IT TAKES TWO TO INCORPORATE: THE ROLE OF PATENT CO-OWNERSHIP IN INVENTOR CHOICE OF BUSINESS FORM

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The literature on the theory of the firm and the reasons why entrepreneurs choose one type of business organization over another is massive. However, few empirical studies have been conducted to test the importance of the various proposed determinants of choice of legal form of organization in real-world industries. This paper helps fill that gap through an econometric investigation of the differences in the characteristics of two groups of independent inventors engaged in the business of patent monetization: inventors operating as sole proprietors and those operating through business organizations, almost always LLCs or close corporations.

The results suggest that commonly proposed rationales for "incorporating," including deferred taxation and limited liability, might play a role in inventors choosing to monetize and litigate their patent rights through a business organization rather than as individuals. However, I find that the key determinant of legal form of organization for inventors is the presence of co-owners of the patents. Strikingly, 75% of independent inventors who have taken their monetization business to court through a business organization share their patent rights with other owners. The same is true of only 15% of independent inventors who litigate as natural persons. This is far and away the largest difference in the traits of these two inventor groups, and I argue it provides

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strong evidence for the transaction costs theory of the firm, whereby the costs of making business decisions and negotiating profit shares outside of a firm increase with the number of stakeholders. I thus conclude that independent inventors who share ownership of their patents frequently utilize business organizations in order to pre-commit to cooperation in conducting their licensing business.

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INTRODUCTION

In the United States, patents are granted to human inventors and not to entities, whatever their legal form of organization.[1] However, invention is distinct from ownership, and the overwhelming majority of patents are granted to inventors who innovate as part of their employment.[2] In these cases, inventors assign their ownership rights to their employer before it files the patent application or shortly thereafter.[3] Nevertheless, every year thousands of patents are obtained by independent inventors who continue to own their own intellectual

1. *See* 37 C.F.R. § 3.73[a] (2001) (establishing that, in the absence of an assignment, the inventor is the presumed owner of a patent application and any patent that may issue therefrom).

2. Of U.S. patents granted between January 1963 and December 1999, only 18.4% were unassigned. Bronwyn H. Hall, Adam B. Jaffe & Manuel Trajtenberg, *The NBER Patent Citations Data File: Lessons, Insights and Methodological Tools* 12 (Nat'l Bureau of Econ. Rsch., Working Paper No. 8498, 2001). More recently, less than 10% of newly granted U.S. patents were unassigned. *See, e.g.*, Dennis Crouch, *Patents Issuing with No Assignee*, (May 22, 2014), https://patentlyo.com/patent/2014/05/patents-issuing-with-assignee.html [https://perma.cc/S4AX-KWSY].

3. Mark A. Lemley, *Rethinking Assignor Estoppel*, 54 HOUS. L. REV. 513, 525–26 (2016) ("Employees are regularly required to assign all their inventions as a condition of employment. Those assignment agreements are standard-form contracts, usually presented to the employee on their first day of work, after they have quit their prior job and perhaps relocated. So they apply by definition to inventions that have not yet been made. Companies and universities impose them on all their employees, not just designated inventors").

property rights.[4] These inventors have been extensively romanticized[5] and, according to conventional wisdom, play a critical role in American innovation.[6]

The technological contributions and motivations of independent inventors are likely as diverse as any large group of actors. Some probably innovate because they are curious tinkerers who are compelled to try out, discover, and build new things. Some others might be motivated by the prospect of fame and fortune. Others might consider patenting as their business and direct their efforts towards maximizing revenue through non-exclusive licensing with users of their technology. Independent inventors with this last motivation are part of the big business of patent monetization that has emerged over the last two decades.

Little empirical work has investigated the importance of these or other motivations for independent inventors to innovate and patent, but this paper identifies one intriguing variation in independent inventor patent monetization: about half of inventors whose licensing efforts lead to litigation sue in their individual capacity, while the other half enforce their rights via a business organization they own that engages in no discernable activity other than patent holding and enforcement.[7] I call the first category of independent inventors "individual inventors" and the second "inventor-owned licensing firms."

This is an unstudied and curious aspect of the behavior of independent inventors, and I argue that it represents a case study that can be used to shed light on important questions in the corporate law literature whose answers have been long on theory and short on evidence: why do entrepreneurs use business organizations at all and when they do how do they choose among available forms? These choices have been written about extensively since Coase published *The Nature of the Firm*,[8] but again, not enough empirical work has tested the

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4. *See* U.S. PATENT AND TRADEMARK OFFICE, INDEPENDENT INVENTORS BY STATE BY YEAR ALL PATENT TYPES REPORT: JANUARY 1977–DECEMBER 2015, https://www.uspto.gov/web/offices/ac/ido/oeip/taf/inv_all.htm (reporting that from 2000 through 2015 between 17,000 and 26,000 patents per year were issued to individuals).

5. Christopher A. Cotropia, *The Individual Inventor Motif in the Age of the Patent Troll*, 12 YALE J.L. & TECH. 52, 54–55 (2009).

6. *Id.* at 55.

7. *See infra* Part II.

8. Ronald H. Coase, *The Nature of the Firm*, 4 ECONOMICA 386 (1937).

theory. Accordingly, the principal purpose of this paper is to help fill the gap in evidence related to the various theoretical determinants of choice of legal form of organization. It does so through descriptive and econometric investigation of the differences in the traits of inventor-owned licensing firms and individual inventors that are all engaged in the same patent licensing business.

I find strong evidence for the transaction costs theory of the firm, whereby costs in negotiating partners' management roles, financing obligations, and profit shares increase with the number of stakeholders and decrease with familial ties.[9] Most notably, 75% of inventors who sue through business organizations share their patent rights with other owners of the firm, either co-inventors or non-inventor co-owners.[10] The same is true of only 15% of independent inventors who litigate as natural persons.[11] Further, family ties decrease transaction costs, and 89% of individual inventor suits are brought by solo-inventors or with co-inventors who share a surname and thus are overwhelmingly kin or married.[12] This difference between the two groups of inventors is striking and likely explained by current patent law, which allows any co-owner of a patent to grant a non-exclusive license to practice the invention, even without the agreement of the other co-owners. Thus, I conclude that when independent inventors share ownership of their patents with other individuals, the co-owners often assign their legal interests to an LLC or a close corporation, which they also own, in order to pre-commit to cooperation and to prevent their co-owners from separately negotiating with potential infringers.[13]

Supporting existing empirical evidence on the choice of legal form of organization in new business ventures, I find that inventors suing through more complex business organizations and not as sole proprietors possess more experience relevant to their venture.[14] In particular, I find that independent inventors who monetize their patents through business organizations acquire more patents and file more patent lawsuits.[15] Prior work has also found that entrepreneurs select more complex forms of organization when they expect that the venture will be more complex and valuable. Consistent with these

9. *See infra* Section III.B.
10. *See infra* Section VI.A.
11. *See infra* Part I.
12. *See infra* Section V.A.2.
13. *See infra* Section III.A.
14. *See infra* Section V.A.
15. *See infra* text accompanying notes 36–37.

results, I find that inventors suing through business organizations possess more valuable patents with an arguably broader scope such that they have more prospective infringers with whom to negotiate.[16]

While I am unable to directly test the importance of limited liability and the availability of corporate taxation on independent inventors' choice of form of organization, my findings are consistent with the conclusion that each plays a role, though not one as important as the need for co-owners to commit to coordination. Concerning limited liability, because the inventor plaintiffs I study are non-practicing, they cannot be counter-sued for infringement by the companies they target. However, shifting of attorney fees and costs is an available remedy in patent litigation. While rarely ordered, I find that when there is fee shifting, the average award to defendants is higher in cases brought by inventors suing through business organizations than in individual inventor suits.[17] Further, the average inventor-owned licensing firm asserts its patents against twice as many different defendants, compounding the risk that it might be ordered to pay a defendant's legal expenses.[18]

Concerning taxes, some inventors who sue through business organizations may take advantage of the ability of close corporations to delay distributions to owners in order to minimize the taxes paid by the owners over time. My evidence for the importance of taxation is, again, indirect, but includes that inventors suing through business organizations on average pursue longer and more complex licensing campaigns. This indicates that these inventors would tend to benefit more from the ability to defer distributions to owners.[19] Additionally, the finding that these inventors also tend to assert more valuable patents suggests that they might expect that they will have to manage greater income over the course of their licensing campaigns than the average inventor suing in her natural capacity.

Beyond contributing to the corporate literature on the theory of the firm and choice of legal form of organization, I investigate other determinants of inventor plaintiff type that inform the patent literature on independent inventors.[20] First, I find that inventors who

16. *See infra* Section V.D.

17. *See infra* Sections V.C.6–7.

18. *See infra* Section V.C.7.

19. Benjamin C. Ayers, Bryan Cloyd & John R. Robinson, *Organizational Form and Taxes: An Empirical Analysis of Small Businesses*, 18 J. AM. TAX'N ASS'N 49, 64 (1996).

20. *See infra* Section V.B.

sue through business organizations seem to be better financed during the patent application process and later during litigation.[21] Next, I find that they also obtain and assert patents with greater economic value than the patents of individual inventor plaintiffs.[22] My findings that individual inventor plaintiffs on average possess cheaper legal representation during the prosecution of their patent applications and also during litigation of their granted patents support these conclusions. So too, do the lower average importance scores I use as one measure of the value of their litigated patents.

Further, I find that inventors who sue through inventor-owned licensing firms more often look and act like other patent assertion entities (PAEs) who acquire patents from third parties and whose business, by definition, is to maximize licensing revenue.[23] As with PAEs, a majority of the patents that inventor-owned licensing firms litigate cover computer and communications technologies that tend to be used by more potential infringers than other types of patents covering, for example, mechanical, chemical, or medical device innovation. The result is that they can, and do, file more lawsuits against more defendants than individual inventor plaintiffs. Finally, inventor-owned licensing firms have far more frequently filed suit in the Eastern District of Texas, the forum of choice for PAEs, than have individual inventors.

Relevant to litigation strategy, I find that inventor-owned licensing firms are less likely to laud the professional and technological accomplishments of the inventors in their lawsuit complaints.[24] This, along with preliminary evidence suggesting that more inventor-owned licensing firm inventors are attorneys, while more individual inventor plaintiffs are medical doctors, may indicate that some unsympathetic plaintiffs sue through business entities rather than as natural persons in order to mask indicia of low quality or opportunistic litigation. It certainly appears true that some inventors litigate as natural persons, at least in part, because they wish their personal contributions and efforts to be front-and-center in the narrative of the dispute.

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21. *See infra* Section V.B.2.

22. *See infra* Section V.B.2.

23. *See* Colleen V. Chien, *From Arms Race to Marketplace: The Complex Patent Ecosystem and Its Implications for the Patent System*, 62 HASTINGS L.J. 297, 300 (2010) [hereinafter Chien (2010)] (defining PAEs as entities that utilize patents to generate licensing fees instead of commercializing or transferring technology).

24. *See infra* Section V.C.4.

Thus, the results of this study provide important contributions to three different fields—the theory of the firm, intellectual property, and litigation behavior. Part I of the paper reviews the literature on independent inventor patenting and litigation.[25] Part II explores the growth of patent licensing as a business.[26] Part III reviews the literature on choice of legal form of organization and explains how the theory of the firm helps explain the choice of half of independent inventors to litigate through an LLC or close corporation.[27] Part IV describes the data and methodology, Part V presents the results, Part VI discusses their implications, and the Conclusion ends the paper.[28]

I. INDEPENDENT INVENTORS

Independent inventors were once a dominant source of new inventions, but in recent decades they have been responsible for a smaller share of all patenting.[29] Despite the decline in independent invention, as detailed by Chris Cotropia, independent inventors have continued to be extensively romanticized in American culture:

> The garage inventor is as American as apple pie. We enjoy stories of independent inventors, working against all odds to provide society with amazing technological breakthroughs. The stories are so entertaining that popular movies are made about such individuals—such as *Flash of Genius*, telling the story of Robert Kerns, the inventor of the intermittent windshield wiper system. Intel has even launched an ad campaign championing the individual inventor, portraying individuals such as Alay Bhatt, the inventor of the Universal Serial Bus (USB), as modern-day rock stars.
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> The individual inventor story generally goes as follows: A lone individual toils in her limited free time—evenings after work and perhaps the weekend—to come up with an amazing breakthrough that turns out to be incredibly beneficial to society. This entrepreneur is unconstrained by both the bureaucracy of a large corporate structure and the traditional thinking in a given technological field. The drive and ingenuity of these small inventors is the life-blood of American innovation. It's hard-working, creative

25. *Infra* Part I.
26. *Infra* Part II.
27. *Infra* Part III.
28. *Infra* Parts IV–VI.
29. JAMES BESSEN & MICHAEL J. MEURER, PATENT FAILURE: HOW JUDGES, BUREAUCRATS, AND LAWYERS PUT INNOVATORS AT RISK 166 (2008).

> individuals like Thomas Edison, Steve Jobs, and Bill Gates that bring about true innovations.[30]

The idea that individual independent inventors play a crucial role in revolutionary innovation is accepted as conventional wisdom.[31] Further, there is widespread support for independent inventor enforcement of their patent rights. Nearly 140 years ago, Congress described their lawsuits against manufacturing firms as countering the attempt of corporations to "fight down the inventor and rob [them] of all the benefits of [their] invention[s]."[32] Much more recently, juries have wholeheartedly shared this sympathy with independent inventors, favoring them over corporate defendants in nearly three-quarters of patent jury trials.[33] Perhaps this success explains in part the finding that individuals are more likely to sue for patent infringement than firms.[34]

The litigiousness of independent inventors might be surprising given that patent litigation is expensive, having been described as the "sport of kings,"[35] and that independent inventors appear to be disadvantaged relative to corporate plaintiffs by a lack of financial resources.[36] However, the growth of intermediary markets for patent enforcement helps finance lawsuits that otherwise might be

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30. Cotropia, *supra* note 5, at 54–55.

31. *Id.* at 55.

32. 13 CONG. REC. 3952 (1882).

33. Kimberly A. Moore, *Populism and Patents*, 82 N.Y.U. L. REV. 69, 81 (2007) (reporting that in such match-ups, juries ruled in favor of independent inventors 74% of the time and defendant corporations only 26% of the time).

34. Josh Lerner, *The Litigation of Financial Innovations* 15 (Harv. Bus. Sch., Working Paper No. 09-027, 2008), http://www.hbs.edu/research/pdf/09-027.pdf [https://perma.cc/YKJ4-MDD2] ("Patents assigned to individuals are five times more likely to be litigated than those held by public corporations, and about 50% more likely to be so than those held by private firms (which include both smaller operating firms and patent holding companies).").

35. Douglas J. Kline, *Patent Litigation: The Sport of Kings*, MIT TECH. REV., (Apr. 28, 2004), https://www.technologyreview.com/2004/04/28/232981/patent-litigation-the-sport-of-kings (last visited Apr. 25, 2023) (explaining that "in cases where between $1 million and $25 million is at risk, a patent owner should expect to spend more than $2 million to litigate a patent through trial and appeal. Where more than $25 million is at risk, costs climb above $4 million").

36. *See* Ryan T. Holte, *Trolls or Great Inventors: Case Studies of Patent Assertion Entities*, 59 ST. LOUIS U. L.J. 1, 40 (reporting that from the PAE case studies he analyzed, "the only evidence of large actors using size or resources to their advantage is on the part of the large-company defendant patent infringers").

unaffordable for individual inventors.[37] Further, the rise of contingent fee representation in patent litigation likely plays an even greater role in facilitating independent inventor litigation.[38] The emergence of these third-party financing options also blurs the distinction between underdog inventors and so-called patent trolls.[39]

While many independent inventors may live up to the romanticized vision of their work, their technological contributions and motivations are likely as diverse as the traits of any large group of actors. Nonpecuniary considerations undoubtedly do play a role in motivating independent inventor patent litigation. For example, at least some individual inventors seem to have public vindication as their primary motivation.[40] Famously, Robert Kearns turned down a thirty-million-dollar settlement offer from Ford Motor Company, asserting that "[t]o accept money from Ford would have been like admitting it was O.K. for them to do what they did," namely knowingly use his invention without his permission.[41] Kearns is not the only independent inventor who cares about public vindication, as evidenced by prior work showing that inventor plaintiffs settle less frequently than other types of patent plaintiffs.[42]

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37. Colleen V. Chien, *Of Trolls, Davids, Goliaths, and Kings: Narratives and Evidence in the Litigation of High-Tech Patents*, 87 N.C. L. REV. 1571, 1578–79 (2009) [hereinafter Chien (2009)].

38. *See* David L. Schwartz, *The Rise of Contingent Fee Representation in Patent Litigation*, 64 ALA. L. REV. 335, 372 (2012) (arguing that individual inventors "almost always rel[y] upon contingent representation" because "patent litigation is too expensive for almost any individual to afford").

39. Chien (2009), *supra* note 37, at 1586.

40. *Id.* at 1587 ("[S]ome independent inventors are perceived as seeking not only money, the main objective of licensing shops, but also justice or vindication by a court.").

41. *See* John Seabrook, The Flash of Genius, NEW YORKER (Jan. 3, 1993), https://www.newyorker.com/magazine/1993/01/11/the-flash-of-genius [https://perma.cc/EM6R-685V] (quoting Robert Kearns).

42. *See* Shawn P. Miller et al., *Who's Suing Us? Decoding Patent Plaintiffs Since 2000 with the Stanford NPE Litigation Dataset*, 21 STAN. TECH. L. REV. 235, 267 (2018) (explaining the commercialization of the patent litigation process and its outcomes); 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) (tracking various types of patent litigation plaintiffs and their mixed success across several industries). *But see* Christopher A. Cotropia, Jay P. Kesan & David L. Schwartz, *Heterogeneity Among Patent Owners in Litigation: An Empirical Analysis of Settlement, Case Progression, and Adjudication* 22 (Hoover Inst. Working Grp. on Intell. Prop., Innovation, & Prosperity, Working Paper No. 16008 17, 2016) (finding "[I]ndividual Inventors who litigated in their personal capacity survived shorter," meaning their "cases were resolved faster").

Even if many independent inventors are motivated to litigate in part by a desire for public vindication, the litigation data used in this paper suggests that most independent inventors sue primarily to make money through licensing fees.[43] Among the independent inventor lawsuits that I study, 86% end in settlement, and among these settlements, only 2% include a consent judgment with a permanent injunction against infringement by the defendant.[44] Thus, it appears that almost all independent inventor settlements are exchanges of money to the inventor for a license to use the patented technology. The implication is that most independent inventor plaintiffs are not primarily motivated by a desire for injunctive relief. This is in sharp contrast with plaintiffs who sell products and services that utilize their innovations and often sue to prevent competition.[45] Thus, despite nonpecuniary motives, it appears at first glance that independent inventor litigation is largely a money-seeking business activity.

