Article

The Sound and Fury of Patent Activity

Robin C. Feldman† & Mark A. Lemley††

† Arthur J. Goldberg Distinguished Professor, University of California Hastings College of the Law; Visiting Professor UCLA Law.

†† William H. Neukom Professor, Stanford Law School; Partner, Durie Tangri LLP. Thanks to the National Science Foundation for a grant that supported this research, the Indiana Survey Center for fielding the survey, and Ramy Alsaffar, Jason Reinecke, Nick Thieme, and Connie Wang for outstanding research and design assistance. Thanks also to John Gray and Prianka Misra for additional research assistance and project management. Thanks to Rose Hagan, Tim Holbrook, Brian Love, Kent Richardson, Michael Risch, and Jonathan Stroud for comments on a prior draft.

"It is a tale . . . full of sound and fury, signifying nothing."[1]

INTRODUCTION

Patent reform is a hotly contested issue, occupying the attention of Congress, the Supreme Court, and many of the most innovative companies in the world.[2] Most of that dispute centers on patent enforcement, and in particular on the role of non-practicing entities (NPEs) or "patent trolls" – companies that don't themselves make products but sue those that do.[3] To technology companies, NPEs are a drag on innovation, taxing them tens of billions of dollars every year while achieving no social purpose.[4] To NPEs and their supporters, they are enabling the first inventor to get paid and creating a working market for the transfer of technology.[5]

1. WILLIAM SHAKESPEARE, THE TRAGEDY OF MACBETH act. 5, sc. 5.

2. *See, e.g.*, 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. 1256, 1260 (2009); Sannu Shrestha, Note, *Trolls or Market-Makers? An Empirical Analysis of Nonpracticing Entities*, 110 COLUM. L. REV. 114, 116 (2010).

3. That is possible because, unlike most IP rights, there is no requirement that the defendant copy the invention from the plaintiff, and indeed the vast majority of patent suits are filed against defendants who independently developed the technology rather than copying it. *See* Christopher A. Cotropia & Mark A. Lemley, *Copying in Patent Law*, 87 N.C. L. REV. 1421, 1423 (2009) ("Patent law is virtually alone in intellectual property ("IP") in punishing independent development.").

4. James Bessen & Michael J. Meurer, *The Direct Costs from NPE Disputes*, 99 CORNELL L. REV. 387, 389 (2014) (estimating that the direct, accrued cost of NPE patent assertions totaled $29 billion in 2011); Mark A. Lemley et al., *The Patent Enforcement Iceberg*, 97 TEX. L. REV. (forthcoming 2019) (estimating that the total cost of patent assertions to assertion recipients in 2015 was between $77.7 billion and $122.2 billion). For a criticism of the Bessen study, see David L. Schwartz & Jay P. Kesan, *Analyzing the Role of Non-Practicing Entities in the Patent System*, 99 CORNELL L. REV. 425 (2014); *see also* Christopher A. Cotropia et al., *Unpacking Patent Assertion Entities*, 99 MINN. L. REV. 649, 650–52 (2014). For an analysis that covers the total social cost of patent trolls, see James E. Bessen et al., *The Private and Social Costs of Patent Trolls* 20, 32 tbl.3 (Bos. Univ. Sch. of Law, Working Paper No. 11-45, 2011) (estimating an aggregate cost of patent trolls around $500 billion, where most of this value is social loss, and little is transferred to inventors).

5. James F. McDonough III, Comment, *The Myth of the Patent Troll: An*

Which is it? Over the past several years, we have sought to answer this question. We began by modeling as a matter of economic theory the circumstances under which patent enforcement contributes to society.[6] We then conducted a pilot survey, asking IP licensing lawyers at companies about their experiences with patent enforcement and the effects of patent licensing demands on subsequent innovation.[7] The results were not encouraging; very few patent licensing demands seemed to be associated with any indicia of innovation or legitimate technology transfer.[8] But the pilot study was also preliminary, and may well have been skewed by the focus on professionals who deal with patent lawsuits licensing demands on a daily basis.

In this paper, we turn that pilot study into a full analysis of the effect of patent licensing demands on the economy. With the help of a National Science Foundation grant and experts in survey design, we sent our survey out to every US-based business with at least one employee and revenue of $1 million or more—over 45,000 companies. Our results provide important insights into the nature and limits of patent licensing demands and their role (or lack thereof) in driving innovation.

First, our full survey of U.S. businesses validates and extends our initial result that NPE licensing demands almost never lead to innovation by the target firm. None of the indicia we would expect of real technology transfer were common in patent licensing demands. Moreover, NPE demands were particularly unlikely to be accompanied by the sharing of know-how or employees, the creation of joint ventures, or the development of new products.

Second, NPEs do not seem to be a monolithic group. The results for certain types of NPEs were more promising. Federal labs that assert patents are the group most likely to transfer knowledge or drive new products when they license patents. Interestingly, those labs are the ones that depend least on patents

Alternative View of the Function of Patent Dealers in an Idea Economy, 56 EMORY L.J. 189, 190 (2006); Michael Risch, *Patent Troll Myths*, 42 SETON HALL L. REV. 457, 459 (2012); *see also* Shrestha, *supra* note 2, at 115–16.

6. *See generally* Mark A. Lemley & Robin Feldman, *Patent Licensing, Technology Transfer, and Innovation*, 106 AM. ECON. REV. 188 (2016) [hereinafter Lemley & Feldman, *Patent Licensing*]; *see also* Mark A. Lemley & Robin C. Feldman, Essay, *Is Patent Enforcement Efficient?*, 98 B.U. L. REV. 649, 651 (2018) [hereinafter Lemley & Feldman, *Efficient*].

7. *See generally* Robin Feldman & Mark A. Lemley, *Do Patent Licensing Demands Mean Innovation?*, 101 IOWA L. REV. 137 (2015).

8. *Id.* at 139.

themselves as drivers of licensing.[9] The results for universities are more mixed. University patent demands are more likely to drive innovation than demands by other sorts of NPEs, but most of them still don't involve any indicia of technology transfer. That is consistent with the hybrid role university patenting plays. Sometimes university patents are in fact responsible for spinning new technologies out to the private sector. But at other times universities act as patent trolls, not disseminating new inventions but merely suing those who develop those inventions independently.[10]

Third, our results confirm prior literature finding that the patent system works differently in different industries.[11] Patent licensing demands almost never result in technology transfer or new innovation in the computer industry, particularly when NPEs are doing the asserting. They are somewhat more likely to

9. Adam B. Jaffe & Josh Lerner, *Reinventing Public R&D: Patent Policy and the Commercialization of National Laboratory Technologies*, 32 RAND J. ECON. 167, 168 (2001); *see* Albert N. Link et al., *Public Science and Public Innovation: Assessing the Relationship Between Patenting at U.S. National Laboratories and the Bayh-Dole Act*, 40 RES. POL'Y 1094, 1095 (2011) (explaining that research universities are more market focused and driven to commercialize intellectual property than national labs).

10. Mark A. Lemley, *Are Universities Patent Trolls?*, 18 FORDHAM INTELL. PROP. MEDIA & ENT. L.J. 611, 611 (2008).

11. DAN L. BURK & MARK A. LEMLEY, THE PATENT CRISIS AND HOW THE COURTS CAN SOLVE IT 37–65 (2009) [hereinafter BURK & LEMLEY]; WILLIAM M. LANDES & RICHARD A. POSNER, THE ECONOMIC STRUCTURE OF INTELLECTUAL PROPERTY LAW 316 (2003) (discussing that the drug industry provides the strongest case for patents in their present form); Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155, 1156 (2002) (determining that our seemingly unitary patent system actually varies by industry); Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1577 (2003) (finding that technology "displays highly diverse characteristics across different sectors" and that the patent system operates differently in these industries); Alan Devlin, *Patent Law's Parsimony Principle*, 25 BERKELEY TECH. L.J. 1693, 1694–95 (2010); 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, 1326 (2009); Amy Kapczynski et al., *Addressing Global Health Inequities: An Open Licensing Approach for University Innovations*, 20 BERKELEY TECH. L.J. 1031, 1044–45 (2005) ("Many who accept [the notion that strong patent protection reduces social welfare] nonetheless consider the pharmaceutical sector an exception."); Lisa Larrimore Ouelette, *How Many Patents Does It Take To Make a Drug? Follow-On Pharmaceutical Patents and University Licensing,* 17 MICH. TELECOMM. TECH. L. REV. 299, 300 (2010) ("The pharmaceutical industry is the poster child for a strong patent system."); Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting*, 1 INNOVATION POL'Y & ECON. 119, 119 (2000); Ted Sichelman, *Purging Patent Law of "Private Law" Remedies*, 92 TEX. L. REV. 517, 523–25 (2014).

be productive in the life sciences, but the industry variation we observe doesn't map neatly to the traditional life sciences versus computer divide that has dominated the last decades of patent reform debates.[12] Instead, it is areas like energy that see the most new products resulting from patent assertions. That suggests both that patent policy experts need to acknowledge the reality of industry differences, and that we need to look beyond the one-dimensional debate between computer and life sciences firms, just as we need to look beyond the single dimension of operating companies versus NPEs.

Fourth, when we asked firms about the licensing of their own patents rather than licensing patents from others, we got a somewhat different story. Companies think their own patents drive innovation by others somewhat more than they think others' patents drive their own innovation. While it is possible that the firms we surveyed happened to transfer a lot of technology out with their patents while taking in very little from other firms' patents, we suspect that the survey responses show some bias. This could be bias in either direction. The data doesn't tell us, though we think the most likely explanation is optimism bias: patentees think they are generating more innovation than licensees think they are, and licensees in turn think their own contributions are more important. Whichever way the skew cuts, this result also helps explain the very different perceptions of the patent system by patentees and defendants. They really do seem to see their contributions to the world differently.

Finally, and perhaps most important in the long run, a significant majority of respondents simply didn't face patent licensing demands at all. It is true that those companies may be smaller and less innovative than the ones that do face licensing demands. But given the raging debates over the patent system and its role in driving the economy, it is important to recognize

12. *See, e.g.*, BURK & LEMLEY, *supra* note 11, at 38–41; Dan L. Burk & Mark A. Lemley, *Biotechnology's Uncertainty Principle*, 54 CASE W. RES. L. REV. 691, 706 (2004) (juxtaposing biotechnology and information technology (IT) patent cases); Graham et al., *supra* note 11, at 1268 ("Given the extensive writing, opinion, and theory about the differences in innovation and patenting characteristics between the life sciences and information technologies firms, we focused primarily on companies in the biotechnology and software industries."); Sichelman, *supra* note 11, at 523–24 (noting that while "the costs of invention and commercialization in the software industry are far below those in the pharmaceutical industry," the "duration of software and pharmaceutical patents are exactly the same" and "the scope of software patents often exceeds the scope of pharmaceutical patents").

that there are large swaths of American businesses that simply don't deal with patent licensing demands at all.

To be clear, nothing in our data suggests that the patent system as a whole doesn't matter or isn't working. Patent acquisition and patent licensing remain important parts of the innovation ecosystem. And patent enforcement too can promote innovation by giving operating companies exclusivity. But our study does belie claims that the *patent enforcement* system is itself a driver of innovation. It isn't.

In Part I we discuss the debate over the role of NPEs and prior work on patent enforcement by NPEs. In Part II we explain our methodology. We present our results in Part III and discuss some implications of those results in Part IV.

I. PATENT ENFORCEMENT AND INNOVATION

A. THE DEBATE OVER NPES[13]

The role of NPEs (aka patent trolls or "patent assertion entities" (PAEs)) is central to the debate over patent reform.[14] Roughly half of the patent suits filed in the last few years have been filed by trolls.[15] In some industries, notably computers and telecommunications, the percentage is much higher.[16] NPEs are

13. Portions of Part I.A are adapted from our pilot study.

14. *See, e.g.*, Mark A. Lemley & A. Douglas Melamed, *Missing the Forest for the Trolls*, 113 COLUM. L. REV. 2117, 2118–21 (2013).

15. *See, e.g.*, Cotropia et al., *supra* note 4, at 651–52; Sara Jeruss, Robin Feldman & Joshua Walker, *The America Invents Act 500: Effects of Patent Monetization Entities on US Litigation*, 11 DUKE L. & TECH. REV. 357, 361 (2013). *See generally* Colleen Chien, *Patent Trolls by the Numbers* (Santa Clara Univ. Legal Studies Research, Working Paper No. 08-13, 2013). The measurement is complicated not only by different definitions of patent trolls, but by the fact that until September of 2011 a party could file suit against multiple defendants in a single case. Patent trolls tend to sue far more defendants than practicing entities, often suing dozens at the same time. So, studies before 2011 of lawsuits filed—as opposed to the number of defendants sued—produced a misleadingly low measure of troll activity. Cotropia, Kesan, and Schwartz, using a restrictive definition of a patent troll, still find that roughly half of the assertions in both 2010 and 2012 were made by NPEs, though in 2010 many of those assertions were bundled into a single suit. Cotropia et al., *supra* note 4, at 655, 662, 687, 692–96.

16. *See, e.g.*, John R. Allison et al., *Patent Quality and Settlement Among Repeat Patent Litigants*, 99 GEO. L.J. 677, 691–92 (2011). Allison, Lemley, and Schwartz completed a comprehensive study of how case outcomes differ between trolls and practicing entities. *See generally* John R. Allison, Mark A. Lemley & David L. Schwartz, *How Often Do Non-Practicing Entities Win Patent Suits?*, 32 BERKELEY TECH. L.J. 237 (2017).

controversial because they do not make products themselves.[17] As a result, patent enforcement by NPEs represents a tax on innovation because they file costly lawsuits and obtain substantial settlements from other innovative companies.[18] Courts, Congress, and private organizations have sought to cut back on problematic lawsuits by NPEs.[19] Many of these efforts have been driven by concerns about the harm to innovation done by patent trolls.[20]

We know that actual technology transfer happens within the patent system in the ex ante context.[21] Both practicing entities and some NPEs engage in ex ante technology transfer. In particular, universities and inventors create alliances with companies that can more easily develop and commercialize their inventions through joint ventures and other types of technology and research sharing agreements.[22] These agreements frequently occur before a patent issues or even before any of the parties file for a patent.[23] Notably, these agreements involve technology transfer.[24] Universities and other inventors in these deals provide new technology to those in a position to implement

17. *See, e.g.*, Cotropia, *supra* note 4, at 651.

18. *See, e.g.*, JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK 144–47 (2008); FED. TRADE COMM'N, THE EVOLVING IP MARKETPLACE: ALIGNING PATENT NOTICE AND REMEDIES WITH COMPETITION 53 (2011); Tom Ewing & Robin Feldman, *The Giants Among Us*, 2012 STAN. TECH. L. REV. 1, 25, 41 (2012); Charles Duhigg & Steve Lohr, *The Patent, Used as a Sword*, N.Y. TIMES (Oct. 7, 2012), https://www.nytimes.com/2012/10/08/technology/patent-wars-among-tech-giants-can-stifle-competition.html; Ashby Jones, *Patent 'Troll' Tactics Spread*, WALL STREET J. (July 8, 2012), http://online.wsj.com/article/SB10001424052702303292204577514782932390996.html; *This American Life: When Patents Attack!*, WBEZ (July 22, 2011), https://www.thisamericanlife.org/441/when-patents-attack.

19. *See, e.g.*, Leahy–Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (codified as amended in scattered sections of 35 U.S.C.); Saving High-Tech Innovators from Egregious Legal Disputes Act of 2013, H.R. 845, 113th Cong. (2013).

20. *See* H.R. 845.

21. ASHISH ARORA, ANDREA FOSFURI & ALFONSO GAMBARDELLA, MARKETS FOR TECHNOLOGY: THE ECONOMICS OF INNOVATION AND CORPORATE STRATEGY 116–17 (2001). *See generally* Colleen V. Chien, *Software Patents as a Currency, Not Tax, on Innovation*, 31 BERKELEY TECH. L.J. 1669 (2016) (documenting technology transfer in many software licenses, but also a large number of software patent licenses without technology transfer). For a discussion of what we mean by ex ante versus ex post licensing activity, see *infra* note 102 and accompanying text.

22. Feldman & Lemley, *supra* note 7, at 155–56.

23. *Id.* at 139.

24. *Id.* at 155–56.

it.[25] And that technology often includes trade secrets and know-how beyond the to-be-patented technology itself.[26] Further, technology transfer can occur informally, by the communication of information at scientific conferences, through journal articles, and even though commitments to open sharing of patented technologies.[27]

Patent litigation and licensing demands for existing patents, by contrast, tend to occur well after the defendant has developed and implemented the technology. This is particularly true of NPE patent assertions and licensing demands, which some evidence suggests tend to happen in the last few years of a patent's life or even after they expire.[28] NPE licensing demands and litigation against companies that are producing products do not seem to involve technology transfer or other indicia of new innovation. Indeed, evidence suggests NPEs may buy patents with vaguely worded claims that are optimized for litigation but lacking in technical merit[29] and that they may delay licensing of patents to increase revenue by targeting successful implementers after the fact.[30]

25. *Id.*

26. *Id.* at 155 n.40.

27. *See generally* Colleen V. Chien, *Opening the Patent System: Diffusionary Levers in Patent Law*, 89 S. CAL. L. REV. 793 (2016) (discussing ways patents can help diffuse knowledge).

28. *See, e.g.*, Brian J. Love, *An Empirical Study of Patent Litigation Timing: Could a Patent Term Reduction Decimate Trolls Without Harming Innovators?*, 161 U. PA. L. REV. 1309, 1312, 1355 (2013) ("NPEs . . . assert[] their patents relatively late in the patent term and frequently continue to litigate their patents to expiration."). *But see* Robin Feldman et al., *The AIA 500 Expanded: The Effects of Patent Monetization Entities*, 17 UCLA J.L. & TECH. 1, 8–9 (2013) (finding from litigation data that newer patents were asserted more frequently and that NPEs were more willing to assert patents of any age, and suggesting that studies showing NPEs asserting relatively late in a patent's life may reflect historic changes during the time frame of the studies). Love agrees that his findings "could be inflated by the fact that fewer NPEs existed during the 1990s and early 2000s when, perhaps, they might have enforced younger patents." Love, *supra*, at 1355.

29. *See* Josh Feng & Xavier Jaravel, Crafting Intellectual Property Rights: Implications for Patent Assertion Entities, Litigation, and Innovation 1, 24–31 (Dec. 11, 2018) (unpublished paper), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2838017.

30. *See* Erik Hovenkamp & Jonathan Masur, *How Patent Damages Skew Licensing Markets*, 36 REV. LITIG. 379, 405 (2017). For thoughts on how to break the "vicious cycle of excessive, socially harmful remedies," see William F. Lee & A. Douglas Melamed, *Breaking the Vicious Cycle of Patent Damages*, 101 CORNELL L. REV. 385, 385 (2016).

Patent trolls may be collecting payments on patents that are invalid or not infringed.[31] Given the economics of patent litigation, a rational company may choose to pay a "nuisance-value settlement" and thereby avoid the costs and risks of a lawsuit.[32] The patent in that case is not benefitting society at all but rather serving as a drag on innovation.[33] While that nuisance-value settlement model is clearly socially unproductive, it is also reasonable to worry that patent enforcement itself is socially costly. Without some benefit in the form of innovation or technology transfer, patent enforcement by NPEs seems like a pure cost to society— one that runs to the tens of billions of dollars per year.[34]

Operating companies, by contrast, generally disseminate innovations directly. The traditional justification for patent enforcement—that enforcement increases the return to patented goods by restricting competition, and therefore gives more incentive to innovate—can work for those companies. Whether it works, and under what circumstances, is an empirical question beyond the scope of this paper. Our point is only that operating companies, unlike NPEs, don't need to engage in technology transfer to licensees to disseminate innovations; they do so directly by selling products. The traditional justifications for patents have operating companies in mind.

Defenders of patent trolls argue that they can serve as business intermediaries between inventors and commercializers.[35]

31. *See* Lemley & Melamed, *supra* note 14, at 2126 (describing patent trolls that generate significant revenue by licensing patents with little or no actual litigation).

32. Robin Feldman, *Intellectual Property Wrongs,* 18 STAN. J.L. BUS. & FIN. 250 (2013) (describing the phenomenon and exploring case studies); Lemley & Melamed, *supra* note 14, at 2124 (noting the prevalence of this model).

33. *See* Feldman & Lemley, *supra* note 7, at 1 (discussing the tax that patent trolls exact on innovation as a result of forcing companies to license patents without providing any technical knowledge with the patent or license).

34. *Supra* note 4.

