isolated & Recombinant Protein			0.377 (0.267)	0.147 (0.064)
Chemical & Materials Engineering			0.475 (0.368)	0.243 (0.098)
Cryptography, Security			0.0448* (0.019)	0.0152** (0.003)
Computer Networks			0.327 (0.231)	0.113* (0.038)
Comp. Architecture, Software & Info. Sec.			0.112** (0.007)	0.0479*** (0.000)

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Digital Comm.			0.398 (0.377)	0.0910 (0.057)
Electrical Circuits & Systems			0.0310** (0.002)	0.0188** (0.004)
Printing/Measuring & Testing			0.378 (0.449)	0.148 (0.174)
Optics			0.0158*** (0.000)	0.0123*** (0.000)
Surface Transportation			0.0432** (0.005)	0.0362** (0.004)
Electronic Commerce			0.0352* (0.028)	0.0169** (0.008)
Medical and Surgical Instruments			0.0220** (0.008)	0.0135** (0.006)
Patentee is public	0.422 (0.360)	0.752 (0.747)	0.456 (0.298)	0.688 (0.666)
Reexam - Added	0.0507** (0.001)	0.0513** (0.001)	0.162* (0.030)	0.0629* (0.012)
Log backward	1.454* (0.015)	1.288 (0.154)	1.422* (0.045)	1.330 (0.159)
Log adj forward citations	0.846 (0.411)	1.182 (0.403)	1.150 (0.512)	0.906 (0.684)
Log pendency	0.956 (0.903)	1.272 (0.530)	0.852 (0.702)	1.160 (0.716)
Log claimcount	1.084 (0.651)	1.104 (0.568)	1.058 (0.751)	1.157 (0.477)
Yearfiled	1.004 (0.954)	1.117 (0.129)	1.037 (0.446)	1.076 (0.284)
Log prioritytosuit	0.525 (0.142)	0.373* (0.032)	0.469 (0.051)	0.457 (0.133)
Number of Inventors	0.883 (0.338)	1.051 (0.672)	0.890 (0.309)	0.932 (0.615)
Number of Continuations	0.986 (0.630)	0.998 (0.954)	1.000 (0.997)	0.997 (0.921)

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Rexamined	1.421* (0.013)	1.378* (0.036)	1.593** (0.006)	1.486* (0.025)
Stayed	8.947*** (0.000)	4.305** (0.001)	8.361*** (0.000)	6.004*** (0.000)
Xfer/Consolidation	11.77*** (0.000)	8.183*** (0.000)	10.48*** (0.000)	12.52*** (0.000)
NumDefs	1.028*** (0.000)	1.030*** (0.000)	1.044** (0.001)	1.032*** (0.000)
Dec. Relief	1.253 (0.514)	1.083 (0.827)	0.977 (0.956)	1.052 (0.909)
Prior Assertions	0.968* (0.012)	0.965* (0.017)	0.970* (0.020)	0.962** (0.004)
Total Assertions	1.034*** (0.000)	1.039*** (0.000)	1.038** (0.004)	1.043** (0.002)
NumPatentsCase	0.989 (0.470)	0.989 (0.486)	0.967 (0.063)	1.016 (0.197)
Observations	5295	5538	4615	4382
Pseudo R^2	0.333	0.353	0.326	0.363
Chi-squared	214.0	462.7	.	.
p>chi2	6.18e-34	8.80e-83	.	.

Exponentiated coefficients;⁷³ p-values in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The first result, consistent across all four regressions, is that selection variables—including number of defendants, number of times the patent is asserted, transfers, consolidations, stays, and reexaminations—are statistically significant and positively correlated with invalidation findings. This serves as a robustness test for previous findings that litigation choices likely predict invalidation more than any other observable factor.⁷⁴

The second result, also consistent across all four regressions and with prior work, is that observable patent characteristics such as claims, forward citations, patent age, and continuations are not significant in the model. Two of the estimates include a significant coefficient on backward citations,

⁷³ Exponentiated coefficients in a logistic regression can be read as a percentage change in the non-transformed dependent variable. For each unit the independent variable changes, the likelihood of invalidity increases or decreases by the percentage above/below one. Thus, a coefficient below one implies a decrease in likelihood of invalidity.

⁷⁴ Risch, *supra* note 10, at **.

but in a surprising direction—more citations increase chances of invalidity. This is consistent with prior work,⁷⁵ and implies that more backward citations may be better evidence of highly challenged patents than patent quality.

