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Evaluating Market Reactions to Non-Practicing Entity Litigation

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ABSTRACT

An ongoing debate in patent law involves the role "non-practicing entities," sometimes called "patent trolls," serve in the patent system. Some argue they serve as valuable market intermediaries, while others contend they are a drain on innovation and an impediment to a well-functioning patent system. This Article adds to the data available in this debate by conducting an event study that analyzes the market reaction to patent litigation filed by large "mass aggregator" non-practicing entities against large publicly traded companies. This study advances the literature by attempting to reproduce the results of previous event studies done in this area with newer market data and by subjecting the event study results to more rigorous statistical analysis. In contrast to a previous event study, the Authors found that the market reacted little, if at all, to the patent litigation filed by large non-practicing entities.

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I. INTRODUCTION

An ongoing and important debate in patent law concerns the actions of "non-practicing entities" or "patent assertion entities," which are sometimes pejoratively referred to as "patent trolls" (hereinafter collectively referred to as "NPEs").[1] Generally, NPEs are individuals or entities that own a patent, either through invention or acquisition, but do not use it to produce or manufacture anything.[2] Most NPEs referred to as patent trolls do not invent—their typical business model is to license or purchase patent rights and assert them through litigation against entities that make products that allegedly infringe upon their patent rights.[3] Depending upon whom you ask, NPEs are either valid, useful actors in the market for innovation or leeches that feed off the innovation of others.[4]

This Article seeks to add to the literature on this debate by analyzing what the market has to say about NPE litigation through an event study.[5] Many of the targets of NPE litigation are publicly traded companies. If the market exhibits at least some level of efficiency, and if NPE litigation in fact stifles innovation and creates costs for product-producing companies, one would expect to see some effect on the market when new patent litigation is filed.[6] Using the

1. *See* Robin Feldman & Mark A. Lemley, *Do Patent Licensing Demands Mean Innovation?*, 101 IOWA L. REV. 137, 138–39 (2015) ("Patent trolls—patent-holding entities that do not make any products but sue or threaten others with patent infringement—are the subject of intense debate.").

2. *See id.* at 139 (defining NPEs as "individuals or businesses that do not make any products and instead make their money from licensing or asserting patents against entities that do make products").

3. *See id.*

4. *See, e.g.*, Michael Risch, *Patent Troll Myths*, 42 SETON HALL L. REV. 457, 462–66 (2012) (summarizing the debate between critics of and advocates for NPEs).

5. *See* A. Craig MacKinlay, *Event Studies in Economics and Finance*, 35 J. ECON. LITERATURE 13, 13 (1997) ("Using financial market data, an event study measures the impact of a specific event on the value of a firm.").

6. *Id.* ("The usefulness of such a study comes from the fact that, given rationality in the marketplace, the effects of an event will be reflected immediately in security prices."); *see also* James Bessen, Jennifer Ford & Michael J. Meurer, *The Private and Social Costs of Patent Trolls*, 34 REG. 26, 28 (2011) (conducting a previous event study on patent litigation).

RPX Corporation patent litigation database,[7] this study analyzes the effect that NPE patent litigation brought by the ten largest NPEs had on the stock price of the eight largest targets of NPE patent litigation claims to determine whether and to what extent the market reacts to the filing of these claims.[8] Based upon this analysis, it appears the market largely ignores the filing of NPE patent claims against large companies, calling into question the damaging effect on innovation and the economy claimed by the opponents of NPEs.

This Article proceeds in three parts. Part II provides an overview of NPEs and briefly discusses previous studies of their activities. Part III discusses the empirical analysis of eight large targets of NPE claims and fully discusses the research methodology, results, and conclusions of this research. Finally, Part IV provides concluding remarks addressing the impact of this study on the NPE policy debate and further research that needs to be conducted.

II. THE NPE DEBATE AND PRIOR STUDIES

The presence of NPEs is controversial because their actions do not reflect how one typically envisions the patent system working. A traditional (arguably idealized) view of the patent system involves an inventor slaving away in a laboratory to refine an invention or scientific process.[9] Once perfected, the inventor (or the inventor's employer) either uses that invention to advance a scientific discipline or make a product, or licenses the patent rights to someone who will use them.[10] Simply put, the patent system is intended to further innovation and invention by providing economic incentives to inventors through patent rights.[11] The rise of NPEs has sparked a

7. RPX CORP., https://insight.rpxcorp.com/ [https://perma.cc/5V2G-SCBX] (last visited Sep. 24, 2016).

8. *See infra* Part II.

9. *See* Robin Feldman & Tom Ewing, *The Giants Among Us*, STAN. TECH. L. REV., Jan. 2012, at 18 ("In a perfect world . . . . [a]n inventor, incentivized by the rewards available through the patent system, creates an invention bringing forth the idea for all to see and benefit from. The inventor either manufactures a product resulting from the invention or licenses the invention to others for manufacture.").

10. *See* COUNCIL OF ECON. ADVISERS, EXEC. OFFICE OF THE PRESIDENT, THE PATENT LITIGATION LANDSCAPE: RECENT RESEARCH AND DEVELOPMENTS 1 (2016), https://obamawhitehouse.archives.gov/sites/default/files/page/files/201603_patent_litigation_issue_brief_cea.pdf [https://perma.cc/4H5P-JSBU] (last visited Sept. 23, 2017).

11. *See, e.g.*, *Patent Trolls,* ELECTRONIC FRONTIER FOUND., http://www.eff.org/issues/resources-patent-troll-victims [https://perma.cc/8E5Y-KX2B] (last visited Sept. 23, 2017) ("The U.S. Patent System is supposed to represent a bargain between inventors and the public. In theory, it is simple: in exchange for dedicating a novel invention to society, along with a clear explanation of how to practice that invention, a patent applicant gets a 20-year monopoly.").

debate regarding their role in this system. Some claim that NPEs further the intent of the patent system by allowing nonproducing inventors to receive compensation for their valuable patent rights, while others assert they simply take advantage of this system by exploiting those actively utilizing patents.[12] Next, this Article discusses these conflicting viewpoints.

In the minds of critics, NPEs are not valuable contributors to this system; instead, they are merely exploiters of it.[13] The Obama administration referred to NPEs as a "major problem."[14] Some of these critics argue NPE patent claims are asserted against companies that are not being accused of illegitimately or intentionally copying the patent, but have instead independently invented something that allegedly infringes upon the purchased patent rights.[15] Thus, if NPEs, which have invented nothing, are asserting patents that would otherwise not be asserted against inventors and producers of products, their actions are a drag on innovation and an abuse of the patent system.[16] Furthermore, given the realities of patent litigation, some argue that many defendants in NPE litigation settle, even though they do not believe the suit has merit, simply because the costs and uncertainty of litigation are too high.[17] Under this view of NPEs, their actions do not represent a contribution to the aims of the patent system but rather its illegitimate use, necessitating patent law reform to curtail their activities.[18] Some have even argued this problem is becoming worse because NPEs are growing in size and acquiring

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12. *See* Risch, *supra* note 4, at 462–66.

13. *See, e.g.*, Gene Sperling, *Taking on Patent Trolls to Protect American Innovation*, WHITE HOUSE BLOG (June 4, 2013, 1:55 PM), https://www.whitehouse.gov/blog/2013/06/04/taking-patent-trolls-protect-american-innovation [https://perma.cc/2QRW-6CE2] (quoting President Obama as saying NPEs "don't actually produce anything themselves. They're just trying to essentially leverage and hijack somebody else's idea and see if they can extort some money out of them.").

14. *See id.*

15. *See* Feldman & Lemley, *supra* note 1, at 142–43 ("Finally, the evidence suggests that the overwhelming majority of patent cases do not involve alleged copying, but rather independent invention. . . . Under these circumstances, patent licensing does not benefit society by encouraging learning or dissemination of the patentee's invention." (internal footnotes omitted)).

16. *See id.* ("The dissemination of that technology was already happening, no thanks to the patentee; the patent troll is just collecting a tax from people who not only came up with the idea on their own, but actually put the invention into practice.").

17. *See id.* at 140 ("At worst, patent trolls may be collecting payments on patents that are invalid, or not infringed. Given the economics of patent litigation, a rational company may choose to pay a license fee and thereby avoid the costs and risks of a lawsuit.").

18. *See, e.g.*, Sperling, *supra* note 13 (noting the Obama administration's belief that NPE litigation takes a "significant toll" on the economy and innovation, necessitating executive and legislative action).

larger patent portfolios, becoming "mass aggregators."[19] If the activity of NPEs truly is damaging, then these mass aggregator NPEs could be capable of larger-scale damage to innovation and the economy than previous NPE activity.[20]

The basic argument for the positive value of NPEs is they can serve an intermediary function in the patent economy.[21] Some patent holders may not have the resources to either enforce their patent rights or otherwise economically exploit their invention.[22] If an NPE purchases the patent rights from these holders, they can then receive some economic benefit from their inventive efforts. In return, the NPE economically benefits from its purchase by enforcing valid legal rights that were previously unenforced.[23] If NPEs truly operate in this way, then they may be serving a valuable intermediary market function by funneling resources to inventors who would otherwise not be compensated for their efforts.[24] Presumably, some of these inventors will use these resources to continue to innovate, furthering the goals of the patent system.[25]

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19. *See* Feldman & Ewing, *supra* note 9, at 1–2 (estimating that Intellectual Ventures, a large NPE, has a patent portfolio of "30,000–60,000 patents worldwide, which would make it the 5th largest patent portfolio of any domestic US company and the 15th largest of any company in the world.").