35. Jennifer Kahaulelio Gregory, Comment, *The Troll Next Door*, 6 J. MARSHALL REV. INTELL. PROP. L. 292, 306–09 (2007); Gerard N. Magliocca, *Blackberries and Barnyards: Patent Trolls and the Perils of Innovation*, 82 NOTRE DAME L. REV. 1809, 1818 (2007); McDonough, *supra* note 5, at 190; Kristen Osenga, *Formerly Manufacturing Entities: Piercing the "Patent Troll" Rhetoric*, 47 CONN. L. REV. 435, 451 (2014); Shrestha, *supra* note 2, at 118; *see also* Ashish Arora & Robert P. Merges, *Specialized Supply Firms, Property Rights and Firm Boundaries*, 13 INDUS. & CORP. CHANGE 451, 470–72 (2004); Robert P. Merges, *A Transactional View of Property Rights*, 20 BERKELEY TECH. L.J. 1477, 1519–20 (2005). For discussion of this patent market idea, see, for example, Stéphanie Chuffart-Finsterwald, *Patent Markets: An Opportunity for Technology Diffusion and FRAND Licensing?*, 18 MARQ. INTELL. PROP. L. REV. 335 (2014) (analyzing legal opportunities presented by patent markets that enable

The traditional theory of the patent system posits that patents encourage innovation by allowing inventors to exclude competitors from the market, thereby earning supracompetitive returns and recouping investment.[36] A number of scholars have argued, however, that the patent system can encourage commercialization of inventions by allowing the inventor to control who can develop the technology.[37] And if the inventor is not in a position to commercialize the invention at all, in theory, patents can serve as a mechanism that allows the inventor to provide her new idea to someone who can make use of it. On this theory, patent trolls can serve an intermediation function, helping to deliver good ideas to companies who can put them to good use.[38] One can think of this as the efficient middleman hypothesis—NPEs are making a market for transactions in patents, and

technology diffusion); Andrei Hagiu & David B. Yoffie, *The New Patent Intermediaries: Platforms, Defensive Aggregators, and Super-Aggregators*, 27 J. ECON. PERSP. 45, 53–56 (2013); Ryan T. Holte, *Trolls or Great Inventors: Case Studies of Patent Assertion Entities*, 59 ST. LOUIS U. L.J. 1 (2014); Michael Risch, *Licensing Acquired Patents*, 21 GEO. MASON L. REV. 979 (2014) (discussing how "patent licensing might aid commercialization").

36. *See, e.g.*, LANDES & POSNER, *supra* note 11, at 319–26; Mark A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989, 993–96 (1997).

37. Michael Abramowicz, *The Danger of Underdeveloped Patent Prospects*, 92 CORNELL L. REV. 1065, 1067–69 (2007); *accord* Michael Abramowicz & John F. Duffy, *Intellectual Property for Market Experimentation*, 83 N.Y.U. L. REV. 337, 398–404 (2008); F. Scott Kieff, *Property Rights and Property Rules for Commercializing Inventions*, 85 MINN. L. REV. 697, 707–12 (2001); Ted Sichelman, *Commercializing Patents*, 62 STAN. L. REV. 341, 345 (2010).

38. Daniel A. Crane, *Intellectual Liability*, 88 TEX. L. REV. 253, 286–87 (2009) ("Troll defenders counter that trolls are socially useful intermediaries between small inventors and commercialization. Small inventors may not have the resources to engage in detecting infringers, licensing negotiations, or patent infringement lawsuits against infringers. By buying up patents from small inventors, trolls may 'spur innovation by investing in undercapitalized projects and reducing transaction costs for small inventors who are routinely robbed by large corporations.'"); Daniel F. Spulber, *Intellectual Property and the Theory of the Firm*, *in* PERSPECTIVES ON COMMERCIALIZING INNOVATION 9, 31 (F. Scott Kieff & Troy A. Paredes eds., 2012) ("Specialized intermediaries began to create a market for patented technologies in the late 19th and early 20th century . . . . This important development 'facilitated the emergence of a group of highly specialized and productive inventors by making it possible for them to transfer to others responsibility for developing and commercializing their inventions.'"); B. Zorina Khan, *Trolls and Other Patent Inventions: Economic History and the Patent Controversy in the Twenty-First Century*, 21 GEO. MASON L. REV. 825, 832 (2014) ("Specialized intermediaries are especially valuable in new or emerging markets and in instances in which asymmetries of information and other transaction costs are significant.").

those patents help the world when they are put in productive hands.[39]

For this theory to work, however, patent trolls must actually facilitate the use of the patented inventions by companies who were not otherwise using them. A patent market isn't a good thing in and of itself. It is desirable only if it promotes innovation or technology transfer.[40] Our study attempts to examine whether the activity of patent trolls does facilitate the development or use of new technology by licensees. As described below, the results are not encouraging.[41]

If patent trolls do not operate as efficient middlemen, transferring new technology, perhaps they are serving the social good as tax collectors for small inventors whose ideas have been appropriated. Under this theory, the patent holder has properly contributed to learning and dissemination by publishing its ideas in the form of a patent, and the product company has simply taken the idea from the patent's disclosure. The patent troll, therefore, would be operating as a tax collector to facilitate the transfer of an appropriate payment to the person who gave the idea to the world.

Several factors cast doubt on the appropriate payment theory, however. First, much of the patent troll activity occurs in fast-moving technologies such as computers and telecommunications, where the patent is often on a technology that bears little resemblance to the defendant's product.[42] In these circumstances, the patent troll asserts that the patent covers any means of solving a problem, even if the defendant's implementation looks nothing like the patentee's original idea.[43] The distance between the patent disclosures in these cases and the accused product makes it unlikely that the company making the product learned the idea from the patent's disclosure. That delay

39. Mark A. Lemley & Nathan Myhrvold, *How to Make a Patent Market*, 36 HOFSTRA L. REV. 257, 258–59 (2007).

A separate argument is that patents serve as a currency, allowing otherwise-intangible ideas to have a realizable transaction value. *See* Chien, *supra* note 21; Mark A. Lemley, *The Surprising Resilience of the Patent System*, 95 TEX. L. REV. 1, 40–41 (2016). But for that to be true, there must be some underlying technology transfer for which the patent serves as a marker.

40. Michael J. Burstein, *Patent Markets: A Framework for Evaluation*, 47 ARIZ. ST. L.J. 507, 514–20 (2015).

41. *See infra* Part III.

42. *See, e.g.*, Mark A. Lemley, *Software Patents and the Return of Functional Claiming*, 2013 WIS. L. REV. 905, 907–08 (2013).

43. *Id.*

tends to be even greater when the patent is first sold to an NPE and then asserted.[44] The hypothesis also assumes a level of quality in patents and adequacy of patent disclosure that is generally not attributed to the modern patent system by scholars and commentators.[45] Finally, the evidence suggests that the overwhelming majority of patent cases do not involve alleged copying, but rather independent invention.[46] If the parties taking patent licenses are doing so to avoid being sued on technology they themselves developed independently, the tax the patent system is imposing is a tax on one set of inventors (those who actually put their inventions to good use) for the benefit of another set of inventors (those who did not). That is hard to justify.[47]

44. Love, *supra* note 28, at 1331.

45. *See, e.g.*, U.S. Gov't Accountability Office, GAO-13-465, Intellectual Property: Assessing Factors That Affect Patent Infringement Litigation Could Help Improve Patent Quality 45(2013); Colleen V. Chien, *Contextualizing Patent Disclosure*, 69 Vand. L. Rev. 1849 (2016); Jeanne C. Fromer, *Patent Disclosure*, 94 Iowa L. Rev. 539 (2009) (arguing that patent disclosures of the modern patent system are underperforming); Timothy R. Holbrook, *Possession in Patent Law*, 59 SMU L. Rev. 123 (2006) (arguing that disclosures in patents do not serve the teaching function well); Mark A. Lemley, *Rational Ignorance at the Patent Office*, 95 Nw. U. L. Rev. 1495, 1500–01 (2001); Sean B. Seymore, *The Teaching Function of Patents*, 85 Notre Dame L. Rev. 621 (2010) (arguing that patents rarely communicate knowledge or technical information); *cf.* Brian T. Yeh, Cong. Research Serv., R42668, An Overview of the "Patent Trolls" Debate 9 (2013) (describing why "it is economically infeasible or irrational for [parties] to search through existing patents to avoid infringement"); Robin Feldman, Rethinking Patent Law 52–53 (2012) (describing limitations of disclosure in the modern patent system).

46. There is no independent invention defense in patent law, and the vast majority of patent lawsuits are filed not against those accused of copying the invention from the patentee but against other inventors who came up with the same idea independently. *See, e.g.*, Cotropia & Lemley, *supra* note 3, at 1424 (finding that allegations of copying are quite rare in patent cases).

47. If independent invention is widespread, it may suggest that the bar for obviousness is set too low within the patent system. In other words, if others can develop an idea without the benefit of the inventor's wisdom, perhaps we are not seeing wisdom but rather an advance that is obvious to those in the art. *Cf.* Tun-Jen Chiang, *A Cost-Benefit Approach to Patent Obviousness*, 82 SAINT JOHN'S L. REV. 39, 94–96 (2008) (noting that the Federal Circuit has looked disfavorably upon the idea that independent invention is relevant to an obviousness determination); Mark A. Lemley, *Should Patent Infringement Require Proof of Copying?*, 105 MICH. L. REV. 1525, 1534–35 (2007) (arguing that evidence of independent invention should be a factor pointing toward obviousness). Courts in a prior era had given more credence to this evidence. *See, e.g.*, Concrete Appliances Co. v. Gomery, 269 U.S. 177, 185 (1925) (stating that independent inventions "within a comparatively short space of time . . . are in themselves persuasive evidence that this use . . . was the product only of ordinary mechanical or engineering skill").

Under these circumstances, patent licensing does not benefit society by encouraging learning or dissemination of the patentee's invention. The dissemination of that technology was already happening, no thanks to the patentee; the patent troll is just collecting a tax from people who not only came up with the idea on their own,[48] but actually put the invention into practice.

One could argue that in its tax collector role, patent trolls are at least returning dollars to original inventors, thereby encouraging innovation by facilitating the rewards that the patent system promises to those who invent and disclose.[49] In the absence of technology transfer, however, it is reasonable to question how much society wants to invest in moving money from one independent inventor to another. Further, studies suggest that such rewards are not flowing. In what economists are calling the "leaky bucket," only an estimated twenty percent of the payments to NPEs get back to the original inventor or into internal research and development by the NPE.[50] And there is some evidence that the prospect of later patent licenses is not what motivates many inventors, particularly in universities.[51]

As we discuss elsewhere, patentees can benefit society in several possible ways: by making innovative products, by selling or licensing the new knowledge to those who do, by sharing that knowledge freely with those who learn from it, or even if others illegally copy the invention from them.[52] But patent enforcement by NPEs against independent inventors (as opposed to those who copied from the patent owner) doesn't achieve any of those goals

48. Some independent invention occurs after the patentee invents, but before the patent has issued. Other independent invention occurs even before the patentee invents, but it may not bar the later inventor from patenting if the first inventor kept the idea secret. *See, e.g.*, ROBERT PATRICK MERGES & JOHN FITZGERALD DUFFY, PATENT LAW AND POLICY: CASES AND MATERIALS 507–11 (6th ed. 2013).

49. Trolls may be intermediaries in this very different sense—not transmitting new technology to licensees and defendants, but facilitating suit by individuals or small companies who could not otherwise afford to sue. *See, e.g.*, Stephen H. Haber & Seth H. Werfel, *Patent Trolls as Financial Intermediaries? Experimental Evidence*, 149 ECON. LETTERS 64 (2016) (finding evidence in controlled experiments to support this hypothesis).

50. *See* Bessen & Meurer, *supra* note 4, at 411; Fiona M. Scott Morton & Carl Shapiro, *Strategic Patent Acquisitions*, 79 ANTITRUST L.J. 463, 482–83 (2014). For challenges to this evidence, see Schwartz & Kesan, *supra* note 4.

51. *See, e.g.*, Brian J. Love, *Do University Patents Pay Off? Evidence from a Survey of University Inventors in Computer Science and Electrical Engineering*, 16 YALE J.L. & TECH. 285, 286 (2014).

52. Lemley & Feldman, *Patent Licensing*, *supra* note 6, at 191; Lemley & Feldman, *Efficient*, *supra* note 6, at 649.

directly. If patent trolls are also not returning much to original inventors, it will be particularly important to see if their enforcement activity is leading to innovation by licensees. Otherwise, all this patent assertion and licensing activity may simply be a tax on current productivity with relatively little return to the innovation ecosystem.

B. EVIDENCE SO FAR; OUR PILOT STUDY

In prior work we provided the first survey evidence of the direct measure of new product creation resulting from patent assertions by NPEs.[53] We also tested commercialization effects by measuring other markers of potential innovation, such as technology transfer beyond the patent.[54] By including such markers, we create a more dynamic picture of the potential for future commercialization, even if that commercialization has yet to occur.

While some have argued that NPEs serve as efficient middlemen—transferring inventions from creators to commercializers—we found no such evidence in our 2015 study.[55] We surveyed 191 in-house licensing attorneys at companies that produce products on the theory that these parties have direct knowledge of whether the company implemented new technology and because in-house counsel tend to negotiate licenses both as patent holders and as potential licensees.[56] The survey examined the effects of licenses that a company took after receiving a patent demand, which was defined to include calls or letters suggesting areas of mutual interest or joint ventures, offering to license patents, threatening litigation, giving notice of intent to file an infringement lawsuit, or actually filing an infringement lawsuit.[57] We asked whether those licenses led to any markers of innovation.[58] Direct markers of innovation included the addition of new products or features.[59] Indirect markers of innovation included whether the patent holder transferred know-how, other technical knowledge, or personnel (including through a consulting agreement) along with the patent, and whether any joint

53. Lemley & Feldman, *supra* note 7.
54. *Id.*
55. *See generally id.*
56. *Id.* at 144–49 (describing methodology of 2015 study).
57. *Id.* at 149–55.
58. *Id.* at 155–66.
59. *Id.* at 160 fig.9, 161 figs.10 & 11.

ventures were created.[60] Again, our survey considered only licenses taken in response to unsolicited licensing requests.[61]

It did not look at the practice, particularly among university inventors, of entering into technology transfer agreements before embarking on development of a new technology.[62]

The responses from our pilot study suggested that licensing requests from NPEs rarely lead to direct or indirect markers of innovation. Ninety-two percent of respondents reported that when they licensed technology from NPEs, they added new products or features as a result of that licensing zero to ten percent of the time.[63] The results were even stronger when respondents were asked about indirect markers of innovation, with respondents reporting with complete unanimity that they rarely received technical knowledge, transfer of personnel, or joint ventures along with a patent license.[64] Thus, the results suggest that NPEs do not appear to be playing the role of efficient middlemen. While it is certainly possible that a middleman role could be reflected in some other markers than the ones we examined, we did not find such evidence in our preliminary work. Nor have other studies. To the contrary, Lauren Cohen, Umit Gurun, and Scott Duke Kominers find that NPE patent assertions are associated with less, not more, subsequent innovation by the targeted firm.[65] And Brian Love, Kent Richardson, Erik Oliver, and Michael Costa find that less than one percent of patent portfolios offered for sale through brokers include any form of know-how or technology beyond the patents themselves.[66]

Interestingly, the evidence was also dismal when ex post licensing requests came from those other than traditional NPEs.[67] When product producing companies and universities made unsolicited approaches and those approaches resulted in a licensing agreement, the agreements were unlikely to lead to direct or

60. *Id.* at 162 figs.12 & 13, 163 figs.14 & 15, 164 figs.16 & 17, 165 figs.18 & 19, 166 fig.20.

61. *Id.* at 156.

62. *Id.*

63. *Id.* Zero to ten percent was the lowest category offered. *See id.* at 157 fig.5. We suspect, though we cannot prove, that for almost all of respondents the number was in fact zero.

64. *Id.* at 157.

65. Lauren Cohen et al., *Patent Trolls: Evidence from Targeted Firms* 4 (Harvard Bus. Sch., Working Paper No. 15-002, 2018).

66. Brian Love et al., *An Empirical Look at the "Brokered" Market for Patents*, 83 MO. L. REV. 359, 371 (2018).

67. Feldman & Lemley, *supra* note 7, at 160.

indirect markers of innovation.[68] Roughly three-quarters of respondents reported new products or features from zero to ten percent of the time,[69] ninety-four percent reported transfers of personnel (including through consulting agreements) zero to ten percent of the time,[70] and ninety-one percent reported joint ventures from zero to ten percent of the time.[71] These observational results suggest that ex post patent licensing demands don't appear to lead to technology transfer or other markers of innovation, no matter what type of party initiates the unsolicited approach.

But as we noted in that study, these results were preliminary and subject to a number of limitations:

But before we conclude that the patent system is not working, or that it is working only for practicing entities that want to exclude their competitors from the market, we should gather more data. Our survey is limited, both in the number of respondents and because of its low response rate. There may be other, underrepresented sectors of the economy in which patent-based technology transfer is significant. Or we may have found an unrepresentative subset of technology companies to survey. Our intent is to follow up with a more comprehensive survey in the near future.[72]

This paper reflects that broader effort.

II. WHAT WE DID

We set out to survey a wide range of American businesses about their experiences with patent assertion and enforcement and its relationship to innovation. We put together a series of questions about their experiences both with licensing demands received from outside and about licensing demands they made of other firms. We made clear that we were interested in patent licensing demands that related to existing products (what we called in the Iowa paper "ex post" licensing demands).[73] We wanted to know what sorts of entities sent those requests, and what, if anything, happened as a result. In this Section we discuss how we decided who to contact and how we designed the survey. We present the results in Part III.

68. *Id.* at 160–62.
69. *Id.* at 160 fig.9.
70. *Id.* at 164 fig.16.
71. *Id.* at 165 fig.18.
72. *Id.* at 177.
73. *See id.* at 139.

A. DATA SOURCES AND PARTNERS

In developing the methodology and carrying out the study, we worked closely with two organizations: the Indiana University Center for Survey Research (CSR) and Dun & Bradstreet (D&B).[74] We chose to partner with CSR to minimize methodological limitations encountered in the pilot study, as well as to preserve objectivity and confidentiality in data collection. CSR is an academic research facility that has been conducting research projects for over thirty years and is a founding member of the Association of Academic Survey Research Organizations.[75] The senior methodologists at CSR have advanced training in quantitative and qualitative research methods and many years of experience in survey design, implementation, and analysis.[76] Our colleagues at CSR were primarily responsible for sending the survey communications and managing the survey site, processes, and data.

Our second partner, Dun & Bradstreet, served as the source of our survey sample. Specifically, we used Hoovers Inc., which is a subsidiary of Dun & Bradstreet that offers proprietary business information.[77] Dun & Bradstreet Hoovers (D&B Hoovers) provides a database of over 120 million business records, representing the most comprehensive commercially available repository for data on U.S. companies.[78] We are grateful to the National Science Foundation (NSF) for funding that allowed us access to this proprietary database and permitted us to work with professional survey experts.

B. SURVEY POPULATION

Working with our colleagues at CSR, the first step we undertook was to develop a sampling design to guide selection of companies from the D&B Hoovers database. Our overall aim was to approximate a stratified, random sample of the U.S. business landscape. By consulting with individuals at Dun & Bradstreet,

74. Throughout the article, the Indiana University Center for Survey Research will primarily be referred to as "CSR." Dun & Bradstreet will be identified by its full name in most places, except when discussing its database, which we refer to in most places as the "D&B Hoovers database."

75. *See About: Center for Survey Research*, IND. U. BLOOMINGTON, https://csr.indiana.edu/about (last visited Mar. 11, 2019).

76. *See Team: About: Center for Survey Research*, IND. U. BLOOMINGTON, https://csr.indiana.edu/about/team/index.html (last visited Mar. 11, 2019).

77. *See What Is D&B Hoovers?*, D&B HOOVERS, http://hoovers.com/what-is-dnb-hoovers.html (last visited Mar. 11, 2019).

78. *See id.*

we determined the range of criteria that we could use in building sample lists of companies. Such criteria included industry sectors, firm size (by number of employees or revenue), and titles or type of employee.[79] We included companies headquartered in the United States with at least one employee and annual sales of $1 million or more. To avoid the problem of including companies with multiple branches more than once, we chose to eliminate branches from our sample. To avoid including both parent companies and their subsidiaries, we established that if an identified subsidiary firm had a parent company within the same industry group, then the subsidiary firm would be removed from the sample.[80] As for the annual sales criterion of $1 million or greater, we decided relatively early on to exclude extremely small companies, as they might not experience much patent licensing activity and/or be large enough to have in-house counsel available to answer our survey. We were also concerned about the ability of surveyors to find all startups, let alone good contact information for those startups, which could have made our results unrepresentative. We considered several different exclusion criteria, such as the Small Business Association (SBA) definition of a "small business,"[81] but we ultimately settled on annual sales of $1 million or greater. The large majority of firms with annual receipts of $1 million or less are likely to be non-employer firms (e.g., self-employed proprietorships) for which it would be extremely difficult to obtain any sort of survey response. By applying this sales minimum, we may be excluding small start-up companies, but we believe that $1 million is low enough of a threshold to capture a representative swath of the U.S. business landscape.[82]

79. For a full list of data fields available through the D&B Hoovers database, see *Access Hoover's Data Descriptions*, D&B HOOVERS, http://images.hoovers.com/images/pdfs/Access_Hoovers_Data_Elements.pdf (last visited Mar. 11, 2019).