II. PATENT LICENSING (AND LITIGATION) AS A BUSINESS

Given prior work describing recent trends in the use of patents, it is not surprising that the business of many independent inventors is patent monetization, nor that many who fail to commercialize their inventions would turn to it as a source of revenue. Colleen Chien details the growth of patent enforcement as a business model where owners "use patents not as a basis for producing and selling goods but, instead, primarily for obtaining licensing fees."[46] In other words, patent assertion entities ("PAEs"), also derisively known as "patent trolls," exist "to assert patents against other actors."[47] PAEs should be distinguished from non-practicing entities (NPEs) more generally: PAEs are NPEs because they do "not create or sell products or services," but there are other types of NPEs, including universities and technology development companies that possess a primarily business purpose other than patent monetization.[48]

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43. *See infra* Part II.

44. *See infra* Table 13.

45. Chien (2010), *supra* note 23, at 330.

46. *Id.* at 310 (quoting eBay, Inc. v. MercExchange, L.L.C., 547 U.S. 388, 396 (2006) (Kennedy, J., concurring)).

47. Miller et al., *supra* note 42, at 238. *See also* Chien (2010), *supra* note 23, at 300 (defining PAEs as entities that use patents primarily to gain licensing fees rather than to commercialize or transfer technology).

48. Miller et al., *supra* note 42, at 238.

Prior to the early 2000s, PAEs were rare, with the overwhelming majority of patent lawsuits involving competing producers in the same industry.[49] Patent monetization by non-practicing PAEs is now such a big business that recent estimates suggest that their targets lose between $30 and $80 billion per year.[50] These losses are primarily fees paid to defense attorneys, settlement payments, and damages awarded to the plaintiff PAEs.[51]

Vincent Johnson further details the size of the patent monetization industry, citing a PricewaterhouseCoopers analysis estimating that about two-thirds of all patent infringement cases nationwide are filed by patent trolls.[52] Further, he reports that, in the U.S., patent infringement has been threatened against more than 100,000 companies in 2013 alone.[53] Johnson explained that the costs of patent trolling in the United States have quadrupled in the past decade.[54] By 2011, the combined market for legal services and transactions involving IP was more than $56 billion.[55]

The growth of patent assertion as a business was spurred by key public examples, including those of several prolific independent inventors.[56] One, Jerome Lemelson, was granted over 600 patents covering a wide variety of technologies.[57] During the 1980s and 1990s, Lemelson signed licenses with around a thousand companies worth, in

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49. Nevertheless, research from legal historians indicates that PAEs, then called "patent sharks," were common and an integral part of the market for innovation during the nineteenth and early twentieth century before largely disappearing with the rise of large corporations and in-house research and development departments. *See, e.g.*, Adam Mossoff, *Patent Licensing and Secondary Markets in the Nineteenth Century*, 22 GEO. MASON L. REV. 959 (2015); Christopher Beauchamp, *The First Patent Litigation Explosion*, 125 YALE L.J. 848 (2016).

50. *See* Mark A. Lemley & A. Douglas Melamed, *Missing the Forest for the Trolls*, 113 COLUM. L. REV. 2117, 2119 (2013) (citation omitted); Michael J. Meurer, James Bessen & Jennifer Ford, *The Private and Social Costs of Patent Trolls*, 34 REGULATION at 35 (2012) ("[D]efendants have lost over half a trillion dollars in wealth—over $83 billion per year during recent years.").

51. Bessen et al., *supra* note 50, at 31.

52. Vincent R. Johnson, *Minimizing the Costs of Patent Trolling*, 18 UCLA J.L. & TECH 1, 5 (2014).

53. *Id.*

54. *Id.*

55. Gregory T. Huang, *Charles River VC, a $300M Investor in Intellectual Ventures, Says Patents Are Huge Market, Not a "Dirty World"*, XCONOMY (May 4, 2011).

56. Chien (2010), *supra* note 23, at 311.

57. *Id.*

aggregate, over one billion dollars.[58] Another prolific non-practicing independent inventor is Ron Katz, the inventor and owner of twenty of the top one hundred most litigated patents.[59] Other famous independent inventor plaintiffs include Robert Kearns, discussed earlier,[60] and Microsoft co-founder Paul Allen, who used the patents he re-acquired from his former startup to sue internet companies.[61] These campaigns inspired the proliferation of patent monetization as an alternative business model to commercialization and sale of patented goods or services.[62] Success stories have also drawn the attention of entrepreneurial attorneys and have popularized the contingent-fee arrangement Lemelson had with his attorney, who earned hundreds of millions of dollars enforcing his client's patents.[63]

Patent monetization has flourished in the information technology and software sectors in particular, with nearly 80% of PAE lawsuits asserting patents covering these technologies in recent years.[64] This trend was at least in part spurred by decisions of the U.S. Court of Appeals for the Federal Circuit during the 1990s that broadened the scope of patentability of software and electronic business methods.[65] Taking electronic business methods as one example, one venture capital and high tech industry insider suggested that "*State Street* transformed the public's perception of the U.S. Patent and Trademark Office from an Executive Branch backwater into the Land of Milk and

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58. Mary Waldron, *The Patent Prosecution Pioneer: Intellectual Property Attorney Gerald Hosier*, LAWCROSSING (Aug. 20, 2007), https://www.lawcrossing.com/article/3445/The-Patent-Prosecution-Pioneer-Intellectual-Property-Attorney-Gerald-Hosier (last visited Apr. 16, 2023) ("To date, Hosier has retrieved about $1.5 billion . . . for Jerome Lemelson and his estate.").

59. John R. Allison, Mark A. Lemley & Joshua Walker, *Extreme Value or Trolls on Top? The Characteristics of the Most-Litigated Patents*, 158 UNIV. PA. L. REV. 1, 35–37 (2009).

60. *See supra* Part I.

61. Dionne Searcey, *Microsoft Co-Founder Launches Patent War*, WALL ST. J. (Aug. 28, 2010, 12:01 AM), https://www.wsj.com/articles/SB10001424052748703294904575385241453119382 (last visited Apr. 16, 2023).

62. Chien (2010), *supra* note 23, at 310–12.

63. *Id.*

64. *See, e.g.*, Miller et al., *supra* note 42, at 265 t.6 (reporting that in 2014 78.0% of PAE litigation involved patents covering computer and communications technology).

65. *See In re* Alappat, 33 F.3d 1526, 1543–44 (Fed. Cir. 1994) (software); State St. Bank & Trust Co. v. Signature Fin. Grp., Inc., 149 F.3d 1368, 1375 (Fed. Cir. 1998) (business methods).

Honey."[66] One result of the gold rush in high technology patents has been that "[s]tartups and established companies alike operate in a business environment awash in patents and capital invested in generating returns through licensing and enforcement."[67] In such an environment, more often than not, patent enforcement is now a business activity unto itself rather than a method of excluding competition with a patent owner's own products.

III. CHOICE OF LEGAL FORM OF BUSINESS ORGANIZATION

One of the first decisions that entrepreneurs must make in any new business enterprise is the choice of legal form of organization.[68] If independent invention and litigation can be properly thought of as a business, then what determines inventors' choice of legal form of organization in negotiating licenses and litigating their patents? This is the principal inquiry of this paper, and for answers, I first consider the broader empirical literature on choice of business form. I then explain the relevance of the transaction costs theory of the firm to the key discovery of this study, that business organizations are frequently used by independent inventors with co-owners of their patents to pre-commitment to cooperation among the owners in licensing their patents.

A. Empirical Literature on the Choice of Legal Form of Organization

The business law literature on the benefits of different types of business organizations is rich. However, there have been only a few empirical studies seeking to determine why entrepreneurs pick one legal form of doing business over another.[69] Larry Ribstein discussed

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66. Jorge Torres, *IP and VC: A Framework for Funding Disruption of the Intellectual Property Markets*, KAUFFMAN FELLOWS (Mar. 23, 2012), https://www.kauffmanfellows.org/journal_posts/ip-and-vc-a-framework-for-funding-disruption-of-the-intellectual-property-markets [https://perma.cc/4GGD-HUJF].

67. *Id.*

68. Rebel A. Cole & Tatyana Sokolyk, How Do Firms Choose Legal Form of Organization?, (July 26, 2018) (unpublished manuscript at 1), https://ssrn.com/abstract=1682263.

69. *See, e.g.*, *id.* at 1–2 (explaining the results of a study investigating the choice of the legal forms of organization); Ribstein & Kobayashi, *Choice of Form and Network Externalities*, 43 WM. & MARY L. REV. 79, 82 (2001) (investigating the choice between LLP and LLC); Thomas A. Turk & Lois Shelton, *Growth Aspirations, Risk, Gender and Legal Form: A Look at the Services Industries*, 12 ACAD. ENTREPRENEURSHIP J. 35, 37–38 (2006) (same).

one common explanation, that "[l]awyers tend to assume that statutory business forms are artifacts of tax law."[70] But there are a variety of other reasons to select one type of business form over another that stem from other differences in the rules governing different forms. These include the desire for limited liability, the need to raise outside capital, and preferences for flexibility in management roles, profit shares, and exit. Given the variety of reasons entrepreneurs might prefer one type of legal form over another, it is surprising that few scholars have attempted to validate the theoretical determinants of choice of legal form generally or in particular industries. One likely reason for the lack of empirical research is that, until recently, there have not been publicly available business datasets suitable to the task.[71] Nevertheless, the question is important because there is robust empirical literature showing that enterprises with more complex legal forms of organization grow more rapidly and fail less frequently.[72]

Cole and Sokolyk provide one of the few comprehensive studies of the determinants of legal form of organization. They studied new businesses established in 2004 that participated in the Kauffman Firm Survey. They categorized the following legal forms of business in order of ascending complexity: proprietorships, partnerships, LLCs, S-corporations, and C-corporations. They found that entrepreneurs' initial choice of entity type is based upon factors including access to capital markets, tax consequences, personal liability, and risk exposure.[73] Concerning liability and risk exposure, owners of LLCs and corporations, but not proprietorships and common law partnerships, enjoy the benefits of limited liability, such that the owners' losses are limited to their investment in the business entity and do not reach to their personal assets.[74]

Additionally, Cole and Sokolyk found that entrepreneurs pick more complex organizational types, for example, an LLC over a partnership, when their new venture begins with more employees, more comprehensive employee benefits, positive accounts receivable, and possession of intellectual property assets. Further, new ventures are

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70. Larry E. Ribstein, Statutory Forms for Closely Held Firms: Theories and Evidence From LLCS, 73 WASH. UNIV. L.Q. 369, 371 (1995).

71. Cole & Sokolyk, *supra* note 68, at 9.

72. Thomas A. Turk & Lois Shelton, *Growth Aspirations, Risk, Gender and Legal Form: A Look at the Services Industries*, 12 ACAD. ENTREPRENEURSHIP J. 35, 37–38 (2006).

73. Cole & Sokolyk, *supra* note 68, at 1.

74. Frank H. Easterbrook & Daniel R. Fischel, *Limited Liability and the Corporation*, 52 UNIV. CHI. L. REV. 89, 89–90 (1985).

more likely to select a more complex legal form when the primary owner of the business is more educated, has had more experience with prior start-ups, and puts more working hours into the firm.[75] Their most intriguing finding is that entrepreneurs tend to select the type of organization that can accommodate their expectations of the future complexity of the enterprise.[76]

In another study, Turk and Shelton find no evidence that the likelihood of organizing as a corporation rather than a sole proprietorship is related to the gender of the owner.[77] They studied a sample of nearly 12,000 service businesses in San Diego County, and their main results counter the theory that female and male entrepreneurs generally differ in their attitudes toward risk and growth. Turk and Shelton left unexplained one interesting finding that female entrepreneurs are more likely to organize as corporations when their business is in a male-dominated industry.[78]

Finally, Ayers, Cloyd, and Robinson find only weak evidence that tax law determines choice of organizational form.[79] They do find that injury risk, default risk, and firm age are important determinants of organizational form.[80] They studied over 3,000 small businesses and found that increases in default risk raise the likelihood that a firm will be a C-corporation rather than a sole proprietorship.[81] They also found that while manufacturers are more likely to be incorporated, service firms are more likely to be unincorporated.[82]

I contend that the decision of independent inventors to monetize their patent rights via a business entity rather than individually is a special case of entrepreneurial choice of legal form. After all, inventors suing as natural persons lack limited liability and are thus analogous to a proprietorship. The results I report in Part V support this argument and validate the results in the choice of legal form literature just reviewed. For example, just as Cole and Sokolyk found that entrepreneurs with more experience select more complex forms of

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75. Cole & Sokolyk, *supra* note 68, at 22.
76. *Id.* at 2.
77. Turk & Shelton, *supra* note 69, at 35.
78. *Id.* at 43.
79. Benjamin C. Ayers, Bryan Cloyd & John R. Robinson, *Organizational Form and Taxes: An Empirical Analysis of Small Businesses*, 18 J. AM. TAX'N ASS'N 49, 65 (1996).
80. *Id.* at 61–62, 64–65.
81. *Id.* at 64.
82. *Id.* at 65.

organization,[83] I find inventors who litigate through LLCs or close corporations possess more experience inventing, patenting, and litigating than inventors who sue as natural persons.

B. Transaction Costs Theory of the Firm and Cooperation Among Co-Owners of Patents

I further contend that choice of independent inventor business form often depends on one particular concept from the theory of the firm literature: The presence or absence of the need for legally binding pre-commitment to cooperation in the exploitation of the assets necessary to successfully conduct an entrepreneurial venture. I argue that cooperation is necessary when multiple people co-own patents and absent when a single inventor is the sole owner of her patents. I explain the theoretical underpinnings of this hypothesis, beginning with Ronald Coase's transaction costs theory of the firm.[84] According to Coase, decisions are made within a firm by the entrepreneurial coordinator, who directs production rather than through exchange transactions in the market.[85] Firms emerge, or grow, when market transactions to purchase inputs necessary for a productive venture are more costly than coordinating and producing the inputs internally.[86] When this condition exists, the firm purchases what is necessary to produce the inputs.[87] Coase later identified three broad types of market transaction costs: search and information; bargaining and decision; and policing and enforcement.[88]

In investigating the determinants of the form of organization for inventors who share their patents with co-owners, I am particularly interested in the costs of bargaining and decision-making. Since Coase published his article, more recent work focusing on the relatively new LLC form has theorized that LLCs quickly became popular because they provide a cheap and flexible structure for contract between

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83. Cole & Sokolyk, *supra* note 68, at 25–26.
84. Coase, *supra* note 8, at 386.
85. *Id.* at 388.
86. *Id.* at 394.
87. *Id.* at 395.
88. R. H. Coase, *The Problem of Social Cost*, 56 J.L. & ECON. 837, 850 (2013) ("In order to carry out a market transaction it is necessary to discover who it is that one wishes to deal with, . . . to conduct negotiations leading up to a bargain, to draw up the contract, to undertake the inspection needed to make sure that the terms of the contract are being observed, and so on.").

multiple owners of an enterprise.[89] Scholars have often described LLC law as highly contractual,[90] going so far as to describe it as "the contractarian test case, and one frequently hears that the LLC is a 'creature of contract,' a contractarian dream entity where any deal can be structured among the parties."[91]

Most state LLC statutes explicitly offer a legal form of business that allows multiple owners wide flexibility in contracting for important terms, including management roles, profit distributions, and shares.[92] Manesh, for example, argues that "Delaware LLC law, like the LLC law of several other states, affords parties an extraordinarily high degree of contractibility, allowing LLCs to contractually tailor virtually all matters of the firm's internal governance in the terms of the LLC's governing agreement."[93] The transactions cost theory is more salient given the flexibility of modern LLCs and close corporations. This theory may describe how partner entrepreneurs use firms to coordinate and cooperate in a more efficient way than using arms-length negotiations to make each decision together. In fact, some have argued that the choice of legal form of organization can be predicted strictly based on transaction costs theory.[94]

Oliver Hart developed one vein of transaction costs theory focusing on the situation of multiple owners of complementary assets that are

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89. *E.g.*, Martin Schaper, *Hybrid Legal Forms at the Gates: The Transition from Combined Legal Forms to Hybrid Corporations and its Consequences for Creditor Protection*, 10 EUR. CO. & FIN. L. REV, 75, 84–85 (2013). Many of the following characteristics of LLCs that provide this benefit are shared by close corporations.

90. Joan MacLeod Heminway, *The Ties that Bind: LLC Operating Agreements as Binding Commitments*, 68 SMU L. REV. 811, 812 (2015). *But see* Mohsen Manesh, *Creatures of Contract: A Half-Truth About LLCs*, 42 DEL. J. CORP. L. 391, 398 (2018) (arguing that LLCs should not be considered "creatures of contract" as they have been frequently characterized by courts, but rather: "LLCs embody a complex interaction of contract terms, statutory rules, and judicial doctrine. Consequently, LLCs are creatures of contract *and* creatures of statute *and* creatures of equity.").

91. J. William Callison & Allan W. Vestal, *Contractarianism and Its Discontents: Reflections on Unincorporated Business Organization Law Reform*, 42 SUFFOLK U.L. REV. 493, 496 (2009).

92. *See, e.g.*, COLO. REV. STAT. § 7-80-108(4) (2016); GA. CODE. ANN. § 14-11-1107(b) (2009); KAN. STAT. ANN. § 17-76-134(b) (2009).

93. Mohsen Manesh, *Delaware and the Market for LLC Law: A Theory of Contractibility and Legal Indeterminacy*, 52 B.C. L. REV. 189, 193 (2011).

94. *See, e.g.*, J. T. Mahoney, *The Choice of Organizational Form: Vertical Financial Ownership Versus Other Methods of Vertical Integration*, 13 STRATEGIC MGMT. J. 559, 568 (1992) (noting that the transaction costs theory describes advantages to vertical financial ownership).

necessary to complete an enterprise.[95] His work suggests that as the number of owners of necessary assets increases, so do the transaction costs of completing the work and dividing any surplus.[96] The reason is that the separate owners of complementary assets have the power to "hold-up" the projects of the enterprise.[97] The solution to the problem of hold-up is unified ownership of the assets.[98] Thus, in joining together to form a firm, multiple entrepreneurs can assign their complementary assets to the separate legal entity after negotiating each partner's ownership interest and management role in the enterprise.

While Hart's analysis focused on multiple tangible assets necessary for industrial production, hold-up applies in an analogous manner when there are multiple co-owners of a patent who combined would be better off working together to maximize licensing revenue from users of their technology. This is true because co-owners of patents are treated as tenants in common.[99] Further, since *Waterman v. MacKenzie*,[100] federal courts have uniformly required all owners of a patent to be joined as parties to a patent lawsuit.[101] The policy reason for this requirement is the existence of the legal right of each co-owner of a patent to license the patented technology on non-exclusive terms

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95. See, e.g., Oliver Hart, *An Economist's Perspective on the Theory of the Firm*, 89 COLUM. L. REV. 1757 (1989).

96. *Id.* at 1770 ("Giving control of these assets to two different management teams is therefore bound to be detrimental to actors' incentives, since it increases the number of parties with hold-up power. This result confirms the notion that when lock-in effects are extreme, integration will dominate nonintegration.").

97. *Id.*; *see also* Bengt Holmström & John Roberts, *The Boundaries of the Firm Revisited*, 12 J. ECON. PERSPS. 73, 74 (1988) (describing that the best solution to the hold-up problem may be vertical integration).

98. *See* Hart, *supra* note 95, at 1770 ("[H]ighly complementary assets should be owned in common, which may provide a minimum size for the firm.").