20. *See id.* at 23–35 (discussing the potential harms to the economy and innovation created by large NPE mass aggregators with huge patent portfolios).

21. *See* David L. Schwartz & Jay P. Kesan, *Analyzing the Role of Non-Practicing Entities in the Patent System,* 99 CORNELL L. REV. 425, 428 (2014) ("Under one narrative, NPEs serve an important market need: acting as an intermediary for some patentees.").

22. *Id.*

23. *See id.* ("NPEs accept the risks and uncertainty associated with attempting to enforce the patent rights. And NPEs expect and are entitled to make money for assuming those risks and uncertainty. Without the payment from an NPE, the inventors would receive no compensation whatsoever for their invention.").

24. *See* Ronald J. Mann, *Do Patents Facilitate Financing in the Software Industry?*, 83 TEX. L. REV. 961, 1024 (2005) ("Essentially, trolls are serving a function as intermediaries that specialize in litigation to exploit the value of patents that cannot be exploited effectively by those that have originally obtained them. That is not in and of itself a bad thing.").

25. *See* Edith Ramirez, Chairwoman, Fed. Trade Comm'n, Opening Remarks at the Computer & Communications Industry Association and American Antitrust Institute Program: Competition Law & Patent Assertion Entities: What Antitrust Enforcers Can Do 3 (June 20, 2013), https://www.ftc.gov/sites/default/files/documents/public_statements/competition-law-patent-assertion-entities-what-antitrust-enforcers-can-do/130620paespeech.pdf [https://perma.cc/6CWW-7WF5] (noting that selling patent rights to NPEs can provide money to start-ups that have valuable technology but which have failed as operating businesses, allowing them to invest in more research and development).

This debate regarding NPEs persists because each of these positions are logical, rational, and difficult to prove.[26] Researchers have previously conducted numerous empirical studies in an attempt to determine which position in this debate is supported by evidence.[27] These studies utilized various methodologies and came to different conclusions.[28] The differing results of these studies reveal some fundamental difficulties in studying this area, including disagreements on both how to properly identify NPE litigation and how to define what types of entities should be considered NPEs.[29] Numerous entities that do not produce goods, such as universities or individual inventors, may still seek to enforce their patent rights yet do not fit the description of the NPEs which are accused of exploiting and abusing the patent system.[30] When studies lump all of these various entities together for purposes of analyzing litigation, the results may be potentially misleading or inaccurate.[31] The goal of these studies is to determine whether NPEs accused of exploiting the patent system, such as mass aggregators, have a negative effect on the patent system. Thus, lawsuits filed by NPEs that are not accused of being exploitative, such as universities that license or enforce patents without producing goods, need to be removed from the dataset of

26. *See, e.g.*, Gerard N. Magliocca, *Blackberries and Barnyards: Patent Trolls and the Perils of Innovation*, 82 NOTRE DAME L. REV. 1809, 1810–11 (2007) ("Like most fresh legal questions, the debate on patent trolls is long on passion and short on proof. . . . The only thing that both sides might agree upon is that there is no real evidence about the impact that trolls are having on technology investment, which makes drawing policy conclusions in this area especially hazardous."); *see also* Schwartz & Kesan, *supra* note 21, at 451 ("Currently, there is a lack of scientific evidence that widespread and systematic problems exist with NPEs, and if they do, what the magnitude of the problems is.").

27. *See* Michael J. Mazzeo, Jonathan H. Ashtor & Samantha Zyontz, *Do NPEs Matter? Non-Practicing Entities and Patent Litigation Outcomes*, 9 J. COMPETITION L. & ECON. 879, 884–85 (2013) (discussing various empirical studies of NPE litigation).

28. *See id.*; *see also* John R. Allison, Mark A. Lemley & Joshua Walker, *Patent Quality and Settlement Among Repeat Patent Litigants*, 99 GEO. L.J. 677, 708–09 (2011) (examining patent quality of repeat patent litigants and finding evidence that indicates that NPEs tend to litigate weaker patents than producing companies, indicating potential social harm from NPE litigation). *But see, e.g.*, Sannu K. Shrestha, Note, *Trolls or Market-Makers? An Empirical Analysis of Nonpracticing Entities*, 110 COLUM. L. REV. 114, 118 (2010) (conducting an analysis of NPE-owned patents and finding that "NPE patents and their litigation behavior provide a generally favorable picture of NPEs").

29. *See, e.g.*, Christopher A. Cotropia, Jay P. Kesan & David L. Schwartz, *Unpacking Patent Assertion Entities (PAEs)*, 99 MINN. L. REV. 649, 654 (2015) (arguing that a lack of transparency regarding the data underlying previous studies about entities such as NPEs led to a "fundamental barrier" in understanding the NPE debate and that a more thorough dataset concerning litigation from 2010 to 2012 presents a differing narrative).

30. *See id.* at 654, 656–57.

31. *See id.* at 654.

litigation and entities being studied in order to obtain reliable results.[32]

This Article seeks to advance the literature in this area by providing empirical results of an event study that analyzes the stock price effects of patent lawsuits—filed by a defined universe of large mass aggregator NPEs—against publicly traded companies. These are the types of NPEs that are almost universally considered dangerous patent trolls, disruptive to innovation.[33] Focusing on these entities avoids the definitional difficulties inherent in many of these previous studies.

Before discussing methodology and results, it is important to discuss a previous prominent event study of NPE litigation conducted by James Bessen, Jennifer Ford, and Michael J. Meurer, which used a similar methodology.[34] That study used a sample of 1,630 lawsuits filed by NPEs against one or more publicly traded companies between January 1990 and October 2010 and analyzed the impact these lawsuits had on the stock prices of the defendant companies.[35] Since many of these lawsuits involved multiple corporate defendants, the total number of events analyzed was 4,114.[36] These events were then analyzed to determine whether investors in the stock market react positively, negatively, or not at all when an NPE filed a patent lawsuit against a public company.[37] If markets are reasonably efficient, and if NPEs are reducing innovation and investment in new technology, then one would expect the filing of a patent lawsuit by an NPE to result in abnormal negative returns to a defendant company's stock price.[38]

Using that methodology, the Bessen, Ford, and Meurer study claimed NPE lawsuits resulted in "half a trillion dollars of lost wealth to defendants from 1990 through 2010" and, during the last four years of that study, averaged over $80 billion per year in lost wealth, measured by a decline in market value of the subject stock.[39] The

32. *See id.* at 656.

33. *See, e.g.*, Feldman & Ewing, *supra* note 9, at 1–2 (discussing the potential harms to the economy and innovation created by large NPE mass aggregators with huge patent portfolios).

34. *See* Bessen, Ford & Meurer, *supra* note 6, at 28.

35. *Id.*

36. *Id.*

37. *See id.*

38. *See id.* at 26 ("To the extent that the recent NPEs opportunistically assert 'fuzzy patents' against real technology firms, they can decrease the incentives for these firms to innovate. Innovators deciding to invest in new technology have to consider the risk of inadvertent infringement as a cost of doing business. This risk reduces the rents they can expect to earn on their investment and hence decreases their willingness to invest.").

39. *Id.*

Executive Office of the President cited that study in its 2013 report on the dangers NPEs pose to the patent system.[40] However, a subsequent article by Ron Katznelson in the same journal criticized its methodology and findings.[41]

Katznelson appeared to take issue with Bessen, Ford, and Meurer's attempt to quantify the amount of wealth lost to NPE lawsuits through an event study.[42] He noted that event studies can be valuable economic studies, but only if they capture the entire event and its effect on the market, which can be a difficult-to-determine window of time.[43] With respect to the Bessen, Ford, and Meurer study, he argued that in order to get a full accounting of the economic impact of NPE lawsuits, the study should have included not only the filing of the lawsuit itself (the event which was measured) but also the resolution of the lawsuit (which was not measured).[44] By attempting to measure the total economic impact of these lawsuits only by their filing, Katznelson argued their study ignored any corrections to stock price that may be made upon the disposition of a suit.[45] Indeed, Katznelson claimed that upon reviewing the full disposition of three patent cases analyzed in that study, he found the stock price positively

40. *See* PRESIDENT'S COUNCIL OF ECON. ADVISERS, NAT'L ECON. COUNCIL & OFFICE OF SCI. & TECH. POLICY, EXEC. OFFICE OF THE PRESIDENT, PATENT ASSERTION AND U.S. INNOVATION 9 (2013), [hereinafter EXEC. OFFICE OF THE PRESIDENT] https://obamawhitehouse.archives.gov/sites/default/files/docs/patent_report.pdf [https://perma.cc/3EP6-RUN2].

41. *See* Ron D. Katznelson, *The $83 Billion Patent Litigation Fallacy*, 39 REG. 14, 15 (2016) (criticizing Bessen, Ford, and Meurer's study and asserting that "its cost estimates and inferences should be dismissed, along with their indictment of NPEs and similar patent holders").

42. *See id.* ("A central claim of the report is that patent lawsuits by NPEs recently caused lost wealth of over $300 billion over four years. . . . They claim losses to defendants in NPE patent suits during a period of four years 'average over $83 billion per year in 2010 dollars, which equals over a quarter of U.S. industrial R&D spending per annum.' . . . As I explain below, its cost estimates and inferences should be dismissed, along with their indictment of NPEs and similar patent holders.").

43. *See id.* at 15–16.