80. This was a judgment call. There are circumstances in which the subsidiary might be the better choice. But we were not in a position to evaluate those decisions case-by-case, and we wanted to make sure we didn't double count related companies.

81. The definition is complicated and industry-specific. *See* 13 C.F.R. § 121.201 (2018).

82. This too was a judgment call. Arguably $1 million in revenue is too small for many companies to worry very much about the patent system. But startups do face patent threats, and we wanted to err on the side of over-inclusiveness. For information on patent demands and startup companies, see Colleen Chien, *Startups and Patent Trolls*, 17 STAN. TECH. L. REV. 461 (2014); Robin Feldman, *Patent Demands & Startup Companies: The View from the Venture Capital Community*, 16 YALE J.L. & TECH. 236 (2014).

We aimed our survey at operating companies. But given this definition, it is possible some of the companies we surveyed are "hidden non-practicing entities" that began by generating products or services but failed as businesses and switched to asserting patents against other companies as a business strategy. If those hidden NPEs are answering our survey questions honestly, however, they will most likely be directed into an extremely abbreviated version of the survey via branching logic. They will not have inbound licensing demands and so will not reach most questions in the survey. The first screener question in the survey asks whether the respondent has received patent licensing demands in the past three years; if the company in question is in fact a hidden NPE, and they are not generating products or services, they are unlikely to receive patent demands and will be screened out of the rest of the survey.[83]

The next step was to identify the specific industries to include. In the pilot study, we selected eleven industry sectors: Computers & Other Electronics; Semiconductor; Pharmaceutical; Medical Devices, Methods & Other Medical; Biotechnology; Communications; Transportation; Construction; Energy; Goods & Services for Industrial & Business Uses; and Goods & Services for Consumer Uses.[84] To ensure an adequate number of companies per industry group in the current study, we chose to consolidate the industry categories from eleven to five. The five we chose were: Computers & Related Fields (including other electronics, communications, and semiconductors); Life Sciences & Related Fields (including pharmaceutical; biotechnology; and medical devices, methods, or other medical); Transportation; Energy; and Chemistry. We then mapped the five industries selected onto the more granular industry codes by which companies are sorted in the D&B Hoovers database. Doing so allowed us to more efficiently search for and precisely target companies within the database.[85]

83. As with any survey, however, there is always a risk that a few respondents will answer dishonestly or try to distort the survey results.

84. Feldman & Lemley, *supra* note 7, at 145.

85. There were two different sets of industry codes that were available to us: the North American Industry Classification System (NAICS) and the Standard Industrial Classification (SIC). SIC codes were four-digit numerical codes assigned to businesses by the U.S. government to identify the primary business of the establishment. *See Frequently Asked Questions (FAQs) - NAICS*, U.S. CENSUS BUREAU, https://www.census.gov/eos/www/naics/faqs/faqs.html (last updated Sept. 4, 2018); *SIC Division Structure*, OCCUPATIONAL SAFETY & HEALTH ADMIN., https://www.osha.gov/pls/imis/sic_manual.html (last visited Mar. 11, 2019) (providing a list of SIC codes for various industries). NAICS was

To guarantee sufficient statistical power, we aimed to get responses from 400 companies per industry. From the pilot study, the pretest, and other research in patent assertion, we knew the difficulties involved in obtaining survey responses from companies.[86] Thus, a generous response rate of ten percent would require us to sample at least 4000 companies per industry.[87] With five industries, the total would be 20,000 companies. We decided to double that number to increase the buffer and ensure enough responses, resulting in a total sample size of 40,000. Weighted by the number of companies in each industry in the D&B Hoovers database population, 40,000 survey targets broke down into 7272 companies from Computers & Related Fields, 8535 companies from Life Sciences & Related Fields, 18,735 companies from Transportation, 3262 companies from Energy, and 2196 companies from Chemistry.

However, some percentage of the email addresses in the D&B Hoovers database were likely to be outdated or inaccurate, resulting in bounce-backs. Further, D&B Hoovers only has email addresses for some of its company contacts.[88] To account for possible bounce-backs, we asked Dun & Bradstreet to increase the strata sizes, resulting in a total of 44,112 companies surveyed. And to account for the companies without email addresses in the D&B Hoovers database, we increased the sample size again, to 92,000 companies.[89]

adopted in 1997 to replace SIC and is similar in that it serves as a classification of business establishments. *Frequently Asked Questions (FAQs) - NAICS*, *supra*. NAICS is the standard used today by federal statistical agencies for collecting, analyzing, and publishing statistical data related to the U.S. business economy. *Id.* Given that NAICS was adopted more recently, and because U.S. census data is more readily available through NAICS at this point, we chose to use NAICS codes as opposed to SIC codes in identifying industries for our study. A full mapping of NAICS codes onto our industries of interest is available from the authors.

86. *See, e.g.*, Chien, *supra* note 82, at 470; Robin Feldman & Evan Frondorf, *Patent Demands and Initial Public Offerings*, 19 STAN. TECH. L. REV. 52, 68 (2015); Feldman, *supra* note 82, at 259–60; Lemley et al., *supra* note 4 (manuscript at 4–6).

87. These back-of-the-envelope calculations weren't indicative of any survey design but rather rough estimates of what we expected to see.

88. The number of companies with at least one email address out of the total 46,851 companies turned out to be 14,835 (or 31.66% of the total). Thus, we could expect only about one third of our sample to have email addresses listed in the D&B Hoovers database.

89. We made sure to request that Dun & Bradstreet not expunge the approximately two-thirds of the companies without emails so that we could attempt to contact those companies through non-email means. Specifically, we asked Dun & Bradstreet to provide general firm contact information (e.g., front

Next, we had to specify which, and how many, individuals within each company should be selected for contact purposes. We established a goal of at least one personnel contact per firm. Many firms, however, have more than one personnel contact; in those cases, we decided to have Dun & Bradstreet deliver all contacts available up to a maximum of three per firm.

Within a firm, we believed that those within the legal department of a company, especially patent or intellectual property counsel, would be most qualified to respond to a survey regarding patent licensing requests, so we prioritized legal job functions in our sampling design. The D&B Hoovers database sorts contacts by job title, such as "General Counsel" or "Chief Executive Officer."[90] There were fourteen relevant job titles within the legal job function group in the database, including "Patent Law," "Vice-President Legal," "General Counsel," and "Legal Executive."

One option was to have D&B Hoovers sort by companies that have a legal email contact in their database, essentially including legal job function as another one of the broad search criteria along with our location, annual sales, etc. requirements. This would have guaranteed a sample in which every company had a contact in its legal department for us to survey, which would have in turn increased our response rates and the likelihood that those answering the survey would be knowledgeable about patent licensing. The problem with this approach was that it would have created significant selection bias. There may be notable differences between the type of company that would

desk phone number and postal addresses) if a company had no email addresses available; this would allow us to supplement our email distribution of the survey by calling and sending mail to a subset of those companies without any emails listed in the D&B Hoovers database.

One limitation to quadrupling the strata sizes and then adding thirty percent on top was that it caused us to reach out to a larger percentage of companies in some industries than others to ensure that we had enough positive responses from each of the industries we tested. For example, the D&B Hoovers database only had 17,801 companies available in the life sciences industry (defined by our NAICS codes), and we had initially requested 8535. Doubling that initial request would result in 17,070 companies. Adding fifteen percent on top of that would result in approximately 19,630 companies requested from an overall pool of 17,801 companies. As such, Dun & Bradstreet would have had to give us *all* of the companies in the life sciences industry, which would eliminate the possibility of pulling a random sample from the overall pool. We determined that the benefits of having a larger pool of companies included in the sample and thus increasing the number of companies with email contacts outweighed the concerns about randomization.

90. *See Access Hoover's Data Descriptions*, *supra* note 79.

have a legal contact listed in the D&B Hoovers database and the type of company that would not, and by selecting for those with legal contacts up front, we could be skewing the data in unknown ways. Instead, we had Dun & Bradstreet search for companies meeting our specified criteria, whether they had a legal contact listed or not, and then provide us with all of those companies resulting from the randomized selection, separated into a file for those with legal contacts and a file for those without legal contacts. If a firm had fewer than three legal contacts, we determined that the rest of the contacts should be made up by non-legal contacts. We had initially considered specifying a short list of non-legal job functions to include, such as "Chief Executive Officer" or "Managing Director," but we ultimately decided to include a broader range of non-legal job functions to increase our yield of potential email contacts. To that end, we had Dun & Bradstreet provide us with a full list of possible job functions, and we simply whittled out the ones that were clearly not worthwhile, rather than hand-picking a few high-level, non-legal job functions. The intention was not necessarily to have these non-legal individuals take the survey, but rather to have them forward the email to the individual at their company who would be the ideal respondent, whether that person was in the legal department or not.

C. DESIGNING THE SURVEY INSTRUMENT

1. Pretest and Response Analysis

We conducted a small-scale "pretest" before carrying out the full study to allow us to uncover and resolve methodological and execution problems prior to the main data collection period. We chose to limit the pretest to just three industries—Computers & Related Fields, Life Sciences & Related Fields, and Transportation—and we set a target sample size of 3000 for the pretest. The specific strata sizes for the three industries were 632 companies for Computers & Related Fields, 741 for Life Sciences & Related Fields, and 1627 for Transportation. As with the full study sample, we then chose to add fifteen percent on top of those figures to account for email bounce-backs. We then doubled the sample size for the pretest, as we did for the full study sample, to compensate for the fact that a significant percentage of the companies listed in the D&B Hoovers database do not have any email contacts listed, resulting in a final sample size of approximately 6900 for the pretest.

Having already carried out a pilot version of the study, we had an existing questionnaire from which to build on at the start of our study.[91] We conducted several iterations of revisions to the questionnaire, addressing issues such as wording, question type, data type, branching logic, visual design and formatting, usability, and other methodological issues.

After carrying out a first round of edits to our survey questionnaire, we used cognitive testing to ensure the robustness and accuracy of the questionnaire. Cognitive interviewing, using a semi-structured interviewing protocol and special probing techniques, is an important method of identifying problems and limitations in the design of questionnaires.[92] We approached fourteen individuals in the legal departments of companies including Google, Dropbox, LinkedIn, Cisco, and Amneal Pharmaceuticals. Though some of the cognitive interviewees may have been aware of the article published about the pilot study, we had no reason to believe that any of them had previously been exposed to the text of the questionnaire itself. Our colleagues at CSR conducted a total of six cognitive interviews. The cognitive interviews involved administering the revised questionnaire to the participants and asking follow-up questions to assess the participants' thoughts on the questionnaire and possible ways to improve it. The participants were sent the questionnaire in advance, and the follow-up questions were administered over the phone. Based on the feedback obtained through the cognitive interviews, we made further revisions to the survey.

First, through the cognitive interviews, we learned that we needed to break up the questionnaire into clearly demarcated sections, so that participants would be able to grasp the flow of the questions earlier on in the survey. For the final version, we separated the questions into different sections and began each with a brief explanation describing the nature of that particular section with the hope that this would help respondents understand the structure of the questionnaire more easily.

Another common question we received from cognitive interviewees was whether we wanted them to provide top-of-the-mind responses or to look up company records in response to questions in our survey asking for percentage estimates. For instance, for

91. The pilot survey questionnaire was published at Feldman & Lemley, *supra* note 7, at 180–89.

92. For a comprehensive guide to cognitive interviewing techniques, see generally GORDON B. WILLIS, COGNITIVE INTERVIEWING: A TOOL FOR IMPROVING QUESTIONNAIRE DESIGN (2005).

the question, "What percentage of licensing requests from non-practicing entities led your company to take a patent license?" with the options "None," "1-10%," "11-25%," "26-50%," "51-75%," "76-99%," and "All," the cognitive interviewees expressed uncertainty about whether they were simply supposed to provide a best guess or were supposed to consult records to obtain a precise figure. Without specifying, we could encounter a situation in which some respondents were conducting external research while others were simply providing best guesses, which would create inconsistency in the data. We felt that it would be unreasonable to ask participants to invest the time and effort required to conduct research and provide answers with 100% certainty, so we revised the questionnaire to make explicit that we simply wanted participants to supply their "best approximation."[93]

There were a few other comments that we received from the cognitive interview respondents that led us to change the content of the questionnaire. We shortened the length of time we asked respondents to consider from five years to three. We clarified that the term "entities or individuals whose core activity involves licensing or litigating patents" meant "NPE" as that term is commonly used in the intellectual property sphere.[94] And we clarified some of the language of the questionnaires.

Finally, many of the cognitive interview respondents noted to our colleagues at CSR that they would not have participated had they not known that the Principal Investigators (PIs) were involved. As such, we took steps to leverage name recognition to induce participation in the survey, such as including a "Note from the Researchers," signed by both PIs, at the beginning of the survey.

In the pilot study, we had several unusable responses in which the participants began the survey but did not complete it in its entirety. To encourage a higher rate of complete responses and minimize the burden on participants, we streamlined the language of the questions and branching logic of the survey. For example, in the pilot study, we asked about how often patent licensing requests from other companies led to transfer of technical knowledge, transfer of personnel, and creation of a joint

93. At the beginning of the survey, we included a page stating: "Some questions in this survey ask for frequency counts or percentages. Please feel free to answer simply using your best estimate or approximation." *Infra* app. B. As a follow-up, with the first question asking participants to estimate a percentage, we included the language, "Please feel free to answer with your best approximation, here and throughout the survey." *Id.*

94. *Id.*

venture in three separate questions. For the current study, we compressed those three questions into one question which asked what portion of patent licensing requests "resulted in the operating company transferring technical knowledge, personnel (e.g., through a consulting agreement), or creating a joint venture with your company . . . ."[95] Furthermore, the language of the questions and the response options were revised to maximize clarity. In the pilot survey, one response option offered to participants when asked how often licenses from competitors resulted in new products was "0-10%" of the time.[96] We split this response option up into categories of "None" and "1-10%" so that we would be able to distinguish between respondents for which licenses *never* led to new products and those for which licenses simply led to new products infrequently. We also revised the options offered in response to the question, "What parties initiated these [patent licensing] requests?"[97] In the pilot study, the parties included were competitors, product-producing companies that are not competitors, entities or individuals whose core activity involves licensing or litigating patents, universities, and a "[n]ature of the party was unclear" option.[98] In the revised survey, we chose not to make a distinction between competitors and non-competitors, compressing the two into a category for "[c]ompanies whose core activity is producing a product or service (i.e., operating companies)." We also added the option "[f]ederal labs, federal facilities, federal research centers, and other federal government sources"[99] in response to a request from the Government Accountability Office (GAO).

Additionally, we supplemented the questionnaire with a few new question banks. One concerned out-licensing requests, which are circumstances in which the participant's company holds the patent and it is his/her company that approaches an outside party to request they take a patent license.[100]

Another branch of questions that was added during our revision process concerned the practice of ex ante patent licensing.[101] As opposed to ex post licensing agreements, which are agreements formed after the technology in question has already

95. *Id.*
96. Feldman & Lemley, *supra* note 7, at 181.
97. *Infra* app. B.
98. Feldman & Lemley, *supra* note 7, at 180.
99. *Infra* app. B.
100. *Infra* app. B.
101. *Infra* app. B.

been invented and patented, ex ante licensing involves agreements that are formed at the beginning of the innovation process, granting patent rights to a technology that has yet to be invented or is in the process of being invented.[102] Though our study is primarily focused on ex post licensing requests, collecting information on ex ante agreements allowed us to more fully assess the state of the patent licensing landscape, and how levels of innovation compare between ex ante and ex post situations. This addition was made in response to suggestions gathered during the NSF peer review process. Within this ex ante licensing question bank, we included two branches: one concerning collaboration with universities and one concerning collaboration with federal labs or centers, such as Department of Energy national labs, NASA research centers, and NIH centers or institutes.[103] The inclusion of questions about federal labs and centers was again prompted by a request from the GAO.

Once the questionnaire was finalized, staff at CSR programmed it as a web survey through Qualtrics. Prior to launching the pretest, we conducted several test runs of the online survey instrument to catch any flaws that might not have been apparent before. We noticed that, in some cases, the email containing the link to the survey was directed to the spam or junk folder rather than the inbox. Our colleagues at CSR ran the email through a website that scores emails based on their likelihood of being flagged as spam—the email was rated as having a low likelihood of alerting spam filters. Filters for spam and junk mail are largely a black box controlled by proprietary email clients and platforms, so it is impossible to know for sure what might have led our email to be directed into spam folders on occasion, but nevertheless, we took steps to reduce the likelihood of this occurring during the actual administration of the survey. For instance, the PIs received several responses to the email campaigns asking for confirmation that the survey that they received from CSR was legitimate and not a scam. In response, we decided to change the from line of the emails from "Indiana University Center for Survey Research" to "Professor Mark Lemley, Stanford Law School," because we felt that an email sent directly from one of the researchers, especially given his high name recognition in the field, would be less likely to raise unwarranted

102. *See* Ralph Siebert, *What Determines Firms' Choices Between* Ex Ante *and* Ex Post *Licensing Agreements?*, 11 J. COMPETITION L. & ECON. 165, 167–69 (2015).

103. *Infra* app. B.

suspicion. We also put contact information for both of the PIs in the signature line of the emails. We also modified the language and tone of the emails to err more on the formal as opposed to casual side, with the hope that such language would help create the impression of legitimacy.[104] Battling the spam misperception is a concern in any survey research administered by email, and there is only so much one can do to combat it. Given that we received only a handful of responses expressing concern that the email might be spam, out of over 34,000 advance notification emails and over 30,000 survey invitation emails sent out, we believe that spam misperception is an important concern, but not one that would greatly impact our study. This field test also led us to make further minor modifications to the final questionnaire.

A final version of the questionnaire can be found in Appendix B.

2. Pretest Response Rate and Study Modifications

The overall response rate for the pretest, as well as the percentage of respondents with patent licensing activity, was lower than expected. Of the approximately 2700 companies contacted by email or phone, we received sixty-four complete survey responses. Of the sixty-four complete responses, only eight companies reported having received patent licensing requests within the past three years. Separate from the phone treatment, CSR also conducted follow-up calls for fifty companies who had been emailed to assess why people might be disinclined to participate. Apart from the general issue of not having enough time, those called cited low topic salience, especially those who came from companies with no patent activity. Respondents had a hard time understanding why they should take a survey about something entirely unrelated to them; this comment from those who were called was reinforced by responses we received to the email campaigns. This finding bolsters our hypothesis that the low response rate in the pretest was largely due to imprecise targeting of the most relevant population, resulting in low topic salience among many of those who were contacted.

Part of the problem was that we cast an extremely wide net to obtain a representative sample of the overall U.S. business landscape, so it was inevitable that for a large percentage of our

104. For instance, various exclamation points were replaced with periods and phrases like "This might be of interest on your Friday afternoon" were removed.

individuals, patent licensing would be an irrelevant topic. Additionally, however, the failure to reach those for which the survey would have the highest topic salience was in large part due to problems with the sample supplied by Dun & Bradstreet, as it became clear that their database was lacking in contacts from legal departments. Rather, the large majority of the contacts we received from Dun & Bradstreet were miscellaneous individuals within random departments, who unsurprisingly, had no experience with patent licensing. Of the approximately 2500 contacts supplied for the pretest, only sixty-six were classified by Dun & Bradstreet as legal contacts.[105]

The dearth of legal contacts was a problem in the main survey sample as well—of the approximately 87,000 companies provided for the main test, only 778 of them came with an email address of a legal individual from the company. Moreover, a significant number of the companies included were holding or liquidating companies. Given that such companies do not tend to be actual product or service generating businesses, they fall outside the scope of the type of companies we had intended to target.

The pretest revealed other problems with the database as well. In the pretest, the number of email addresses that resulted in bounce-backs was higher than the estimate we were originally given by Dun & Bradstreet. In the pretest, approximately seventeen percent of the companies emailed (426 of the 2477 companies with email addresses) had a final disposition of bounced, meaning that all email addresses on file for that company had been tried and had bounced back.

Most of the methodological changes we made after the pretest were aimed at re-directing our contact efforts toward individuals within a company for which patent licensing would be a more salient topic, like those in legal departments. Inevitably, however, we would still be reaching many individuals from companies with very little to no patent licensing activity and for which patent licensing is thus a low salience topic. It is important that we receive completed survey responses from those individuals as well, as such counterfactual cases are crucial to confirming or denying our original hypothesis. Although the study materials (emails, website, etc.) we used during the pretest touched on this issue minimally, we decided to further emphasize the necessity of participation even for those without patent licensing activities in the full survey rather than risk

105. Of those sixty-six legal individuals contacted, only two completed the survey.

biasing the results towards those companies that had actually been the target of patent licensing demands.