99. *See* 35 U.S.C. § 262 (1952) (noting that joint owners of a patent "may make, use or sell the patented invention without the consent of and without accounting to the other owners").

100. 138 U.S. 252 (1891).

101. Richard F. Cahaly, Note, *At Each Other's Mercy: Do Courts Fairly Apply Rule 19 of the Federal Rules of Civil Procedure to Protect Patent Co-Owners' Property Rights?*, 35 SUFFOLK U. L. REV. 671, 672 (2001); see also Indep. Wireless Tel. Co. v. Radio Corp. of Am., 269 U.S. 459, 473 (1926) (affirming obligatory use of patent owner's name as plaintiff in exclusive licensee's infringement action); Ethicon, Inc. v. U.S. Surgical Corp., 135 F.3d 1456, 1467 (Fed. Cir. 1998) (observing requirement for all patent co-owners to join infringement suit); Willingham v. Lawton, 555 F.2d 1340, 1344 (6th Cir. 1977) (recognizing all patent co-owners must join infringement suit, including those owning unequal shares of undivided patent interest).

on their own without the agreement of the other owners. Thus, the often-quoted principle that patent "co-owners are at the mercy of each other."[102]

For the purpose of committing to a unified, profit-maximizing patent licensing campaign, there would then seem to be no more necessary assets than the joint interests of co-inventors who retain their own separate ownership rights. The gains from eliminating hold-up through assignment of co-owned patents to a single firm can be large because it eliminates the risk of one co-owner threatening to license on her own without being given a larger share of the profits. My empirical analysis, discussed in the subsequent Part of this paper, tests this theory and reveals that when there are co-owners of independent inventor patents, they are far more likely to monetize their patents through a business organization that they own rather than as natural persons. As explained in this Part, the theoretical reason for this difference is that a business organization prevents the defection of an intellectual property asset co-owner in the middle of a joint monetization campaign. Seen from the opposite side, infringers lose the ability to pit one co-inventor against another through one-on-one licensing negotiations.

IV. DATA AND METHODOLOGY

The analysis in this paper is comprised of two parts. The first part consists of descriptive statistics reporting differences in the inventors, patents, and litigation of independent inventors who assert their patents in their individual capacity versus those who do so through non-practicing business organizations.[103] The second part of the analysis includes multivariate regression analysis that determines which traits most powerfully predict independent inventor business form.[104]

The entire analysis supports the conclusion that inventor plaintiff form is a special case of entrepreneurs' choice of legal form of organization. Further, within this example of business form selection, the most important determinant appears to be the presence of multiple patent owners. The best explanation for this is that co-owners can achieve greater success by pre-committing to cooperation with all owners in deciding patent licensing strategy and profit shares

102. *Willingham*, 555 F.2d at 1344.
103. *Supra* Parts I–III.
104. *Infra* Parts IV–V.

throughout their campaigns. Traits of business organizations that are the usual focus of corporate law scholarship, like tax treatment and limited liability, do not appear to be the primary drivers of independent inventor choice of legal form.

To complete the analysis, I use several sources of data to identify which patent infringement lawsuits are filed by the two independent inventor groups and to collect characteristics of the inventors, their patents, and their litigation. The first source of data is the Stanford NPE Litigation Database ("NPE Database").[105] The NPE Database categorizes the patent plaintiffs in every patent lawsuit filed in U.S. district courts from 2000 to the present as practicing entities that make or sell products and services or as one of eleven categories of non-practicing entities ("NPEs") that do not sell products or services.[106]

Two NPE categories in the NPE Database closely track the two inventor groups that are the subject of this paper. These are "Individual-inventor-started companies" and "Individual" plaintiffs.[107] The NPE Database defines "Individual-inventor-started companies" as "firms primarily in the business of asserting patents, where the original inventor of the patents is the founder and/or owner of the NPE."[108] The vast majority of these entities "exist solely to hold and enforce those patents,"[109] making this category equivalent to my definition of an "inventor-owned licensing firm."[110] Within the NPE Database, "Individual" plaintiffs include any persons asserting patents in their individual capacity, and they are almost always "the original inventors suing in their own name rather than through an L.L.C. or other

105. *NPE Litigation Database*, STAN. PROGRAM IN L., SCI. & TECH., http://npe.law.stanford.edu [https://perma.cc/H6BM-SR45] [hereinafter NPE Database].

106. *Id.*

107. *See* Miller et al., *supra* note 42, at 244 (describing the methodology used to create the NPE Database, explaining the categories of patent plaintiffs, and reporting descriptive trends in lawsuits involving the various categories).

108. *Id.*

109. *Id.*

110. While reviewing complaints to collect other data about inventor-owned licensing firms, I determined that some "Individual-inventor-started company" cases were miscoded in the NPE Database, typically because the business organizations either were not owned by the inventors or sold goods and services at the time of litigation. I exclude these cases from the analysis.

company they own."[111] Thus, for my analysis, I consider cases with only "Individual" patent plaintiffs as "individual inventor" lawsuits.[112]

In some of my descriptive analyses, I also report results for the two most common plaintiff categories in the NPE Database in order to compare how these other plaintiffs differ from independent inventors. The first comparison group includes litigated patents asserted by "Product Companies" that "manufacture products, sell products, or deliver services (unrelated to patent enforcement)."[113] The second comparison group includes patents asserted by "Acquired Patents" plaintiffs that are "in the business of asserting patents . . . acquired from other entities."[114] These are the most common type of PAE.[115] Again, a PAE is "an entity that owns patents but does not create or sell products or services" and further "that exists to assert patents against other actors."[116] In this paper, I refer to "Acquired Patents" plaintiffs as "other PAEs" since the definition of an inventor-owned licensing firm is consistent with the definition of a PAE.

I utilize data from all patent infringement lawsuits filed during the fifteen-year period from January 1, 2003, through December 31, 2017. As reported in Table 1, there were 55,406 patent lawsuits filed in U.S. district court during this period.[117] Among these, 29,185 (52.7%) included a product company as a patent plaintiff, and 14,483 (26.1%) included other PAEs.[118] There were 2,810 lawsuits (5.1%) where the only plaintiffs were individual inventors and 7,240 lawsuits (13.1%) where the only plaintiffs were inventor-owned licensing firms.[119] However, the gap in the number of unique patents asserted by each of

111. Miller et al., *supra* note 42, at 245.

112. While reviewing complaints to collect other data about the inventors and their lawsuits, I determined that several dozen "Individual" lawsuits were filed by individual plaintiffs who were not the inventors of the asserted patents suing in their individual capacity. For example, individual plaintiffs include trustees of the family trusts of deceased inventors and alternatively other natural persons who purchase patents from the inventors. I exclude these cases from the analysis as they are not lawsuits by independent inventors.

113. Miller et al., *supra* note 42, at 245.

114. *Id.* at 244.

115. *Id.* at 255.

116. *Id.* at 238; *see also* Chien (2010), *supra* note 23, at 300 (defining PAEs as entities that use patents primarily to gain licensing fees rather than to commercialize or transfer technology).

117. *See infra* Table 1.

118. *See infra* Table 1.

119. *See infra* Table 1.

the two inventor groups is much narrower than the difference in total lawsuits filed—2,040 unique patents were asserted by individual inventors over the fifteen-year period and 3,224 by inventor-owned licensing firms.[120]

Among independent inventor lawsuits, there are 828 unique individual inventor plaintiffs and 873 unique inventor-owned licensing firm plaintiffs.[121] Individual inventor plaintiffs filed, on average, 3.4 lawsuits during the fifteen-year period of the study, while the average inventor-owned licensing firm filed 8.2 lawsuits.[122] Thus, the average inventor-owned licensing firm filed over twice as many different lawsuits as the average individual inventor plaintiff. This is an early indication that substantial differences exist in the behavior of these two groups of inventors.

120. *See infra* Table 1.
121. *See infra* Table 1.
122. *See infra* Table 1.

Table 1. Description of Patent Litigation—By Plaintiff Type

	Individual Inventor	Inventor-Owned Firm	All Patent Litigation
No. of Lawsuits	2,810	7,240	55,406
% of All Patent Litigation	5.1%	13.1%	100%
No. of Unique Patents Asserted	2,040	3,224	–
No. of Unique Plaintiffs / Number of First Lawsuits by an Independent Inventor	828	873	–
Average No. of Lawsuits Per Independent Inventor	3.4	8.2	–

Note—"All Patent Litigation" includes the population of all patent lawsuits included in the Stanford NPE Database that were filed in U.S. federal district court from 2003 through 2017. The total "Number of Lawsuits" for individual inventors includes all cases where all patent infringement plaintiffs were the inventors of the asserted patents suing as natural persons. The total "Number of Lawsuits" for inventor-owned licensing firms includes all cases where all patent infringement plaintiffs were non-practicing business organizations owned at least in part by one inventor of the asserted patents. "Number of Unique Plaintiffs" includes the total number of unique sets of individual inventor plaintiffs and of unique inventor-owned licensing firms filing suit between 2003 and 2017. Logically, these totals are equal to the total "Number of First Lawsuits by an Independent Inventor."

To complete my analysis, I collected data from several other sources beyond the NPE Database. I obtained additional litigation data from Lex Machina, including the patents asserted, the law firm representing the plaintiff, the federal district court venue, the filing date, the lawsuit duration, the number of docket entries filed in the case, and case outcomes.[123] I also used Lex Machina to access and read the initial complaints filed in each inventor plaintiff's earliest-filed lawsuit. From this review, I collected biographical information about the inventors, when such information was included in the allegations, and

123. *See generally* LEX MACHINA (2021), https://lexmachina.com (providing a searchable online litigation database for legal analytics); *supra* Table 1.

determined whether or not the complaint praised the inventor's effort and accomplishments.

I collected most patent characteristics from the U.S. Patent and Trademark Office-backed online patent data platform, PatentsView.[124] This data includes the names of the law firms that obtained the inventors' patents, the number of citations received by each patent, and the National Bureau of Economic Research's (NBER) classification of the technologies covered by their inventions.[125] I also received importance scores that proxy the value of each litigated patent from the variable's creators, Torrance and West.[126] From Google Patents, I determined the number of patents granted to each inventor.[127] Finally, I obtained information on inventor-owned licensing firms from online searches of state business entity databases.[128] In Part V, I explain each of the variables I collect in greater detail as I report the differences between inventor groups.[129]

For the statistical analysis in this paper, it is important to stress that I am studying population data rather than a sample.[130] This is because the Stanford NPE Litigation Database includes all patent infringement lawsuits.[131] However, several of the characteristics I study are unobservable for some inventors or incredibly time-consuming to collect. For these, I report results on large samples of the lawsuits. Where data collection was merely difficult, these samples are random.

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124. *See generally* PATENTSVIEW, https://www.patentsview.org (providing an online database of formatted patent data derived from the PTO bulk data files); *supra* Table 1.

125. Hall et al., *supra* note 2, at 4, 12, 24.

126. For a description of these importance scores, see Andrew W. Torrance & Jevin D. West, *All Patents Great and Small: A Big Data Network Approach to Valuation*, 20 VA. J. L. & TECH. 468, 469 (2017), which describes the use of eigenvector centrality and hierarchical clustering methods to evaluate the patent citation network and the relative importance of individual U.S. patents.

127. *See generally* GOOGLE PATENTS, https://patents.google.com (providing a search engine for patents); *supra* Table 1.

128. E.g., CAL. SEC'Y OF STATE BUS. SEARCH https://businesssearch.sos.ca.gov (providing a search engine for state business entity databases); *supra* Table 1.

129. *See infra* Part V.

130. I emphasize my use of population-level data because a number of common statistical metrics associated with comparisons of population samples (e.g., measures of statistically significant difference at defined p-levels) are considered meaningless in the context of entire populations. Thus, the lack of such metrics in the instant article is not an oversight.

131. *See generally* NPE Database, *supra* note 105 (providing a comprehensive database of patent litigation); *supra* Table 1.

In the rare instances where collection was nonrandom, I explain potential biases in the results.

Further, in order to avoid double counting inventors in the results, I analyzed only the first lawsuit filed by each unique inventor plaintiff or group of plaintiffs where multiple inventors sued together. Where there are multiple patents asserted in that first lawsuit, I analyzed the oldest asserted patent in reporting many inventor, patent, and litigation characteristics. These included the time to litigation and licensing firm formation after patent grant. I believe an inventor's first-filed lawsuit is the most informative unit of analysis for this study as it is closest in time to the choice of legal form of organization and to the decision to begin a licensing campaign. Fundamentally important to interpreting the results of this study is the exclusion of all inventor plaintiffs that I determined were making products or offering services at the time of litigation. In other words, all of the individual inventors included in the analysis were non-practicing entities engaged in the business of patent licensing at and after litigation.

Among the 873 unique inventor-owned licensing firm plaintiffs in the study, 59% (513) are LLCs, 35% (306) are corporations, 2% (20) are limited or limited liability partnerships, and 4.5% (39) are foreign business organizations.[132] In future work, I will determine if there are significant differences in the traits of inventor-owned licensing firms organized as LLCs versus those that are incorporated.

V. ANALYSIS AND RESULTS

Turning to the analysis and results, I begin by reporting descriptive differences between inventor-owned licensing firms and individual inventors in the characteristics of the inventors, their patents, and their litigation. I explain what these differences might mean along the way. I then turn to multivariate analysis, determining which characteristics are most important in understanding why some independent inventors sue as natural persons while others sue through business organizations.

A. Differences in Inventor Characteristics

I investigated differences between the two groups of independent inventors across several traits of the inventors themselves. First, I report differences in the presence of co-inventors. Second, I report

132. In five inventor-owned licensing firm lawsuits, there are two plaintiffs with one organized as an LLC and the other incorporated.

differences in a proxy for co-inventor family ties. Third, I explore the frequency and roles of non-inventor co-owners of inventor-owned licensing firms. Finally, I describe differences in the average number of patents acquired by each inventor.

1. Number of co-inventors

As detailed in Section III.B., versions of the transaction costs theory of the firm predict that coordination costs increase with the number of individuals with control over an enterprise. This is not a new idea within the context of patent litigation. For example, Alison, Lemley, and Walker argue that formulating a defense strategy in multi-defendant patent lawsuits can be more expensive per defendant because coordinating strategy among many different lawyers can be difficult.[133] The same logic would appear to apply where there are multiple plaintiffs, each of whom can refuse to join a proposed settlement. In patent litigation, the coordination problem is amplified by the fact that hold-out is legal, and each co-owner of a patent individually has the ability to grant non-exclusive licenses to anyone without agreement from the other co-owners.[134] Thus, I hypothesize that independent inventors with co-inventors are more likely to litigate via an inventor-owned licensing firm that serves as a vehicle for multiple inventors of the same patents to pre-commit to cooperative management of their patent licensing enterprise.

To test this hypothesis, I determined the mean number of inventors listed on the oldest patent asserted in the earliest lawsuit filed by a unique plaintiff or set of plaintiffs where multiple independent inventors sued together. I find and report in Table 2 that, on average, inventor-owned licensing firms possess more named inventors on their asserted patents than individual inventor plaintiffs.[135] The difference is striking, with inventor-owned licensing firms possessing, on average, 45% more inventors than lawsuits brought by individual inventors (1.72 versus 1.19).

Also striking is the difference in the percentage of lawsuits involving a single inventor. Less than 16% of individual inventor lawsuits include co-inventors, while 44% of inventor-owned licensing firm lawsuits

133. John R. Allison, Mark A. Lemley & Joshua Walker, *Patent Quality and Settlement Among Repeat Patent Litigants*, 99 GEO. L.J. 677, 679, n.9 (2011).

134. *See supra* note 12 and accompanying text (explaining the current state of patent law).

135. *See infra* Table 2.

assert patents with multiple inventors. Finally, among all independent inventor first assertions, an impressive 74.7% of those with multiple inventors were litigated through inventor-owned licensing firms (383 of 513).[136] These findings are strong support for the coordination theory of the firm, at least in businesses like patent monetization, where success depends on a few important assets that are often jointly owned. With patents as essentially the only necessary assets, business organizations allow co-owners to pre-commit to coordinated management and profit sharing in their patent licensing enterprise. Again, pre-commitment is necessary in this business because co-owners of patents possess the legal right to negotiate their own individual deals with prospective licensees.

Table 2. Inventor Characteristics—First Lawsuit by Unique Plaintiff

	Individual Inventor	Inventor-Owned Licensing Firm
Mean No. of Inventors per 1st Lawsuit	1.19	1.72
No. of 1st Lawsuits with Multiple Inventors	130	383
% with Multiple Inventors	15.7%	43.9%
% of Multiple Inventor First Lawsuits	25.3%	74.7%
N First Lawsuits =	828	873

Note—Population of 828 first lawsuits filed by unique individual inventors and 873 first lawsuits filed by inventor-owned licensing firms between 2003 and 2017. Number of inventors per first lawsuit obtained from the oldest granted patent asserted in the lawsuit.

The results in Table 2 also demonstrate that the need to commit to cooperation is not the only reason why independent inventors choose to litigate through business organizations. In fact, 56% of inventor-owned licensing firms assert patents with a single inventor. Later analysis in this paper indicates that inventors with more experience and more valuable patents are also more likely to enforce their patents through a business organization. These findings validate additional

136. In unreported regressions, I also determined that non-U.S. foreign inventors are statistically neither more nor less likely than domestic inventors to sue through business organizations. Nevertheless, I find that a similar share of foreign inventors with co-inventors do sue through business organizations (seventy-eight percent).

determinants of the choice of legal form of organization identified in the literature and suggest that, beyond coordination, sophisticated inventors with potentially valuable patents may litigate through business organizations to benefit from limited liability and easier access to litigation financing. But before turning to other determinants of independent inventors' choice of legal form, I explain two more characteristics of independent inventors that suggest that coordination among co-owners is the most important factor in choice of form of organization, even if it is not the only one.

2. Co-inventor family ties

Substantial literature across multiple disciplines shows that kinship facilitates trust and cooperation within a family group for reasons including sizeable reputation costs for bad behavior against kin.[137] Further, a group with strong cohesion has greater trust and cooperation within the group.[138] Thus, the literature on family businesses suggests that owners tend to distinguish between employees or partners that are family members and those that are not, "the former subject to rules of trust and cooperation between family, and the latter subject to the usual 'buyer beware' rules of the market."[139]

Given that trust and cooperation tend to be easier within family groups, I hypothesize that where independent inventor litigation is brought by co-inventors who are related by blood or marriage, they will be less likely to perceive the need to form a business entity to pre-commit to cooperation. As a proxy for family relationship, I reviewed

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137. *See, e.g.*, Mark Granovetter, *Economic Action and Social Structure: The Problem of Embeddedness*, 91 AM. J. SOCIOL. 481, 481–82 (1985) (demonstrating how kinship facilitates trust in the discipline of sociology); James S. Coleman, *Social Capital in the Creation of Human Capital*, 94 AM. J. SOCIO. 95, 95–97 (1988) (demonstrating how kinship facilitates trust in the discipline of sociology); Avner Greif, *Reputation and Coalitions in Medieval Trade: Evidence on the Maghribi Traders*, 49 J. ECON. HIST. 857, 857–82 (1989) (demonstrating how kinship facilitates trust in the discipline of economics); ROBERT C. ELLICKSON, ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES 175, 234 (1991) (demonstrating how kinship facilitates trust in the discipline of law); Lisa Bernstein, *Opting out of the Legal System: Extralegal Contractual Relations in the Diamond Industry*, 21 J. LEGAL STUD. 115, 138 (1992) (demonstrating how kinship facilitates trust in the discipline of law); ROBERT D. PUTNAM, MAKING DEMOCRACY WORK: CIVIC TRADITIONS IN MODERN ITALY 737 (1993) (demonstrating how kinship facilitates trust in the discipline of political science).