44. *See id.* at 16 ("Another problem with the authors' analysis is they fail to include all components of each patent litigation 'event.' Their method tracks the stock value effects of patent litigation only upon filing of the lawsuit, but they ignore any subsequent related stock value corrections or gains upon disposition of the lawsuit in an announced settlement or a final verdict.").

45. *See id.* ("The initial stock price hit is conflated by uncertainty over who is right and who is wrong, uncertainty about how the courts will resolve the matter if it goes to trial, and uncertainty about how the parties will settle the matter if they do not go to trial. Put simply, by not including analysis of the disposition of the lawsuit, Bessen, Ford, and Meurer fail to account for the market *economic* information effect of the 'complete transaction' of the patent litigation.").

adjusted—sometimes greater than the initial decline—after resolution of the dispute.[46]

Katznelson further criticized an inference drawn by the authors of that study—namely, the economic loss that they estimated represented a direct economic disincentive to innovate due to NPE litigation.[47] Katznelson argued there was a more plausible alternative interpretation of the results—that the defendants' stock price was previously inflated due to their unlawful infringement.[48] Under this interpretation, the defendant companies were "free riding" by using patents in their business without any right to do so.[49] If their stock price represented the economic rents gained from this free riding, then a suit filed to "keep them honest" could (and arguably should) represent a proportional decrease in stock price reflecting a correction of this free riding.[50] Katznelson further argued this inference is made all the more plausible by the fact that research and development (R&D) expenditures of large companies increased after they were sued for patent infringement.[51] If NPE litigation was truly a disincentive to innovate, he argued these companies should not have been increasing their R&D budgets.[52]

Finally, Katznelson argued the Bessen, Ford, and Meurer study ignored important social costs and gains which may arise from patent litigation but are not reflected in the defendants' stock price.[53] By focusing only on the negative economic costs reflected in the stock

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46. *See id.* at 17 ("Using identical statistical method and event windows, I carefully examined three of the authors' NPE cases, creating a 'full transaction' analysis that accounts for decision, settlement, or other legal disposition. Not surprisingly, the CAR values I obtained were negative on filing of the lawsuit in all three cases, ranging from –0.26 percent to –2.45 percent. However, I found the opposite sign upon case disposition—indeed, sometimes the gain in value on disposition far exceeded the loss on filing.").

47. *See id.* at 16.

48. *See id.* ("Rather than a deadweight loss to innovation, a more plausible interpretation is that the lost market value simply reflects the disappearance of projected gains from patent infringement. The defendant firm's stock value prior to the suit's filing should include substantial built-in market valuation of the firm's free-riding on others' patented technologies.").

49. *See id.*

50. *See id.* ("Rather than a deadweight loss in innovation, a more plausible interpretation is that the lost market value simply reflects the disappearence of projected gains from patent infringement.").

51. *See id.* (noting that a previous study, conducted by Bessen and Meurer, found that firms that were sued for patent infringement spend more heavily on R&D).

52. *See id.*

53. *See id.* at 17 ("The authors also miscalculate the social cost of patent litigation because they overlook fundamental economic effects of patent enforcement and because they do not include the wealth effects on parties other than the specific defendants in the lawsuits they covered.").

price at the time the litigation was filed, Katznelson argued that the study does not take into account potentially positive spillover economic effects of the lawsuit filing that should be netted against any decrease in stock price.[54] Katznelson argued that Bessen, Ford, and Meurer fail to account for potential positive effects, such as the increase in value of other patents not being litigated, the benefits gained from being incentivized to "design around" the patent claims, and the deterrent effect against misappropriation of technology by other potential infringers.[55] It is possible that these effects of NPE litigation could outweigh any potential decreases in the stock price of the corporate defendants.

While valid, these criticisms largely stem from a fundamental problem of overextending the conclusions that can be drawn from a particular event study.[56] Event studies can be valuable tools for analyzing whether a particular event, in the judgment of the stock market, matters with respect to a specific company in that they represent a piece of potentially valuable evidence regarding whether that event is sufficiently important to affect stock price.[57] However, it is problematic to assume any single event study could be considered an accurate measure of all, or even a significant portion of, the societal economic gains or losses caused by the event. For example, as Katznelson pointed out, there are various spillover effects—both positive and negative—that may occur from the filing of patent litigation which may not be reflected in the defendant's stock price because they do not directly affect the defendant.[58] This is particularly the case in areas of social study, such as legal and policy decision-making, where determining whether and to what extent economic impact can be attributed to that particular action can be difficult.[59] Thus, the Authors argue that the main problem with the

54. *See id.* at 17–18 ("'Costs' are net reductions in aggregate welfare. Failing to net them is an obvious error.").

55. *See id.* at 18 (discussing various spillover effects of patent litigation not accounted for in the Bessen, Ford, and Meurer analysis).

56. *See, e.g.*, Abagail McWilliams & Donald Siegel, *Event Studies in Management Research: Theoretical and Empirical Issues*, 40 ACAD. MGMT. J. 626, 627 (1997) ("We do not have any quarrel with the validity of the event study methodology or its use in management research, per se. . . . However, the lack of information regarding the validity of assumptions and several research design issues in some articles raises questions about the confidence that readers can place in the conclusions drawn.").

57. *See id.*

58. *See* Katznelson, *supra* note 41, at 17–18.

59. *See* McWilliams & Siegel, *supra* note 56, at 639 (discussing the problem with using event studies in measuring the impact of corporate social responsibility (CSR) decisions, noting that "[t]his is an area in which researchers desire to have an impact on public policy decision

Bessen, Ford, and Meurer study is not so much with its methodology (although it has some potential methodological problems, namely additional statistical analysis needed, which the Authors' study addresses), but rather with the strength of the inferences it draws.[60] This is particularly problematic because that study has been fairly heavily relied upon by the Executive Office of the President in criticizing the value of NPEs.[61]

This Article tests the strength of the inferences drawn from the Bessen, Ford, and Meurer study by attempting to replicate its results.[62] This event study uses a more limited subset of large, publicly traded companies targeted with patent infringement suits by large mass aggregator NPEs.[63] This study focuses on these large NPEs due to their size and prominence, because if the filing of NPE litigation is a noticeable event to investors that leads to abnormal returns in the stock market, then the abnormal returns should be most noticeable when a large NPE files suit against a large company. This is because large NPEs are asserted to have the most power to cause the most economic damage through patent litigation, due to their size.[64] Additionally, this study focuses on only these large NPE entities who file patent litigation as a business, and which are generally referred to by the pejorative "patent troll," to differentiate them from other NPEs, such as universities or individual inventors that may own patents and assert them but do not produce products.[65] This isolates the effect of mass aggregator NPE litigation and addresses the criticisms raised by Cotropia, Kesan, and Schwartz regarding the classification of NPE entities affecting results of studies.[66] The Authors further test the results of the Bessen, Ford,

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making, but it has been difficult for them to do so because of the problems involved in measuring the impact of managerial decisions").

60. *See id.* at 646 (noting that some previous event studies claimed "quite dramatic value effects" but that these results could not be replicated and could be explained by more advanced statistical tests).

61. *See* EXEC. OFFICE OF THE PRESIDENT, *supra* note 40, at 9.

62. *See* McWilliams & Siegel, *supra* note 56, at 639 (utilizing this same methodology to evaluate event studies in the area of CSR).

63. *See, e.g.*, Feldman & Ewing, *supra* note 9, at 1–2 (discussing large NPE mass aggregators with huge patent portfolios).

64. *See id.* at 27–29 (discussing the potential harms to the economy and innovation created by mass aggregators that may extort large settlements from practicing entities).

65. *See* Cotropia, Kesan & Schwartz, *supra* note 29, at 651, 653 (describing patent trolls, then noting that previous studies confused these different entities: "[O]ther researchers cannot often determine which entities were classified as PAEs or NPEs, what revenue numbers were associated with these entities, and other information necessary to evaluate the claims. This information is critical to verify, as a policy matter, whether PAEs are engaging in strategic and opportunistic behavior that does not benefit anyone except them.").

66. *See id.*

and Meurer study by conducting more advanced statistical analysis on the results, including nonparametric tests.[67]

If the findings of the Bessen, Ford, and Meurer study are valid and current, then one would expect to see larger abnormal returns in this more limited dataset than in their previous study. If these findings cannot be replicated, the next question is why. It could be that the results of the original study were invalid or the inferences drawn therefrom were simply too sweeping. Or, it could be that something has happened over time to ameliorate any negative effects of NPE litigation. Part III discusses the methodology of this event study and provides results.

III. RESEARCH METHODOLOGY AND RESULTS

The overall purpose of this event study is to provide evidence about investors' perceptions of NPE legal action against publicly traded companies. If investors perceive that litigation will be costly to the defending firm, their trading actions could result in a drop in stock price.[68] In this context, it is important to notice the "cost of litigation" is not limited to the cost of the trial or the size of monetary awards to the NPEs—it extends to *expected* economic consequences on *future* production of technological products and services.[69]

Market reactions to news are not restricted to the size of changes in stock prices (i.e., returns) but could also have an impact on their dynamic evolution.[70] For example, if investors are concerned with the content of an imminent press release from the CEO of a firm, that firm's stock might exhibit frantic price swings leading to a wide range of returns (i.e., volatility). While this might appear to be inconsequential, it could have serious repercussions in the prices of financial options[71] and in the execution of automated trading orders,[72]

67. *See* McWilliams & Siegel, *supra* note 56, at 635 (noting the importance of conducting nonparametric statistical tests to explain any potential outliers or nonnormal results).