Of the problems encountered in the pretest, the greater than anticipated number of bounce-backs had the most straightforward solution. We had initially requested that Dun & Bradstreet increase the size of our samples by fifteen percent to account for email bounce-backs. Given that the percentage of bounce-backs was even higher than we had initially been led to believe, falling at approximately seventeen percent for the pretest, we requested that Dun & Bradstreet increase the percentage of additional companies for the main sample from fifteen to twenty percent.[106]

Given that one of the key problems from the pretest was not targeting the firms and individuals for which the survey would be most relevant with enough precision, we decided to identify a group of companies that we could presume would have a higher likelihood of patent licensing activity, and thus would be more likely to answer the survey. We decided that the primary variable available in the D&B Hoovers database that would be correlated with a higher likelihood of patent licensing activity was firm size, with revenue as a proxy for size. Companies with higher revenues are more likely to be engaging in activities that would prompt other entities to request that they take patent licenses. Moreover, those companies are more likely to be large enough to have a dedicated legal department to deal with patent licensing requests and litigation. We set various revenue benchmarks to separate out this "higher likelihood" subset—additional measures would be targeted to the group with revenues of $25 million or greater, and certain resource-intensive efforts would be reserved for the group with revenues of $100 million or greater.

We also decided to establish an industry-based definition of companies with a higher likelihood of patent licensing activity. Specifically, we believed the Computers and Life Science indus-

106. After asking Dun & Bradstreet to increase the bump in the sample size for bounce-backs from fifteen to twenty percent, the number of companies requested in the Life Sciences and Transportation industries was large enough that Dun & Bradstreet provided us with *all* companies in those industries in its database. The same was almost true of Energy, with Dun & Bradstreet supplying 7829 companies out of 7846 available. We discuss the implications of receiving all companies in a particular industry *supra* note 89. As we decided earlier, when this issue came up with Life Sciences after we decided to add fifteen percent and double the strata sizes, the benefits of having a larger sample size outweighed the possible randomization limitations in our view.

tries were the two most likely industries to see strong effects related to patent licensing and innovation (or lack thereof). Thus, given our limited resources, we decided to target certain supplementary efforts aimed at increasing response rate at just those two industries.

Our final defining characteristic for companies we would consider to have a "higher likelihood" of having patent licensing activity and answering the survey was companies with a *legal* contact provided by Dun & Bradstreet. We expected that individuals in legal departments would be most likely to take the survey, given their greater familiarity with the field of patent licensing. Additionally, we believed that those companies that were large enough to have a legal department for which Dun & Bradstreet was able to obtain contact information would be large enough to have experience with patent licensing requests.

One problem from the pretest was identifying those companies for which patent licensing would be most relevant. Another related problem was identifying the *individual* within those companies for whom patent licensing would be most relevant. Ideally, the person answering the survey would be an intellectual property or patent lawyer at a company—the type of person who would have firsthand experience with patent licensing activities. If such an individual was not available, however, then any individual within the legal department (provided that they were high-ranking enough, and not just an intern or paralegal) would be preferred. If no legal individual was available, then our next priority would be senior management, such as CEOs and high-level managers. Much of our ability to reach the appropriate individual, however, was subject to the quality of the data provided by Dun & Bradstreet—if their database was not expansive enough to include a legal contact from a particular company, then we were stuck with contacting whatever non-legal individual they did have listed and asking for the legal department.

Rather than rely solely on the Dun & Bradstreet contacts database, we used a variety of methods to find contact information for persons at the companies in our sample who were in legal departments or otherwise more qualified to take the survey. These methods included having research assistants search for contact information online using LinkedIn, using the online search tool called Hunter to locate email addresses, and having staff at CSR place phone calls to companies. Phone calls and mailed letters are resource-intensive, however, at least compared to email communication. Thus, we could not target every

company included in our study with these supplemental modes of contact. We decided to focus these additional efforts on the "higher likelihood" subset, as we did the research assistant searches and other efforts at obtaining more useful contact information. To be clear, we still surveyed the entire sample we received from Dun & Bradstreet using the email method from the pretest. With this new approach, we simply targeted a relevant subset with *additional* phone and mail communications. That may have increased their response rate compared to other companies, an approach that CSR used design and post-stratification weights to attempt to correct for.

D. THE FINAL SURVEY

The full survey was launched on May 22, 2017, with the advance notification email going out to over 34,000 companies. The survey invitation email was sent out four days later, on May 25, 2017, to over 30,000 companies (the number is reduced because a certain percentage of the companies who received the advance notification emails bounced back or opted out).

As of June 7, 2017, we had received 414 responses to the survey, with the highest percentage of responses after sending out the survey invitation email and the second reminder email. At that point, we noted that some of the respondents were starting to show signs of email fatigue. Thus, we held off on sending the next reminder email to provide a break between campaigns. In the meantime, secondary and tertiary contacts, who were added as replacements to bounced primary contacts, were emailed, as they had yet to receive any additional reminders. Of the 414 responses we had received, seventy had answered "yes" to the preliminary screening question of, "In the last three years, has your company received patent licensing requests?"[107]

As of July 6, 2017, we had emailed 35,116 companies. At that point, we sent postal nudges to companies in two "higher likelihood" subsets: (1) all companies for which we had a legal contact, regardless of industry and revenue, and (2) Computers and Life Sciences companies with no legal contact, with revenues greater than $25 million, and who had been emailed with no response. Of those companies who had been sent the postal nudge,

107. As for the other primary questions about patent licensing activities, thirty-eight had answered yes to the question about out-licensing, fifty had answered yes to the question about ex ante collaboration with universities, and twenty had answered yes to the question about ex ante collaboration with federal labs or centers.

357 had not been emailed simply because there was no email address on file. We contacted those companies via telephone to obtain an email address so that they could subsequently be sent the email campaigns.

A subsample of those companies that received the postal nudge also then received a phone nudge. The subsample for the phone nudge consisted of two "higher likelihood" subsets: (1) all companies for which we had a legal contact, regardless of industry and revenue, and (2) Computers and Life Sciences companies with no legal contact and with revenues greater than $100 million.

Throughout this process, CSR continued to call companies without an email contact to obtain updated contact information and to ask the screener questions. Companies for which the interviewers were able to obtain an email address were then sent the email campaigns unless they answered "no" to all of the screener questions.

As of July 6, 2017, we had received 539 completed responses, 103 of which had answered "yes" to the question, "In the last three years, has your company received any patent licensing requests?" We had also received 151 responses through the phone screenings, all of which answered "no" to the screener questions.

On July 10, 2017, to improve response rates further, we decided to expand the parameters of the phone nudge to match those of the postal nudge. Previously, we had planned on calling only non-respondent companies with a legal contact and non-respondent companies without a legal contact in Computers and Life Sciences with revenues greater than $100 million. We decided to lower the revenue criterion for the phone nudges from $100 million to $25 million ($25 million being the revenue criterion used for the postal nudges) to increase the scope of our phone contact efforts.

The total survey requests sent out by industry are detailed in Table 1.

Table 1
Total Contacts Available for Surveying

Industry	**Requested Strata**	**Increased by 20%**	**Doubled**	**Counts Based on Availability in Database**
Computers	7,272	8,726	17,453	17,453
Life Sciences	8,535	10,242	20,484	13,374
Transportation	18,735	22,482	44,964	42,942
Energy	3,262	3,914	7,829	7,829
Chemistry	2,196	2,635	5,270	5,270
				TOTAL: 86,868

Table 2
Count of Units Sampled by Industry and Mode

Industry	**Total Sampled for Email**	**Total Sampled for Phone**	**Total Worked**
Chemistry	2,580	1,734	4,314
Computer	9,161	1,287	10,448
Energy	3,140	2,802	5,942
Life Science	4,536	2,344	6,880
Transportation	14,910	1,618	16,528
All Industries	**34,237**	**9,785**	**44,112**

During the field period, CSR attempted contact with 44,112 businesses at a contact rate of 17.3%.[108]

The questionnaire was composed of a set of four preliminary, screener questions meant to gage the level of patent activity at the business followed by up to twenty-eight possible questions in the core questionnaire. Lastly, the questionnaire posed four establishment-level and one respondent-level demographic questions. In addition, an optional prompt for contact information was provided in case the respondent would like to be sent the findings of the study. The overall response rate to the survey as a whole, including the preliminary questions and core questionnaire, was 4.5%. Response rate to the core questionnaire by companies deemed to be eligible by the screener questions was 100%. While we would have preferred a higher response rate, this is in

108. We sampled 34,327 by email and 9785 by follow-up phone survey.

line with other work using similar designs.[109] Further, given the weighting scheme described below,[110] it is unlikely the nonresponse rate significantly biased the sample in a way that made it unrepresentative of the population of interest.[111]

The full breakdown of responses to email and phone surveys is reported in Table 3:

Table 3

Survey Disposition Summary Results

Codes	Disposition Label	Disposition Definition	Cases
Eligible, Interview			
1.11	Complete screener (eligible)	Respondent answered at least one preliminary question and screened into core questionnaire	421
1.12	Complete screener (ineligible)	Respondent answered all preliminary questions and screened out of core questionnaire	1,297
Eligible, Non-Interview			
2.11	Refusal	Informant or target respondent refused to participate in the survey on behalf of the company	1,430
2.112	Implicit Refusal	Email recipient logged on to the Qualtrics instrument but did not answer any questions	25
2.2	Non-contact	Direct contact could not be made with the establishment but the existence of the listed company was confirmed	1,218

109. *See, e.g.*, Graham et al., *supra* note 11, at 1272 (obtaining a 7.0% uncorrected and 8.4% corrected response rate for their Dun & Bradstreet sample); Lisa Larrimore Ouellette, *Who Reads Patents?*, 35 NATURE BIOTECHNOLOGY 421, 421 (2017) (reporting a ten percent response rate for industry respondents).

110. *See infra* Part II.D.

111. Robert M. Groves, *Nonresponse Rates and Nonresponse Bias in Household Surveys*, 70 PUB. OPINION Q. 646, 647–50 (2006).

2.3	Other eligible, non-interview	Contact could be made with the establishment but not with the target respondent. Existence of listed establishment has been confirmed.	3,370
Unknown Eligibility			
3.11	No invitation sent	Company was sampled but not worked in any survey component	4,907
3.19	Nothing ever returned	No indication of whether email recipient received the survey invitation or any subsequent reminders	26,089
3.3	Invitation returned undeliverable	All emails were returned undeliverable by all email addresses	5,065
Ineligible			
4.1	Out of sample	Company was identified as out of sample during the survey field period (i.e. informant confirmed that the company no longer exists in its sampled form)	290
			Total: 44,112

E. WEIGHTING

The weighting process undertaken by CSR is simple in its aim and intuition but mathematically complex in practice. As such, we present the intuition and some simple justification. At its core, the goal of survey weighting is to make a sample of a population more representative of the population itself. It does this by inflating the influence of some observations in the sample on the results by increasing their weights and deflating the influence of others by decreasing their weights. CSR performed this inflation and deflation based on the responding company's industry, census region, and revenue.

After correcting for the possible bias introduced by email address and telephone restrictions, our survey experts tuned the

weights[112] to make the sample representative of the U.S. business distribution of revenue and industry. We matched the U.S.

112. The mechanisms by which email addresses are located by Dun & Bradstreet are likely not random. In such situations, the American Association of Public Opinion Research recommends estimating the probability of being included in an email panel using available information. REG BAKER ET AL., AAPOR, REPORT OF THE AAPOR TASK FORCE ON NON-PROBABILITY SAMPLING 41 (2013), https://www.aapor.org/AAPOR_Main/media/MainSiteFiles/NPS_TF_Report_Final_7_revised_FNL_6_22_13.pdf. We used a method described by Sunghee Lee and Richard Valliant in which probabilities are estimated for both the email group and a reference group—in this case the portion not selected for the email/web component. Sunghee Lee & Richard Valliant, *Estimation for Volunteer Panel Web Surveys Using Propensity Score Adjustment and Calibration Adjustment*, 37 SOC. METHODS & RES. 319 (2009). To perform this estimation, CSR fit the following logistic regression model on auxiliary variables provided by Dun & Bradstreet for the entire sample:

$$\hat{y} = \alpha + \beta 1 I + \beta 2 R + \ln Rv\ (\beta 3 I + \beta 4 R) + \varepsilon$$

where $\hat{y}$, a binary indicator of whether the company had an email address available, is regressed onto:

I = the industry group of the company (mapped by NAICS code as described in appendix A);

R = the U.S. census region (mapped by state of establishment address); and

$\ln Rv$ = the natural log of the company's annual revenue in $U.S. millions.

These covariates, which predicted the presence of an email within the provided dataset with 70.2% accuracy, were chosen based not only on their perceived strength in explaining the independent variable but also their possible correlation with survey analysis variables. While other variables were available in the dataset, many either had missing data or added little additional explanatory power. However, without knowing the full scope of Dun & Bradstreet's methods for obtaining email addresses, the model could be subject to misspecification.

Using these estimated probabilities, we followed guidance provided by Lee and Valliant of using propensity score classification to group like probabilities together such that each grouping matches establishments with and without an email address based on estimated likelihood of having an email address as determined by the covariates. Following the suggestion of Lee & Valliant and Cochran, we developed five classes. *See id.* at 321; *see also* W.G. Cochran, *The Effectiveness of Adjustment by Subclassification in Removing Bias in Observational Studies*, 24 BIOMETRICS 295, 296–97 (1968). Each class is then provided a single adjustment factor that is equal to:

$$f\ c = \sum de\ t\ e \in (sc\ t) / \sum de\ t\ e \in (st) \sum de\ m\ e \in (scm) / \sum de\ m\ e \in (sm)$$

where the proportion of class membership to entire subsample for the non-email, reference group is represented in the numerator and the proportion of class membership to entire subsample for the email group is represented in the denominator. This adjustment is then multiplied by the base weight to form an adjusted base weight. A similar adjustment was also made to the telephone screener subsample based on the estimated probability of not having an email.

In addition to the unknown probability of having an email, a significant portion of the worked sample were deemed to have an unknown eligibility to participate in the overall survey at the end of the field period. We could not

business population percentages exactly to the 2012 U.S. economic census.[113]

CSR's weighting also addresses concerns that could have resulted from low response rates. A low response rate is problematic when the small sample of responders isn't representative of the population. If the sample is representative of the population, however, the response sizes do not raise the same concerns. Our weighting makes our sample more representative of the population and thus reduces potential sample size concerns.

As an example, consider the transportation portion of our sample. In the weighted analysis, transportation companies make up forty-two percent of our sample. The large proportion of transportation companies is partly due to restrictions we put on the data. According to the U.S. census, when you restrict the pool of all companies to those within one of the five industry sectors we studied having a U.S. zip code, not a subsidiary, greater than $1 million in revenue, and having at least one employee, forty-seven percent of the resulting companies are transportation companies. Put differently, when you only consider energy, computer, life science, chemistry, and transportation companies, transportation companies make up a large proportion of the

confirm those companies were still operating during the field period. The sample weights for these cases were distributed equally among all other response types, including respondents, non-respondents, and ineligibles such that the weight of the "knowns" scale up to the aggregate weight of the contacted portion (i.e. known and unknown).

We then balanced the resultant weights for all respondent cases to approximate U.S. population proportions using a method referred to as raking. We used the survey package of the statistical programming language R. In balancing the sample weights, we focused on two auxiliary variables: count of firms by case-level industry group (mapped by NAICS code, U.S. CENSUS BUREAU, https://www.census.gov/cgi-bin/sssd/naics/naicsrch?chart=2012 (last visited Mar. 11, 2019)) and count of firms by revenue class. Upon examining cell counts of respondent companies for each variable, we collapsed certain revenue classes to increase the number of units in each cell and facilitate more stable estimates.

Finally, after balancing the weights, we examined the distribution to identify outliers with the potential to significantly increase the variance. According to a commonly used criterion, we trimmed weights to the value of the median weight plus six times the interquartile range and distributed the excess among all other weights to maintain the total population counts. Since redistribution has potential to increase weights, we repeated the process of trimming and redistribution until all weights were within the bounding limit. SADEQ CHOWDHURY ET AL., WEIGHT TRIMMING IN THE NATIONAL IMMUNIZATION SURVEY 2652–55 (2007), https://www.researchgate.net/publication/260348642_Weight_Trimming_in_the_National_Immunization_Survey.

113. *See generally* U.S. CENSUS BUREAU, 2012 SUSB ANNUAL DATASETS BY ESTABLISHMENT INDUSTRY (2012), https://www.census.gov/data/datasets/2012/econ/susb/2012-susb.html.

available respondents. Thus, weighting makes the sample more representative of the population.

Last, while the weighting changed the sample demographics from those recorded to ones matching the population demographics, it does not change the categorical conclusions we make. To confirm this conclusion, we show the unweighted numbers in Appendix A.[114] The Appendix demonstrates that the results with unweighted data differed only in minor magnitude and not in direction or trend.

III. RESULTS

A. OVERALL DESCRIPTIVE STATISTICS

Our survey generated responses from 1718 companies. Of those, 1297, or 75.5%, were identified in the screener questionnaire as having never received patent licensing demands. Companies with no experience with patent licensing demands answered only a few questions, since most questions did not apply to them.[115]

We report the breakdown by revenue and industry in Table 4, as well as the weighting we applied to match responses to the census data.

Table 4
Results by Industry

Industry	**Count of Cases**	**% of total**	**Sum of Balanced Weights**	**% of total**	**Count of Firms in U.S. Pop.**	**% of total**
Chemistry	222	12.9	6,233	5.5	6,233	5.5
Computer	433	25.2	20,635	18.2	20,635	18.2
Energy	185	10.8	9,257	8.2	9,257	8.2
Life Science	410	23.9	24,220	21.3	24,220	21.3
Transportation	468	27.2	53,167	46.8	53,167	46.8
Total	**1,718**	**100**	**113,512**	**100**	**113,512**	**100**

Companies in the transportation industry were less likely to respond to our survey at all than companies in the chemistry and

114. Because of the relatively complicated survey design involved in this project, we choose to exclude hypothesis tests based on unweighted data. To avoid biased estimates and inferences, we only present inference based on weighed data.

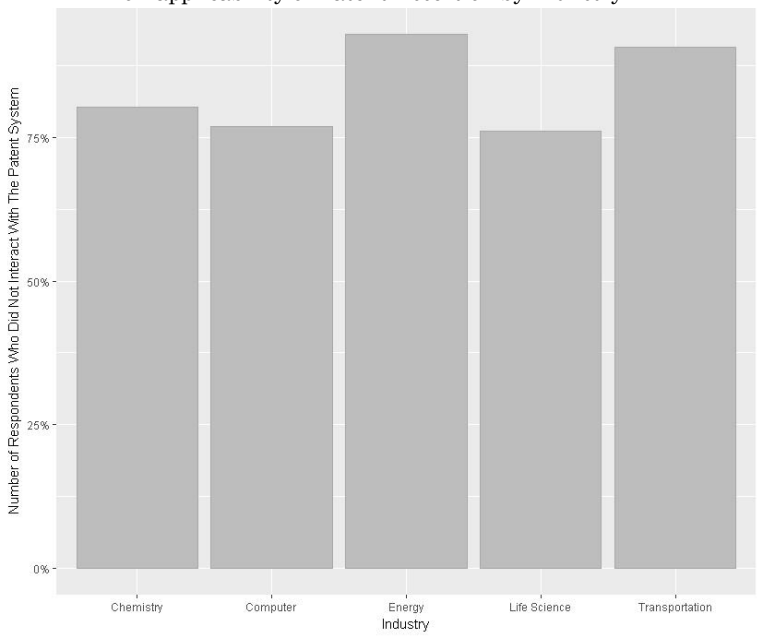
115. If companies answered only some but not all questions, we included them only in considering the questions they answered.

computer industries. That may well be because patents simply aren't that important to many transportation businesses, particularly small trucking or shipping firms, and firms with no connection to the patent system were naturally less likely to respond to our survey, despite our entreaties.

We did worry that while transportation companies make up forty-seven percent of our population, the patent system is disproportionately irrelevant to them when compared with other industries. If this were the case, we would be biasing the observations on patent assertion toward companies that typically do not have patents asserted against them. It is unlikely that this is the case. We studied the "nonapplicability rate" by industry—the percentage of respondents who had never faced a patent assertion. We report the results in Table 5. The average nonapplicability rate is around eighty percent. While it is slightly higher than average in transportation, transportation companies were more likely to report patent assertions than the energy industry, and in any event the results are not dramatically different by industry. The patent system may not affect a large portion of transportation companies, but it does not ignore them disproportionately.[116]

116. We cannot exclude the possibility that companies in certain industries were less likely to respond because the patent system was simply not relevant to them. Weighting should account for this in our substantive results.

Table 5
Non-applicability of Patent Assertion by Industry



In most of what follows, we report only data from the subset of companies within each industry that faced at least one patent licensing demand during the three-year study period.