With respect to enforcer, assignee, and technology layers, the results show how complex the interactions are. For example, in regression (1), both licensing entities and failed startups were more likely to have patents invalidated as compared to product companies, but inventor-owned companies were only slightly more likely all else equal, and the coefficient was not significant.⁷⁶ This alone implies that any blanket categorization of plaintiffs as an NPE is too simple.⁷⁷

However, in regression (2), patents initially assigned to failed startups continued to signal invalidation at high rates, but no patents initially assigned to licensing entities were found invalid. Additionally, patents obtained by individuals were more likely to be invalidated. This points to a potential interconnection between layers, because licensing entities obtain many patents from individuals. It also points to potential omitted variable bias in regressions (1) and (2): is invalidation risk more correlated with licensing *plaintiffs* or with individual *patentees*?

Regression (3) yields some interesting results. First, each of the coefficients is far below 1, which implies that adding the technology group makes a patent less likely to be invalidated. But that can't be right, because every patent has a technology. The small coefficients are likely because so few patents in each group are invalidated. In the group with the most invalidations, computer architecture, only slightly more than 12% of the case-patent pairs included an invalid claim. Thus, the best way to understand these coefficients may be in comparison to each other. For example, computer architecture patents were much more likely to be invalidated than cryptography, optics, or electric circuit patents, all else equal. Recombinant patents, a marker of biotechnology, performed even more poorly than computer architecture patents,⁷⁸ though the coefficient was not significant.

But here, too, something may be missing. Perhaps some patentees obtained better computer architecture patents than others. Regression (4) combines all three of the layers, and the results are surprising. First, plaintiff

⁷⁵ Risch, *supra* note 8, at **.

⁷⁶ This is particularly surprising, given that many invalidations were of patents owned by Ronald A. Katz Licensing, an inventor-owned plaintiff.

⁷⁷ *Accord*, Risch, *supra* note 10, at ** (finding that NPE status was insignificant and added no explanatory value in addition to litigation selection effects).

⁷⁸ This is consistent with findings of others. Allison, Lemley, & Schwartz, *supra* note 2.

type no longer seems to matter as much; the coefficients are smaller and no longer statistically significant. Among initial assignees, however, failed startups and individuals⁷⁹ are still statistically significant.

One possible inference is that patents granted to individuals are more likely to be invalidated, regardless of who asserts them. This is an important observation. It means that the historic difficulties individuals in litigation⁸⁰ is caused not because of their litigation disadvantages as plaintiffs but because of their patents. It is unclear how strong this inference is, because licensing companies are more likely to have patents invalidated, even if the coefficient is not statistically significant.

Additionally, the technology group coefficients indicate interaction between layers. Some coefficients, such as optics, medical instruments, and surface transportation are unchanged between estimate (3) and (4). Other coefficients are much smaller, though still significant. For example, computer architecture decreases by more than half, from .112 to .048. Computer networks, cryptography, and electrical circuits also decreased substantially.

One inference from these changes in regression (4) is that plaintiff and initial assignee type is capturing some of the explanatory power of the model that would have ordinarily been attributed to technology alone. But the effect is only in certain technologies and not others. A close comparison of the different estimates provides some insight in the layered patent system. Party type seems to make more of a difference in computer architecture, cryptography, and electronic commerce, but not in surface transportation, optics, and medical instruments. The results may be driven in part by the technology choices of each type of assignee, an interesting finding in itself. However, quantity of patents cannot be the entire answer because product companies had patents in each of the technology groups that saw the largest changes.

Other, unreported regressions yield similar results with respect to software. When considered independently, software patents are about 2.5 times more likely to be invalidated than non-software patents. However, when the nature of the patentee and plaintiff is included, software status is no longer statistically significant in the model.⁸¹ This result is potentially ambiguous. On the one hand, it is irrefutable that software patents were more likely to be invalidated. On the other hand, it implies that software

⁷⁹ These are true individuals. Individual inventor-owned companies are a separate variable.

⁸⁰ PRICEWATERHOUSECOOPERS, *supra* note 4.

⁸¹ The coefficient also decreases to nearly 1, implying no effect.

patents may be biased because other, unobserved variables might affect patent quality and *also* yield more software patents. Given the growth of software and computer technology—especially as a proportion of all litigation—over the past twenty-five years, it is not surprising that other factors might affect patent quality other than simply being software.

VI. CONCLUSION: BEYOND THE PATENT TROLL NARRATIVE

A closer examination of the different layers of the patent system – enforcers, patentees, and technology – reveals that the NPE narrative is far more complex than the conventional discussion implies. These most-litigious examples are an arbitrary extreme, but they illustrate that most of the research on patent trolls is somewhat arbitrary.⁸² One researcher’s most-litigious NPE may, quite literally, be another researcher’s practicing company.⁸³

For example, many of the Papst patents were originally invented by employees at Papst Moteren, a functioning product company at the time of patenting. It was only upon sale of the company that the son of one of the primary inventors obtained rights to pursue enforcement of the patents.⁸⁴ Similarly, many of the Katz patents were obtained while Katz worked at First Data Corporation, a public corporation through which most credit card transactions are cleared.⁸⁵ Catch Curve, which enforces patents for j2Global, an operating public company, may have been a wholly owned subsidiary of j2.⁸⁶ Even Rates Technology, a very small business, apparently offered telephone call rate setting services to go along with patent licenses.⁸⁷

⁸² Michael Risch, *Framing the Patent Troll Debate*, 24 EXPERT OPN. THERAPEUTIC PATENTS 127, 127 (2014) (“This definitional morass is a symptom of a bigger problem in the patent troll debate: a lack of analytical rigor that leads interested parties to talk past each other.”).