138. Ronald S. Burt, Sonja Opper & Na Zou, *Social Network and Family Business: Uncovering Hybrid Family Firms*, 65 SOC. NETWORKS 141, 143 (2021) (citations omitted).

139. *Id.*

the names of inventors of the oldest granted patent in each first lawsuit and determined whether or not every coinventor on a patent possesses the same surname.

Table 3. Inventor Characteristics—First Lawsuit by Unique Plaintiff

	Individual Inventor	Inventor-Owned Licensing Firm
Mean No. of Inventors per First Lawsuit	1.19	1.72
No. of 1st Lawsuits with Multiple Inventors	130	383
% with Multiple Inventors	15.7%	43.9%
No. of Multiple Inventor First Suits w/ Same Last Name	36	37
% with Multiple Inventors with Same Last Name	27.7%	9.7%
No. of 1st Suits with Sole Inventor or Same Last Name	734	527
% with Sole Inventor or Same Last Name	88.6%	60.4%
N First Lawsuits =	828	873

Note—Population of 828 first lawsuits filed by unique individual inventors and 873 first lawsuits filed by inventor-owned licensing firms between 2003 and 2017. The number of inventors per first lawsuit and percent with same last name obtained from the oldest granted patent asserted in the lawsuit.

I find and report in Table 3 that among the individual inventor lawsuits with multiple inventors on the asserted patents, 28% had co-inventors with the same last name.[140] By contrast, less than 10% of multiple inventor lawsuits filed by inventor-owned licensing firms included co-inventors with the same last name.[141] Combined with the shares of solo inventors, only about 11% of individual inventor lawsuits were filed by multiple co-inventors who do not share their surname.[142]

140. *Infra* Table 3.
141. *Infra* Table 3.
142. *Infra* Table 3.

By contrast, 40% of inventor-owned licensing firms' cases involve multiple unrelated co-inventors.[143]

In other words, just about nine-in-ten individual inventor lawsuits are by solo inventors or by co-inventors from the same family. Ninety percent is a pretty staggering share for any trait in investigating a complex phenomenon. Accordingly, it seems very likely that the need to pre-commit to coordination among multiple unrelated co-owners is an important reason why many non-practicing independent inventors monetize their patents through business organizations.

Of course, it is possible that other traits of individual inventor litigation explain why the vast majority involve solo inventors or related coinventors. One explanation might be that solo inventors and family inventors just tend to be much less experienced and sophisticated than unrelated co-inventors. However, as will be shown in reporting the multivariate analysis in Section V.D., inventor-owned licensing firms are much more likely to assert patents with coinventors, even controlling for other traits that are highly correlated with experience, patent value, and other theoretical determinants of inventor type besides the need for commitment to cooperation. Absent evidence for an explanation not considered, I conclude that many independent inventors form business organizations in order to bind themselves and their co-owners to a coordinated patent licensing business.

3. Non-inventor co-owners of inventor-owned licensing firms

The same coordination argument that applies to co-inventor co-owners applies to co-owners of patents who were not inventors. In order to find evidence that coordination with non-inventor co-owners influences the choice of independent inventors to monetize their patents through a business organization, I recorded from the initial complaint in the earliest filed lawsuit the state of incorporation or LLC registration of each inventor-owned licensing firm. For a large random sample of these lawsuits, I then searched the relevant secretary of state's online business entity database for lists of LLC members and close corporation officers.

I have identified complete stakeholder lists for 34.5% of the inventor-owned licensing firms (301 of 873). As Table 4 reports, over 60% include a non-inventor stakeholder, whether a member or an officer. From internet research of the backgrounds of these stakeholders, I found that they fit into one or more of the following

143. *Infra* Table 3.

categories with about equal frequency: investors, business managers, and IP enforcement experts, including patent attorneys.

From this data, I derived a reasonable estimate of the share of the population of inventor-owned licensing firms that are owned by solo inventors who also lack non-inventor co-owners. Among the 301 firms for which I have collected stakeholder data, 179 possess solo inventors. Just under 56%, or 110 firms, also lack non-inventor co-owners. Applying this share to the population of 490 inventor-owned licensing firms with solo inventors, I estimate that 274 of 490 firms with solo inventors possess co-owners. Adding these to the 383 inventor-owned licensing firms with multiple inventors, I estimate that 75.3% (657 of 873) of the inventor-owned licensing firms in this study possess either co-inventor or non-inventor co-owners.

Put another way, just under one quarter (24.7%) of inventor-owned licensing firms lack co-owners of the patents, while nearly 85% (84.3%) of individual inventors lack co-owners. This is a compelling difference between the two inventor groups, one that suggests that the most important determinant of inventor form just might be the need to pre-commit to unified patent licensing efforts when there are multiple patent owners.

However, it is unlikely that my estimated percentage of inventor-owned licensing firms without co-owners is the true population share. The main reason is that states vary in the amount of information on shareholders and members reported on their registered business websites. Some, like California, provide comprehensive information via lists of owners and accessible PDF copies of business filings, including articles of incorporation and registration statements.[144] Other states share little more than the date of incorporation or registration, whether the entity is active, and the registered agent name and contact information. The most problematic of these latter states is Delaware because more inventor-owned licensing firms are formed there than in any other state.[145] Further, Delaware is an increasingly popular venue for patent litigation.[146] The direction of any "Delaware

144. *See generally* CAL. SEC'Y OF STATE BUS. SEARCH (available at https://businesssearch.sos.ca.gov/) (providing a search engine for state business entity databases).

145. Shawn P. Miller, *Venue One Year After* TC Heartland*: An Early Empirical Assessment of the Major Changes in Patent Filing*, 52 AKRON L. REV. 763, 767 (2018).

146. *Id.* at 781–82 (reporting that the share of all U.S. patent litigation filed in Delaware increased from 12% during the year before the Supreme Court decided TC Heartland to 24% during the year after that decision).

bias" is unclear, but if there is a systemic difference in the inventor-owned licensing firms at home in Delaware versus those in reporting states like California, then the share of inventor-owned licensing firms with non-inventor owners could be significantly larger or smaller than the 62% reported for my sample in Table 4.

Nevertheless, some share of inventor-owned licensing firms possesses non-inventor owners of the firm, and this fact increases the share of these firms with multiple stakeholders. Even if one assumes that all unobserved inventor-owned licensing firms lack non-inventor co-owners, I identified 110 solo inventor firms with non-inventor co-owners. This, combined with the 383 firms, provides an unrealistically pessimistic lower bound of 56.5% of inventor-owned licensing firms with co-owners as compared with the 15.7% of the population of individual inventors with co-owners. Further, recall from Table 3 that only about one in ten individual inventor suits are brought by multiple unrelated inventors. Thus, all of the results reported so far indicate that a major reason why independent inventors choose to monetize their patents and litigate through a business organization is that the entity serves as a vehicle for multiple stakeholders to pre-commit to cooperative management of the enterprise.

Table 4. Percent of Inventor-Owned Licensing Firms Lacking Inventor and Non-Inventor Co-Owners

	Individual Inventor	Inventor-Owned Licensing Firm
No. of Inventor-owned Licensing Firms w/ Identified Non-inventor Co-owners		187
% of Reviewed Inventor-owned Licensing Firms with Non-inventor Co-owners		62.1% (187 of 301)
% of Reviewed Solo Inventor Licensing Firms with Non-inventor Co-owners		55.9% (110 of 179)
Estimated % of Inventor-owned Licensing Firms with Solo Inventors and No Non-inventor Co-owners		24.7% (216 of 873)
% with Solo Inventors	84.3% (698 of 828)	56.1% (490 of 873)
N First Lawsuits =	828	873

Note—Population of 828 first lawsuits filed by unique individual inventors and 873 first lawsuits filed by inventor-owned licensing firms between 2003 and 2017. Complete lists of business organization shareholders obtained for a non-random sample of 34.5% of the inventor-owned licensing firms (301 of 873).

Nonetheless, the presence of non-inventor stakeholders in inventor-owned licensing firms might also be partially explained by other mechanisms discussed in the choice of legal form of organization literature. For example, prior work finds that entrepreneurs with greater expectations as to the future prospects of a business tend to select more complex organizational forms.[147] The choice of inventors to bring in investment partners willing to contribute capital towards licensing efforts or professionals with licensing or asset management

147. *See* Cole & Sokolyk, *supra* note 68, at 2 (noting that the complexity of organizational form selected is directly related to the entrepreneurs expectations for how large and complex their business will be).

expertise might be due in part to more experienced inventor-owners believing their personal gain from licensing will exceed the expense of sharing with these new partners. Nevertheless, in Section V.D, I will report that in multivariate analysis, the presence of co-inventors is the most significant predictor of inventor type, even controlling for patent value and proxies for complexity.

4. Number of patents per inventor

As a final inventor characteristic, I determined the number of patents obtained by each independent inventor from Google Patents. The total number of patents ever granted to an inventor is a plausible proxy for greater experience inventing and patenting. Inventors with more patents might also tend to view invention and patenting as their profession. By contrast, inventors with one or two patents might have pursued invention as a hobby.

This has been a difficult variable to create, given that some inventor names are quite common, for example, "John Smith," and for these, it must be determined which patents were granted to the litigating inventor who is actually a part of this study. Thus, I have collected lifetime patent family[148] counts for about 50% of the inventor plaintiffs. This includes a random sample of 43.8% of inventor-owned licensing firm inventors (382 of 873 unique plaintiffs) and 53.3% of the individual inventors (441 of 828 unique plaintiffs).

On average, inventors suing through an inventor-owned licensing firm have been granted patents from 14.4 patent families (standard deviation = 33.6), while those suing individually have been granted patents from 7.1 families (standard deviation = 14.4). In other words, inventors who choose to assert their patents through a licensing firm have been granted patents in over twice as many distinct patent families as those who sue in their individual capacity.

Further, 53% of inventors suing as individuals have been granted patents from only one or two distinct families (235 of 441). By contrast, 67% of inventors suing through licensing firms have obtained patents from more than two families (256 of 382). These findings show that inventors who litigate through licensing firms possess more experience

148. I count patent families rather than total patents to avoid double counting the same invention patented in different nations. According to the USPTO, a patent family "is the same invention disclosed by a common inventor(s) and patented in more than one country." *Glossary*, U.S. PATENT & TRADEMARK OFF., https://www.uspto.gov/learning-and-resources/glossary.

patenting. Further, they may also indicate that independent inventors who litigate through licensing firms more frequently view inventing and patenting as their profession and not just a hobby.

B. Differences in Patent Characteristics

Now that I have discussed differences in independent inventor characteristics that help explain the choice of only some inventors to monetize their patents through business organizations, I turn to investigating the differences in their inventions and patents. First, I review variation in the technology covered by inventor patents. Second, I report differences in the economic value and importance of the patents of the two inventor groups. Third, I reveal differences in the groups' legal representation when they obtained their patents from the U.S. Patent and Trademark Office (PTO). For the analysis in this part, I also include results for comparison groups, including all other patents, practicing entity patents, and/or PAE patents.

1. Technology

Differences in the technology covered by litigated patents might shed light on the reasons why some inventors sue through a business organization while others sue in their individual capacity. For example, inventing within some technologies, like software, is cheaper than in others, like pharmaceuticals.[149] Further, team invention might be more common with some technologies than others, and that might help explain my finding that independent inventors with co-inventors are more likely to license through a business organization. Technology may also explain differences in the litigation behavior of these two groups. For example, litigated telecommunications patents may be asserted against more alleged infringers than pharmaceutical patents simply because there are more firms practicing in the former industry.

From PatentsView's "nber" data file, I obtained the NBER classification of the technologies covered by the independent inventor patents in this study.[150] Table 5 shows that there are large differences

149. *See* Mark Rawls, Note, *Fixing Notice Failure: How to Tame the Trolls and Restore Balance to the Patent System*, 5 WM. & MARY BUS. L. REV. 561, 570 (2014) (explaining that in pharmaceutical development, "huge outlays are spent on research and development, drug testing, and regulation compliance," while software development "tends to happen quickly and incrementally" with the primary cost being "the labor of the software developer").

150. *See generally* Hall et al., *supra* note 2 (providing a database of U.S. patents and their characteristics).

across plaintiff type in the technologies of the asserted patents. Notably, the mix of individual inventor patents is much closer to that of practicing entities, who, because of their large share of all litigated patents, more closely reflect the mix of patented innovation in the economy. By contrast, the technological mix of inventor-owned licensing firm patents appears similar to that of PAEs who acquire their patents from third parties.

Table 5. Share of Litigated Patents in Each NBER Technology Category—By Plaintiff Type

	Individual Inventor	Inventor-Owned Firm	Other PAE	Practicing	All
Chemical	6.5	4.1	1.5	7.3	6.73
Computer & Communications	19.3	55.3	71.1	26.3	33.47
Drugs & Medical	9.3	6.4	5.0	18.1	15.5
Electrical	11.9	10.1	12.6	13.7	13.3
Mechanical	18.3	9.1	4.6	13.1	11.9
Other	34.7	15.0	5.2	21.2	19.2
N =	1,669	2,917	5,001	33,406	43,964

Note—All patents litigated in U.S. federal district court from 2003 through 2017 that include NBER technology codes on PatentsView. There is a significant lag in the addition of new patents to the NBER Patent Data file. Accordingly, NBER technology categories were only available for 85% of independent inventor litigated patents.

The most striking result reported in Table 5 is that over 70% of patents litigated by PAEs cover computer hardware, software, electronic business methods, or communications technology (NBER's "Computer & Communications" category). There are a variety of reasons why software and communications patents have been the favorite tools of PAEs. These patents tend to use more abstract functional language to describe the technology protected such that creative lawyers can argue that their scope is broader than the invention originally conceived, thus covering more follow-on

innovation.[151] The information technology and communications industries have also been characterized by rapid incremental innovation[152] and widespread application. Thus, there have been many more patents per product in these areas than in older industries focused on chemical, pharmaceutical, or mechanical innovation.[153]

While not quite as concentrated as PAEs, a clear majority (55%) of inventor-owned licensing firm patents also cover computers and communications. This suggests that there is significant overlap in the kinds of patents bought by PAEs and those obtained by inventors suing through business organizations. Combining this technology overlap with the litigation behavior reported later in Section V.C, I find that not only do many inventor-owned licensing firms use similar patents as PAEs, but many also behave like them in their patent enforcement campaigns.

2. Value and importance

Patent value is a complex subject made even more complicated by the fact that there are at least several distinct definitions. Two common meanings of patent value are the importance of the technological innovations claimed in a patent to society and, separately, the private economic value of a patent to its owner. More innovative patents will also tend to possess more private value. However, in industries like computing and communications with incremental innovation, patents covering minor technological improvements potentially possess high private value when the improvement is adopted by an entire industry.

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151. *See* BESSEN & MEURER, *supra* note 29, at 22, 200 (arguing software patents claim more abstract ideas and that with abstract ideas it is harder to "relate the words that describe patent boundaries to actual technologies").

152. *See, e.g.*, Rawls, *supra* note 149, at 570 (demonstrating the rapid rate of innovation in software development).

153. For example, it has been estimated that smartphones contain over 250,000 patentable components. Mike Masnick, *There Are 250,000 Active Patents that Impact Smartphones*, TECHDIRT (Oct. 18, 2012, 8:28 AM), https://www.techdirt.com/2012/10/18/there-are-250000-active-patents-that-impact-smartphones-representing-one-six-active-patents-today [https://perma.cc/9M4N-RB8T]. By contrast, "[i]n some industries, such as chemistry and pharmaceuticals, a single patent normally covers a single product." Dan L. Burk & Mark A. Lemley, *Policy Levers in Patent Law*, 89 VA. L. REV. 1575, 1590 (2003).

The most common and simplest measure of patent value is a simple count of the number of other patents citing a patent as "prior art."[154] The idea of patent citations, also called "citations received" or "forward citations," is analogous to the number of citations to an academic article like this one. The more that subsequent inventors know about an earlier innovation and think it is relevant to their own inventions, the more important the earlier contribution. In Table 6 below, I report the mean citations received from later-granted patents by the two groups of inventor patents and by all other litigated patents. I find that patents litigated by inventor-owned licensing firms are on average cited by over 20% more later patents than all other litigated patents (eighty-three versus sixty-eight citations received). By contrast, patents litigated by individual inventors receive only 62% as many citations as all other litigated patents (forty-two versus sixty-eight citations received). Thus, insofar as "citations received" is a good proxy of patent value, inventor-owned licensing firm patents possess higher value than individual inventor patents.

In Table 6, I also include the mean number of prior patents cited in independent inventor patents. In the literature, citations given by a patent are referred to as "backward citations." They theoretically proxy several traits, but the most plausible seems to be that patents that cite to more prior art references were more carefully drafted.[155] More careful drafting may correlate with higher-quality representation during the application's prosecution. This in turn may correlate with private patent value insofar as better legal representation correlates with higher-quality and thus a lower chance that a patent would be found invalid during litigation.

Comparison of the mean citations given among the three groups reveals a similar story as that reported for citations received. Individual inventor patents on average cite to fewer prior patents than all other litigated patents. By contrast, inventor-owned licensing firm patents on

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154. *See generally* Bronwyn H. Hall, Adam B. Jaffe & Manuel Trajtenberg, *Market Value and Patent Citations*, 36 RAND J. ECON. 16, 16 (2005) (studying "the usefulness of patent citations as a measure of the 'importance' of a firm's patents, as indicated by the stock market valuation of the firm's intangible stock of knowledge"); ADAM B. JAFFE & MANUEL TRAJTENBERG, PATENTS, CITATIONS, AND INNOVATIONS: A WINDOW ON THE KNOWLEDGE ECONOMY (2002); Manuel Trajtenberg, *A Penny for Your Quotes: Patent Citations and the Value of Innovations*, 21 RAND J. ECON. 172 (1990).

155. *See, e.g.*, Kimberly A. Moore, *Xenophobia in American Courts*, 97 NW. U. L. REV. 1497, 1507, 1538 (2003) (hypothesizing that "patents that include more citations or more diverse citations are more likely to be valid").

average cite to more prior patents than all other litigated patents. This may indicate both that individual inventor patents on average possess lower private value and also that on average they enjoyed lower quality legal assistance obtaining their patents during prosecution.

Returning to patent value, more sophisticated measures of private value exist, including some that utilize network theory to determine the importance of a patent within the entire patent ecosystem.[156] Such measures not only account for how many citations a patent receives, but also how many patents the citing patents receive, and so on. In other words, they measure the relative importance of each patent within the entire network of patented innovation. As an additional proxy for patent value, I utilize one such measure of importance scores created by Torrance and West.[157] Table 6 reports the mean importance score, mean normalized importance score accounting for the patent's age, and mean percentile importance score for the two categories of inventor-litigated patents. Table 6 also includes these averages for all other litigated patents.