B. RESULTS BY TYPE OF LICENSING ENTITY

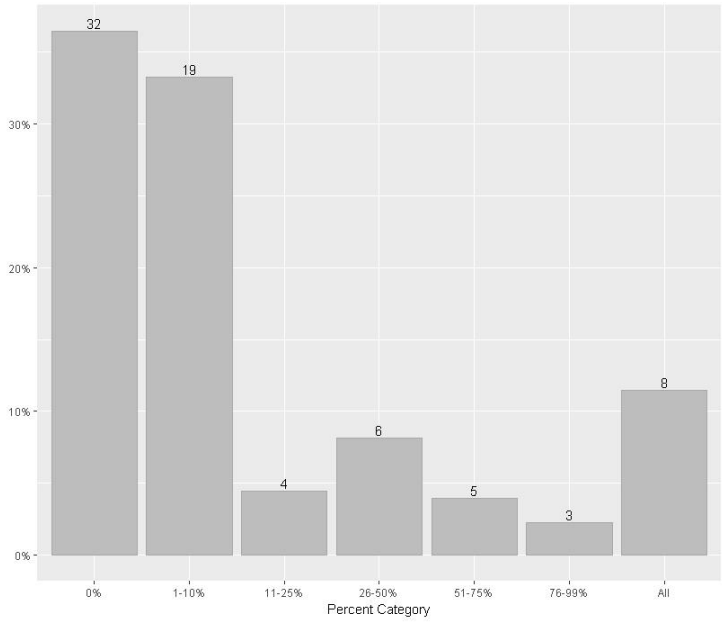
The results of our broader study largely validates the results of our initial pilot survey. We find that patent licensing demands rarely lead to further innovation. We asked directly whether the presence of a patent license demand led to the creation of a new product, as that could be an indication that the patent license led to new innovation.[117]

117. Or maybe not. Some of the respondents who said yes may well have redesigned their products to avoid infringement without necessarily making those products better, and indeed possibly making them worse. Such a litigation-induced design-around is innovation of a sort and will sometimes lead a company to valuable new avenues. *See* Matthew J. Conigliaro et al., *Foreseeability in Patent Law*, 16 BERKELEY TECH. L.J. 1045, 1050 n.17 (2001) (collecting sources). But sometimes it is just a wasteful expenditure to avoid having to pay a royalty on an existing product. *See, e.g.*, Michael Abramowicz, *Perfecting Patent Prizes*, 56 VAND. L. REV. 115, 190–93 (2003) ("[E]mpirical evidence indicates that inventing around is widespread and costly."); Colleen V. Chien & Mark A.

When operating companies asserted patents, two-thirds of respondents indicated that they never or almost never changed their products or developed new products as a result of the patent license request, *even when they took a license to the patent*. Only eleven percent of respondents indicated that they always did so.

Table 6

Percent of Firms whose Purchased Operating Company Patents Led to New Products

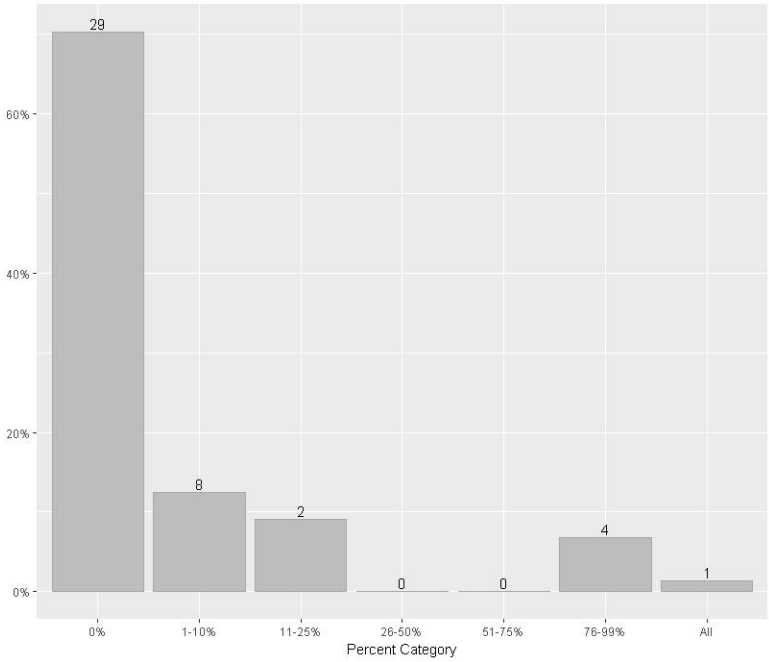


Lemley, *Patent Holdup, The ITC, and the Public Interest*, 98 CORNELL L. REV. 1, 34–35 (2012) (calling designing around a patent to avoid litigation "wasted effort" because most patent suits fail); Louis Kaplow, *The Patent-Antitrust Intersection: A Reappraisal*, 97 HARV. L. REV. 1813, 1869–70 (1984) ("Because inventing around does not contribute to welfare when combinations are permitted, the resources devoted to the task are entirely wasted."); Richard C. Levin et al., *Appropriating the Returns from Industrial Research and Development*, BROOKINGS PAPERS ON ECON. ACTIVITY: SPECIAL ISSUE ON MICROECONOMICS, 1987, at 783, 807–12; Edwin Mansfield et al., *Imitation Costs and Patents: An Empirical Study*, 91 ECON. J. 907, 913 (1981) (finding that sixty percent of studied patented innovations were imitated within four years, generally at increased cost); Donald F. Turner, *The Patent System and Competitive Policy*, 44 N.Y.U. L. REV. 450, 455 (1969) (arguing that while duplicative research may "produce new net gains," it is often "wasteful" because that same effort could have gone to addressing unsolved problems).

Compared to operating company assertions, patent licenses demanded by NPEs were even less likely to lead to new products or product changes. More than five in every six firms said they never or almost never changed their product or developed new products as a result of taking a license from an NPE; less than three percent indicated that they always did so.

Table 7

Percent of Firms Whose Purchased NPE Patents Led to New Products



Not all NPEs are created equal, however. Universities and federal labs are NPEs in the strict sense—they don't make products.[118] In our study we defined NPEs more narrowly, to focus on those in the business of asserting patents.[119] Licensing requests

118. Lemley, *supra* note 10, at 629–31 (contrasting universities with other NPEs because their licenses are generally not just forbearance from suit but instead include technology transfer and expertise).

119. We defined NPEs as those "whose core activity involves licensing or litigating patents." That is a broader definition than what some would consider a pure PAE, because it includes companies and individuals who assert their own patents rather than acquiring those patents from outside. The follow-up questions then asked about NPEs separately from universities and federal labs. It is possible that some people still lumped universities in when they were answering about NPEs, but our questions should have guided them away from that.

by two types of NPEs—universities and federal labs—were much more likely to lead to new products. Still, more than half of respondents said university licensing requests almost never led to the creation of new products. The federal lab numbers are somewhat better, but the small number of companies who got licensing requests from federal labs makes it hard to generalize. It is notable, however, that demands from both universities and federal labs were more likely to generate new products than operating companies, and certainly than other types of NPEs.[120]

120. We performed all statistical testing using two-sample z-tests for difference in proportions and statistical significance was assessed at the .05 level. We used the survey weights and not the raw data. We performed a statistical test to determine whether federal labs patent assertions were more likely to lead to innovation than other forms of patent assertion and found a statistically significant difference in most results. See Table 8.

Table 8

Statistical Tests Comparing Federal Labs to Other Entities

	OC 0-10% pat: 36%	NPE 0-10% pat: 70%	Uni 0-10% pat: 33%
NPE 0-10% pat: 70%	**-34%**		
Uni 0-10% pat: 33%	3%	**37%**	
Fed 0-10% pat: 19%	**17%**	**51%**	**14%**

In the margins of the tables are the estimated percentages for the individual variables. For example, in the first table the cell labeled "OC 0-10% pat" has "36%" below it. That means that the percentage of companies that responded 0-10% on converting purchased patents into products when the patent was asserted by operating companies was 36%. The cells inside the table are the differences in the observed proportions subtracting the left margin from the top margin. Numbers are in bold when the difference is statistically significant at the $p<0.05$ level. Because we calculated a series of hypothesis tests, it was important to take into account the issue of multiple comparisons. Statistics teaches us that by running enough tests, something will eventually come up significant purely by chance. In fact, running tests until significance is encountered and generating many new hypotheses after inspecting the data are what constitute "p-hacking." *See* Stephan B. Bruns & John P.A. Ioannidis, *p-Curve and p-Hacking in Observational Research*, PLOS ONE, Feb. 17, 2016, at 2, http://europepmc.org/backend/ptpmcrender.fcgi?accid=PMC4757561&blobtype=pdf. To avoid both of these issues, we specified the hypotheses we were interested in testing prior to testing and used the Benjamini-Hochberg procedure to correct for multiple comparisons. *See generally* Yoav Benjamini & Yosef Hochberg, *Controlling the False Discovery Rate: A Practical and Powerful Approach to Multiple Testing*, 57 J. ROYAL STAT. SOC'Y 289 (1995).

A small number of respondents indicated patent licensing demands from "others" besides operating companies, NPEs, universities, or federal labs. That might include patent pools or individuals. Forty percent of those companies indicated that they almost never changed their products as a result, but the numbers are too small to draw many conclusions.

Table 9
Percent of Firms Whose Purchased University Patents Led to New Products

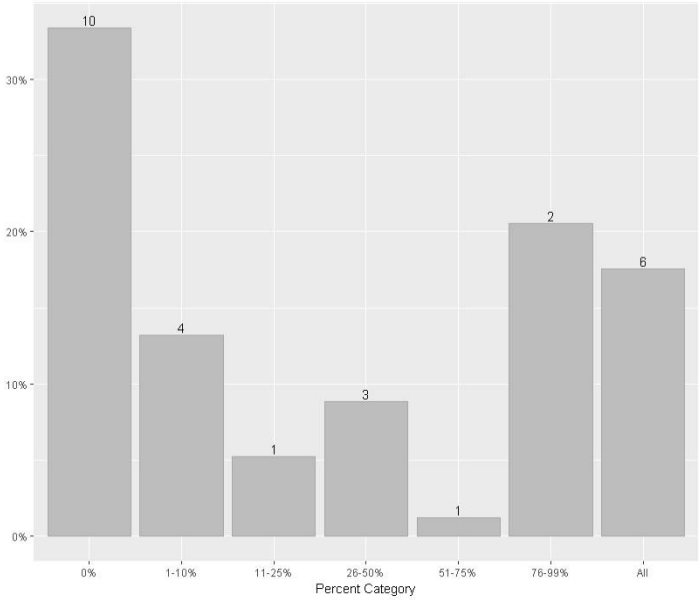
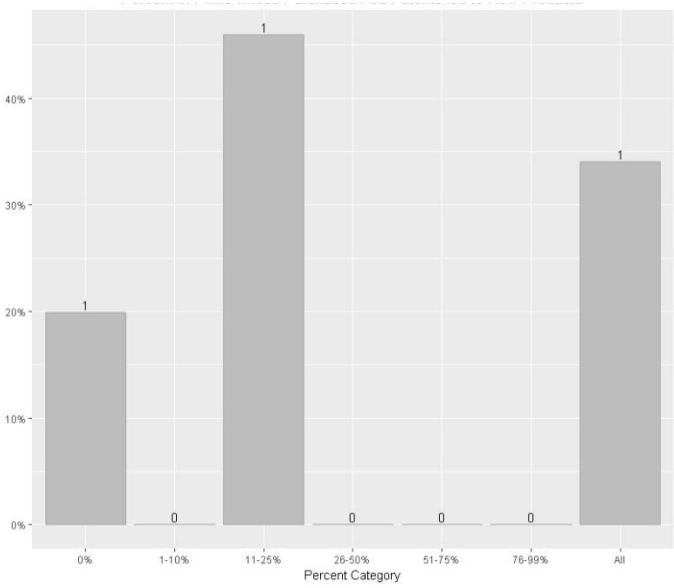


Table 10
Percent of Firms Whose Purchased Federal Patents Led to New Products



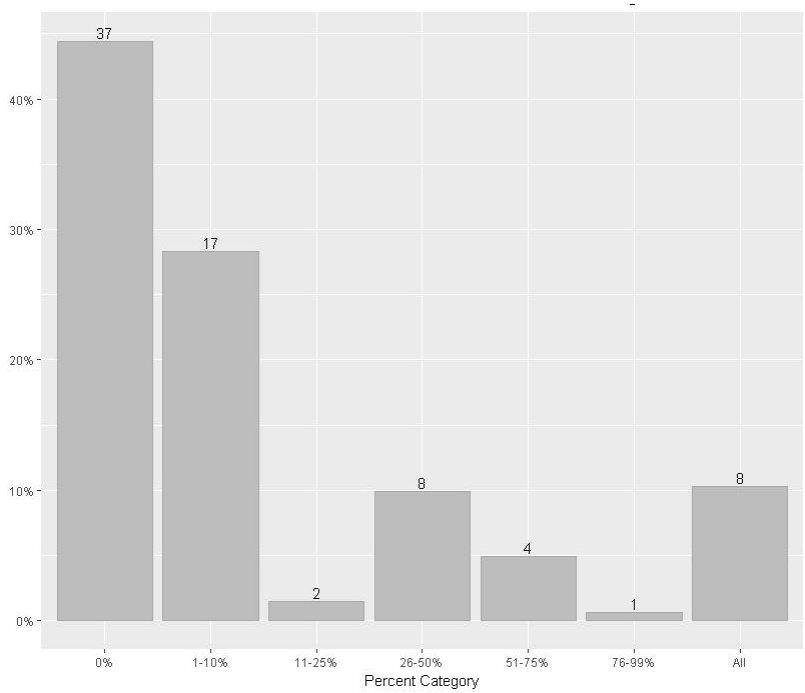
We also asked about various indicia that might indicate a patent license involved the transfer of knowledge. Specifically, we asked whether the patent license came with any trade secrets or other know-how, came with new employees, or was part of a joint venture. The economic literature emphasizes the importance of tacit knowledge in innovation.[121] True innovation and learning is rarely accomplished by a written document alone; it often requires cooperation and the communication of information learned on the job about how to make things work and solve particular problems.[122] Thus, this complex of questions gets at indirect measures of knowledge transfer and might indicate a socially valuable transaction even if the recipient denied designing a new product as a result. It might also provide a way to distinguish between socially valuable new products and those created merely to avoid infringing a patent right.

The results for evidence of knowledge transfer associated with patents is dismal. Even fewer companies report any indicia of knowledge transfer than reported developing new products. When operating companies demanded patent licenses, more than seventy percent of firms told us that those demands were almost never accompanied by any sort of knowledge transfer, and only ten percent indicated that they always were.

121. *See, e.g.*, Lemley, *supra* note 36, at 997–98 (using the example of designing an automobile).

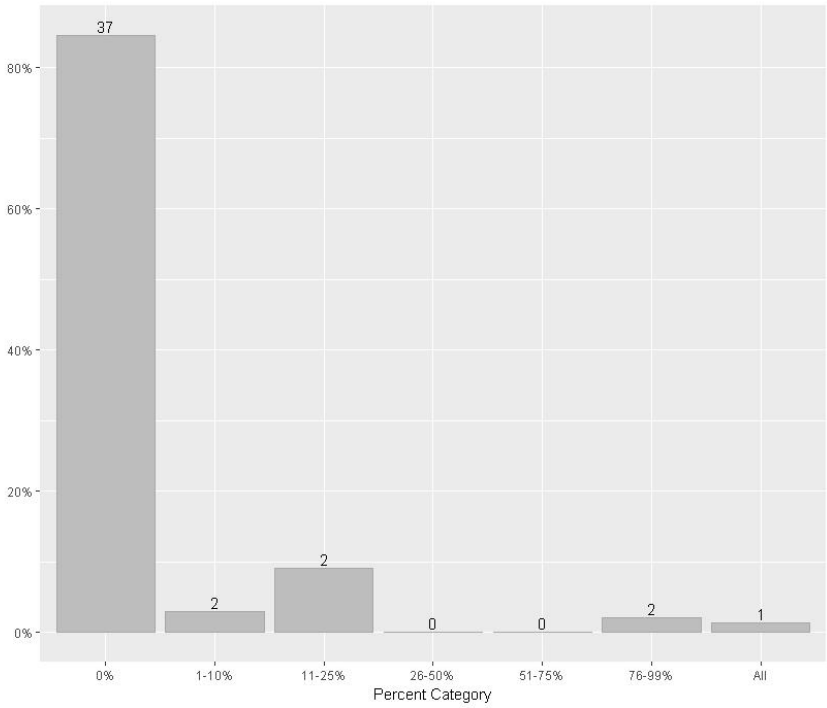
122. This is likely to be truer in some industries than others and for some inventions than others. Some ideas are simple and can be learned from reading a patent. But in more complex industries reading a patent is not a common way to advance knowledge. *See, e.g.*, Mark A. Lemley, *Ignoring Patents*, 2008 MICH. ST. L. REV. 19, 21–22 (2008) (describing how engineers and university researchers in the IT industries intentionally avoid reading patents). *But see* Lisa Larrimore Ouellette, *Do Patents Disclose Useful Information?*, 25 HARV. J.L. & TECH. 545, 548 (2012) (finding that sixty-four percent of surveyed nanotechnology researchers had read patents, and seventy percent of those did so for technical information); Ouellette, *supra* note 109, at 421–23 (surveying who reads patents and their purposes for doing so across six industries).

Table 11
Percent of Firms Whose Purchased Operating Company Patents Led to Knowledge Transfer



The results are even worse for NPEs. Nearly ninety percent of respondents told us they almost never got knowledge transfer from NPE patent license demands; only one respondent said they always did.

Table 12
Percent of Firms Whose Purchased NPE Patents Led to Knowledge Transfer



Universities did better than NPEs when it came to knowledge transfer, but not by much; more than seventy percent of respondents said they almost never got knowledge from university patent licenses, while just over ten percent said they always did. Federal labs did the best, as with the new product questions.[123] Patent assertions by federal labs were statistically

123. Patent assertions by federal labs were statistically more likely to lead to knowledge transfer than other forms of patent assertion.

Table 13
Knowledge Transfer by Federal Labs Compared to Other Entities

	OC 0-10% pat: 44%	NPE 0-10% pat: 84%	Uni 0-10% pat: 28%
NPE 0-10% pat: 84%	**-40%**		
Uni 0-10% pat: 28%	**16%**	**56%**	
Fed 0-10% pat: 20%	**24%**	**64%**	8%

more likely to lead to knowledge transfer than other forms of patent assertion.

Table 14

Percent of Firms Whose Purchased University Patents Led to Knowledge Transfer

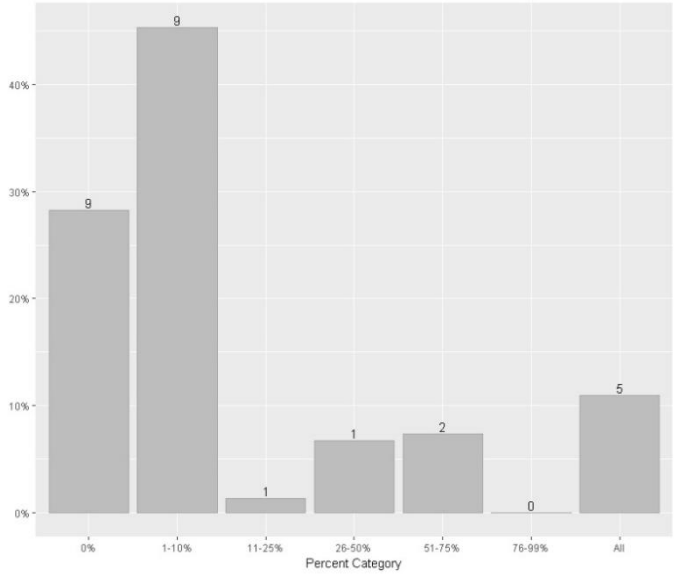
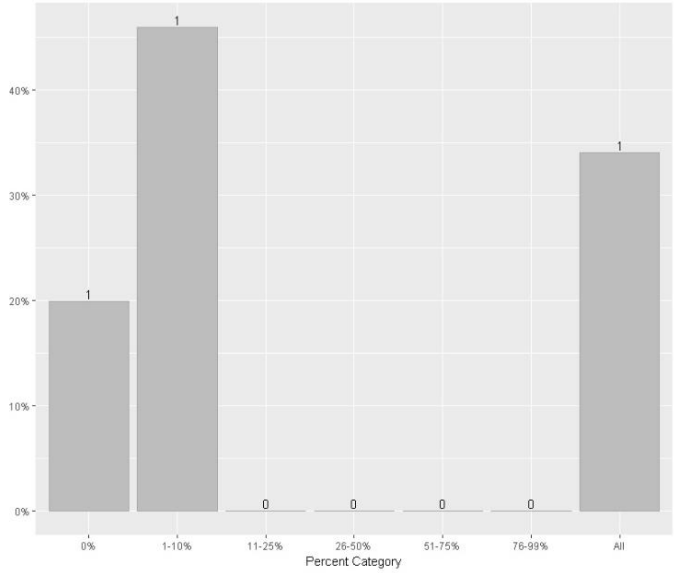


Table 15

Percent of Firms Whose Purchased Federal Patents Led to Knowledge Transfer

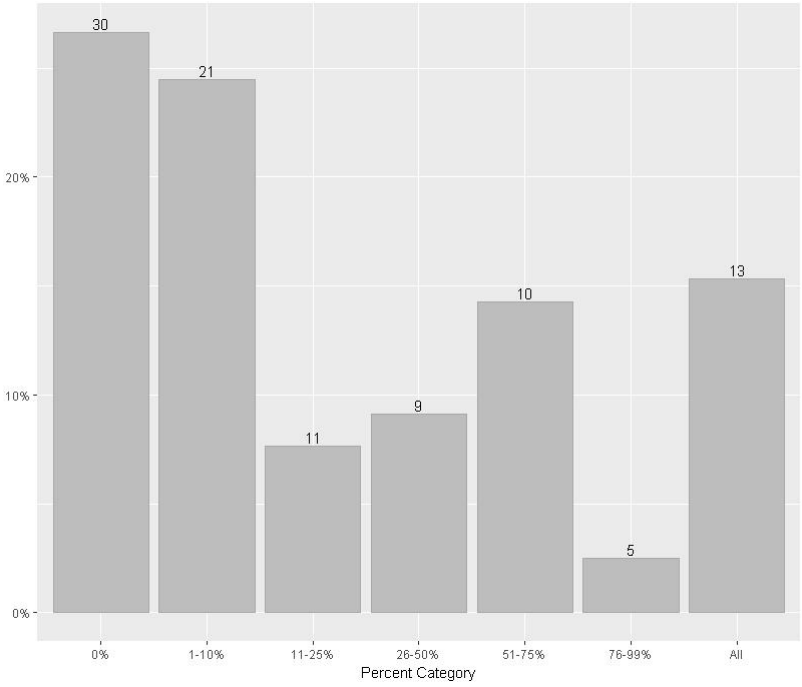


C. BIAS IN THE PERCEPTION OF KNOWLEDGE TRANSFER

While our focus was on companies that received patent licensing demands, we also asked companies whether they made patent license demands of others and, if so, what happened with those demands. A significant share of our respondents did in fact report patent outlicensing efforts. Of those, just over half indicated that their patent license requests were unsuccessful—that almost no one took a patent license. Just fifteen percent reported that respondents always took a patent license.