68. *See* Katznelson, *supra* note 41, at 16–17 (discussing the potential economic impacts to future production of patent litigation and how they could be reflected in stock price).

69. *See id.*

70. *See* Robert F. Engle & Victor K. Ng, *Measuring and Testing the Impact of News on Volatility*, 48 J. FIN. 1749, 1750 (1993) (noting that the relationship between the volatility of stock returns and some types of events is well known in financial literature and that statistical techniques have been developed to assess different aspects of this relationship).

71. The price of a financial option depends on the price of the underlying asset and on the volatility of the returns of the underlying asset. *See, e.g.*, John Hull & Alan White, *The Pricing of Options on Assets with Stochastic Volatilities*, 42 J. FIN. 281, 281 (1987) (discussing the solution for the valuation of certain options).

possibly spilling over to prices of assets not directly involved in the content of the press release.[73] Given that the filings of patent litigation initiated by NPEs are publicly available information, this study aims to detect investors' reactions around the date of filing.

A. Event Study Methodology

The first battery of tests aims to measure whether returns of the defending firm departed from their typical (or expected) behavior around the filing date (i.e., the event window). At any point in time (*t*), the difference between the actual return of the firm *i* ($r_{i,t}$) and the return that is expected from *i* ($E\left[r_{i,t}\right]$) is termed the *abnormal return* of the firm ($AR_{i,t}$).[74] Abnormal returns are collected for each firm and grouped according to their timing relative to the filing event. For instance, one group is formed of all abnormal returns obtained three trading days before the filing date, another with the abnormal returns obtained two days before the filing date, etc. The abnormal returns in each group are then averaged and tested.

The main issue with the event study methodology is defining what the *expected return* should be.[75] Many variants have been used previously, which can be grouped into two broad categories: models without adjustments for differences in risk and risk-adjusted models.[76]

The simplest unadjusted form defines abnormal returns as follows:

$$AR_{i,t} = r_{i,t} - r_{m,t} \qquad (1)^{77}$$

Where $r_{i,t}$ is the return of firm *i* at time *t* and $r_{m,t}$ is the return of the broad index (i.e., the S&P500) at time *t*.[78] In this case, the

72. *See, e.g.*, Jerry W. Markham, *High-Speed Trading on Stock and Commodity Markets—From Courier Pigeons to Computers*, 52 SAN DIEGO L. REV. 555, 556 (2015) (discussing high speed algorithmic trading, which now dominates stock market trading volume).

73. Many investors place buy or sell orders that are automatically executed if prices of an asset reach a specified value. *See, e.g.*, David Easley, Marcos M. López de Prado & Maureen O'Hara, *The Microstructure of the "Flash Crash": Flow Toxicity, Liquidity Crashes and the Probability of Informed Trading*, 37 J. PORTFOLIO MGMT. 118, 119 (2011). Volatility could lead to price swings large enough to cause execution of large blocks of those orders, leading to a subsequent price change, thus triggering other similar orders in a chain reaction. *See, e.g.*, *id.* at 118–19 (discussing the "Flash Crash" of 2010, which was initially believed to be triggered by an accidental trade followed by a cascade of automatic stop loss orders).

74. *See* MacKinlay, *supra* note 5, at 15 (discussing abnormal returns in event studies).

75. *See id.* at 17–21 (discussing methods for calculating expected and abnormal returns in event studies).

76. *See id.* at 17–19.

77. *See id.* at 15.

expected return is proxied by the return of the broad index. The implication of this model is that each stock is expected to perform identically to the index or an "abnormality" is detected.[79]

The risk-adjusted models recognize that different firms could exhibit different relations with the broad index and compute the abnormal return after netting out the effects of this systematic relationship with the index. The finance literature has popularized two risk-adjusted models: the market model and the Capital Asset Pricing Model (CAPM).[80] The market model rests on a set of statistical assumptions and posits there is a direct relationship between the returns of an asset and the returns of the index; however, this specification lacks a sound economical foundation like the CAPM.[81] The CAPM is developed on solid theoretical grounds and states that, under conditions of equilibrium, the expected returns of an asset $\left(E\left[r_{i,t}\right]\right)$ should be equal to the returns of an asset with no risk (r_{RF}), plus a premium that is proportional to the systematic risk of the asset (β_i):

$$E\left[r_{i,t}\right] = r_{RF} + \beta_i\left(E\left[r_{i,t}\right] - r_{RF}\right) \qquad (2)^{82}$$

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78. *See id.*

79. *See id.* at 17 ("For firm i and event date τ the abnormal return is $AR_{i\tau} = R_{i\tau} - E(R_{i\tau}|X_{i\tau})$ where $AR_{i\tau}$, $R_{i\tau}$, and $E(R_{i\tau}|X_{\tau})$ are the abnormal, actual, and normal returns respectively for time period τ. X_{τ} is the conditioning information for the normal return model. There are two common choices for modeling the return—the *constant mean return model* where X_{τ} is a constant, and the *market model* where X_{τ} is the market return. . . . The market model assumes a stable linear relation between the market return and the security return." (emphasis in original)). Equation (1) uses the term $r_{m,t}$ to represent X_{τ}. *See also* JOHN Y. CAMPBELL, ANDREW W. LO & A. CRAIG MACKINLAY, THE ECONOMETRICS OF FINANCIAL MARKETS 158 (2d ed. 1997) ("[T]he methodology is built around the assumption that the event impact is captured by the abnormal returns.").

80. *See, e.g.*, R. Richardson Pettit & Randolph Westerfield, *Using the Capital Asset Pricing Model and the Market Model to Predict Security Returns*, 9 J. FIN. & QUANTITATIVE ANALYSIS 579, 579, 582 (1974) (discussing and comparing the CAPM and market model methods of evaluating portfolio returns).

81. *See* R.C. Stapleton & M.G. Subrahmanyam, *The Market Model and Capital Asset Pricing Theory: A Note*, 5 J. FIN. 1637, 1638 (1983) ("The market model in any of these forms is a purely statistical relation while asset pricing theories have economic content."); *see also* John Lintner, *The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets*, 47 REV. ECON. & STAT. 13, 14 (1965) (discussing how to use the CAPM to value investments in stock portfolios).

82. *See* Cheol S. Eun, *The Benchmark Beta, CAPM, and Pricing Anomalies*, 46 OXFORD ECON. PAPERS 330, 330, 332 (1994) ("[I]n the classical CAPM . . . the structure of capital market equilibrium is presented in a highly parsimonious way, relating the equilibrium asset returns to a single risk factor, namely, the market beta. This parsimonious approach enables the equilibrium asset pricing relationship to be expounded in a simple and intuitively appealing way, thereby helping the CAPM to become one of the dominant paradigms in modern finance. . . . The Sharpe-Lintner CAPM holds that in equilibrium, the expected return on an asset should be linearly related to the market beta of the asset.").

In order to estimate the abnormal returns using the CAPM as a benchmark, there is a need to first estimate the risk of the firm (β_i).[83] This goal is accomplished with the following linear regression:

$$r_{i,t} - r_{RF} = \hat{\alpha}_i + \widehat{\beta_i}\left(r_{M,t} - r_{RF}\right) + \widehat{\varepsilon_{i,t}} \qquad (3)^{84}$$

Where:

$r_{i,t}$ is the return of firm i at time t,
$r_{M,t}$ is the return of the market (i.e., the S&P500) at time t,
r_{RF} is the risk-free rate (the return of Treasury Bills),
$\hat{\alpha}_i$ is a constant,
$\widehat{\beta_i}$ is the estimated beta, the measure of risk of firm i, and
$\widehat{\varepsilon_{i,t}}$ is an error term.[85]

Once the beta is estimated, the risk-adjusted return of the firm $(r_{i,t}^{CAPM})$ can be computed for a given value of market returns:

$$r_{i,t}^{CAPM} = r_{RF} + \hat{\alpha}_i + \widehat{\beta_i}\left(r_{M,t} - r_{RF}\right) \qquad (4)^{86}$$

Finally, the risk-adjusted abnormal returns can be computed by subtracting the predicted returns computed in (4) from the actual returns of the firm:

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83. *See id.*; *see also* William F. Sharpe, *Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk*, 19 J. FIN. 425, 426 (1964) ("[Without a] theory describing the manner in which the price of risk results from the basic influences of investor preferences, the physical attributes of capital assets, etc.[,] . . . it is difficult to give any real meaning to the relationship between the price of a single asset and its risk."). The theoretical derivation of CAPM occurs in terms of *expected* returns (i.e., forecasted returns), as in equation (2). However, empirical modeling can only be conducted using realized returns, as in equation (3). *See* ZVI BODIE, ALEX KANE & ALAN J. MARCUS, INVESTMENTS 293 (9th ed. 2011) ("We have said that the CAPM is a statement about ex ante or expected returns, whereas in practice all anyone can observe directly are ex post or realized returns."); *see also* Lintner, *supra* note 81, at 14; Stapleton & Subrahmanyam, *supra* note 81, at 1638. Furthermore, the linear relation between firm returns and the market risk premium $\left(r_{M,t} - r_{RF}\right)$ is shown to be the risk of the firm (β). *See, e.g.*, Eun, *supra* note 82, at 332. Empirical models estimate β by means of linear regression. *See, e.g.*, *id.* at 330–32 ("[I]f the CAPM holds, then the expected asset returns will be linearly related not only to the market beta, but also to each of the betas computed against the component portfolios of the market."). For excellent nontechnical explanations of the models and their empirical applications, see BODIE, KANE & MARCUS, *supra* at 280–310, and EDWIN J. ELTON, MARTIN J. GRUBER, STEPHEN J. BROWN & WILLIAM N. GOETZMANN, MODERN PORTFOLIO THEORY AND INVESTMENT ANALYSIS 292–305, 338–44 (6th ed. 2003).