156. *Id.* at 1538.

157. Torrance & West, *supra* note 126, at 468–69. They set the mean importance score for all patents to 1.0, so that a patent with an importance score of 10.0 is ten times more important than a patent with mean importance. *Id.* at 489.

Table 6. Mean Patent Citations Received—By Plaintiff Type

	Inventor-Owned Licensing Firms	Individual Inventors	Other Litigated Patents
Mean Patent Citations Received	82.9	42.3	68.3
Standard Deviation	176.5	99.6	154.2
Mean Patent Citations Given	41.7	17.3	34.1
Standard Deviation	57.9	21.9	92.4
Mean PV Score	19.1	9.3	14.8
Standard Deviation	52.0	26.8	40.4
Mean Normalized PV Score	11.0	5.4	9.1
Standard Deviation	25.5	15.4	22.1
Mean PV Percentile	86.4	84.3	86.4
Standard Deviation	19.4	19.1	18.8
N =	3,212	1,949	47,741

Note—Importance scores are calculated via a citations network method developed and applied by Javin West and Andrew Torrance.[158] Means based on all U.S. patents litigated from 2003 through 2017.

158. *Id.* at 486–88 (describing the use of eigenvector centrality and hierarchical clustering methods to evaluate the patent citation network and the relative importance of individual U.S. patents).

I find that inventor-owned licensing firms assert patents with higher importance scores than all other litigated patents (11.0 versus 9.1). Further, individual inventor patents have an average importance score that is about half that of inventor-owned licensing firms (5.4 versus 11.0) and 60% of that of other litigated patents (5.4 versus 9.1). Thus, inventor-owned licensing firm patents appear to possess, on average, higher value than other patents litigated by non-inventors, who in turn litigate higher-valued patents than individual inventors.[159]

3. Prosecuting law firm size

Acquiring patents from the PTO is expensive and typically involves an inventor, or an inventor's employer, for on-the-job innovation, hiring a registered patent attorney or agent to draft a patent application, file it with the PTO, and argue that it should be granted through ex parte proceedings between the applicant and a PTO examiner. This work of patent attorneys and agents on behalf of inventors is known as patent prosecution. An inventor's choice of legal representation in patent prosecution may indicate the level of sophistication of the inventor or their financial resources. It may also correlate with the private value of the invention since one would expect applicants to spend less money obtaining patents they perceive as less valuable.

To determine whether differences exist between the two inventor groups in their choice of patent prosecutors, I obtained the name of the prosecution law firm, where recorded by the PTO, for all patents litigated from 2003 through 2017. This data is available in PatentsView's downloadable "lawyer" patent data file.[160] Over one-quarter of the litigated patents did not have a law firm listed in PatentsView, and these appear to have been prosecuted by a sole practitioner or in-house counsel for the inventor's employer.

To categorize the law firms collected by level of expense and perhaps quality, I reviewed a publicly available selection of Intellectual Property Today's annual rankings of law firms that prosecuted the most granted patent applications. I then compiled a list of law firms that were ranked within the top-25 in these rankings during at least one of the available years: 2003, 2005, 2010, and 2017. There were thirty-eight such firms. In Table 7 below, I report the percentage of patents obtained by "No

159. *See supra* Table 6 (comparing patent citations that are inventor-owned with those of non-inventors).

160. PATENTSVIEW, *supra* note 124.

Firm," a "Top-25 Firm," and by any "Other Firm" for patents litigated by individual inventors, inventor-owned licensing firms, PAEs, and practicing entities.

Among the inventor-owned patents without an identified prosecution law firm, it is likely that almost all were obtained by a sole practitioner, inventor-owned licensing firm, or by the inventor without the aid of a patent attorney or agent.[161] Even if the PatentsView prosecution firm data is incomplete, it is reasonable to conclude that on average the patents prosecuted by a "Top-25" law firm were obtained by more experienced and more expensive patent professionals. Further, the middle category of "Other Firm" patents is plausibly intermediate between the "Top-25" and the "No Firm" groups of patents in terms of prosecution experience and cost.

Table 7. Share of Litigated Patents Obtained by Top Law Firms, Other Law Firms, or No Firm

	Individual Inventor	Inventor-Owned Firm	Other PAE	Practicing	All
No Firm	43.0%	33.1%	28.9%	24.1%	–
Top-25 Firm	5.3%	9.7%	16.7%	16.9%	–
Other Firm	51.7%	57.2%	54.4%	59.0%	–
N =	2,040	3,224	5,338	40,668	52,352

Note—Law firm names obtained from PatentsView "lawyer" data file for all patents litigated from 2003 through 2017.

Referencing Table 7, the breakdown of prosecutor categories is quite similar for both PAE and practicing entity patents, with about 17% of litigated patents in each category obtained with the help of top law firms. A much smaller share of both types of independent inventor patents was obtained by the top prosecution firms. This suggests that independent inventors tend to employ cheaper and less experienced

161. It is possible that some prosecuting law firms for some patent applications were not included in the PTO data files. However, validating those files is beyond the scope of this project.

prosecutors than practicing entities or PAEs.[162] While this indicates that inventors tend to assert lower-value patents than other plaintiffs, recall that average patent citations and importance scores are higher for inventor-owned licensing firm patents than for all other litigated patents. Thus, inventors who litigate through business organizations might possess more important and more valuable patents than the average patent litigated by a practicing entity, even while spending less money to obtain them.

While fewer litigated independent inventor patents are acquired with the help of top law firms, Table 7 reports large differences in prosecutor type across the two inventor categories. The share of inventor-owned licensing firm patents obtained with the help of top law firms is nearly twice that of individual inventors (9.7 versus 5.3%), and 10% more of the latter group's patents were acquired without any firm (43 versus 33%). These differences support the conclusion that on average inventors-owned licensing firms assert more valuable patents and also suggest they spend more money acquiring them than inventors who assert in their individual capacity. It might also indicate that litigating individual inventors possess less sophistication in locating and securing professional assistance with their patent applications.

C. Differences in Litigation Characteristics

So far, I have explored how individual inventors and inventor-owned licensing firms vary in the characteristics of their inventors and patents. Differences in the characteristics of the litigation of the two groups of independent inventors also shed light on the choice to engage in the patent monetization business through an entity or individually. Additionally, they reveal whether there are differences in the litigation success of the two groups of inventors. I begin this part of the paper by exploring the differences between individual inventors and inventor-owned licensing firms in the number of lawsuits they file. I then investigate the difference in their average time between obtaining their first patent and filing their first infringement suit. Next, I report differences in litigation law firm experience across the two groups. After, I investigate whether individual inventor complaints laud the inventor's contributions and accomplishments more frequently than inventor-owned licensing firm complaints. I follow that up by

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162. As a reminder, PAEs are patent licensing firms that acquire their patents from third parties. *Supra* note 116 and accompanying text.

explaining that differences in the professions of the inventors across the two groups might reveal that inventors sometimes sue through business organizations in order to hide characteristics of themselves that might influence the perceptions of judges and juries. I then determine differences in choice of venue and end with differences in the duration and outcome of first lawsuits.

1. Number of lawsuits asserting the same patent

In order to determine if there are differences in litigiousness across the two inventor groups, I calculated the mean number of lawsuits asserting each independent inventor patent litigated from 2003 through 2017. I also calculated the number of unique defendants sued for infringement of each patent. I use data from Lex Machina for both of these measures and also calculated them for the comparison groups of PAEs and practicing entities. Table 8 reveals large differences in litigiousness across the plaintiff categories. Individual inventor and practicing entity patents are asserted in far fewer cases on average (1.6 and 2.3, respectively) and against fewer defendants (4.5 and 4.4, respectively) than the other two groups.

PAEs are the most litigious group, with their patents asserted in an average of six cases and against twelve unique defendants. This is consistent with the robust finding in past work that PAEs often buy patents that cover widely adopted software and communications technology.[163] They do so because their business is maximizing licensing revenue. Somewhat surprising is that inventor-owned licensing firm patents are not far behind PAEs in litigiousness, with their patents asserted on average in about one less lawsuit and against 1.5 fewer defendants. Thus, not only do the patents of PAEs and inventor-owned licensing firms cover similar technology, they are also asserted with similar frequency against far more defendants than other plaintiff categories.

163. *See infra* Section V.C.6 (discussing differences in technology between PAEs and other patent owners).

Table 8. Frequency of Assertion by Patent and by Plaintiff Type

	Individual Inventor	Inventor-Owned Firm	Other PAE	Practicing
No. of Lawsuits Asserting Patent				
Mean	1.63	4.93	6.06	2.25
Stand. Dev.	0.05	0.22	0.15	0.02
P =	0.000	0.000	0.000	0.000
N =	2,040	3,224	5,338	40,668
No. of Defendants Sued in All Cases Asserting the Patent				
Mean	4.53	10.58	11.96	4.42
Stand. Dev.	0.21	0.37	0.27	0.05
P =	0.000	0.000	0.000	0.000
N =	2,040	3,224	5,338	40,668

Note—All patents litigated in U.S. federal district court from 2003 through 2017.

2. Timing of first lawsuit from patent grant and entity formation

I also investigate whether the two independent inventor groups vary in the speed with which they begin litigation. If inventor-owned licensing firms take longer to litigate their patents than individual inventors, it might indicate that they spend more time and effort trying to commercialize products before resorting to non-exclusive patent licensing as their business. If, on the other hand, non-practicing inventor plaintiffs sue quickly after their patents are granted, then it would seem less likely they attempted to commercialize their patented ideas on their own.

I obtained the filing date of the first lawsuit of each independent inventor from Lex Machina and the grant date of the oldest litigated patent of each from PatentsView. From these dates, I calculated the duration between grant and first assertion. As reported in Table 9, the times to litigation of the two independent inventor groups appear similar. Individual inventors did sue 132 days later on average than inventor-owned licensing firms (2,625 versus 2,493 days, respectively). This represents a 5.3% longer delay in the time to litigation. Nevertheless, Table 9 reveals that the two groups possess similar distributions in time to first assertion, with about 12% of individual

inventors and 11.5% of inventor-owned licensing firms suing within a year of grant of their oldest asserted patent.

Table 9. Litigation Characteristics—First Lawsuit by Unique Plaintiff

	Individual Inventor	Inventor-Owned Licensing Firm
Average Days from Patent Grant to Filing of 1st Lawsuit	2,625	2,493
No. Filing 1st Lawsuit within 90 Days of Patent Grant	37	30
% Filing 1st Lawsuit within 90 Days of Patent Grant	4.5%	3.4%
No. Filing 1st Lawsuit within 180 Days of Patent Grant	64	51
% Filing 1st Lawsuit within 180 Days of Patent Grant	7.7%	5.8%
No. Filing 1st Lawsuit within 1 Year of Patent Grant	100	101
% Filing 1st Lawsuit within 1 Year of Patent Grant	12.1%	11.6%
No. Filing 1st Lawsuit within 2 Years of Patent Grant	160	179
% Filing 1st Lawsuit within 2 Years of Patent Grant	19.3%	20.5%
No. Filing 1st Lawsuit over 3 Years after Patent Grant	604	632
% Filing 1st Lawsuit over 3 Years after Patent Grant	72.9%	72.4%
N First Lawsuits =	828	873

Note—Population of 828 first lawsuits filed by unique individual inventors and 873 first lawsuits filed by inventor-owned licensing firms between 2003 and 2017.

Over 70% of the first assertions of independent inventor plaintiffs occurred more than three years after grant of their oldest litigated patent. Despite the fact that these inventor plaintiffs are non-practicing at the time of litigation, they cannot be said to have patented in order to rush to court and start suing those who would not take a license. Rather, it is likely that most independent inventors spend years developing their technology and in many cases working to see it commercialized. Only when those efforts end do most independent inventor plaintiffs turn to litigation to monetize their patents through licensing.

Closely related to the time between patent grant and litigation, I determined the length of time between legal formation and the filing of the first infringement action of inventor-owned licensing firms. I do so for a sample of 40% of those firms. Similar to the arguments above, entities that are formed shortly before litigation would seem to be created for litigation.

Consistent with the results in Table 9, just under 55% of inventor-owned licensing firms did not file their first infringement lawsuit for more than two years after forming their business.[164] However, a sizeable minority appear to have been created solely to monetize patents. Among the 349 inventor-owned licensing firm plaintiffs whose formation dates I have determined, 20.5% were formed less than ninety days, and 31.5% were formed less than 180 days, before filing their first infringement action. This is in stark contrast with the mere 5% suing within 180 days of the grant of their oldest patent.

If my sample is representative of the population, then perhaps three-in-ten inventor-owned licensing firms were created for imminent litigation. How does that square with the finding that over 70% of inventor-owned licensing firms litigate more than three years after patenting? The complete answer is beyond the scope of this paper. However, I have observed that some of the inventor-owned licensing firm inventors that litigated shortly after formation had previously sold, or were continuing to sell, products using the technology, but through a different business organization. Nevertheless, the existence of so many entities that were formed for litigation indicates these inventor-owners perceived benefits to monetizing through a business organization rather than in their individual capacity.

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164. In fact, 54.7% (191 of 349) of the inventor-owned licensing firms studied filed their first infringement action more than two years after legal formation of the entity.

3. Inventor litigation law firm experience

I find that inventors who sue through business organizations possess more experienced litigation counsel. This likely indicates that, on average, inventors who sue individually tend to possess less money for patent enforcement, at least insofar as more experienced patent litigators are more expensive. Further, more experienced litigation counsel plausibly correlates with higher private economic patent value. In litigation, this value depends on both the probability that a patent would be found valid and infringed if litigated through a final judgment and the expected damage award. All else equal, one would expect experienced litigators to better estimate this expected litigation value and take a pass on representing owners with lower-value claims.

To determine the experience of litigation counsel, I first determined whether plaintiffs in a random sample of independent inventor first lawsuits filed their complaints pro se, or whether an attorney filed it on their behalf. Second, from Lex Machina, I obtained a list of the law firms representing plaintiffs in the most infringement lawsuits between 2003 and 2017. From the complaints, I then collected the name of the law firm representing each independent inventor plaintiff. If the law firm was one of 388 firms that, according to Lex Machina, represented patent plaintiffs in fifty or more infringement suits over the fifteen-year period of this study, I categorized the case as having "Experienced Firm Representation."

After reviewing nearly half of first assertions, I report in Table 10 the striking differences between the two groups of independent inventor plaintiffs. First, about 10% of individual inventors represent themselves pro se, suggesting some combination of lack of financing, low-value claims, and lack of sophistication. Even though the Supreme Court has held that corporations cannot represent themselves pro se,[165] I identified two inventor-owned licensing firms that tried to do so. Second, while over 70% of inventor-owned licensing firms acquire experienced firm representation, the same is true of less than 35% of individual inventors. These results suggest that both on average and at the bottom of the distribution, individual inventors assert patents with lower economic value, at least as licensing assets.

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165. Rowland v. Cal. Men's Colony, 506 U.S. 194, 208–09 (1993) (interpreting "persons" in 28 U.S.C. § 1915(d) as only applying to natural persons and not business organizations).

Table 10. Litigation Firm Characteristics—First Lawsuit by Unique Plaintiff

	Individual Inventor	Inventor-Owned Firm
No. 1st Suits with Pro Se Representation	44	2
% 1st Suits with Pro Se Representation	11.1%	0.5%
No. 1st Suits with Experienced Firm Representation	138	302
% 1st Suits with Experienced Firm Representation	34.7%	72.9%
No. of First Lawsuits Reviewed	398 of 828	414 of 873

Note—Random sample of 48% of first lawsuits.

4. Inventor recognition in the complaint (and inventor profession)

Many of the lawsuits I study were filed before the Supreme Court's adoption of heightened pleading standards in *Bell Atlantic Corp. v. Twombly*[166] and *Ashcroft v. Iqbal* (hereinafter *Twiqbal*).[167] Further, the Supreme Court did not abrogate Form 18[168] until 2015, and thereafter the Federal Circuit Court of Appeals remained silent on the impact of these events on patent infringement pleadings until 2018,[169] one year beyond the coverage of this study. Accordingly, most of the independent inventor complaints are examples of bare bones notice pleading: they state and very simply describe the causes of actions, allege ownership of the asserted patents, name the parties, and provide the basis for jurisdiction and venue. However, throughout my review, I noticed that even during the pre-*Twiqbal* era, some independent

166. 550 U.S. 544 (2007).

167. *See id.* at 545 (holding that a complaint must contain sufficient facts to be plausible on its face); Ashcroft v. Iqbal, 556 U.S. 662 (2009) (upholding *Twombly* and clarifying that its holding applies to all federal causes of action).

168. Form 18, authorized by form FRCP 84, provided a simple way to plead patent infringement that required a plaintiff to provide little more than the asserted patent number and a general statement that defendant's products infringed the patent. Fed. R. Civ. P. 84.

169. Nalco Co. v. Chem-Mod, LLC, 883 F.3d 1337, 1350 (Fed. Cir. 2018) (suggesting that plausibility pleading does not require factual allegations establishing that each element of an asserted claim is met by the allegedly infringing products).

inventor complaints included much detail about the hard work, credentials, and accomplishments of the inventors.

To test the hypothesis that more appealing inventors might tend to sue individually, I determined whether inventor plaintiffs are mentioned by name in their initial complaints.[170] Further, for both types of inventor, I determined whether the inventor's efforts, contribution, or pedigree were lauded in that first filing. Table 11 reports results from a random sample of just over 50% of first lawsuits. Surprisingly, I find that half of inventor-owned licensing firm complaints do not even name the inventor(s) of the patent. In these cases, the business entity plaintiff simply asserts that it owns the patent. Further, individual inventor complaints laud the inventor(s) hard work, credentials, and contributions to innovation nearly twice as frequently as inventor-owned licensing firm complaints (29.6 versus 16.4%).[171]

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170. In individual inventor cases, the inventors are always mentioned because they are the plaintiffs.

171. One example of inventor promotion by an inventor-owned licensing firm is in *Advanced Aerospace Technologies, Inc. v. Boeing Co.* where plaintiff alleged that inventor non-party:

"William Randall McDonnell is a member of the McDonnell family of aviation pioneers who founded McDonnell Aircraft. He holds a BSE majoring in Aeronautical Engineering from Princeton and an MBA from Washington University. Mr. McDonnell is the President and sole owner of AATI." Complaint For Willful Patent Infringement at 3, Advanced Aerospace Techs., Inc. v. Boeing Co., No. 12-cv-00226-RWS (E.D. Mo. Feb. 9, 2012).