Table 16

Percent of Outlicensing Requests that Led to Purchase

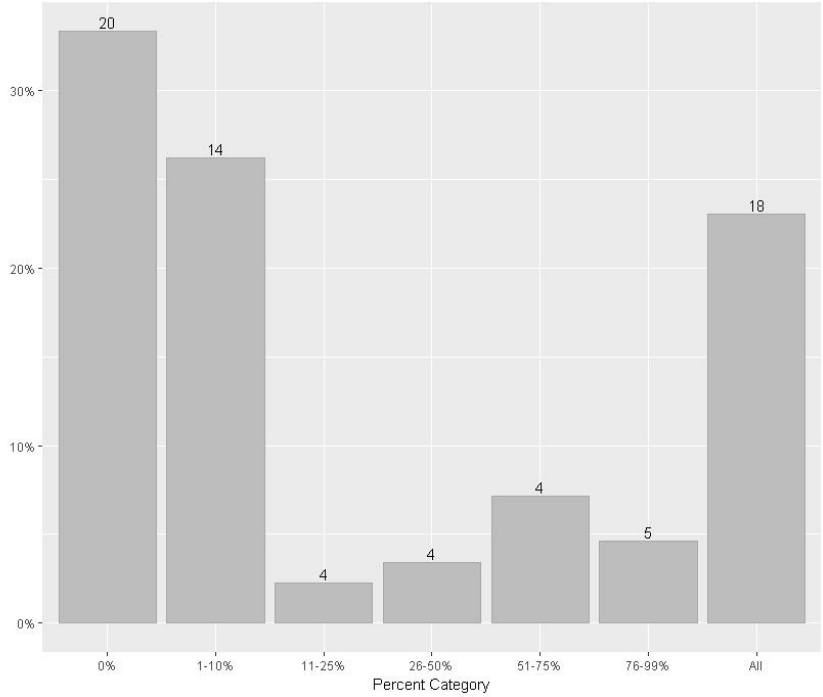


Interestingly, companies that outlicensed patents reported a significantly higher rate of technology transfer associated with their outlicenses than our respondents reported when licensing patents from others. While nearly sixty percent conceded that their outgoing patent licenses almost never led to technology transfer, almost a quarter said that their licensing demands to others always involved technology transfer.

The difference in these proportions is statistically significant at the .05 level,[124] meaning that we can reject the claim that we would have observed a difference as great as the one observed if there was no difference in the true proportions of knowledge transfer with ninety-five percent certainty.

Table 17

Percent of Outlicensing Patents that Led to Knowledge Transfer



The outlicensing data confirms that most patent license demands don't lead to technology transfer. But the disconnect between what companies reported when being on the licensor side and what they reported on the licensee side is interesting, so we looked further into the data. In particular, we wanted to explore the extent to which egocentric bias might play a role.

124. Current statistical practice recommends against the use of blind statistical significance as an exact replacement for real-world significance. *See supra* note 112 and accompanying text. Statistical significance is one of many potential indicators of real-world significance and we recommend considering effect sizes and trends when reading these results.

With egocentric bias, individuals value their own point of view more than that of others, in part due to greater familiarity.[125] In the patent context, that may operate as a form of optimism in which patent owners think they are contributing more by licensing than licensees think they are receiving. Prior literature suggests that IP owners overvaluing their own contributions is a particular problem.[126] But the bias could also move in the other direction, with licensees minimizing the contributions others make and overvaluing their own contributions. Whichever way the bias cuts, evidence that patentees think they are contributing more than licensees think they are receiving could help explain some of the difficulty the two sides have had in engaging in a constructive conversation over patent reform.[127]

125. Psychology literature confirms the existence of an "egocentrism" bias, in which individuals view their own contributions as more important and the contributions of others as less important. *See, e.g.*, Michael Ross & Fiore Sicoly, *Egocentric Biases in Availability and Attribution*, 37 J. PERSONALITY & SOC. PSYCHOL. 322, 323–325 (1979) (discussing four possible processes explaining egocentrism bias).

126. Christopher Buccafusco and Christopher Sprigman experimentally showed that there is "a substantial valuation asymmetry between authors of poems and potential purchasers of them," suggesting that the IP owners tend to overvalue their contributions. Christopher Buccafusco & Christopher Sprigman, *Valuing Intellectual Property: An Experiment*, 96 CORNELL L. REV. 1, 4 (2010). In making this finding, Buccafusco and Sprigman draw on a rich literature in behavioral economics discussing the "endowment effect"—the notion that people ascribe more value to things merely because they own them. *See, e.g.*, Daniel Kahneman et al., *Anomalies: The Endowment Effect, Loss Aversion, and Status Quo Bias*, 5 J. ECON. PERSP. 193, 194–97 (1991); Daniel Kahneman et al., *Experimental Tests of the Endowment Effect and the Coase Theorem*, 98 J. POL. ECON. 1325, 1342–43 (1990) (finding evidence of an endowment effect even when items are only possessed for a short time). Prior to Buccafusco's and Sprigman's work, the endowment effect had been shown for information, Daphne R. Raban & Sheizaf Rafaeli, *The Effect of Source Nature and Status on the Subjective Value of Information*, 57 J. AM. SOC'Y FOR INFO. SCI. & TECH. 321, 326 (2006), which, like IP, is a nonrival good. Previous studies also showed that people who believed that they received goods as a result of superior performance on a test valued the goods more highly than people who obtained the same goods by chance alone. George Loewenstein & Samuel Issacharoff, *Source Dependence in the Valuation of Objects*, 7 J. BEHAV. DECISION MAKING 157, 160–61 (1994). Buccafusco and Sprigman showed, for the first time, that the endowment effect extends to knowledge goods an owner creates. Buccafusco & Sprigman, *supra*, at 4–5.

127. For examples of extreme rhetoric on both sides, compare Neal Solomon, *The Disintegration of the American Patent System*, IP WATCHDOG (Jan. 26, 2017), http://www.ipwatchdog.com/2017/01/26/disintegration-american-patent-system/id=77594 (claiming that efforts to moderate abuses are causing the "disintegration" of the U.S. patent system and threatening innovation), with Mike Masnick, *When Patents Attack: How Patents Are Destroying Innovation in Silicon Valley*, TECHDIRT (July 25, 2011), https://www.techdirt.com/articles/

Thus, we wanted to determine the extent to which that form of bias might be influencing the responses.

To be sure, there is a scenario that would explain the results without any egocentrism bias, given two things that are evident in the data. First, we observe limited overlap between those who answered the licensor questions and those who answered the licensee questions. Only about twenty percent of the participants responded that they had experience *both* with taking a license when approached by others *and* with getting others to take a license in their own technology.

Further, if we think of success as the quality of leading to markers of innovation such as technology transfer, there is an uneven distribution of success among the companies who got others to take a license from them. Moreover, that uneven distribution is much greater than among companies who took a license when approached by others. Thus, it is possible a small number of highly successful outlicensors could cause the result we are seeing in that category of companies, which would not be mirrored in the category of those who took licenses when approached. If so, rather than egocentric bias, it may be that a small number of companies have very good patents to offer for license.

To look further at the question of egocentric bias, we focused in on those respondents who answered both sides of the question—that is, those who reported experience on both the licensor and licensee side. With companies having experience on both sides of the fence, the reported markers of innovation on both sides were considerably more similar. Although respondents reported greater markers of innovation when they licensed their patents out to other companies than when they took a license, the difference was only about eight percent. Thus, at least for those who have experience on both sides, we are not seeing such a wide margin of egocentrism.

One cannot necessarily project those results onto the respondents who reported experience with only one side of the question. It is possible that the experience of sitting on both sides of the fence at different times could make some respondents more able to see the value from the other side, an experience that the one-sided respondents would not share. Nevertheless, the delta between the two sides appears likely to be less striking

20110724/22250715225/when-patents-attack-how-patents-are-destroying-innovation-silicon-valley.shtml (claiming that abuses by patent trolls are destroying innovation in Silicon Valley).

than at first glance. Most important, at the end of the day, the outlicensing data confirms that most patent license demands don't lead to markers of innovation such as technology transfer. Coupled with other evidence, that suggests there is some egocentrism bias at work.

D. INDUSTRY-SPECIFIC RESULTS

Prior work has found significant differences by industry in the functioning of the patent system.[128] Our results provide further evidence for that divide. In addition to finding significant differences between the computer and life sciences industries, we also show that other industries have unique experiences with patent licensing.[129]

In Table 18, we report the percentage of responding companies in each industry that developed a new product or modified an existing product more than ten percent of the time in response to a licensing request from each sort of patent owner. These results sum all the categories in our survey other than the 0–10% category. One thing that is notable is that there is much less variation in how respondents behave when the licensor is an operating company than in any of the other categories. For some categories—federal labs, other—that may be an artifact of the small number of responses, but the contrast with universities and NPEs is particularly remarkable. In the computer industry, not one respondent indicated that they made new or modified products in response to a licensing demand from an NPE or a university. By contrast, all other industries were much more responsive to university licensing requests, and most industries were also much more responsive to NPE licensing requests.

Table 19 presents another way of looking at the same results. For this table, we added up the responses in all columns and generated a mean percentage of times each group made or modified a product. For instance, if five companies responded, and four said they created a new product 0% of the time and one said they created a new product 100% of the time, we summed

128. *See* sources cited *supra* note 11.

129. For an argument that the decision to assert patents in licensing is industry-specific, see Clark D. Asay, *Patent Pacifism*, 85 GEO. WASH. L. REV. 645, 667–702 (2017) (using the software, pharmaceutical, biotechnology, and semiconductor industries as examples).

the percentages so that overall, the responding companies generated new products 20% of the time.[130] The results here are similar to those in Table 14. We see surprisingly little variation by industry when responding to demands from operating companies, but quite a lot of variation in responses to NPE and university licensing demands.

The combination of NPEs and the computer industry—or, for that matter, university ex post licensing demands and the computer industry—seems particularly unlikely to drive product innovation. That may be a function of the nature of the patents asserted in those industries, the behavior of plaintiffs or defendants, or the speed with which technology moves in that industry compared to the others we studied. Regardless of the reason, it is an indication that patent licensing demands by NPEs may drive product changes in some industries, but not in computers. And it is notable that it does not seem to reflect a flat unwillingness on the part of the computer industry to deal with patents; computer companies *are* willing to change products or make new ones when faced with licensing demands from other operating companies.

130. This assumes that each company faced the same number of licensing assertions. That is unrealistic. But because we don't know how many assertions each company faced, it provides a way of looking in a single number at the impact of the dispersion of all the answers, not just isolating one set.

Table 18
Share of Companies Generating New Products More than Ten Percent of the Time by Industry and Patent Entity Type

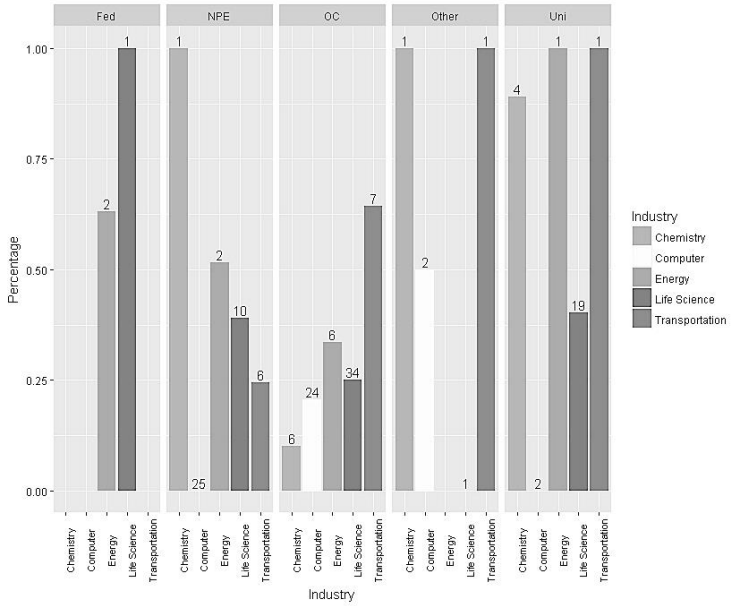
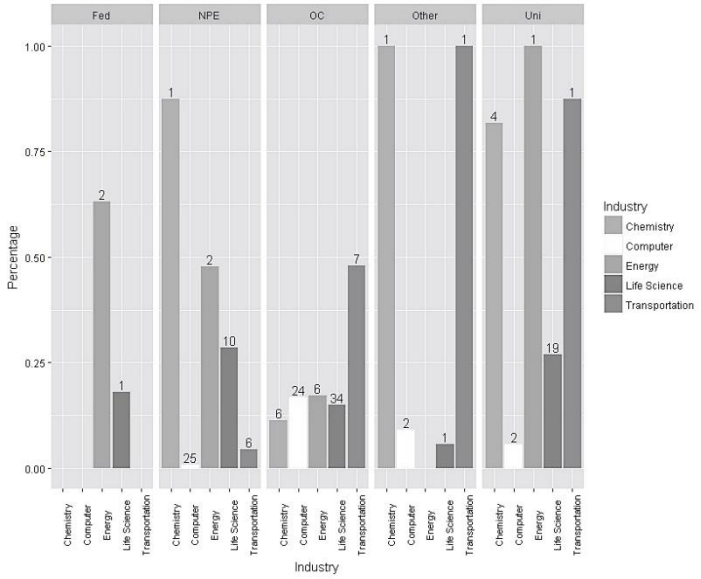


Table 19
Summed Percentage of Times Companies Generated New Products by Industry and Patent Entity Type



These differences are statistically significant for both operating companies and NPEs in most cells.

Table 20

Statistical Significance of Industry Differences for OC's:

	Chem know: 60%	Comp know: 85%	Energy know: 44%	Life Sci know: 81%
Comp know: 85%	**-25%**			
Energy know: 44%	16%	**41%**		
Life Sci know: 81%	**-21%**	**4%**	**-37%**	
Trans know: 39%	**21%**	**46%**	5%	**42%**

For NPE's:

	Chem know: 0%	Comp know: 100%	Energy know: 48%	Life Sci know: 88%
Comp know: 100%	**-100%**			
Energy know: 48%	-48%			
Life Sci know: 88%	**-88%**	**12%**	**-40%**	
Trans know: 72%	**-72%**	**28%**	**-24%**	**16%**

But, we emphasize that the differences are not all that great—no industry, including life sciences, exhibits all that much knowledge transfer or product improvement from patent assertions.

E. RESULTS SORTED BY RESPONDENT JOB DESCRIPTION

In addition to sorting by industry, we wanted to see whether the results differed based on whether respondents held legal or non-legal jobs in their companies.[131] Out of the 1718 respondents, only about twelve percent specified that they held legal jobs in the company, as opposed to non-legal jobs or unspecified. Specifically, 202 respondents held legal jobs; 1384 respondents held

131. For a description of job categories in the study, see *supra* notes 89–91 and accompanying text (methodology section).

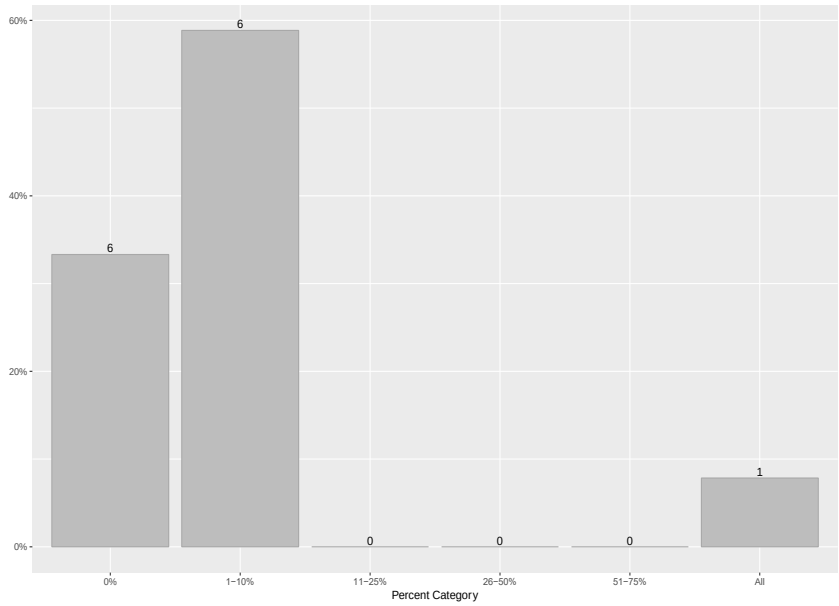
non-legal jobs, and 132 were unknown. Given that the vast majority of respondents held non-legal or unspecified jobs, we analyzed the data to see if any of the results changed by looking only at those in the legal field. The alternate sorting, however, revealed little difference, and the results were unchanged for most questions.

The two exceptions arose in the university and out-licensing contexts. The first variation arose with the question related to whether patent licenses purchased from universities included a transfer of knowledge. Recall that with the group as a whole, universities did better than NPEs when it came to knowledge transfer, but not by much; more than seventy percent of respondents said they almost never got knowledge from university patent licenses, while just over ten percent said they always did.

Looking at the respondents who specifically identified themselves as holding non-legal jobs, the responses were spread more evenly. Roughly forty-three percent responded that the company almost never received knowledge transfer from a university patent, almost thirty percent responded that the company always received knowledge from a university patent, and the remaining percentages were spread among the possible responses.

Those in the legal field were more pessimistic. All but one of the respondents in the legal field said that company almost never received knowledge transfer from a university patent. The remaining respondent said that the company always received knowledge transfer from a university.