⁸³ Risch, *supra* note 10, at ** (discussing Network Signatures, coded as a highly litigious NPE by some, but as a practicing entity by others, depending on time of identification).

⁸⁴ Daniel Papst, *NPEs And Patent Aggregators—New, Complementary Business Models For Modern IP Markets*, LES NOUVELLES 95 (June 2013), http://www.lesi.org/docs/default-source/lnjune2013/2_papstr.pdf (“Georg Papst turned necessity into a virtue by making a high-risk investment in buying back the respective patent portfolios and founding the NPE “Papst Licensing.”)

⁸⁵ Robert Ambrogi, *For Ronald Katz, Patent Litigation Pays Billions*, BULLSEYE (Dec. 11, 2007), <http://www.ims-expertservices.com/bullseye/december-2007/for-ronald-katz-patent-litigation-pays-billions/>.

⁸⁶ *Subsidiaries of j2 Global*, JFAX.ORG (Aug. 29, 2014), <http://jfax.org/article/subsidiaries-of-j2-global/>.

⁸⁷ Sabra Chartrand, *A little box holds out the enticing promise of the lowest long-*

The meme that NPEs have no technology transfer goals also seems to fail. Consider, for example, F&G and its scrolling mouse patent. F&G's first major litigation was a *trade secrets* case against KeyTronic for disclosing *pre-patent* information to Microsoft and others.⁸⁸ F&G won \$16.5 million dollars in a jury verdict,⁸⁹ and wound up on the most-litigious list when it asserted its patent against others who used the information (whether knowingly or not) and effectively locked F&G out of the market.

Calling productive companies NPEs and/or patent trolls continues beyond the most-litigious list. Consider Soverain Software, which lost a well-publicized appeal to Newegg.⁹⁰ In reality, Soverain licenses software and provides support services to its customers, even if its business is not what it once was.⁹¹

The matching litigation side shows the similar traits in many of its plaintiffs. Both Network Signatures and US Ethernet LLC are now enforcing patents that used to be relevant to going businesses of varying success. Eastman Kodak enforced several patents in the set, and later auctioned them off in bankruptcy; at least one of those litigated patents is now owned by Intellectual Ventures (a licensing NPE) and another is owned by Apple, Inc. (a product nonNPE).⁹²

Two patents appear in both sets: they were first enforced by the individual inventor, then assigned to a large product company, and then assigned to an NPE for enforcement.

This Article's somewhat agnostic analysis sheds some light on a policy debate dominated by pejoratives and blanket statements about frivolous patents and impeded innovation. This Article's goal has been to expand analysis to more of the layers of the patent system. There are surely more

distance rate every time you call, N.Y. TIMES D8 (Jun 17, 1996).

⁸⁸ *Key Tronic Settles Suit with Scrolling Mouse*, PUGET SOUND BUSINESS JOURNAL (Oct. 24, 2002), <http://www.bizjournals.com/seattle/stories/2002/10/21/daily40.html>.

⁸⁹ *Id.*

⁹⁰ Joe Mullin, *How Newegg Crushed the "Shopping Cart" Patent and Saved Online Retail*, ARS TECHNICA (Jan. 27, 2013), <http://arstechnica.com/tech-policy/2013/01/how-newegg-crushed-the-shopping-cart-patent-and-saved-online-retail/> ("The ruling in the Newegg case is a total wipeout for a patent troll...").

⁹¹ Osenga, *supra* note 14, at 458–60 ("Further, Soverain Software is possibly mislabeled as a "formerly manufacturing entity," as it continues to offer Open Market's Transact product for e-commerce business, as well as support, training, and consulting for the product. Soverain's customers range from mid-market to blue chip companies.").

⁹² Nick Brown, *Kodak Patent Sale Plan Gets Bankruptcy Court Approval*, REUTERS (Jan. 11, 2013), <http://www.reuters.com/article/2013/01/11/us-kodak-patent-sale-idUSBRE90A0YN20130111>.

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layers to be addressed in future research, such as inventor geography, citation, and spillovers. Putting these layers together allows policymakers to move beyond a single rhetoric to understand the complexities of the system.