84. Pettit & Westerfield, *supra* note 80, at 581 n.3.

85. *See id.* at 581.

86. *See id.* This equation is obtained by algebraic manipulation of equation (3).

$$AR_{i,t} = r_{i,t} - r_{i,t}^{CAPM} \qquad (5)^{87}$$

This study used equation (5) to calculate risk-adjusted abnormal returns of each stock. To accommodate changes in the beta of the stocks, it estimated this parameter using the two hundred trading days prior to each of the filing events. This treatment allowed flexibility in the model in order to accommodate changes in the firms, market conditions, and technological innovation. The abnormal returns were then grouped by their timing relative to the event date and then subjected to statistical analysis.

B. Description of the Data

The stock and filing data were collected from Yahoo! Finance and from the RPX Litigation Database.[88] The RPX Litigation Database is an online database of patent litigation maintained by RPX Corporation[89] that has been used by other researchers studying NPE litigation.[90] The target firms involved in this study were selected by using the top ten companies ranked by the largest number of active cases filed against them by NPEs at the end of 2014, as reported by RPX Corporation.[91] Two of these companies (Samsung and LG Electronics) were not included in the study because they are not traded on a US stock exchange.[92] This left a set of eight companies from the technology and telecommunications industry that were studied: Apple (AAPL), Amazon.com (AMZN), Alphabet (GOOG), Microsoft Corporation (MSFT), Sprint Corporation (S), Sony Corporation (SNE), AT&T (T), and Verizon Communications (VZ).[93]

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87. *See id.* This equation is obtained by combining equations (1) and (4).

88. *See Yahoo! Finance*, YAHOO!, https://finance.yahoo.com/ [https://perma.cc/3DDK-27R7] (last visited Sep. 24, 2017); RPX CORP., *supra* note 7.

89. *See* RPX CORP., *supra* note 7.

90. *See, e.g.*, Lauren Cohen, Umit G. Gurun & Scott Duke Kominers, *Patent Trolls: Evidence from Targeted Firms* 2 (Harvard Bus. Sch. Fin., Working Paper No. 15-002, 2016), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2464303 [https://perma.cc/VJA3-UUG7].

91. *See* RPX CORP., 2014 NPE LITIGATION REPORT 29 tbl.4 (2015) [hereinafter RPX LITIGATION REPORT], https://www.rpxcorp.com/wp-content/uploads/sites/2/2015/03/RPX_Litigation-Report-2014_FNL_040615.pdf [https://perma.cc/F9RJ-W4BJ].

92. *See* Prableen Bajpai, *Why, and How to Invest in Samsung (SSNLF)*, NASDAQ (Apr. 22, 2016, 10:21:36 AM EDT), http://www.nasdaq.com/article/why-and-how-to-invest-in-samsung-ssnlf-cm610116 [https://perma.cc/2D2V-2GYE]; *LG Electronics: You Have to Go Overseas to Buy It*, ABC NEWS (Oct. 17, 2007) http://abcnews.go.com/Business/story?id=3737510&page=1 [https://perma.cc/CUC3-XEPW].

93. *See* RPX LITIGATION REPORT, *supra* note 91, at 29 tbl.4; *see also Company List (NASDAQ, NYSE, & AMEX)*, NASDAQ, http://www.nasdaq.com/screening/company-list.aspx

With respect to the plaintiffs, this study's dataset only includes lawsuits filed by the top ten NPEs reported by RPX Corporation, ranked by the number of cases filed between 2010 and 2014.[94] These NPE litigants are large, well-known patent litigation firms: Acacia Research Corporation, IPNav, Empire IP LLC, Arrivalstar SA/Melvino Technologies Limited, Marathon Patent Group Incorporated, eDekka LLC, Uniloc Corporation Pty Limited, Novelpoint Holdings LLC, Altitude Capital Partners, and Pragmatus.[95] The RPX Litigation Database allows for lawsuits to be filtered by plaintiff and includes subsidiaries of these corporations when performing such searches.[96] Thus, the dataset includes lawsuits filed by wholly owned subsidiaries of the above companies. By limiting the event study to only these top NPE litigants, the hope is to remove any potential inaccuracies in the conclusions that could result from including NPEs which are not generally considered to be patent trolls, such as universities, in the data.[97] When applying these filters to the RPX Litigation Database, the earliest reported lawsuit was in 2003.[98] Although this results in a more limited sample size of 555 lawsuits and 380 events,[99] this more limited dataset responds to criticisms of previous patent litigation studies while still resulting in a sufficient sample of events from which to draw statistically meaningful results.[100]

The average return and the standard deviation are reported in Table 1, subdivided by year.[101] All of the firms in the sample experienced negative returns, and an increase in standard deviation, during the financial crisis in 2008.[102] That low performance of 2008 was followed by a decrease in volatility for all firms in the sample. Furthermore, in 2009 MSFT experienced its highest average returns in the sample while AAPL, AMZN, S, and SNE exhibited their

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[https://perma.cc/Y44J-HSKC] (last visited Sept. 24, 2017); Heather Kelly, *Meet Google Alphabet—Google's New Parent Company*, CNN (Aug. 11, 2015, 6:01 PM ET), http://money.cnn.com/2015/08/10/technology/alphabet-google/index.html, [https://perma.cc/VAP8-8SEA].

94. *See* RPX LITIGATION REPORT, *supra* note 91, at 30 tbl.7.

95. *See id.*

96. *See* RPX CORP., *supra* note 7; *NPE Identification*, https://insight.rpxcorp.com/features#npe_identification [https://perma.cc/V8Q3-HM3K] (last visited Aug. 15, 2017).

97. *See* Cotropia, Kesan & Schwartz, *supra* note 29, at 650–53 (noting that many NPEs are not patent trolls because they play important economic roles).

98. *See infra* Table 2.

99. *See infra* Table 2. The number of "events" for purposes of the event study is smaller than the number of lawsuits because on some dates multiple lawsuits were filed against the same defendant.

100. *See* Cotropia, Kesan & Schwartz, *supra* note 29, at 653.

101. *See infra* Table 1.

102. *See infra* Table 1.

second-highest average returns.[103] Overall, the sample period includes both bear and bull markets, with fifty-nine out of eighty-five years-firm with average positive returns.[104]

Table 2 reports the number of days with at least one patent litigation filing by NPEs against the firms in the sample.[105] The original data from the RPX Litigation Database included lawsuits that were not new filings but were instead transfers from another district court. Accordingly, the Authors analyzed the data manually and removed any transferred cases reported as new filings. The number of days with filings markedly increased over the years included in the study.[106] Overall, AAPL and T were the firms targeted the most frequently by NPEs.[107] The rapidly increasing volume of legal actions could indicate that the firms in the sample have become increasingly careless in violating patent laws or that undertaking litigation has become increasingly more rewarding for the NPEs initiating the litigation.

Table 3 reports the number of events (days with at least one litigation filing) for each month of the year.[108] The firms in the sample were involved in litigation an average of 2.5 times each month over the 152 months of the dataset.[109] Given that most lawsuits were filed in the recent few years, this average is a considerably conservative estimate of NPEs' activity.[110] Table 3 also suggests March (4.62 days with at least one filing) is by far the most popular month for filing a lawsuit, followed by November (3.17), while December (1.75) and July (1.71) are the least popular.[111] Furthermore, almost 40 percent of the lawsuits are filed in a month in which the firms prepare their quarterly reports.[112] While the reports are normally released to the public one month later, only 28 percent of the lawsuits are filed in months during which the companies released quarterly reports.[113] This filing pattern indicates NPEs opportunistically file lawsuits around financial reporting periods.

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103. *See infra* Table 1.

104. *See* Jen Wieczner, *Happy Birthday, Bull Market! It May Be Your Last*, FORTUNE (Mar. 9, 2017) http://fortune.com/2017/03/09/stock-market-bull-market-longest/, [https://perma.cc/TRP9-BHUZ]; *infra* Table 1.

105. *See infra* Table 2.

106. *See infra* Table 2.

107. *See infra* Table 2.

108. *See infra* Table 3.

109. *See infra* Table 3.

110. *See infra* Table 2.

111. *See infra* Table 3.

112. *See infra* Table 3.

113. *See infra* Table 3.

C. Results

The statistical tests on the abnormal returns were conducted by aggregating the abnormal returns for all the firms and by testing the impact of the lawsuits on each individual firm. The results of the statistical tests are reported in Tables 4, 5A, 5B, and 5C and examine the abnormal returns for each day in the two trading weeks around the filing date.[114]

At the aggregate level, tests of the mean abnormal returns appear to be negative on filing date; however, they are not statistically significant.[115] Five trading days after the filing the target firms exhibit a positive abnormal return.[116] This could suggest that investors realize the impact of the lawsuits will not have a long-lasting impact on the value of the stock.[117] Perhaps this reaction could be influenced by press releases produced by the target firms in the days following the filing.