Table 21
Legal Respondents to Percent of Firms Whose Purchased University Patents Led to Knowledge Transfer

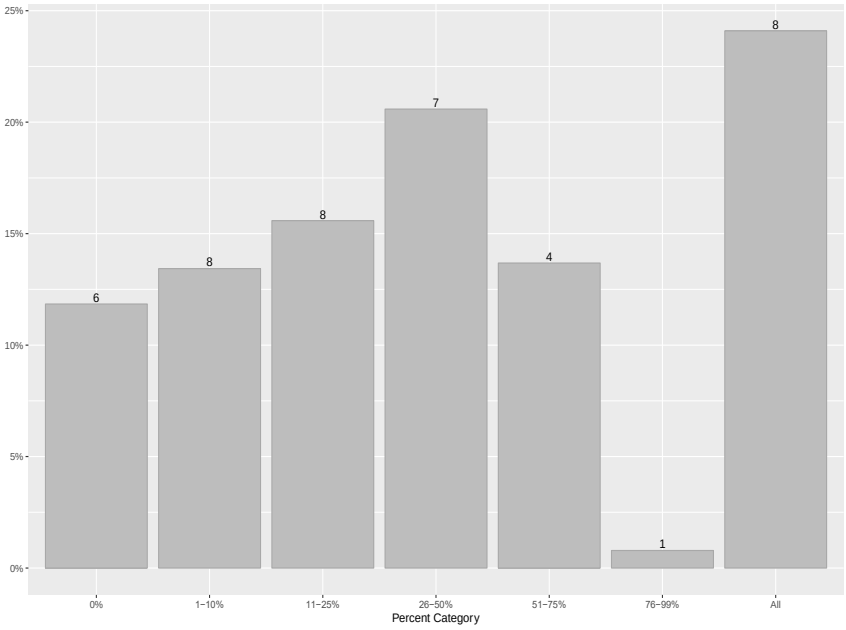


The other difference between legal and non-legal respondents occurred with one of the out-licensing questions—that is, whether their own companies made patent licensing demands of others and how those demands fared. In this context, those with legal jobs had a different perspective regarding whether those approaches led to purchase of a license. Recall that over half of the group as a whole indicated that their requests were unsuccessful—that almost no one took a patent license—and just fifteen percent reported that respondents always took a patent license.

In this case, those with legal jobs were more optimistic about their efforts. Only one-third indicated that their efforts were almost always unsuccessful while almost twenty percent indicated that their efforts were always successful. The remaining responses were spread among the other possible categories.[132]

132. Respondents who identified themselves as having non-legal jobs were more pessimistic about this category, with almost two-thirds indicating that their efforts were almost never successful. Only nine percent said that their efforts were always successful, and the remaining answers were spread among the other possible categories.

Table 22
Legal Respondents to Percent of Outlicensing Requests that Led to Purchase



It is possible that those with legal jobs have greater knowledge of whether efforts to sell licenses to others were successful. After all, the legal department had to negotiate those licenses. And it is possible that companies with in-house counsel focused on IP issues are more likely to license technology that drives innovation. It is also possible, however, that lawyers overestimated the success of their department. Nevertheless, we should note that responses from those with legal jobs to the remaining out-licensing questions were consistent with the responses from the full group. The large majority conceding that their outgoing licenses almost never led to technology transfer.

IV. IMPLICATIONS

Our results have significant implications for our understanding of the patent system and for current debates over patent reform. Two things stand out. First, our patent system is not monolithic. The experiences of different companies vary along every dimension. We may have a nominally unitary patent system, but the experiences of those who encounter that system

are anything but unitary. Second, patent licensing demands do not seem to drive innovation except in unusual circumstances. That has important lessons for the debates over patent trolls and patent reform.

A. THERE IS NO ONE RIGHT ANSWER

There is a natural tendency to generalize in policy debates about the patent system. To many of its defenders, the patent system is the main driver of innovation. Patents are good, so more and stronger patents must be better, regardless of the industry, or who owns them, or what happens with them. To some on the other side, patents themselves are an impediment to innovation. Patent litigation is associated with patent trolls who tax innovative companies.

Our results add to a growing data-driven literature that shows reality to be more complex.[133]

We begin with the patent troll problem. Underlying the debate over the social harm caused by patent trolls is debate over who constitutes a patent troll. For some, any NPE is a troll; for others, the definition is more limited, covering only companies in the business of buying patents to assert them (patent assertion entities or PAEs) or an even narrower group that asserts only bad patents.[134] Prior work has shown that some NPEs, particularly universities and startups, do much better in court than

133. For other work in that vein, see BESSEN & MEURER, *supra* note 18; BURK & LEMLEY, *supra* note 11; John R. Allison et al., *Our Divided Patent System*, 82 U. CHI. L. REV. 1073 (2015).

134. Some commentators appear to label all NPE's as patent trolls. *See* James Bessen, *The Evidence Is In: Patent Trolls Do Hurt Innovation*, HARV. BUS. REV. (Nov. 2014), https://hbr.org/2014/07/the-evidence-is-in-patent-trolls-do-hurt-innovation (defining patent trolls as "firms that make their money asserting patents against other companies, but do not make a useful product of their own"); Schwartz & Kesan, *supra* note 4, at 426 ("Some pejoratively refer to some or all NPEs as 'patent trolls,' analogizing that these patent holders wait until another brings a product to market and then jump from under the bridge to demand a toll."). This is essentially the definition given to patent trolls by Peter Detkin, the man generally credited with coining the term "patent troll." Roger Kay, *Where Did the Patent Troll Narrative Come From?*, MEDIUM (Feb. 12, 2018), https://medium.com/@rogerkay/where-did-the-patent-troll-narrative-come-from-301b20072dac (defining patent trolls as "somebody who tries to make a lot of money from a patent that they are not practicing, have no intention of practicing, and in most cases never practiced"). Others define trolls more narrowly, as encompassing only those who buy patents from others rather than inventing themselves (what we call PAEs), or, alternatively, limiting the term to the assertion of weak patents. Other commentators believe we should get rid of the term troll altogether. *See, e.g.*, McDonough, *supra* note 5, at 200–01 (preferring the term "patent dealer[]" to patent troll in all cases).

others, particularly PAEs.[135] Our data suggests that NPEs are not a monolithic group when it comes to patent licensing demands either. We defined NPEs in our study as entities or individuals whose core activity involves litigating or licensing patents, a broader definition than PAEs because it includes companies in the business of asserting patents developed in-house but narrower than some definitions, putting groups like

Most scholars appear to fall somewhere in-between. Many believe that patent trolls are characterized by those NPEs that wait to assert their patents until after operating companies have already adopted the technology so that the trolls can attempt to charge excessive rents. *See, e.g.*, Timo Fischer & Joachim Henkel, *Patent Trolls on Markets for Technology – An Empirical Analysis of NPEs' Patent Acquisitions*, 41 RES. POL'Y 1519, 1520 (2012) (defining patent trolls as "firms that seek to generate profits" primarily from licensing patented technology to firms only after the firms are infringing the patent and pressured to reach a license agreement); Damien Geradin et al., *Elves or Trolls? The Role of Nonpracticing Patent Owners in the Innovation Economy*, 21 INDUS. & CORP. CHANGE 73, 74–75 (2011) (defining patent trolls as "those entities licensing their patents opportunistically *ex post*," thereby "prey[ing] upon manufacturers and other downstream firms by charging 'supra-competitive' rates for their patents"); Lemley, *supra* note 10, at 630 (arguing that we should abandon the search for companies to call patent trolls and instead modify legal rules to thwart socially suboptimal troll-like behavior: "the capture by patent owners of a disproportionate share of an irreversible investment."); *Patent Trolls*, EFF.ORG, https://www.eff.org/issues/resources-patent-troll-victims (last visited Mar. 11, 2019) ("A patent troll uses patents as legal weapons, instead of actually creating any new products or coming up with new ideas. Instead, trolls are in the business of litigation (or even just threatening litigation)."). Still others define patent trolls as those companies that assert patents in "bad faith," which may include the assertion of low-quality patents. *See, e.g.*, Marc Morgan, *Stop Looking Under the Bridge for Imaginary Creatures: A Comment Examining Who Really Deserves the Title* Patent Troll, 17 FED. CIR. BUS. J. 165, 178 (2008) ("Under a bad faith definition patent trolls could fall into three categories: (1) parties who try to hide owning a patent until a company unsuspectingly infringes it, waiting until the company has expended significant resources so that they can extract a settlement; (2) parties that acquire large patent portfolios solely for the offensive purpose of putting competitors out of business; and (3) parties who intentionally acquire low quality patents in order to enforce them against companies, hoping to receive a settlement because the companies want to avoid the high discovery costs.").

135. Allison, Lemley & Schwartz, *supra* note 16, at 270–71 fig.5, tbl.6(a); Michael Risch, *The Layered Patent System*, 101 IOWA L. REV. 1535, 1544–47 (2016).

universities and federal labs in a different category.[136] NPEs under that definition almost never generate new products or knowledge transfer when they license their patents.[137]

By contrast, the results for certain types of NPEs were more promising. Federal labs that assert patents are the group most likely to transfer knowledge or drive new products when they license patents, though the small number of instances in which federal labs asserted patents makes the data of questionable significance.[138] Interestingly, those federal labs are the ones that depend least on patents themselves as drivers of licensing.[139] So while their licensing may be driving innovation among licensees, it is not clear that the federal lab needs the incentive of patents to drive that innovation. The results for universities are more mixed. University patent demands are more likely to drive innovation than demands by other sorts of NPEs, but most of them still don't involve any indicia of technology transfer.[140] That is consistent with the hybrid role university patenting plays. Sometimes university patents are in fact responsible for spinning new technologies out to the private sector. But at other times universities act as patent trolls, not disseminating new inventions but suing those who develop those inventions independently.[141]

Second, our results confirm prior literature that finds that the patent system works differently in different industries.[142] Patent licensing demands almost never result in technology transfer or innovation in the computer industry, particularly

136. *See supra* Part II.C.1. We asked about interactions with the following groups:

Companies whose core activity is producing a product or service (i.e., operating companies)

Entities or individuals whose core activity involves licensing or litigating patents (i.e., NPEs)

Universities, faculty, or other individuals at universities

Federal labs, federal facilities, federal research centers, and other federal government sources (i.e., Department of Energy national labs, NASA research centers, NIH centers or institutes)

Other, please specify.

137. *See supra* note 119 and accompanying text.

138. *See supra* note 120 and accompanying text.

139. *See supra* note 9 and accompanying text.

140. *See supra* notes 120–23 and accompanying text.

141. *See* Ian Ayres & Lisa Larrimore Ouellette, *A Market Test for Bayh-Dole Patents*, 102 CORNELL L. REV. 271, 274 (2017) (providing an example of Boston University suing tech giants for patent infringing); *cf.* Lemley, *supra* note 10, at 629 (stating that although universities are not trolls, they share some characteristics with trolls).

142. *See* sources cited *supra* note 11.

when NPEs are doing the asserting. They are somewhat more likely to be productive in the life sciences, but there aren't that many NPEs in those industries to begin with. Interestingly, there is less variation than we might have expected when it comes to operating company licensing demands. Patent licensing demands by operating companies in the computer industry were almost as likely as those in the life science industry to lead to new or modified products or knowledge transfer. So much of the computer versus life sciences divide does seem to be driven by the different prevalence and role of NPEs in the two industries.

A related finding regarding the industry differences is that the industry variation we observe doesn't map neatly to the traditional life sciences versus computer divide we have seen in the last decades of patent reform debates.[143] Instead, it is areas like energy and transportation that see the most new products resulting from at least some kinds of patent licensing demands.[144] That suggests both that patent policy experts and advocates on both sides need to acknowledge the reality of industry differences, but also need to look beyond the one-dimensional debate between computer and life sciences firms, just as we need to look beyond the single dimension of operating companies versus NPEs.

A third way in which the patent system seems differentiated has to do with whether the responding firm is acting as a licensor or a licensee. When we asked firms about the licensing of their own patents rather than licensing patents from others, we got a different story. Companies think their own patents drive innovation by others somewhat more than they think others' patents drive their own innovation. While it is possible that the firms we surveyed happened to transfer more technology out with their patents than they receive from other firms' patents, we suspect that the survey responses show some bias. This could be bias in either direction, though we think the most likely explanation is optimism bias: patentees think they are generating more innovation than licensees think they are.[145] Whichever way the skew cuts, this result also helps explain the very different perceptions of the patent system by patentees and defendants. They really

143. *See supra* note 12.

144. *See supra* tbl.20.

145. *See* Buccafusco & Sprigman, *supra* note 126, at 28–30 (showing that creators are wildly optimistic when it comes to valuing their own contributions, suggesting that patent licensors may think they are contributing more to the world than they are).

do seem to see their contributions to the world differently. And that in turn makes it harder for parties to come to terms. It may not be simply that one side or the other is being greedy and demanding too much; they may each see their position as reasonable given the different assessment they place on the contribution of the patent to the licensee's product.

Finally, and perhaps most important in the long run, companies differ in whether they interact with the patent system at all. A significant majority of respondents in our study (seventy-five percent) simply didn't face patent licensing demands at all.[146] That number may be even higher, since many of the companies that did not respond may have done so because they didn't think the survey pertained to them. It is true that the companies that have never faced patent licensing demands may be smaller and less innovative than the ones that do face licensing demands. And the fact that they didn't face patent licensing demands doesn't mean these companies had no interaction at all with the patent system. They might have their own patents, and they might enter into mergers or other business transactions that include patents. But given the raging debates over the patent system and its role in driving the economy, it is important to recognize that there are large swaths of American business that simply don't deal with patent licensing demands at all.

B. PATENT LICENSING DEMANDS DON'T DRIVE INNOVATION

The full survey of U.S. businesses validates and extends our initial result that NPE licensing demands almost never lead to innovation by the target firm.[147] None of the indicia we would expect of real technology transfer were common in patent licensing demands, no matter who made those demands, but NPE demands were particularly unlikely to be accompanied by the sharing of know-how or employees, the creation of joint ventures, or the development of new products.[148]

To be clear, our data do not suggest—and we do not believe—that the patent system as a whole doesn't matter or isn't working. Patent acquisition and patent licensing remain important parts of the innovation ecosystem, particularly for practicing companies. Patent enforcement too can promote innovation by giving operating companies exclusivity. But our study

146. *See supra* Part III.A.

147. Feldman & Lemley, *supra* note 7, at 139, 155–73 (discussing the results of the pilot survey).

148. *See* Lemley & Feldman, *Efficient*, *supra* note 6.

does belie claims that the *patent enforcement* system is itself a driver of innovation. It isn't.

That provides important evidence for the ongoing debate over patent trolls and patent reform. Patents and patent licenses aren't inherent goods in and of themselves. They are valuable if—but only if—they generate innovation or knowledge the world wouldn't otherwise have.[149] The traditional theory of patents is that they promote innovation by insulating their owners from competition, encouraging investment in invention to obtain that benefit.[150] But that traditional theory benefits only companies that actually make products and compete in the marketplace. An inventor who doesn't actually sell products doesn't benefit directly from the traditional justification for patents.

NPEs can nonetheless benefit from the patent system in ways that also benefit society. The exclusivity patents provide can be traded for money, and the prospect of that money may drive new innovation by those NPEs. The case for those who didn't themselves invent anything, but bought patents for others, is less straightforward. The incentive story there depends on the revenue they pay to inventors in exchange for the patent.[151] But unlike operating companies, who turn that new innovation into products that benefit the world, NPEs must find some way of sharing their innovations with the world if society is to benefit.

The traditional way we expect that sharing of knowledge is through the patent instrument itself. Because patents must teach one of ordinary skill in the art how to make and use the invention,[152] NPEs in theory can invent something and teach others how to do it by the mere act of writing and publishing a patent. Unfortunately, that rarely works as hoped. The combination of a slow patent examination process, artful drafting by patent owners, and fast-moving technologies mean that in most industries reading patents is not a productive way of advancing scientific knowledge.[153] And while describing the invention in a patent *could* in some cases advance knowledge, the evidence suggests that very few companies accused of infringement actually

149. *See* Burstein, *supra* note 40, at 514–20 (discussing patents as not inherently valuable); Lemley & Feldman, *Efficient*, *supra* note 6 (discussing patent innovation and value).

150. *See* LANDES & POSNER, *supra* note 11, at 319–26; Lemley, *supra* note 36, at 993–96 (discussing the incentive theory of patents).

151. There is reason to believe PAEs pass relatively little of their revenue on to actual inventors. *See* Bessen & Meurer, *supra* note 4, at 410–11.

152. 35 U.S.C. § 112(a) (2012).

153. *See supra* note 122.

learned about the invention from the patentee, directly or indirectly. Rather, in over ninety percent of cases they independently invented the same thing.[154] That doesn't prevent them from being sued; unlike copyright[155] and trade secret law,[156] independent invention is not a defense to patent infringement.[157] True, some people learn an invention by reading patents. And if they do, the patent has contributed to society. That is true whether the learner pays a license to use the patent or copies the invention without paying. The world has benefited from the invention; enforcement of the patent in that case ensures that the inventor who contributed something to the world (albeit by proxy) gets paid for their contribution. Patent licensing in this case is good for the world, but only because the licensee got the invention

154. *See* Cotropia & Lemley, *supra* note 3, at 1424 (showing little evidence of copying despite significant incentives and ability to prove copying if it exists). *But see* Robert P. Merges, *A Few Kind Words for Absolute Infringement Liability in Patent Law*, 31 BERKELEY TECH. L.J. 1, 9 (2016) (asserting that Cotropia's and Lemley's estimate may be too low "[b]ecause lawyers do not have to establish copying affirmatively, they seldom bother to try"); Sichelman, *supra* note 11, at 544–45 n.143 (arguing that Cotropia's and Lemley's estimate may be too low because (1) product copying is more common than patent copying, and product copying is "unlikely to find its way into the kinds of litigation documents Cotropia and Lemley examined;" and (2) evidence of copying is typically "scant"). Both Merges and Sichelman understate the incentives of trial lawyers to demonstrate copying if it exists.

155. *See* ROBERT P. MERGES ET AL., INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE 476–82 (4th ed. 2006) (discussing copying requirement); *see also* Arnstein v. Porter, 154 F.2d 464, 468–69 (2d Cir. 1946) (same). Some circuits allow copying to be established by a "striking similarity" between the protected work and infringing works, even if there is no evidence that the alleged infringer had any access to the copyrighted work. Gaste v. Kaiserman, 863 F.2d 1061, 1067–68 (2d Cir. 1988). *But see* Selle v. Gibb, 741 F.2d 896, 901 (7th Cir. 1984) (requiring proof of access even with a finding of striking similarity). Under such a test, one might argue that copying is not practically required to establish copyright infringement in all cases. However, the rationale for relying solely on striking similarity is that such evidence "preclude[s] the possibility of independent creation." Ferguson v. NBC, Inc., 584 F.2d 111, 113 (5th Cir. 1978). Thus, copying is still established by inference.

156. *See* RESTATEMENT (THIRD) OF UNFAIR COMPETITION § 40 (AM. LAW INST. 1995); UNIF. TRADE SECRETS ACT § 1 CMT. (UNIF. LAW COMM'N 1985) ("Proper means include . . . [d]iscovery by independent invention . . . .").

157. Cotropia & Lemley, *supra* note 3, at 1423; *see also* Lemley, *supra* note 47, at 1525 (acknowledging Samson Vermont's proposition that independent invention should be a defense, but noting that it currently isn't); Stephen M. Maurer & Suzanne Scotchmer, *The Independent Invention Defence in Intellectual Property*, 69 ECONOMICA 535, 535 (2002) ("Perhaps the most basic difference between patents and other intellectual property such as trade secrets and copyright is that independent invention is not a defence to infringement.").

from the patent and we want to encourage the acquisition of that knowledge to happen through markets rather than illegally.

Alternatively, NPEs can transfer knowledge directly to operating companies that incorporate it into a product. Sometimes the operating companies do so by acquiring the NPE.[158] This is the theoretical basis for patent licensing—I give you the right to use an invention in exchange for money.[159] But here too a patent license benefits the world only if the licensing transaction actually gives new knowledge to the licensee. If it doesn't, the licensee is paying the patent owner for the right to use something the licensee itself invented independently. True, an inventor is likely to get paid (though less likely if the immediate beneficiary is an intermediary like a PAE). But another inventor is the one paying, and that second inventor is the one actually sharing the invention with the world. And since that second inventor by hypothesis didn't learn anything from the first, it's hard to see why we would build a system to encourage that wealth transfer, especially one as costly as our patent enforcement system.[160]

Patentees can benefit the world by making new products or by giving the world information they didn't have that others can use to make new products. But if neither of those things is true, patent enforcement and licensing looks like an unproductive

158. For discussions of vertical integration and acquisition as a means of technology transfer, see, e.g., Jonathan M. Barnett, *Intellectual Property as a Law of Organization*, 84 S. CAL. L. REV. 785 (2011); John F. Coyle & Greg D. Polsky, *Acqui-Hiring*, 63 DUKE L.J. 281 (2013); Peter Lee, *Innovation and the Firm: A New Synthesis*, 70 STAN. L. REV. 1431 (2018).

159. Empirical evidence shows that patent licenses associated with know-how command higher rates than licenses for patents alone. Gaurav Kankanhalli & Alan Kwan, An Empirical Analysis of Bargaining Power in Licensing Contract Terms 12 (Aug. 1, 2018) (unpublished paper), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3171920.