Another inventor-owned licensing firm example of inventor promotion is in *Akeva, L.L.C. v. Nike, Inc.*, where plaintiff alleged: "David Meschan is an avid runner who experienced shoe performance problems spanning his years as a runner, primarily during the 1990s. The problems he noticed included among other issues the loss of cushioning and/or spring over the life of the shoe resulting from compression of foam in the heel region during use. To address these problems, Mr. Meschan came up with several ideas for athletic shoes including, without limitation, a cushioning technology for use in the heel region of such shoes. Mr. Meschan sought patent protection for his ideas and became the inventor (or co-inventor) on more than 30 issued patents in the United States pertaining to improvements in athletic shoes. After filing for the first of these patents in the mid-1990s, Mr. Meschan developed prototypes and approached several leading shoe companies to assess their interest. Akeva was founded in October of 1994 by Mr. Meschan as a holding company for his patents and as a vehicle for the licensing to athletic shoe manufacturers." Complaint For Patent Infringement at 7, Akeva, L.L.C. v. Nike, Inc., No. 1:09-CV-659 (M.D.N.C. Nov. 4, 2003).

One fun example of an individual inventor plaintiff lauding his accomplishments is in *Richardson v. Samsung Electronics Co.*, where plaintiff Douglas Richardson asserted:

Table 11. Complaint Characteristics—First Lawsuit by Unique Plaintiff

	Individual Inventor	Inventor-Owned Firm
Inventors' Effort/Contribution Lauded?	29.6% (133/450)	16.4% (80/488)
Inventor Mentioned?	NA	49.2% (240/488)
Num. of First Lawsuits Reviewed	450 of 828	488 of 873

Note—Random sample of 56% of first lawsuits filed by independent inventors over the period 2003 through 2017. Number of first lawsuits, of those reviewed, that laud or mention the inventors by name in parenthesis.

These results suggest that some inventors (or their counsel) are more likely to choose to litigate individually when they believe that they (or their clients) are appealing claimants. After all, in individual inventor cases, the plaintiff is placing a human being front and center in the dispute. The possibility that inventor appeal might influence plaintiff type seems to be supported by prior work finding that in patent litigation, juries are biased in favor of individuals and against corporations.[172] But if patent juries tend to be biased in favor of inventors, then why would half of inventor-owned licensing firms fail to even name the inventor-owners of the firm?

Before exploring that question, I note that of course some inventor-owned licensing firm complaints laud the non-party inventors. However, they do so only about half as often as individual inventor plaintiffs. Thus, the data is consistent with the idea that inventors who

"Richardson has worked in various capacities as a professional photographer. Starting with his college internship at the Texas Parks and Wildlife Department, Richardson has worked for more than two decades shooting for sports publications, commercial videos, and online advertising . . . . In the late 1990s, Richardson worked for the University of Texas as a photographer for the UT Cheerleading Team." Plaintiff's Original Complaint at 4–5, Richardson v. Samsung Elecs. Co., No. 6:17-cv-428 JRG (E.D. Tex. July 24, 2017). It seems these accomplishments might be most impressive to judges and juries in the State of Texas, where Richardson filed his complaint.

172. Moore, *supra* note 33, at 69 (finding that in jury trials between corporations and individuals, individuals prevailed 74% of the time, while in bench trials, individuals, and corporations experienced similar rates of success).

believe they are personally appealing will tend to sue as natural persons, or at least laud themselves in their licensing firm's complaint. The corollary is that if an inventor prefers to obscure their role in the litigation, they might be more likely to sue through a firm.

Why might some inventors choose to minimize the attention they receive as individuals during their patent assertion, despite the evidence that juries favor individuals? One reason could be low public opinion of the inventor's profession. Polls consistently show that the public holds a low opinion of some professionals, including attorneys, and a high opinion of others, including medical doctors. For example, in its December 2020 poll asking respondents to "rate the honesty and ethical standards of people" in different fields, Gallup found that 77% of respondents had a "very high" or "high" opinion of medical doctors, while only 3% had a "low" or "very low" opinion of them.[173] In stark contrast, only 21% had a "very high" or "high" opinion of lawyers, and 30% had a "low" or "very low" opinion of our profession.[174]

Again, this was a poll of honesty and ethical standards. It seems plausible that juries might carry over their general opinion of persons in different fields when judging inventor plaintiffs. And in fact, within the sample of cases in which I have identified the inventor's education, a whopping 25.7% of inventor-owned licensing firms have an inventor owner who is also an attorney (48 of 187). By contrast, only 13.6% of a 10% sample of individual inventors include attorney inventors (12 of 88). In further contrast, it appears that medical doctor inventors more frequently sue individually than through business organizations.[175]

Finally, there is an even more compelling reason why some attorney-inventors might avoid suing as individuals beyond the risk that juries might consider them dishonest. Some clients or prospective clients, especially those who might find themselves as defendants in patent litigation, may object to their attorney moonlighting as a PAE. These situations appear rare, perhaps because the consequences can be

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173. *Honesty/Ethics in Professions*, GALLUP (Dec. 1–16, 2021), https://news.gallup.com/poll/1654/honesty-ethics-professions.aspx.

174. *Id.* Yes, we are underwater. However, a few other fields are rated less honest and ethical than attorneys; a higher percentage of respondents had a "low" or "very low" opinion of business executives (36%), car salespeople (37%), advertising practitioners (43%) and, last and least, Members of Congress (63%). *Id.*

175. Within the admittedly non-random sample of cases where I have determined whether or not an inventor was a medical doctor, 32% of individual inventors (29 out of 88) and a mere 12% of inventor-owned licensing firms (23 of 187) possess a medical doctor inventor.

career-ending. In 2007, a prominent international IP law firm fired one of its principals after the firm discovered that his shell LLC sued the firm's client, asserting patents that the principal invented and in which he retained a stake.[176]

5. Venue

As I and others have discussed in past work, forum shopping was rampant in patent litigation for nearly two decades prior to the Supreme Court's 2017 decision in *TC Heartland L.L.C. v. Kraft Foods Group Brands L.L.C.*[177] During the period of permissive patent venue, the Eastern District of Texas rose to become the forum of choice for patent plaintiffs, especially PAEs, at least in part due to local rules adopted by that court to attract patent litigation.[178] For similar reasons, the District of Delaware served as the second-choice venue prior to *TC Heartland* and, as predicted, replaced the Eastern District of Texas as the district with the most filed patent lawsuits.[179] In fact, during the year before *TC Heartland*, over 50% of all new patent cases in the United States were filed in just these two districts.[180] Further, over 80% of that litigation was driven by PAEs.[181] These facts suggest that frequent selection of Delaware or the Eastern District of Texas indicates a non-practicing licensing business model.

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176. *See* Mike Masnick, *Patent Troll Attorney Licensed Patents to Be Used Against His Own Firm's Clients*, TECHDIRT (Oct. 19, 2007, 6:22 PM), https://www.techdirt.com/articles/20071019/020936.shtml (describing an attorney who licensed his patents to others who would then sue his firm's clients for infringement, thereby allowing the attorney to personally collect some of the profits).

177. *See, e.g.*, Miller, *supra* note 145, at 782; Colleen V. Chien & Michael Risch, *Recalibrating Patent Venue*, 77 MD. L. REV. 47, 49 (2017); TC Heartland LLC v. Kraft Foods Grp. Brands LLC, 581 U.S. 258 (2017).

178. *See, e.g.*, J. Jonas Anderson, *Court Competition for Patent Cases*, 163 U. PA. L. REV. 631, 653 (2015) (arguing that "[t]he speed, large damage awards, outstanding win-rates, likelihood of getting to trial, and plaintiff-friendly local rules suddenly made the Eastern District the venue of choice for patent plaintiffs" during the mid-2000s); Daniel Klerman & Greg Reilly, *Forum Selling*, 89 S. CAL. L. REV. 241, 245 (2016) (alleging that the Eastern District of Texas engaged in "forum selling" by adopting rules attractive to patent plaintiffs).

179. Ofer Eldar & Neel U. Sukhatme, *Will Delaware Be Different? An Empirical Study of* TC Heartland *and the Shift to Defendant Choice of Venue*, 104 CORNELL L. REV. 101, 122 (2018).

180. Miller, *supra* note 145, at 783 tbl.2.

181. *Id.* at 788–89 tbl.3 (demonstrating that the same was true of less than one quarter of new cases in the nation's other ninety-two federal district courts).

In order to determine the frequency with which independent inventors selected these and other districts, I obtained the venue of each first assertion from Lex Machina. In Table 12, I report the number and percentage of lawsuits filed in the five federal districts that were most popular with inventor-owned licensing firms. I find that between 2003 and 2017, 23% of inventor-owned licensing firm cases were filed in the Eastern District of Texas, and another 7.8% were filed in Delaware. By contrast, only 4.5% of individual inventor first assertions were filed in the Eastern District of Texas and another 1.4% in Delaware. Along with the number of assertions per patent and technology, this suggests that a significant share of inventor-owned licensing firms behaves like PAEs.

Table 12. Litigation Venue—First Lawsuit by Unique Plaintiff

	Individual Inventor	Inventor-Owned Firm
No. 1st Suits Filed in E.D. Texas	37	202
% 1st Suits Filed in E.D. Texas	4.5%	23.1%
No. 1st Suits Filed in D. Delaware	12	68
% 1st Suits Filed in D. Delaware	1.4%	7.8%
No. 1st Suits Filed in C.D. California	73	65
% 1st Suits Filed in C.D. California	8.8%	7.4%
No. 1st Suits Filed in N.D. California	54	60
% 1st Suits Filed in N.D. California	6.5%	6.9%
No. 1st Suits Filed in N.D. Illinois	39	45
% 1st Suits Filed in N.D. Illinois	4.7%	5.2%
Total No. of 1st Lawsuits	828	873

Note—Population of first lawsuits by unique independent inventor plaintiffs filed from 2003 through 2017.

While half of all inventor-owned licensing firm first assertions were filed in the five districts listed in Table 12, the same is true of only about one-quarter of individual inventors. In other work, I show that in the year before *TC Heartland*, two-thirds of all patent infringement lawsuits were filed in the plaintiff's "home court," which I define as the district

containing that plaintiff's principal place of business.[182] Returning to this study, I find that 75% of individual inventor first assertions were filed in the state containing the plaintiff's principal place of business. The same is true of only 65% of inventor-owned licensing firm first assertions.

Thus, it appears that inventor-owned licensing firms more frequently litigate away from home, despite the fact that venue would have been proper in their home court. The greater propensity of inventor-owned licensing firms to travel supports the conclusion that independent inventors who sue through business organizations more frequently engaged in forum shopping. It also complements earlier inferences that these firms possess, on average, patents with higher private economic value that are plausibly infringed by more third parties.

6. Lawsuit duration and outcome

Much prior work has shown that different kinds of patent owners vary in their motivations for obtaining and enforcing patents and, as a result, behave differently in litigation.[183] For example, product companies are often interested in excluding their competitors from using their technology, while PAEs are, by definition, primarily interested in maximizing revenue from licenses.[184] These differences, in turn, are reflected in differences in litigation outcomes.[185]

To test whether there are differences in independent inventor litigation outcomes depending on whether or not they sue through a business organization, I collected lawsuit outcomes and case durations

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182. Shawn P. Miller, *There's No Place like Home (to File Your Patent Lawsuit)*, Working Paper 2021 (on file with the author).

183. *See, e.g.*, Chien (2009), *supra* note 37, at 1600–06 (finding that different entities varied in their approaches to high technology litigation).

184. Miller et al., *supra* note 42, at 238; *see also* Chien (2010), *supra* note 23, at 300 (defining PAEs as entities that use patents primarily to gain licensing fees rather than to commercialize or transfer technology).

185. *See, e.g.*, Miller et al., *supra* note 42, at 267 (analyzing settlement rates for claims brought by different types of patent owners); John R. Allison, Mark A. Lemley & David L. Schwartz, *How Often Do Non-Practicing Entities Win Patent Suits?*, 32 BERKELEY TECH. L.J. 237, 237 (2017) (examining the success of subcategories of patent owners within the NPE group); Christopher A. Cotropia, Jay P. Kesan, & David L. Schwartz, *Heterogeneity Among Patent Owners in Litigation: An Empirical Analysis of Settlement, Case Progression, and Adjudication* 17, 22 (Hoover Inst. Working Grp. on Intell. Prop., Innovation, & Prosperity, Working Paper No. 16008, 2016) (finding that individual inventor "cases were resolved faster").

from Lex Machina. I collected this information for all lawsuits filed from 2003 through 2017, and I separately report descriptive statistics for first assertions. Table 13, below, includes differences in settlement rates, case durations, docket entries filed, and the rates of winning judgment on the merits.[186]

In Table 13, we see that the two inventor groups settle their lawsuits at about the same rate.[187] By contrast, it appears that individual inventors more frequently win cases decided on the merits. For example, individual inventors win about 6% more of their first assertions decided on the merits than inventor-owned licensing firms. However, prior work suggests that the lower inventor-owned licensing firm win rate is another product of technology differences.[188]

Indeed, in unreported regressions, I find that, when controlling for NBER technology categories, there is no statistically significant difference in the win rate across the two plaintiff types. Further, inventor plaintiffs are about 20% less likely to win decisions on the merits when their patents cover Computer and Communications technologies. The reason is that many of these patents protect software and electronic business methods, which tend to possess a more uncertain scope than other types of patents.[189] This greater uncertainty leads NPEs asserting software patents to more frequently litigate to a judgment of non-infringement.[190]

In Table 13, I also report interesting differences between the two categories of inventor disputes in the average duration and in the number of docket entries. The number of docket entries is a proxy for

186. I define a merit win as including not only summary and trial judgments that a patent is valid and infringed, but also consent judgments when defendants expressly admit that they have infringed valid patents of the plaintiff.

187. A series of unreported regressions confirmed that there is no statistically significant difference in settlement rates between the two groups when controlling for NBER technology categories.

188. *See, e.g.*, John R. Allison, Mark A. Lemley & David L. Schwartz, *Our Divided Patent System*, 82 U. CHI. L. REV. 1073, 1099 (2015) (finding significant differences across technologies in infringement plaintiff win rates, including that software patents do worse than those in most other technology fields).

189. *See* Bessen & Meurer, *supra* note 29, at 200 (arguing software patents claim more abstract ideas and that with abstract ideas it is harder to relate the words that describe patent boundaries to actual technologies).

190. *See, e.g.*, Allison et al., *supra* note 188, at 1124–25 (finding that "[t]he vast majority of software patent losses are on noninfringement").

both the length and cost of litigation.[191] Among first assertions, the average individual inventor case is only 81% as long as the average inventor-owned licensing firm suit (472 versus 583 days). Further, only 58% as many docket entries are filed by the parties in the average individual inventor suit as are filed in the average inventor-owned licensing firm case (74.4 versus 127.3). Unlike settlement and win rates, in the unreported regressions, these differences are statistically significant when controlling for technology.

The findings that individual inventor plaintiffs' cases are shorter and include fewer docket entries than those of inventors who sue through business organizations may reflect the tendency of individual inventor plaintiffs to possess less valuable patents and also less expensive litigation counsel. They might also reflect a tendency for inventor-owned licensing firms to sue more defendants in the same lawsuit, increasing the complexity of the dispute. Interestingly, the merits win and settlement rates of the two inventor groups are indistinguishable, suggesting that shorter and less expensive first lawsuits do not disadvantage individual inventors in comparison with inventor-owned licensing firms.

191. *See* Jay P. Kesan & Gwendolyn G. Ball, *How Are Patent Cases Resolved? An Empirical Examination of the Adjudication and Settlement of Patent Disputes*, 84 WASH. U. L. REV. 237, 281 (2006) (arguing that the "number of documents filed in the case is probably more closely correlated with actual costs" compared to case duration, "particularly in the form of 'billable hours' of attorney time").

Table 13. Litigation Duration and Outcomes

	Total Assertions		First Assertion	
	Individual Inventor	Inventor-Owned Firm	Individual Inventor	Inventor-Owned Firm
Settlement Rate	91.4%	95.0%	86.7% (617)	85.2% (661)
N=	2027	5977	712	776
Merits Win Rate	34.6%	25.8%	36.4% (43)	30.5% (40)
N =	243	349	118	131
Average Duration of Terminated cases	395 days	357 days	472 days	583 days
N =	2663	6721	828	873
Average No. Docket Entries	56.2	67.4	74.4	127.3
N =	2810	7240	828	873

Note—Population of First and Total lawsuits by unique independent inventor plaintiffs filed from 2003 through 2017. Merits win rate calculated by dividing the number of lawsuits ending with a final judgment that a defendant infringed a valid patent, after trial, summary judgment, judgment on the pleadings, judgment as a matter of law, or consent judgment, by the total number of cases ending with final judgments after one of these events.

7. Fee shifting and limited liability

The lack of significant differences across the two inventor groups in settlement and win rates appears to cut against the theory that inventors who sue through business organizations do so because they are more concerned than individual inventors about paying their opponents attorneys' fees and costs and thus perceive a greater need for the protections of limited liability than individual inventor

plaintiffs. Fee shifting is possible but rare in patent cases.[192] Further, under Federal Rule of Civil Procedure 54(d), the prevailing party is entitled to costs.[193]

Using outcome data from Lex Machina, I determined whether courts more frequently penalize inventor-owned licensing firm plaintiffs with fee shifting and awards of costs to defendants. I find that it is indeed rare for independent inventors to pay defendants' fees and costs. However, inventor-owned licensing firms are ordered to pay defendants more frequently. Further, when they do, they pay more than individual inventors. Among 873 first assertions by inventor-owned licensing firms, I find only six cases (0.7%) with awards of costs and attorneys' fees pursuant to Section 285 or Rule 11. In another thirty-one first assertions, only costs were awarded (3.6%). By contrast, among the 828 individual inventor first assertions, two cases awarded fees and costs (0.2%), and another eighteen included court awards of costs (2.2%). Concerning the size, the average award of costs to defendants in individual inventor first assertions was $38,200, while it was $54,500 in inventor-owned licensing firm cases. The average award of fees and costs when the court shifted attorneys' fees to the defendant was $458,000 for individual inventors and $614,866 for inventor-owned licensing firms.

These numbers suggest that limited liability might in fact play a role in the decision of some independent inventors to sue through business organizations, perhaps particularly inventors who organize shortly before a licensing campaign. The possibility that some savvier independent inventors create a patent-holding limited liability organization in anticipation of the risk of fee shifting is supported by my earlier estimate that over 60% of inventor-owned licensing firms possess non-inventor stakeholders, who usually provide business and litigation expertise. These partners might find that the cost of creating an LLC is cheap when compared to a 1% chance of paying a defendant around $500,000. Further, inventors who sue through business organizations possess more experience patenting and litigating, and

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192. *See* 35 U.S.C. § 285 (allowing a court to grant attorneys' fees to the prevailing party in exceptional cases); Lionel M. Lavenue, Sean D. Damon & R. Benjamin Cassady, *Making the Nonprevailing Party Pay: The Statistics of Exceptional Cases Two Years After* Octane *and* Highmark, FINNEGAN, Table 1, https://www.finnegan.com/en/insights/articles/making-the-nonprevailing-party-pay-the-statistics-of-exceptional.html (fees shifted in only ten patent cases decided in 2002 and twenty cases decided in 2011).