The weak reactions found in this study are in contrast with the Bessen, Ford, and Meurer study.[118] While this study found no statistically significant abnormal returns, Bessen, Ford, and Meurer found negative cumulative abnormal returns for five- and twenty-five-day event windows.[119]

There are potential explanations for this discrepancy in results, even if both studies were correctly conducted and presented accurate results. The Bessen, Ford, and Meurer study does not clearly identify whether it differentiates between patent troll NPEs and other NPEs who might sue to enforce a patent, such as individual inventors and universities.[120] This failure to account for the different types of litigants could be a contributing factor to the different results, particularly if lawsuits filed by non–patent troll NPEs tend to be more

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114. *See infra* Tables 4, 5A, 5B & 5C.

115. *See infra* Table 4.

116. *See infra* Table 4.

117. *See infra* Table 4. Note that this finding is inconsistent with the findings of Bessen, Ford, and Meurer's previous study, which found no quick price correction. *See* Bessen, Ford & Meurer, *supra* note 6, at 29–30 (discussing that price did not correct after the initial drop, which they claim "suggests that the initial loss of wealth was not an overreaction by investors that was subsequently corrected, at least not within 25 days").

118. *See* Bessen, Ford & Meurer, *supra* note 6, at 26 ("We find that NPE lawsuits are associated with half a trillion dollars of lost wealth to defendants from 1990 through 2010. During the last four years, the lost wealth has averaged over $80 billion per year.").

119. *See id.* at 30.

120. *See id.* at 28 (noting that the methodology of the study and not providing a clear explanation of the type or identity of NPE plaintiffs included in the study).

meritorious, resulting in larger market reactions.[121] Notably, although Bessen, Ford, and Meurer's overall study relied upon all NPE litigants, they did separate out a subset of publicly held NPE firms (which would fit the generally held definition of patent troll–type entities) that filed patent litigation from their overall data.[122] This subset represented 574 separate litigation events, approximately 14 percent of the total events they analyzed.[123] They reported similar results for these publicly traded NPEs, so it would appear that to the extent that Bessen, Ford, and Meurer did analyze different entity types within the data set, they obtained the same results as their overall study.[124]

Another potential explanation for this discrepancy is time. The Bessen, Ford, and Meurer study covered a large sample of diverse firms for a period spanning two decades—from 1990 to 2010.[125] It could be that in the earlier days of NPEs investors were not aware of their true intent (namely to extract a settlement) and responded strongly to a lawsuit, fearing the legal action would impact the future product development of the target firms. Now that this type of litigation is more commonplace, investors may be able to more accurately incorporate it into their investing decisions and not react as strongly.[126]

An intervening event that occurred after the Bessen, Ford, and Meurer study, and which could potentially have been a cause of the differing results, was the passage of the Leahy-Smith America Invents Act (AIA) in 2011.[127] The AIA reforms various aspects of patent law, with some changes aimed at reducing NPE litigation practices regarding joinder that many perceived as abusive.[128] Prior to the enactment of the AIA, NPEs were often accused of opportunistically using the federal joinder rules in patent litigation to file a single

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121. *See* Cotropia, Kesan & Schwartz, *supra* note 29, at 653 (noting the problem in empirical patent studies of not differentiating between different types of NPE litigants).

122. *See* Bessen, Ford & Meurer, *supra* note 6, at 32.

123. *Id.*

124. *Id.* ("The aggregate losses to the defendants in those lawsuits from 2000 through October 2010 total $87.6 billion in 2010 dollars, about 17 percent of the total.").

125. *Id.* at 28.

126. *See, e.g.*, *infra* Table 2.

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

128. *See* David O. Taylor, *Patent Misjoinder*, 88 N.Y.U. L. REV. 652, 654 (2013) ("In enacting this new statutory section, Congress and the President took a significant step toward correcting a perceived problem plaguing patent infringement litigation—so-called 'patent trolls' joining numerous unrelated accused infringers in inconvenient venues.").

patent infringement suit against multiple, unrelated alleged infringers.[129]

One goal of such joinder is to reduce the costs to the NPE of filing suit because a single lawsuit can be filed rather than multiple suits in multiple fora.[130] Another goal is to increase the costs of the lawsuit for the defendants.[131] While there are some potential cost savings for defendants in mounting a joint defense in a single lawsuit, there are various unique aspects to patent litigation that typically significantly drive up costs.[132] Finally, NPE litigants are accused of joining multiple defendants in a case to support venue in a desirable forum, typically the Eastern District of Texas—which is considered a favorable forum for patent litigation plaintiffs.[133]

The AIA seeks to curb this allegedly abusive use of the existing joinder practice in federal courts by essentially creating a special rule of joinder for patent cases.[134] While the details of this new joinder provision are outside the scope of this Article, in essence it requires a heightened standard of commonality between the patent claims and the defendants joined in the lawsuit.[135] This new standard has the goal of reducing joinder of patent defendants to curb abusive practices such as forum shopping.[136]

While the AIA was an intervening event, it is doubtful that this change in law would have a significant effect on the results of this event study relative to the Bessen, Ford, and Meurer study. First, this study's dataset contains a number of lawsuits filed before the AIA's joinder provision took effect, as noted in Table 2.[137] Also, the joinder provision of the AIA seems tailored to curb the location of litigation and costs associated with the number of defendants in a particular lawsuit, as opposed to the economic impact of any

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129. *See id.* at 654, 660 (discussing the allegations that patent troll litigation was a driving force behind the changes to joinder in patent litigation implemented by the AIA).

130. *See id.* at 672.

131. *See id.* at 673.

132. *See id.* ("[W]hen multiple parties, multiple patents, multiple claims, and multiple accused products are involved, the costs and complexities [of patent cases] will often increase exponentially." (alteration in original) (quoting John D. Love, Jessica L. Hannah & Jong K. Choi, *Complex Patent Cases: Observations from the Bench*, 13 SMU SCI. & TECH. L. REV. 121, 121 (2010))).

133. *See id.* at 675–77.

134. *See id.* at 654, 692 ("The AIA effectively creates a new rule governing both permissive joinder and consolidation for trial in most patent infringement litigation.").

135. *See id.* at 696–700 (discussing the joinder provisions of the AIA).

136. *See id.* at 658–59.

137. *See infra* Table 2; *see also* Leahy-Smith America Invents Act, Pub. L. No. 112-29, § 35, 125 Stat. 284, 341 (2011).

particular lawsuit.[138] If anything, this reform might have increased the number of events in this study, as Table 2 notably shows an increase in litigation since 2011.[139] However, this increase in litigation events would be unlikely to have a significant effect on the economic impact of any individual event. Given the size of the companies involved, the cost of carrying out the litigation would likely not predominate in the mind of investors—rather, the more important consideration would be the effect that the outcome of the litigation would have on a company's future cash flows through product development and R&D.[140]

Finally, even after 2011, the dataset reflected the Eastern District of Texas as by far the most popular forum for the litigation filed.[141] As seen in Table 6A, 47.29 percent of the cases brought since September 16, 2011 (the AIA became effective on September 15, 2011) were brought in the Eastern District of Texas.[142] Prior to the

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138. *See* Taylor, *supra* note 128 at 658–59.

139. *See infra* Table 2; *see also* Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (codified in various sections of 35 U.S.C.).

140. The value of a firm can be estimated by adding the present values of future expected cash flows. *See, e.g.*, McWilliams & Siegel, *supra* note 56, at 626–27 ("Stock prices are supposed to reflect the true value of firms, because they are assumed to reflect the discounted value of all future cash flows and incorporate all relevant information."). A one-time settlement would lower the *next* expected cash flow without impacting the remaining future cash flows. *See, e.g.*, Matteo Arena & Brandon Julio, *The Effects of Securities Class Action Litigation on Corporate Liquidity and Investment Policy*, 50 J. FIN. & QUANTITATIVE ANALYSIS 251, 252 (2015) ("Given the potential size of lawsuit settlements, litigation risk has important implications for expected cash flows. . . . One corporate policy that may be particularly sensitive to litigation risk is the decision to accumulate cash flow in the form of liquid assets. . . . Due to the costs associated with raising external financing and the possibility of future cash-flow shocks, firms have an incentive to save more cash to avoid raising external capital to finance new investments and other corporate activities."). However, should litigation result in halting production of a product (by affecting R&D), a *set* of future cash flows could be affected. *See, e.g.*, Cohen, Gurun & Kominers, *supra* note 90, at 37–38 ("[W]e see that losing to an NPE has a large and negative impact on future R&D activities . . . . In all, the evidence in this section strongly supports the idea that NPEs have a real and negative impact on innovation of United States firms."). The latter alternative would have the largest impact on the value of the firm. Furthermore, a one-time settlement is a clearly quantifiable amount, while the alternative scenario would require each investor to estimate the magnitude of its impact, leading to a higher level of uncertainty about the firm. *See, e.g.*, Martine Costello, *Lawsuits and Your Stock*, CNN MONEY (Dec. 3, 1998, 10:08 AM), http://money.cnn.com/1998/12/03/investing/q_classaction/ [https://perma.cc/48XN-D6SC] ("Philip Morris investors may have had a coughing fit when Big Tobacco agreed to pay $206 billion to settle a string of smoking-related lawsuits. But the stock has risen five percent since the Nov. 16 agreement between the major cigarette makers and eight states. So the bad news has actually paid off. 'The settlement removes uncertainty,' said Bonnie Zoller, a tobacco analyst at Credit Suisse First Boston."). The firm would be perceived as being more risky, depressing the stock price even lower. *See id.*

141. *See infra* Tables 6A & 6B.