160. *See supra* note 4. Michael Risch argues that we should put up with the social waste of ex post licensing absent technology transfer because without the threat of that sort of enforcement we wouldn't see ex ante licensing with technology transfer. Michael Risch, *Licensing Acquired Patents*, 21 GEO. MASON L. REV. 979, 981 (2014). Perhaps. But there seem to be good reasons for companies on all sides to engage in real technology transfer without the threat of a lawsuit if they don't. The entities we found to be most successful at technology transfer—federal labs and universities—are the ones who are least likely to file patent lawsuits. *See supra* notes 9–10 and accompanying text. Companies negotiate technology transfer licenses without IP in many different circumstances. Burstein, *supra* note 40, at 514–20. And there is some reason to believe that the prevalence of NPE assertions against independent inventors makes it harder for start-ups to engage in technology transfer by encouraging potential licensees to avoid anyone with patents. *See* Lemley, *supra* note 122, at 32–33.

wealth transfer, not a benefit to society.[161] The most significant finding of our study is that patent licensing demands by NPEs almost never seem to involve knowledge transfer. That doesn't mean NPEs are always a burden on society. They occasionally transfer knowledge, and sometimes their inventions are copied. But it does indicate that they aren't often transferring knowledge or promoting innovation through patent licensing demands. Coupled with evidence that there is very little copying of patents in the industries NPEs frequent[162] and evidence that NPEs tend to assert patents at the end of their lives, well after any learning seems plausible,[163] that means we should be quite skeptical of claims that NPEs are serving as efficient middlemen and promoting innovation.

CONCLUSION

This is the first comprehensive study of how American businesses respond to patent licensing demands. The picture it paints is complex. Patent licensing is not a unitary phenomenon. It differs by the type of patentee, by industry, and by responding company. But one thing does stand out in the results: patent licensing by NPEs doesn't seem to promote innovation, knowledge transfer, or the development of new products. NPEs—the entities responsible for most patent litigation in the United States in recent years—don't seem to be contributing to society by licensing their patents.

161. Some would conclude that the problem is that patent law applies to independent invention at all. Independent inventors, after all, didn't benefit from access to the patent or the patented technology. *See* Carl Shapiro, *Prior User Rights*, 96 AM. ECON. REV. 92, 92 (2006) (discussing the inability for independent inventors to use an independent invention defense); Samson Vermont, *Independent Invention as a Defense to Patent Infringement*, 105 MICH. L. REV. 475, 483–84 (2006) (discussing user rights and different rights afforded to the first and second investor). We wouldn't go that far. Patentees who provide technology to the world at large can provide a social benefit even if the defendant didn't obtain that benefit, and encouraging that technology transfer might require a patent right that forbids even independent invention. *See* Lemley, *supra* note 47, at 1532.

162. Cotropia & Lemley, *supra* note 3, at 1423–24 (finding copying only occurred in 1.76% of cases in the study).

163. *See supra* note 28.

APPENDIX A: UNWEIGHTED RESULTS

Table 23

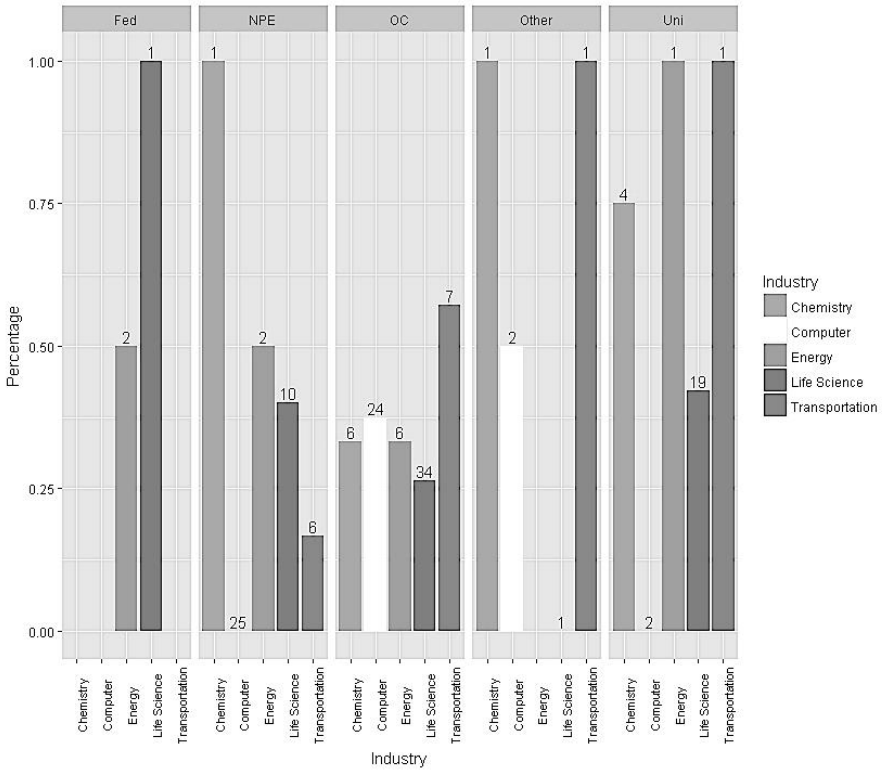
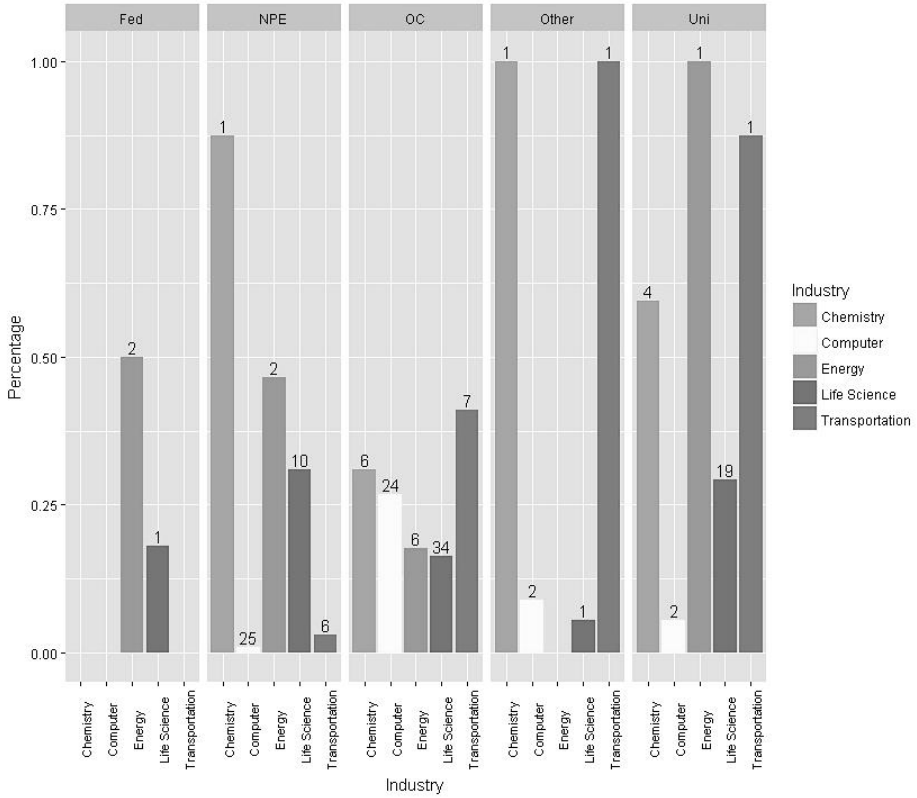


Table 24


Fed
NPE
OC
Other
Uni
Percentage
1.00
0.75
0.50
0.25
0.00
Industry
Chemistry
Computer
Energy
Life Science
Transportation
Industry
Chemistry
Computer
Energy
Life Science
Transportation

APPENDIX B: SURVEY QUESTION TREE[164]

<PATENT>

In the last THREE years, has your company received patent licensing requests? These could be calls or letters from another party suggesting patents in which you may be interested, offering to license patents to you, asserting a patent or threatening litigation, giving notice of intent to file an infringement lawsuit, or noticing the filing of an actual infringement lawsuit.

<1> Yes

<2> No

[DISPLAY IFF <PATENT> ≤1.]

<GUESS>

Some questions in this survey ask for frequency counts or percentages. Please feel free to answer simply using your best estimate or approximation.

[PAGE BREAK]

[DISPLAY IF <PATENT> ≤1.]

<FREQP>

On average over the past THREE years, how often has your company received patent licensing requests?

<1> Less than once a year

<2> 1-5 times per year

<3> 6-10 times per year

<4> 11-50 times per year

<5> More than 50 times per year

<SOURCE>

What parties initiated these requests? Please select all that apply.

<1> Companies whose core activity is producing a product or service (i.e., operating companies)

<2> Entities or individuals whose core activity involves licensing or litigating patents (i.e., NPEs)

<3> Universities, faculty, or other individuals at universities

<4> Federal labs, federal facilities, federal research centers, and other federal government sources (i.e., Department of Energy national labs, NASA research centers, NIH centers or institutes)

164. Note that not all respondents encountered every question. The survey they saw depended on previous answers they had given.

<5> Other, please specify: **[ENTER SHORT TEXT; FORCE TEXT RESPONSE IF SELECTED]**

[DISPLAY IFF AT LEAST ONE RESPONSE IS SELECTED IN <SOURCE>.]

<PERCENTR>

Indicate below the approximate percentage of the requests that came from each source. Please give a best estimation. Note that the total below should sum to 100%.

[DISPLAY RESPONSE CHOICE(S) IFF SELECTED IN <SOURCE>.]

<1> Companies whose core activity is producing a product or service: **[ENTER NUMERIC TEXT]**

<2> Entities or individuals whose core activity involves licensing or litigating patents

<3> Universities, faculty, or other individuals at universities**: [ENTER NUMERIC TEXT]**

<4> Federal labs, facilities, or research centers: **[ENTER NUMERIC TEXT]**

<5> {PIPED-IN TEXT FROM SOURCE=4}: **[ENTER NUMERIC TEXT]**

[DISPLAY NEXT SERIES IFF SOURCE=1 IS SELECTED.]

<OC>

Please think about patent licensing requests <u>from companies whose core activity is producing a product or</u> <u>service (i.e., operating companies)</u> in the last three years.

Approximately what portion of such requests led your company to take a patent license? Please feel free to answer with your best approximation, here and throughout the survey.

<1> None

<2> 1-10%

<3> 11-25%

<4> 26-50%

<5> 51-75%

<6> 76-99%

<7> All

[DISPLAY IFF OC≥2.]

<OCNEW>

Of these requests from operating companies that led to a patent

license, approximately what portion resulted in your company creating new products or features with the technology you licensed (e.g., as opposed to merely taking the license to cover existing products or features)?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[DISPLAY IFF OC≥2.]
<OCTRANSF>

Of these requests from operating companies that led to a patent license, approximately what portion resulted in the operating company transferring technical knowledge, personnel (e.g., through a consulting agreement), or creating a joint venture with your company in addition to the patent license?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[PAGE BREAK]
[DISPLAY NEXT SERIES IFF SOURCE=2 IS SELECTED.]
<NPE>

Please think about patent licensing requests from entities or individuals whose core activity involves licensing or litigating patents (i.e., NPEs) in the last three years.

Approximately what portion of such requests led your company to take a patent license?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%

<7> All

[DISPLAY IFF NPE≥2.]

<NPENEW>

Of these requests from non-practicing entities that led to a patent license, approximately what portion resulted in your company creating new products or features with the technology you licensed (e.g., as opposed to merely taking the license to cover existing products or features)?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[DISPLAY IFF NPE≥2.]

<NPETRANSF>

Of these requests from non-practicing entities that led to a patent license, approximately what portion resulted in the NPE transferring technical knowledge, personnel (e.g., through a consulting agreement), or creating a joint venture with your company in addition to the patent license?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[PAGE BREAK]

[DISPLAY NEXT SERIES IFF SOURCE=3 IS SELECTED.]

<UNI>

Please think about patent licensing requests from universities, faculty, or other individuals at universities in the last three years.

Approximately what portion of such requests led your company to take a patent license?

<1> None
<2> 1-10%
<3> 11-25%

<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[DISPLAY IFF UNI≥2.]
<UNINEW>

Of these requests from universities that led to a patent license, approximately what portion resulted in your company creating new products or features with the technology you licensed (e.g., as opposed to merely taking the license to cover existing products or features)?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%5> 51-75%
<6> 76-99%
<7> All

[DISPLAY IFF UNI≥2.]
<UNITRANSF>

Of these requests from universities that led to a patent license, approximately what portion resulted in the university or individual at the university transferring technical knowledge, personnel (e.g., through a consulting agreement), or creating a joint venture with your company in addition to the patent license?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[PAGE BREAK]
[DISPLAY NEXT SERIES IFF SOURCE=4 IS SELECTED.]
<FED>

Please think about patent licensing requests from federal labs, federal facilities, federal research centers, and other federal government sources in the last three years. Some examples of federal government sources include Department of Energy national labs, NASA research centers, and NIH centers or institutes.

Approximately what portion of such requests led your company to take a patent license?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[DISPLAY IFF FED≥2.]
<FEDNEW>

Of these requests from federal entities that led to a patent license, approximately what portion resulted in your company creating new products or features with the technology you licensed (e.g., as opposed to merely taking the license to cover existing products or features)?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[DISPLAY IFF FED≥2.]
<FEDTRANSF>

Of these requests from federal entities that led to a patent license, approximately what portion resulted in the federal lab, facility, or research center transferring technical knowledge, personnel (e.g., through a consulting agreement), or creating a joint venture with your company in addition to the patent license?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[PAGE BREAK]

[DISPLAY NEXT SERIES IFF SOURCE=5 IS SELECTED.]
<OTHER>

Please think about patent licensing requests from **{PIPED-IN TEXT RESPONSE FROM <SOURCE>}** in the last three years.

Approximately what portion of such requests led your company to take a patent license?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[DISPLAY IFF OTHER≥2.]
<OTHERNEW>

Of these requests from **{PIPED-IN TEXT RESPONSE FROM <SOURCE>}** that led to a patent license, approximately what portion resulted in you creating new products or features with the technology you licensed (e.g., as opposed to merely taking the license to cover existing products or features)?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[DISPLAY IFF OTHER≥2.]
<OTHERTRANSF>

Of these requests from **{PIPED-IN TEXT RESPONSE FROM <SOURCE>}** that led to a patent license, approximately what portion resulted in the {PIPED-IN TEXT} transferring technical knowledge, personnel (e.g., through a consulting agreement), or creating a joint venture with your company in addition to the patent license?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%

<5> 51-75%
<6> 76-99%
<7> All

[PAGE BREAK]

Please transition to thinking about <u>out-licensing</u> requests your company may have made in the last three years. These are circumstances in which your company holds the patent and it is your company that approaches an outside party to request they take a patent license from you.

<OUTL>

In the last THREE years, has your company approached another party to request that the other company take a patent license from you?

<1> Yes
<2> No

[DISPLAY IFF OUTL=1.]
<FREQO>

On average over the past THREE years, how often has your company made such patent licensing requests?

<1> Less than once a year
<2> 1-5 times per year
<3> 6-10 times per year
<4> 11-50 times per year
<5> More than 50 times per year

[DISPLAY IFF OUTL=1.]
<SOURCEO>

To which parties did your company make these requests to take a patent license from you? Please select all that apply.

<1> Companies whose core activity is producing a product or service (i.e., operating companies)

<2> Entities or individuals whose core activity involves licensing or litigating patents (i.e., NPEs)

<3> Universities, faculty, or other individuals at universities

<4> Federal labs, facilities, or research centers (i.e., Department of Energy national labs, NASA research centers, NIH centers or institutes)

<5> Other, please specify: **[ENTER SHORT TEXT; FORCE TEXT RESPONSE IF SELECTED]**

[DISPLAY IFF SOURCEO=1 IS SELECTED.]
<OOC2>

Of the requests your company made to an **operating company** asking them to take a patent license from you, approximately what portion led that company to take a patent license?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[DISPLAY IFF OOC2≥2.]
<OOCTRANS>

Of these out-licensing requests that led to a patent license, approximately what portion resulted in your company transferring technical knowledge, personnel (e.g., through a consulting agreement), or creating a joint venture with the other company in addition to granting a patent license?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[PAGE BREAK]

Now please think about interactions your company has had with universities, faculty, or other individuals at universities in the past three years.

<OUNIP>

In the last THREE years, has your company approached or been approached by a university suggesting a research project prior to the patenting stage?

<1> Yes

<2> No
<3> Don't Know

[DISPLAY IFF OUNIP=1]
<OUNIPFREQ>

Of those encounters between your company and a university that resulted in a joint project, approximately what portion of them resulted in patents?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[DISPLAY IFF OUNIPFREQ≥2]
<OUNIPNEW>

Of those encounters between your company and a university that resulted in a joint project from which your company licensed the patents, approximately what portion of them resulted in your company creating new products or features with the technology you licensed?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[DISPLAY IFF OUNIPFREQ≥2]
<OUNIPTRANSF>

Of those encounters between your company and a university that resulted in a joint project from which your company licensed the patents, approximately what portion of them resulted in the university transferring technical knowledge or personnel (e.g., through a consulting agreement) in addition to the patent license?

<1> None
<2> 1-10%
<3> 11-25%

<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[PAGE BREAK]

Now please think about interactions your company has had with federal labs, federal facilities, federal research centers, and other federal government sources in the last three years. As noted earlier, some examples of federal government sources include Department of Energy national labs, NASA research centers, and NIH centers or institutes.

<OFEDP>

In the last THREE years, has your company approached or been approached by a federal lab, facility, or research center suggesting a research project prior to the patenting stage?

<1> Yes
<2> No
<3> Don't Know

[DISPLAY IFF OFEDP=1]
<OFEDPFREQ>

Of those encounters between your company and a federal entity that resulted in a joint project, approximately what portion of them resulted in patents?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[DISPLAY IFF OFEDPFREQ≥2]
<OFEDPNEW>

Of those encounters between your company and a federal entity that resulted in a joint project from which your company licensed the patents, approximately what portion of them resulted in your company creating new products or features with the technology you licensed?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6> 76-99%
<7> All

[DISPLAY IFF OFEDPFREQ≥2]
<OFEDPTRANSF>

Of those encounters between your company and a federal entity that resulted in a joint project from which your company licensed the patents, approximately what portion of them resulted in the federal entity transferring technical knowledge or personnel (e.g., through a consulting agreement) in addition to the patent license?

<1> None
<2> 1-10%
<3> 11-25%
<4> 26-50%
<5> 51-75%
<6>76-99%
<7>All

[PAGE BREAK]

This final set of questions is for demographic purposes and is only intended for analyses in the aggregate, to give us a better sense of the business landscape.

<JOB>

Which of the following best describes your job position in your company?

<1> Counsel for patent or intellectual property
<2> Counsel for other specialized area
<3> General counsel
<4> Operations manager
<5> Director or other senior management (non-legal)
<6> CEO, owner, or other executive management (non-legal)
<7> Other, please specify: **[ENTER TEXT]**

<INDUSTRY>

What is your company's primary business sector?

<1> Information technology, computers, and related fields (including other electronics, software, communications, and semiconductors)

<2> Chemistry (excluding life sciences)

<3> Energy

<4> Life sciences (including pharmaceutical, biotechnology, medical devices, methods, or other medical)

<5> Transportation

<6> Other, please specify: **[ENTER TEXT]**

<HQ>

Where is your company headquartered?

[DROPDOWN MENU RESPONSE CHOICES]

<1>Alabama
<2>Alaska
<3>Arizona
<4>Arkansas
<5>California (No.)
<6>California (So.)
<7>Colorado
<8>Connecticut
<9>Delaware
<10>District of Columbia
<11>Florida
<12>Georgia
<13>Hawaii
<14>Idaho
<15>Illinois
<16>Indiana
<17>Iowa
<18>Kansas
<19>Kentucky
<20>Louisiana
<21>Maine
<22>Maryland
<23>Massachusetts
<24>Michigan
<25>Minnesota

<26>Mississippi
<27>Missouri
<28>Montana
<29>Nebraska
<30>Nevada
<31>New Hampshire
<32>New Jersey
<33>New Mexico
<34>New York
<35>North Carolina
<36>North Dakota
<37>Ohio
<38>Oklahoma
<39>Oregon
<40>Pennsylvania
<41>Rhode Island
<42>South Carolina
<43>South Dakota
<44>Tennessee
<45>Texas
<46>Utah
<47>Vermont
<48>Virginia
<49>Washington
<50>West Virginia
<51>Wisconsin
<52>Wyoming

<REVENUE>

What is your company's annual revenue? Please note that all survey data are anonymous and analyzed in the aggregate only. No response will be associated with individual respondents.

<1> Less than $5 Million
<2> $6 Million - $10 Million
<3> $11 Million - $50 Million
<4> $51 Million - $100 Million
<5> More than $100 Million

[PAGE BREAK]
<COMM>

If you would like to elaborate on your answers to any of the questions from the survey, please add your comments here: **[ENTER LONG TEXT]**

[PAGE BREAK]
<CONTACT>

If you would like a report of the study findings or other information once the study concludes, please enter your name and email address below.

Please note that all survey data are anonymous and your contact information will not be associated with individual survey responses.

FIRST NAME: **[ENTER TEXT]**
LAST NAME: **[ENTER TEXT]**
EMAIL ADDRESS: **[ENTER TEXT, EMAIL VALIDATION]**