193. Fed. R. Civ. P. 54(d)(1).

the research on choice of legal form of organization includes evidence that more experienced entrepreneurs select more complex LFOs.[194] By contrast, one of the two individuals ordered to pay fees demonstrated his lack of understanding of the risk of fee shifting by litigating pro se.[195]

D. Multivariate Analysis

The differences between the two types of independent inventor plaintiffs reported above are revealing and real, given that I have used population data for most of the traits. However, many of the inventor, patent, and litigation characteristics studied are intercorrelated. In order to determine which traits most powerfully explain plaintiff type, I run a series of probit regressions[196] of the likelihood that an independent inventor will assert her patents through an inventor-owned licensing firm.[197] First, I discuss the results from a model controlling for eighteen independent variables from the population of the oldest patent asserted in the first lawsuit of each unique independent inventor plaintiff. I then report separate regressions with random samples of three additional important, but difficult-to-collect, variables: litigation counsel experience, the number of patents obtained by the inventor, and whether the complaint lauds the inventor. The results of these regressions are consistent with the descriptive analysis above and support the conclusions that inventors who sue through business organizations tend to possess more experience patenting and to assert more valuable patents. They are also less interested in placing their human inventors at the center of their litigation.

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194. *See, e.g.*, Cole & Sokolyk, *supra* note 68, at 2 (finding entrepreneurs are more likely to choose a complex LFO if they have more education, more experience starting businesses, and more time invested in the firm).

195. Pazandeh v. Yamaha Corp. of Am., No. SACV 16-01849 JVS (DFMx), 2017 WL 6940551, at *1 (C.D. Cal. July 25, 2017), *aff'd*, 718 F. App'x 975 (Fed. Cir. 2018) (per curiam).

196. Probit regression is used to model dichotomous or binary outcome variables. In the probit model, the inverse standard normal distribution of the probability is modeled as a linear combination of the predictors. *See Probit Regression | Stata Data Analysis Examples*, UCLA OFF. ADVANCED RSCH. COMPUTING, https://stats.oarc.ucla.edu/stata/dae/probit-regression.

197. I report the marginal effects for each independent variable using Stata's *dprobit* command.

1. Eighteen variables, oldest patent in first assertions

For the first set of multivariate regressions, I selected eighteen variables to determine which differences observed above are statistically significant after accounting for intercorrelation. I selected these eighteen with two considerations in mind: first, the magnitude of the difference in the trait between the two inventor groups reported above, and second, their representativeness of the various categories of data collected.[198] The variables selected are listed below in the first column of Table 14, which also presents the results of five specifications. The first four regressions omit one variable highly correlated with other included traits in order to show its impact on the other variables. The fifth includes all eighteen characteristics.

In Table 14, I report that the presence of co-inventors on the patent is a highly significant positive indicator that an independent inventor plaintiff will litigate through an inventor-owned licensing firm. Again, this is my proxy for the need of independent inventors with co-owners of their patents to pre-commit to cooperation. Apart from one technology category, the impact of possessing co-inventors on plaintiff type is greater than that of any of the other variables. Indeed, the marginal effect of possessing co-inventors is that inventors are over 26% more likely to litigate through a business organization.

Turning to patent characteristics, Table 14 includes the number of backward citations. Again, this theoretically captures crowding in the field of the invention or, alternatively, the prosecutor and examiner's diligence in cataloguing relevant prior art. The latter, in turn, is theoretically correlated with the quality of the patent. Across all specifications, the patents of inventor-owned licensing firms possess significantly more backward citations to earlier-issued patents than those of individual inventors. The magnitude of the effect is perhaps surprisingly large, with ten additional citations to prior art associated with a 4% increase in the probability of an inventor suing through a business organization.

Table 14 also includes both forward citations and Torrance and West's importance scores. Both of these theoretically proxy patent value and possess a positive statistically significant relationship with the likelihood an independent inventor sues through a business organization. The fact that both are significant indicates that they are not identical proxies. Rather, inventor-owned licensing firm patents

198. I also avoid including highly correlated or collinear variables from the same group of characteristics in the same regression.

possess greater private economic value and are also a more important part of the ecosystem of patented innovation. The marginal effect of forward citations is that patents with ten more citations are between seven and 8% more likely to be asserted by inventor-owned licensing firms. The marginal effect of importance is that a ten percentile increase in importance score is associated with about a 2 to 4% increase in the likelihood that an inventor will sue through a business organization.

The year that the oldest patent was granted is significant across the four specifications where it is included and indicates that the newer the asserted patent, the more likely the inventor filed suit through a business organization.[199] Recall from Table 10 that the two inventor groups possess similar lags between patent grant and first assertion. This fact, along with the independent significance of grant year, indicates that, more recently, independent inventors are more frequently litigating through business organizations. The marginal effect of the oldest asserted patent being granted one year later is about a 1% increase in the likelihood that the patent is asserted by an inventor-owned licensing firm.

The results in Table 14 also indicate that patents prosecuted without a law firm are significantly more likely to be asserted by individual inventors, with a marginal effect of over 10%. This result supports the conclusion that individual inventor plaintiffs tend to spend less money on prosecution, perhaps because on average their patents are less valuable. It is also possible that some individual inventor plaintiffs place less value on law firm prosecution or lack the experience and information necessary to locate and enlist professional services.

Interestingly, whether or not an independent inventor hired a top prosecution law firm to obtain her patents is not a significant predictor of plaintiff type. This is surprising given the result in Table 8 that inventor-owned licensing firm inventors employed top prosecution firms at nearly twice the rate as individual inventors (9.7 versus 5.3%). The lack of significance appears to be the result of small correlations between this variable and a variety of others in Table 14. Lack of any prosecution firm is most correlated with top firm prosecutor ($r = -0.22$). Excluding it in specification 3, the magnitude of the top

199. Note that when grant year is omitted in specification 2, the magnitude and significance of forward citations and importance score declines. The reason is that newer patents have not existed as long as older patents and thus there has been less opportunity for other inventors to cite them.

prosecution firm and its significance does increase. This suggests that use of a top law firm prosecutor does have some power in predicting inventor type, but not as much as the "no prosecution firm" variable and other proxies for patent value and inventor resources.

Finally, the regressions in Table 14 include dichotomous variables for five of the six NBER technology categories. "Other" is the category omitted to avoid multicollinearity.[200] The marginal effects and significance of the technology categories reported in Table 14 are less useful since they must be interpreted in relation to the omitted "Other" technology category. To obtain estimates of the impact of each NBER technology category in relation to all others, I ran six additional unreported regressions that include one and only one NBER category and all other variables included in specification 5 of Table 14. From these, I find that inventor-owned licensing firms are not significantly more or less likely to assert Chemical, Drug & Medical, or Electrical patents. The other three categories are statistically significant predictors of inventor type. Regarding marginal effects and the level of significance, Computer & Communications patents are 25% more likely than all other patents to be asserted by inventor-owned licensing firms ($p = 0.000$); Mechanical patents are 8% less likely to be asserted by inventor-owned licensing firms ($p = 0.021$); and Other patents are 18% less likely to be asserted by inventor-owned licensing firms ($p = 0.000$).

Turning to litigation characteristics, consistent with the descriptive analysis, inventor-owned licensing firm first lawsuits include significantly more docket entries than individual inventor first lawsuits. The addition of ten more entries to a litigation docket is associated with about a 0.3% increase in the likelihood that the independent inventor sues through a business organization rather than as a natural person.

By contrast, the number of unique defendants ("alleged infringers") ever sued for infringement of the patent is not statistically significant in the regressions in Table 14. This is surprising, given the finding in Table 8 that patents litigated by inventor-owned licensing firms were on average asserted against 10.6 different defendants, while that number is only 4.5 for individual inventors. The explanation is both

200. Multicollinearity occurs when one variable in a regression model can be linearly predicted from the others. For an explanation of dichotomous variables and the problem of multicollinearity, *see* Daniel B. Suits, *Use of Dummy Variables in Regression Equations*, 52 J. AM. STAT. ASS'N 548, 548–51 (1957).

complex and simple. It is complex because there are several interesting correlations between the number of infringers and other patent traits, including that it covers Computer & Communications technology (r = 0.23), has more claims (r = 0.21), and has more patents citing it as prior art (r = 0.16). These correlations support the theory that software patents tend to possess arguably broad scope given their use of abstract functional language.[201] They also suggest that software innovation tends to be adopted by more parties.

The simple explanation why the number of alleged infringers is not significant is that Computer & Communications patents have been a favorite tool of PAEs because of their broad scope and widespread adoption. We also know that the Eastern District of Texas was by far the favorite venue of PAEs during the years of this study. Thus, it is not surprising that the number of alleged infringers is most highly correlated with the first lawsuit being filed in the Eastern District of Texas (r = 0.27). In fact, simply omitting that venue indicator from the fifth regression in Table 14 results in the number of alleged infringers becoming statistically significant (p = 0.020), with ten additional alleged infringers associated with a 2.7% increase in the likelihood the inventor sues through a business organization. Thus, independent inventors are more likely to litigate via a business organization when they file their first suit in the Eastern District of Texas, and when they do, there are more likely to be more follow-on lawsuits.

Finally, the number of days from the grant of the oldest patent to filing the first lawsuit is significant to the 90% confidence level in four specifications in Table 14. Even this amount of explanatory power is surprising, given the finding in Section V.C.2[202] above, of little difference in the time to first suit between the two types of independent inventors. The explanation for the significance is the high negative correlation between time to first lawsuit and the year the oldest patent was granted (r = -0.77).[203] Quite simply, newer patents in the dataset cannot have had as long of a delay to first assertion as older patents, given the fixed fifteen years of litigation in this study. Accounting for this bias in data, inventor-owned licensing firms on

201. *See* Bessen & Meurer, *supra* note 29, at 200.

202. *See supra* Section V.C.2.

203. To demonstrate the point, I re-ran specification 5 in Table 14 excluding the year the oldest patent was granted. This resulted in the coefficient on "Days Grant to Filing" decreasing by an order of magnitude to -0.000006 with p = 0.463.

average do in fact file their first lawsuit after a longer post-grant delay than do individual inventor plaintiffs.

Table 14. Probit Regressions of Likelihood of an Independent Inventor Suing Through an Inventor-Owned Licensing Firm Rather Than as an Individual Inventor—Oldest Patent in 1st Lawsuit

	1	2	3	4	5
Inventor Characteristics					
Co-Inventors on Patent?	0.272***	0.265***	0.269***	0.262***	0.263***
Patent Characteristics:					
Backward Citations	0.0039***	0.0041***	0.0040***	0.0038***	0.0037***
Norm. Forward Citations		0.0072**	0.0078***	0.0080***	0.0076***
Importance Score Percentile	0.388***	0.178*	0.296***	0.312***	0.305***
Year Patent Granted	0.012***		0.013***	0.012***	0.012***
Large Prosecution Firm	0.061	0.064	0.097*	0.055	0.058
No Prosecution Firm	-0.106***	-0.109***		-0.105***	-0.104***
1. Chemical	0.124**	0.134**	0.138**	0.132**	0.130**
2. Computer & Comm	0.330***	0.325***	0.307***	0.318***	0.310***
3. Drug & Medical	0.111**	0.101*	0.097*	0.097*	0.098*
4. Electrical	0.146***	0.149***	0.144***	0.144***	0.140***
5. Mechanical	0.060	0.060	0.062	0.058	0.057

Litigation Characteristics					
Docket Entries	0.0004***	0.0003***	0.0003***	0.0004***	0.0003***
No. of Alleged Infringers	0.0021*	0.0018	0.0020		0.0019
Days Grant to Filing	0.00002*	0.00000	0.00002*	0.00002*	0.00002*
Filed in E.D. Tex.	0.253***	0.264***	0.248***	0.265***	0.251***
Filed in N.D. Cal.	-0.033	-0.023	-0.034	-0.032	-0.035
Filed in D. Del.	0.243***	0.267***	0.251***	0.254***	0.246***
(Pseudo) R-squared	0.24	0.24	0.24	0.25	0.25
N=	1701	1701	1701	1701	1701

Note—Population of 1,701 patents that were the oldest asserted in the first lawsuit of an independent inventor between 2003 and 2017. Marginal effects reported with discrete change of dichotomous variables from 0 to 1.
* $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.

This result indicates that the average inventor-owned licensing firm tends to spend more time attempting to refine or commercialize their inventions than the average individual inventor plaintiff. However, this is not true of the segment of inventor-owned licensing firms that appear to have adopted a licensing business from their inception. Recall that in Section C.2 above, I also reported that 32% of inventor-owned licensing firms file suit within 180 days of entity formation. These clearly have not been engaged in long-term efforts to commercialize. The difference between the significance of the time to litigation variable and the 32% that are quick to litigate demonstrates that not all independent inventors who sue through business organizations have the same motivations for inventing and patenting.

2. Select samples, oldest patent in first assertions

As previously explained, several of the variables that I include in this study have been incredibly time consuming to collect. However, three of these are theoretically important in determining why some independent inventors litigate through business organizations while

others do so in their natural capacity. The first, the number of patent families obtained by independent inventors, is a plausible proxy for a plaintiff's experience patenting and inventing. Greater experience in an industry, in turn, has been found in the choice of legal form of organization literature to be associated with the selection of a more complex business form at the start of a new venture. I argue that the second variable, whether or not a complaint includes allegations that promote the inventor's achievements, captures the degree to which inventors and their attorneys want the human inventors to be prominent in the litigation. The third variable, use of experienced litigation counsel, undoubtedly correlates with the economic value of the disputes and perhaps the level of sophistication of the inventors.

Turning to the multivariate analysis of the importance of inventor experience patenting and inventing in determining plaintiff type, Table 15 reports a series of five probit regressions, each using a random sample of 823 first lawsuits with the number of patent families granted to an inventor as the first dependent variable.[204] Consistent with the descriptive results in Section V.A.4[205] that inventors who sue through business organizations have been granted patents from 40% more patent families than those suing in their individual capacity, the variable is statistically significant across all five specifications in Table 15. The addition of ten more patent families granted to an inventor is associated with between a 4 and 5% increase in the probability that the inventor will sue through a business organization. This appears to be strong evidence, consistent with the choice of legal form of organization literature, that more experienced inventors are more likely to engage in the business of patent licensing through a more complex legal form of business organization.

In Table 15, independent inventors with co-inventors continue to be significantly more likely to litigate through a business entity. The robustness of this finding provides strong support for the theory that pre-commitment to coordination is a principal reason that some independent inventors chose to litigate through business organizations. As further evidence of the importance of co-inventors, note the much lower Pseudo R-squared in specification 1, which omits

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204. When there are multiple co-inventors of the oldest asserted patent, I determined the number of patent families attributable to each inventor and then use the number of distinct families of the most prolific inventor as the count for that group of inventor co-plaintiffs.

205. *See supra* Section V.A.4.

the co-inventor variable, compared with the value in other specifications that include it. This indicates that models of the type of independent inventor plaintiff that include the presence of coinventors better explain the type of independent inventor than models that exclude it.[206]

The remaining results in Table 15 are consistent with those in the full regressions in Table 14. Importance score remains highly significant in the regressions in Table 15, indicating that inventors of more important patents tend to litigate through business organizations. Large prosecution firm continues to be a positive predictor of suing through a business organization, though the statistical significance continues to be weak due to correlations with other variables. The number of alleged infringers is statistically significant and positive in Table 15.

206. *See FAQ: What Are Pseudo R-Squareds?*, UCLA OFF. ADVANCED RSCH. COMPUTING, https://stats.oarc.ucla.edu/other/mult-pkg/faq/general/faq-what-are-pseudo-r-squareds (explaining that a higher pseudo R-squared value indicates better model fit).

Table 15. Probit Regressions of Likelihood of an Independent Inventor Suing Through an Inventor-Owned Licensing Firm Rather Than As an Individual Inventor—Oldest Patent in 1st Suit

	1	2	3	4	5
No. Inventor Patents	0.0051***	0.0046***	0.0045***	0.0044***	0.0041***
Co-Inventors on Patent?		0.409***	0.406***	0.399***	0.403***
Importance Score Percentile			0.324***	0.322***	0.285**
Large Prosecution Firm				0.132	0.136*
No. of Alleged Infringers					0.0030**
1. Chemical	0.161*	0.165*	0.164*	0.160*	0.164*
2. Computer & Comm	0.458***	0.424***	0.421***	0.415***	0.396***
3. Drug & Medical	0.197***	0.206***	0.192***	0.188***	0.181**
4. Electrical	0.228***	0.231***	0.226***	0.224***	0.218***
5. Mechanical	0.073	0.100*	0.098	0.103*	0.092
(Pseudo) R-squared	0.13	0.21	0.21	0.21	0.22
N=	823	823	823	823	823

Note—Random sample of 823 of 1,701 patents that were the oldest asserted in the first lawsuit of an independent inventor between 2003 and 2017. Marginal effects reported with discrete change of dichotomous variables from 0 to 1. * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.

Turning to inventor promotion, Table 16 reports regression results for a random sample of 932 first assertions, representing about 55% of the population. In all specifications, whether or not the complaint promotes the contributions, accomplishments, and efforts of the people who invented the technology is a significant predictor of

plaintiff type. Complaints promoting the inventor are about 20% more likely to be asserted by individual inventors. I believe this is strong evidence that some inventors choose to litigate as individuals because they wish to be recognized as the sympathetic persons behind the dispute, while some other inventors, who prefer to litigate in the background, litigate through business organizations.

The remainder of the results in Table 16 look quite similar to those in Table 14 and Table 15. Importance score is again significant, while top prosecution firm and the number of alleged infringers is more significant than in prior regressions. The presence of co-inventors is again statistically significant despite any correlation with inventor promotion.

Table 16. Probit Regressions of Likelihood of an Independent Inventor Suing Through an Inventor-Owned Licensing Firm Rather Than as an Individual Inventor—Oldest Patent in 1st Suit

	1	2	3	4	5
Inventor Promoted?	-0.208***	-0.195***	-0.195***	-0.199***	-0.199***
Co-Inventors on Patent?		0.241***	0.233***	0.225***	0.222***
Importance Score Percentile			0.404***	0.397***	0.359***
Large Prosecution Firm				0.143**	0.152**
No. of Alleged Infringers					0.0036**
1. Chemical	0.150**	0.139*	0.139*	0.135*	0.137*
2. Computer & Comm	0.513***	0.500***	0.495***	0.494***	0.473***
3. Drug & Medical	0.248***	0.245***	0.237***	0.241***	0.235***
4. Electrical	0.250***	0.241***	0.239***	0.241***	0.226***
5. Mechanical	0.149***	0.181***	0.180***	0.181***	0.180***
(Pseudo) R-squared	0.16	0.19	0.20	0.20	0.21
N=	932	932	932	932	932

Note—Random sample of 932 of 1,701 patents that were the oldest asserted in the first lawsuit of an independent inventor between 2003 and 2017. Marginal effects reported with discrete change of dichotomous variables from 0 to 1. * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.

Finally, Table 17 investigates the significance of employing an experienced litigation law firm on the choice of inventor plaintiff type. Using a random sample of 47% of the first assertions in the population, the results show that plaintiffs who employ experienced litigation counsel are significantly more likely to sue through a business

organization. Furthermore, the marginal effect is about 30%. Finally, in contrast with prior multivariate analysis, importance score loses its significance in Table 17. This suggests that experienced firm counsel is highly correlated with patent value and thus that inventors who sue through business organizations on average possess patents and claims with higher economic value.