142. *See infra* Table 6A.

enactment of the AIA, 49.40 percent of the cases brought were in the Eastern District of Texas.[143] Thus, while there was some decrease in the number of cases filed in the Eastern District of Texas, it was not significant in our data set, and it appears that the AIA had very little impact with respect to forum shopping.[144] For the foregoing reasons, the Authors believe the passage of the AIA is not sufficient to lead to the different results between this study and the Bessen, Ford, and Meurer study, but this is an area where additional study on the impact of the passage of this reform on NPE litigation, and the impact of choice of venue in general, would be worthwhile.

A final potential explanation is that Bessen, Ford, and Meurer did not conduct sufficient statistical analysis of their data.[145] Their study provides data for cumulative abnormal returns, but it failed to provide any advanced statistical analysis regarding how these returns were distributed.[146] A closer look at the nature of the abnormal returns in this study shows their distribution is negatively skewed on the day after filing.[147] This indicates their distribution is not symmetric, and it is influenced by extreme negative values. At the aggregate level this is quite noticeable since, on all other days around the filing date, abnormal returns are characterized by positively skewed distributions.[148] This suggests investors do react to the filing but not always with the same "intensity": in a few instances the reaction might be more extreme than most, leading to abnormal returns that are not statistically different than zero but that are negatively skewed.[149] The skewness of the returns suggests the

143. *See infra* Table 6B.

144. The effect of the AIA on forum shopping may increase in the wake of the recent Supreme Court decision that the reference to patent defendants' state of "residence" in the patent venue statute means only the state of incorporation for domestic corporations. *See* TC Heartland LLC v. Kraft Foods Grp. Brands, 137 S. Ct. 1514, 1517 (2017) ("We therefore hold that a domestic corporation 'resides' only in its State of incorporation for purposes of the patent venue statute."). This will likely have a strong effect on patent infringement cases going forward, as the "residence" prong of the venue statute was frequently relied upon by patent litigants to establish venue in plaintiff-friendly districts like the Eastern District of Texas for corporations not incorporated in Texas. *See* Jason M. Wejnert, *In* TC Heartland *Decision, U.S. Supreme Court Changes the Landscape—and Possibly the Venue—of Patent Litigation*, NAT'L L. REV. (June 1, 2017), http://www.natlawreview.com/article/tc-heartland-decision-us-supreme-court-changes-landscape-and-possibly-venue-patent [https://perma.cc/43HD-M9XJ].

145. *See, e.g.*, McWilliams & Siegel, *supra* note 56, at 646 (noting that some previous event studies claimed "quite dramatic value effects" but that these results could not be replicated and could be explained by more advanced statistical tests).

146. *See* Bessen, Ford, & Meurer, *supra* note 6, at 29–30; *see also* McWilliams & Siegel, *supra* note 56, at 646.

147. *See infra* Table 4.

148. *See infra* Table 4.

149. *See infra* Table 4.

abnormal returns could follow a distribution that is not normal, and thus we conducted additional nonparametric statistical testing.[150]

The Jarque-Bera test tests the null hypothesis—that the distribution is normally distributed—by examining both the skewness and the kurtosis of the data.[151] Applied to this study's data, in all cases the Jarque-Bera test rejected the normality of the abnormal returns.[152] This finding questions the appropriateness of the t-tests, requiring a closer look at the data through nonparametric tests. Examining the extreme, central, and quartile measures of abnormal returns suggests the day after filing the abnormal returns experience the lowest maximum value (0.054) and the largest negative value (–0.121).[153] Examining the percentage of positive and negative abnormal returns indicates the fifth day after the event has a slightly higher proportion of positive abnormal returns.[154] The Wilcoxon signed-rank test was used to test significance of the median abnormal returns.[155] The largest statistically significant median (0.00048) occurs on the fifth day after the filing.[156] However, all others are not statistically significant.[157] This finding is consistent with the parametric tests discussed above.

The aggregate results of these statistical tests indicate that in terms of mean and median abnormal returns there are no significant reactions on the filing day or its immediate aftermath. However, the abnormal returns exhibit their extreme negative values the day after the filing of the lawsuits (–0.12139).[158] This suggests that either different types of filings trigger different market reactions, some being more extreme, or there are some firms whose investors are more concerned with patent litigation. In order to answer this question, the abnormal returns for each firm must be examined. The firm-level results are reported in Tables 5A, 5B and 5C.[159]

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150. *See* McWilliams & Siegel, *supra* note 56, at 635 (noting the importance of conducting nonparametric statistical tests to explain any potential outliers or nonnormal results).

151. *See* Thorsten Thadewald & Herbert Buning, *Jarque-Bera Test and Its Competitors for Testing Normality—A Power Comparison*, 34 J. APPLIED STAT. 87, 88 (2007) (discussing the Jarque-Bera statistical test and its accepted use in econometrics).

152. *See infra* Table 4.

153. *See infra* Table 4.

154. *See infra* Table 4.

155. *See* S.M. Taheri & G. Hesamian, *A Generalization of the Wilcoxon Signed-Rank Test and Its Applications*, 54 STATISTICAL PAPERS 457, 459 (2013) (discussing the Wilcoxon signed-rank test and its application).

156. *See infra* Table 4.

157. *See* Taheri & Hesamian, *supra* note 155, at 459.

158. *See infra* Table 4.

159. *See infra* Tables 5A, 5B & 5C.

Tables 5A, 5B and 5C summarize the statistical results for the firms with the largest number of lawsuits by NPEs.[160] The firms are listed in alphabetical order, and the number of days with at least one filing is reported next to their names.[161] Examining the abnormal returns shows that on the day of filing only half of the firms (AAPL, AMZN, and T) exhibit negative mean abnormal returns, and only two (AAPL and AMZN) exhibit negative median abnormal returns. In all cases the mean and median are not statistically significant.[162] Only AMZN experiences the lowest percentage of positive abnormal returns (i.e., the highest percentage of negative abnormal returns) on event day (t), while four of them—AAPL (38.2% at t–1), AMZN (35.3% at t), SNE (42.2% at t–2) and T (41.0% at t+2)—experience that effect within three days of filing day.[163] Abnormal returns exhibit negative skewness the day after filing for five of the six firms (all except VZ), and in half of the cases (AMZN, MSFT, and T) also on the day of filing.[164]

The results at the firm level confirm the presence of heterogeneity on how different firms react to the filing of the lawsuits. In all cases, market reactions are relatively weak and affect both the mean and distribution of the abnormal returns.[165] All firms but VZ exhibit negatively skewed abnormal returns on the day subsequent to filing.[166] This suggests that for the *same firm* some lawsuits trigger more extreme reactions than others. Due to this variation of results for different events, it could be that the large cumulative abnormal return results reported by Bessen, Ford, and Meurer represent an accumulation of results from varying events to which investors react substantially differently, and thus the cumulative results reported do not paint an accurate picture of the effect of the losses resulting from all types of NPE litigation.

IV. CONCLUSION

Overall, the empirical results of this study are in sharp contrast with the findings of Bessen, Ford, and Meurer. They examined a large sample of firms across six industries, with firms of a

160. *See infra* Tables 5A, 5B & 5C.
161. *See infra* Tables 5A, 5B & 5C.
162. *See infra* Tables 5A, 5B & 5C.
163. *See infra* Tables 5A, 5B & 5C.
164. *See infra* Tables 5A, 5B & 5C.
165. *See infra* Tables 5A, 5B & 5C.
166. *See infra* Tables 5A, 5B & 5C.

wide range of market capitalizations.[167] Their findings indicate that for the period spanning 1990–2010, markets reacted negatively to the filing of lawsuits by NPEs.[168] Bessen, Ford, and Meurer suggest technology and software are more likely targets because patents in that sector tend to be more vulnerable to inadvertent breaches.[169] This study, by contrast, selects firms among the most targeted in those sectors and spans more recent times. Consistent with Bessen, Ford, and Meurer, this study finds the number of filings has increased over time; however, we find that equity investors do not react as sharply as they suggest. The negative skewness of aggregate abnormal returns the day after the filing indicates that in some instances investors' reactions are quite strong;[170] however, this also indicates parametric statistical tests could be inappropriate.[171] The nonparametric tests conducted in this study confirm the weak reactions of investors.

A number of hypotheses could be consistent with these findings of weak abnormal returns and negative skewness. Suppose with the passage of time, investors now realize that the lawsuits will be quickly settled and the NPEs do not have a real intention to halt the production of a particular product of the target firm; then, filing would produce no abnormal returns and no visible change in the skewness, as a technology-based firm's stock price may already reflect its investors' expectation that it will have to settle some patent lawsuits. This would ameliorate the impact of any information that another NPE patent lawsuit has been filed, as long as that lawsuit is of the type to which investors have become accustomed.

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167. *See* Bessen, Ford, & Meurer, *supra* note 6, at 29.

168. *See id.* at 26.

169. *See id.* at 28 (discussing how software and related technology patents often have "fuzzy boundaries" and can therefore be litigated more frequently due to unintentional breaches).

170. In this context, skewness indicates the asymmetry of the distribution of abnormal returns. The presence of negative skewness, together with the finding of the largest negative abnormal return the day after filing (see Table 4), suggests that around filing dates there are extreme negative abnormal returns. The distribution of abnormal returns outside of the filing dates does not exhibit this behavior. The Authors attribute the change in distribution to the filing event.