Table 17. Probit Regressions of Likelihood of an Independent Inventor Suing Through an Inventor-Owned Licensing Firm Rather Than as an Individual Inventor—Oldest Patent in 1st Suit

	1	2	3	4	5
Experienced Litigation Firm?	0.315***	0.310***	0.305***	0.301***	0.296***
Co-Inventors on Patent?		0.191***	0.189***	0.185***	0.181***
Importance Score Percentile			0.147	0.125	0.119
No. of Alleged Infringers				0.0036***	0.0037**
Large Prosecution Firm					0.112
1. Chemical	0.105	0.107	0.107	0.118	0.109
2. Computer & Comm	0.435***	0.426***	0.425***	0.412***	0.412***
3. Drug & Medical	0.158**	0.169**	0.166**	0.167**	0.167**
4. Electrical	0.140**	0.151**	0.150**	0.143**	0.146**
5. Mechanical	0.097	0.120*	0.119*	0.114*	0.115*
(Pseudo) R-squared	0.20	0.22	0.22	0.23	0.23
N=	807	807	807	807	807

Note—Random sample of 807 of 1,701 patents that were the oldest asserted in the first lawsuit of an independent inventor between 2003 and 2017. Marginal effects reported with discrete change of dichotomous variables from 0 to 1. * $p < 0.10$; ** $p < 0.05$; and *** $p < 0.01$.

VI. IMPLICATIONS

Now that I have finished reporting the results of my empirical analysis of the traits of the patents, inventors, and litigation of independent inventors that predict whether they will sue as natural

persons or via business organizations, I discuss the major implications. First, I argue that the results validate prior studies of the choice of legal form of organization and the transaction costs theory of the firm, at least within the patent licensing business. The principal implication is that business organizations appear to facilitate the cooperation of co-owners of the patents, which are the assets necessary to profit from a licensing campaign. Second, I argue that my finding that some inventor-owned licensing firms look and act like other PAEs indicates that these likely have a similar impact on the patent system and social welfare as licensing firms that acquire their patents from third parties. Third, I explain how my results suggest that some inventors and their attorneys use choice of form of organization, along with litigation pleadings, to control the role of the human beings that are the real parties in interest in the narrative of the case.

A. Inventors Act Like Other Entrepreneurs in Choosing Legal Form, but Pre-Commitment to Cooperation Is Central When There Is Shared Patent Ownership

An important implication of the results in this paper is that the choice of many non-practicing independent inventors, whether to monetize their patent rights via a business or as a natural person, is a special case of entrepreneurial choice of legal form. After all, inventors suing as natural persons lack limited liability and are thus analogous to a proprietorship or perhaps a common law partnership. Just as Cole and Sokolyk found entrepreneurs with more experience select more complex forms of organization at the start of their new ventures,[207] I find inventors who litigate through LLCs or close corporations possess on average more patents and file more patent infringement lawsuits than do inventors who sue as natural persons. Future work should investigate whether inventors licensing through business organizations also possess more experience with entrepreneurial business ventures. I did not collect testable data on business experience that could be used in this study. However, after reviewing the LinkedIn pages of scores of inventors, it does seem that many of the inventors behind inventor-owned licensing firms are serial entrepreneurs.

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207. Cole & Sokolyk, *supra* note 68, at 2. Inventors with more complex monetization campaigns against more prospective infringers might also value limited liability protection more than inventors with fewer prospective infringers since the former face more opportunities for a court to shift fees and costs.

Cole and Sokolyk also find that entrepreneurs pick more complex organizational types when their new venture begins with more employees, more comprehensive employee benefits, positive accounts receivable, and possession of intellectual property assets.[208] Finally, they find that entrepreneurs tend to select the type of organization that can accommodate their expectations of the future complexity of the enterprise.[209] All of these traits plausibly correlate with the economic value of the venture, and I found that inventors suing through business organizations possess more valuable patents—the key assets of the licensing venture—than those suing as individuals. My evidence for higher inventor-owned licensing firm value includes higher average patent importance scores, more forward citations, and more experienced prosecution and litigation counsel than those employed by the average individual inventor.

Beyond value, litigation campaigns by inventor-owned licensing firms can also be said to be more complex on average than those of individual inventors because they target more prospective infringers and assert computer and communications patents that tend to possess more uncertain scope. This last trait of inventor-owned licensing firm litigation, along with the greater chance of fee shifting and cost awards to their opponents, also suggests that these inventors tend to engage in more risky licensing campaigns. This supports the finding of Ayers, Cloyd, and Robinson that ventures with greater default risk are more likely to incorporate rather than do business as a proprietorship.[210] Thus, the results in this paper validate existing work on entrepreneurs' choice of legal form of organization.

The most important empirical findings support the transaction costs theory of the firm, specifically the idea that where different people own assets that must be used together to maximize the profits of a venture, then unified ownership of the assets reduces transaction costs and removes the problem of "hold-up."[211] Because co-owners of patents each possess the legal right to grant anyone a nonexclusive technology license without the permission of the other owners, the risk of hold-up is significant in the patent monetization business. By assigning patent

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208. *Id.*

209. *Id.*

210. Benjamin C. Ayers, C. Bryan Cloyd & John R. Robinson, *Organizational Form and Taxes: An Empirical Analysis of Small Businesses*, 18 J. AM. TAX'N ASS'N 49, 64 (1996).

211. *See, e.g.*, Oliver Hart, *An Economist's Perspective on the Theory of the Firm*, 89 COLUM. L. REV. 1757, 1760–63 (1989) (discussing the history of the transaction costs theory and the "hold up" problem).

rights to a business organization, co-owners of patents create common ownership and control over the assets, decreasing the cost of negotiation with their partners and enabling a unified licensing strategy. My strongest evidence for this theory that firms enable multiple owners of necessary assets to commit to cooperation is the striking estimate that while 75% of inventor-owned licensing firms include co-owners, the same is only true of about 15% of individual inventors.

A plausible implication of these results is that in industries like patent licensing, and perhaps others like real estate investment, where the main assets are property rights that can be shared, co-owners use business organizations as a substitute for contract among stakeholders. In fact, the majority of inventor-owned licensing firms select the LLC form, and extensive scholarship has described that form in particular as a "creature of contract."[212] Put another way, the phenomenon uncovered in this paper is an example of private ordering to solve coordination problems using existing legal institutions created for other purposes. In this case, the institutions are business organizations that were mainly created by law to enable entrepreneurs to benefit from such attributes as separation of ownership and control, limited liability, and options in taxation. Given that patent rights exist to incentivize innovation, we want innovators to be able to successfully exploit their inventions, and it appears that existing legal forms provide a beneficial private solution to coordination problems that are particularly acute in the business of technology licensing.

B. Many Inventor-Owned Licensing Firms Act Like PAEs

The analysis in this paper indicates that many inventor-owned licensing firms look and act like PAEs that acquire their patents from third parties. First, just like other PAEs, the majority of the patents that inventor-owned licensing firms assert cover computer and communications technology. Second, inventor-owned licensing firm patents, like PAE patents, are on average asserted against many more defendants in many more lawsuits than those of the average individual inventor or practicing entity. Third, a sizeable minority of inventor-owned licensing firms, perhaps 30%, appear to be formed in anticipation of litigation. Fourth, nearly 30% select the fora overwhelmingly preferred by other PAEs, but not by other types of

212. Heminway, *supra* note 90, at 812–13, n.3.

patent plaintiffs, namely the Eastern District of Texas and the District of Delaware.

Future research should compare the patent traits and litigation behavior of the 30% of inventor-owned licensing firms suing in these two districts with PAEs. This group of inventor-owned licensing firms may overlap significantly with those formed right before litigation. If that overlap is confirmed, then I would expect this group to behave even more like PAEs than those inventor-owned licensing firms that have existed much longer before litigation or that have chosen to litigate in other districts whose dockets are not dominated by PAEs.

Why does it matter that a large and perhaps identifiable segment of inventor-owned licensing firms behave indistinguishably from PAEs that obtain their patents from third parties? Significant empirical evidence supports the conclusion that PAEs, on net, cost the patent system, producers, and consumers more than they contribute to innovation and social welfare.[213] Insofar as an identifiable segment of inventor-owned licensing firms tend to harm rather than benefit innovation, patent policy should continue to police their enforcement activity using the same policy levers that are currently being used to curb the excesses of PAEs who acquire third party paper patents in order to target productive firms who have independently invented and successfully commercialized the technology. Such recent efforts include Congress's creation of new and easier to utilize post-grant

213. *See, e.g.*, Shawn P. Miller, *Where's the Innovation: An Analysis of the Quantity and Qualities of Anticipated and Obvious Patents*, 18 VA. J.L. & TECH. 1, 49 (2013) (finding that licensing firm patents litigated to an invalidity judgment on the merits were significantly more likely to be invalidated as anticipated or obvious, indicating they lack value as innovation); John R. Allison, Mark A. Lemley & Joshua Walker, *Patent Quality and Settlement Among Repeat Patent Litigants*, 99 GEO. L.J. 677, 708 (2011) (concluding that PAE patents take disproportionate resources in patent litigation and that the social benefit from those cases appears to be slight); James Bessen, Jennifer Ford & Michael J. Meurer, *The Private and Social Costs of Patent Trolls*, 34 REG. 26, 31, 33 (2012) (finding that PAE lawsuits caused half a trillion dollars in lost wealth from 1990 through October 2010 and that this loss of wealth has reduced incentives to innovate); James Bessen & Michael J. Meurer, *The Direct Costs from NPE Disputes*, 99 CORNELL L. REV. 387, 387 (2014) (estimating that in 2011 productive firms accrued $29 billion in direct costs from PAE assertions). *But see, e.g.*, Stephen H. Haber & Seth H. Werfel, *Patent Trolls as Financial Intermediaries? Experimental Evidence*, 149 ECON. LETTERS 64 (2016) (finding experimental evidence that PAEs can serve as financial intermediaries that enable cash-constrained individual patent owners, including inventors, to participate in the market for innovation).

review procedures,[214] the U.S. Supreme Court's limitation of the patentable subject matter of software patents,[215] and the Supreme Court's restriction of choice of venue in patent cases.[216]

Thus, the results seem to support the conclusion that not all independent inventors embody the conventional wisdom of the garage innovator toiling to improve society.[217] Some, including perhaps many of the attorney-inventors identified in this study, have little or no intention of inventing to help develop new and useful products and services. Rather, some inventors use the legal opportunities provided by a generous patent system to transfer wealth to themselves through opportunistic licensing campaigns.[218]

C. Choice of Plaintiff Type Sometimes Depends on Inventors' Preference to Promote or Obscure Personal Involvement in the Dispute

The results in this paper also reveal two ways in which independent inventors appear to differ in the extent to which they personally choose to place themselves front-and-center in the narrative of the litigation. First, even before *Twiqbal*, when the Federal Rules of Civil Procedure were interpreted as allowing bare bones pleading, many of the independent inventors I study chose to include in their complaints detailed and often colorful descriptions of their accomplishments, efforts, and contributions to innovation. Second, the split in the legal form used by inventors to enforce their rights itself shows that about half choose to be personally identified as the injured party, while the other half choose to litigate behind a separate legal entity. While there is significant overlap in the likely motivations of these two manners of displaying the human inventors behind the litigation, some of the explanations are separate.

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214. Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (creating three new procedures for the administrative review of issued patent claims).

215. Alice Corp. v. CLS Bank Int'l, 573 U.S. 208, 223 (2014) (holding that "the mere recitation of a generic computer cannot transform a patent-ineligible abstract idea into a patent-eligible invention").

216. TC Heartland LLC v. Kraft Foods Grp. Brands LLC, 581 U.S. 258, 268–69 (2017) (interpreting "resides" in the patent venue statute as including only a corporation's state of incorporation).

217. Christopher A. Cotropia, *The Individual Inventor Motif in the Age of the Patent Troll*, 12 YALE J.L. & TECH. 52, 54–55 (2009).

218. *See* James Bessen & Michael J. Meurer, *Lessons for Patent Policy from Empirical Research on Patent Litigation*, 9 LEWIS & CLARK L. REV. 1, 14–18 (2005) (discussing factors contributing to the success of opportunistic claims).

Concerning inventor promotion in the complaints, the result is striking that individual inventors laud the human inventor's accomplishments and efforts twice as frequently as inventor-owned licensing firm plaintiffs. Nevertheless, over 16% of inventors who sue through business organizations also promote themselves in their complaints. I am sure there are multiple reasons why inventors and their attorneys promote the inventor's personal contributions in their complaints. Undoubtedly some, like Robert Kearns,[219] sue in significant part to obtain public recognition of their contributions to technology. However, attorneys rather than clients generally control litigation strategy, including how to frame the dispute.

I believe that the main reason why some complaints laud the inventors behind the patents is that the lawyers in those cases think that telling the story of a real person will improve their client's chances of litigation success. Plaintiffs do have the right to a jury trial in patent infringement litigation, and evidence suggests that juries are more likely to decide patent cases in favor of natural persons.[220] Given the potential for bias in favor of individuals, it seems likely that some attorneys choose to laud an inventor's contributions in the complaint in order to signal to opposing counsel that the plaintiff intends to frame the dispute as theft of the rights of a sympathetic human being.

Future research, including surveys of practitioners, should further investigate why some complaints laud the people behind the dispute, while others do not. Such work should also seek to determine why most lawyers have chosen not to promote the contributions of the persons behind the dispute. One theory that I propose in this paper is that some independent inventors do not make for very sympathetic plaintiffs. I offer only limited evidence for this idea in preliminary non-random findings that more attorney-inventors appear to sue through business organizations, while more medical doctors appear to sue in their individual capacity.

Moving beyond differences in the appeal of independent inventors to a prospective jury, some independent inventors may choose not to laud the contributions of the inventors for the same reason that they

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219. *See* Seabrook, *supra* note 41 (profiling Kearns, the inventor of the intermittent windshield wiper, and noting that he was not particularly motivated by large judgments in his favor).

220. *See, e.g.*, Moore, *supra* note 33, at 81 (reporting that in such match-ups, juries ruled in favor of independent inventors 74% of the time and defendant corporations only 26% of the time).

choose to sue through a non-practicing business organization—they simply wish to separate the rest of their lives, both professional and personal, from their patent licensing campaign. Part of this desire for separation could be due to reputational risks, with independent inventors engaged in other full-time careers. Many of these might simply prefer to keep their litigation as private as possible. This was certainly part of the motivation of the prominent San Diego patent attorney fired for suing clients of his firm through a shell company.[221] However, it could also be true that engineers and other professionals working for productive firms know that their employers and clients are not wild about litigation against any producers in their industry. More research is needed to determine how much of a role reputation plays in the choice to minimize the footprint of the individual in inventor patent litigation.

Independent inventors who choose not to laud their accomplishments and who also sue through business organizations might also be motivated by the desire to ensure the protection of limited liability. The use of shell LLCs by PAEs is common[222] and leading users of this strategy do indicate that a major motivation for their use of shell LLCs is limited liability.[223] Given the importance of unrelated determinants of plaintiff type and my findings that individual inventors and inventor-owned licensing firms possess similar litigation success, it is hard to believe that limited liability is the primary motivation for choice of inventor plaintiff form. However, it may be an important one, at least in some circumstances, including where the inventors intend to stretch legal arguments about the scope of their patents.

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221. *See* Masnick, *supra* note 176 (describing an attorney who licensed his patents to others who would then sue his firm's clients for infringement, thereby allowing the attorney to personally collect some of the profits).

222. In fact, a 2013 White House report on the impact of patent assertion on innovation suggested that one of the defining features of patent trolling is the use of shell companies to bring suit. PRESIDENT'S COUNCIL OF ECON. ADVISERS, NAT'L ECON. COUNCIL, & OFF. OF SCI. & TECH. POL'Y, EXEC. OFF. OF THE PRESIDENT, PAT. ASSERTION AND U.S. INNOVATION 4 (2013), https://obamawhitehouse.archives.gov/sites/default/files/docs/patent_report.pdf.

223. Victoria Slind-Flor, *IV Moves from Myth to Reality*, INTELL. ASSET MGMT., Aug./Sept. 2006, at 32 (2006) (references Peter Detkin as acknowledging that Intellectual Ventures, like many other companies, uses shell companies for acquisitions to keep potential liabilities of the acquired company from affecting the whole organization).

Insofar as limited liability is important to independent inventors suing through business organizations, why might so many choose not to even mention the names of the inventor-owners of the asserted patents? While courts are extremely reluctant to pierce the corporate veil,[224] one common requirement to do so is that a claimant shows unity of interest between the entity she is trying to pierce and its owners.[225] It might be that some inventor attorneys believe that promoting or even mentioning the inventor-owners of an inventor-owned licensing firm needlessly provides ammunition to future arguments by their opponents that the firm is an alter ego of the inventors. This is merely speculation and, again, future research, including surveys of practitioners, should be conducted to shed light on the interesting variations I find in this paper in the degree to which independent inventors are placed front-and-center in their litigation.

CONCLUSION

In this paper, I investigate the reasons why about half of independent inventors sue for patent infringement through a business organization, almost always a limited liability company (LLC) or close corporation, while the rest sue as natural persons. I call the first category "inventor-owned licensing firms" and the second "individual inventors." I argue that this phenomenon is a special case of the more general choice of legal form of organization facing all entrepreneurs when they begin a new venture. I find that inventors engaged in the business of patent monetization who sue through business organizations possess more experience patenting and litigating and that they assert higher valued patents. These results support the theory that entrepreneurs with more experience and greater expectations as to the prospects of a venture will select more complex legal forms of organization.

Most importantly, my results support the transaction costs theory of the firm, whereby the relative costs of making decisions and

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224. *See, e.g.*, Sonora Diamond Corp. v. Superior Ct., 99 Cal. Rptr. 2d 824, 836 (2000) (noting that "[a]lter ego [piercing the corporate veil] is an extreme remedy, sparingly used"); *accord* Dole Food Co. v. Patrickson, 538 U.S. 468, 475 (2003) (noting that the doctrine is applied only in exceptional circumstances).

225. In California, the second requirement is an inequitable result from allowing the owners to dodge personal liability for the entity's debts. *See, e.g.*, Automotriz del Golfo de Cal. v. Resnick, 306 P.2d 1, 3 (Cal. 1957) (en banc) (requiring under the second prong that "if the acts are treated as those of the corporation alone, an inequitable result will follow").

negotiating profit shares outside a firm increase with the number of stakeholders and decrease with familial ties. Specifically, I find that 75% of inventor-owned licensing firms possess multiple owners, while nearly 85% of individual inventors lack co-owners of their patents. This result is an important contribution to the literature on the theory of the firm and indicates that in industries like patent monetization, where co-owners of the assets necessary for the business possess the legal right to hold out from profit maximizing deals, owners will utilize business organizations to pre-commit to cooperation.

My analysis also sheds light on differences in the motivations and resources of independent inventors, the most iconic users of the patent system. For example, I find that inventors who sue through business organizations more frequently possess the attributes of corporate patent assertion entities that purchase patents from third parties than individual "garage" inventors. Finally, I find evidence that inventors suing as natural persons are more interested in placing their personal contributions and accomplishments front-and-center in their story of the litigation.