171. Parametric statistical tests are valid only if the distribution of the data follows a known distribution (e.g., normal, Student's t, etc.). Parametric testing is still valid if the data deviates marginally from the underlying distributions; however, if the data deviates too much from the underlying distributions, parametric testing will no longer be valid. *See, e.g.*, TANYA HOSKIN, MAYO CLINIC DEP'T OF HEALTH SCIS. RESEARCH, PARAMETRIC AND NONPARAMETRIC: DEMYSTIFYING THE TERMS 2, https://www.mayo.edu/mayo-edu-docs/center-for-translational-science-activities-documents/berd-5-6.pdf [https://perma.cc/CC6Z-5EQL] ("Parametric statistical procedures rely on assumptions about the shape of the distribution (i.e., assume a normal distribution) in the underlying population and about the form or parameters (i.e., means and standard deviations) of the assumed distribution.").

The negative skew at the aggregate level, however, suggests two alternative hypotheses: either some lawsuits are associated with significant sell-off or investors in some firms perceive the lawsuits as being detrimental in the long run. The tests at the firm level demonstrate that, using parametric and nonparametric tests, the majority of the firms do not experience significant negative returns on the day of filing.[172] All except one of the firms (VZ) experience negative skew the day after the filing.[173] These two findings support the second of the previous hypotheses: investors perceive some filings as being a threat to the target's future profitability and others as nonthreats. These findings suggest further event studies may need to focus on the types of patent filings that are most likely to be used opportunistically by NPEs and could potentially cause unnecessary economic harm.

These findings do not completely contradict those of Bessen, Ford, and Meurer, but shed a different light. Perhaps the increased media coverage on NPEs' activity has educated investors, who realize the true intent of these organizations is to collect monetary compensation rather than prevent the development of a product in its entirety. Investors would perceive this as a one-time expense rather than a permanent hurdle to the firm's ability to innovate and benefit from R&D. The skewness of the results suggests that perhaps investors have become more sophisticated over the years, and instead of initiating selloffs large enough to depress the price of the target's common stock, they evaluate each case and react more conservatively.

Overall, the results indicate the need for further research in this area and highlight the danger of deriving strong inferences of economic losses from event studies without robust statistical testing.[174] While event studies can be useful in public policy research, sweeping conclusions, such as broad statements of the economic loss attributable to NPE litigation made by Bessen, Ford, and Meurer,[175] can be problematic without additional statistical scrutiny. Policymakers tend to seize on large, cumulative numbers, but nuances in the data can be lost when such broad results are reported.[176] This study was not able to confirm the abnormal negative returns from the

172. *See infra* Tables 5A, 5B & 5C.

173. *See infra* Tables 5A, 5B & 5C.

174. *See, e.g.*, McWilliams & Siegel, *supra* note 56, at 646 (noting that some previous event studies claimed "quite dramatic value effects" but that these results could not be replicated and could be explained by more advanced statistical tests).

175. *See* Bessen, Ford & Meurer, *supra* note 6, at 26 ("We find that NPE lawsuits are associated with half a trillion dollars of lost wealth to defendants from 1990 through 2010. During the last four years, the lost wealth has averaged over $80 billion per year.").

176. *See, e.g.*, McWilliams & Siegel, *supra* note 56, at 650.

Bessen, Ford, and Meurer study even when applied to only large NPEs, and any initially perceived abnormal negative returns were slight, or not present, upon further statistical analysis. This study casts at least some doubt on whether mass aggregator NPE entities as a whole—at least in the minds of large public company stockholders—create the economic harm that many allege. Further research is necessary into whether especially problematic types of NPE litigation exist.

APPENDIX

Table 1:
Average Returns and Standard Deviations by Year.

		AAPL	AMZN	GOOG	MSFT	S	SNE	S&P500	T	VZ
2003	Mean	0.001586	0.004065	NA	0.000262	0.000642	-0.000672	0.000929	0.000066	-0.000232
	S.D.	0.023228	0.027486	NA	0.018344	0.022427	0.022047	0.010737	0.021224	0.018373
2004	Mean	0.004377	-0.000684	NA	0.000347	0.001746	0.000488	0.000342	0.000147	0.000733
	S.D.	0.024981	0.026932	NA	0.010749	0.016624	0.014513	0.006988	0.011988	0.010739
2005	Mean	0.003187	0.000248	NA	-0.00003	-0.00019	0.000196	0.000117	0.000009	-0.00099
	S.D.	0.024421	0.022628	NA	0.009031	0.013639	0.014022	0.006477	0.008102	0.008841
2006	Mean	0.000660	-0.00070	NA	0.000586	-0.00043	0.000213	0.000509	0.001699	0.001184
	S.D.	0.024028	0.026083	NA	0.013266	0.016745	0.018393	0.006310	0.010627	0.010181
2007	Mean	0.003378	0.003400	NA	0.000754	-0.00142	0.000963	0.000138	0.000747	0.000799
	S.D.	0.023684	0.031123	NA	0.014309	0.018516	0.018052	0.010093	0.014239	0.012240
2008	Mean	-0.00332	-0.00233	NA	-0.00231	-0.00778	-0.00356	-0.00192	-0.00130	-0.00078
	S.D.	0.036998	0.041318	NA	0.030242	0.073350	0.034387	0.025840	0.028272	0.027227
2009	Mean	0.003587	0.003827	NA	0.001877	0.002751	0.001120	0.000836	0.000181	0.000147
	S.D.	0.021236	0.031718	NA	0.023453	0.047012	0.028274	0.017176	0.016596	0.016132
2010	Mean	0.001689	0.001156	NA	-0.00026	0.000574	0.000826	0.000477	0.000436	0.000807
	S.D.	0.016810	0.020557	NA	0.013844	0.031039	0.019111	0.011378	0.009486	0.010039
2011	Mean	0.000903	-0.00015	NA	-0.00018	-0.00234	-0.00271	0.000000	0.000343	0.000663
	S.D.	0.016536	0.024336	NA	0.014787	0.039101	0.021980	0.014712	0.011483	0.012196
2012	Mean	0.001128	0.001484	NA	0.000225	0.003540	-0.00190	0.000503	0.000645	0.000495
	S.D.	0.018460	0.019656	NA	0.013042	0.031208	0.024867	0.008037	0.008732	0.008934
2013	Mean	0.000308	0.001839	NA	0.001455	0.002539	0.001723	0.001029	0.000368	0.000677
	S.D.	0.018209	0.016949	NA	0.015837	0.022231	0.024070	0.006974	0.009594	0.010836
2014	Mean	0.001353	-0.00099	-0.00030	0.000966	-0.00377	0.000670	0.000428	0.000026	-0.00002
	S.D.	0.013650	0.020677	0.013283	0.011963	0.031317	0.017935	0.007170	0.009017	0.009322

Table 1 reports the average and the standard deviation of the returns obtained from daily stock prices for each of the full calendar years 2003–2014. The S&P500 is included to serve as a benchmark.

Table 2:
Number of Events by Year.

	AAPL	AMZN	GOOG	MSFT	S	SNE	T	VZ	TOTAL
2003	0	1	0	1	0	0	0	0	2
2004	0	0	0	0	0	1	0	0	1
2005	0	1	0	2	0	1	0	0	4
2006	0	0	0	3	0	0	0	0	3
2007	2	1	0	2	2	4	3	2	16
2008	5	0	0	1	0	1	2	1	10
2009	5	2	0	3	3	4	3	3	23
2010	9	5	0	4	1	13	6	1	39
2011	10	5	0	5	1	9	10	9	49
2012	21	4	0	6	4	13	13	8	69
2013	12	8	0	7	5	10	19	16	77
2014	8	5	6	7	1	6	15	16	64
2015*	4	2	0	0	1	2	7	7	23
TOTAL	76	34	6	41	18	64	78	63	380

Table 2 reports the number of days with patent litigation filings against each of the firms in the sample. On some days, multiple filings were made against the same defendant; thus, the total number of actual patent filings is higher than the number of events. The last column and the bottom row report the total number of days with patent filings against each firm and in each year. Overall the sample contains a total of 380 events and 555 individual lawsuits.

Table 3:
Number of Days with Filings Against the Firms by Month.

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	TOTAL
# of days with filings	26	24	60	34	38	32	23	24	37	23	38	21	380
average	2.00	1.85	4.62	2.62	2.92	2.46	1.77	1.85	3.08	1.92	3.17	1.75	2.50

Table 3 reports the number of days with patent litigation filings in each month in the sample along with the average number of days with filings per month. Overall the sample contains a total of 152 months (12 counts of September through December and 13 for all other months).

Note: Quarterly reports are produced in March, June, September and December, but generally released one month later (39.5% of filings occur in quarterly report months, versus 27.9% in the month later and 32.6% in the other months).

Table 4:
Statistical Parameters of Abnormal Returns for Entire Sample (380 events).

	-5 days	-4 days	-3 days	-2 days	-1 day	filing	+1 day	+2 days	+3 days	+4 days	+5 days
Mean	0.000089	-0.000016	0.000678	-0.000174	0.000882	-0.000006	0.000516	0.000142	-0.000084	0.000010	0.001716
St. Dev.	0.017799	0.017938	0.01626	0.016322	0.015285	0.013662	0.01513	0.0133	0.018393	0.016353	0.012706
t (P-value)	0.096 (0.46)	-0.01 (0.49)	0.813 (0.20)	-0.20 (0.41)	1.124 (0.13)	-0.00 (0.49)	0.665 (0.25)	0.208 (0.41)	-0.08 (0.46)	0.011 (0.49)	2.632 (0.00)
Skewness	0.73	0.09	1.06	0.48	1.39	0.87	-1.41	0.64	0.97	1.30	0.81
Kurtosis	14.11	13.62	10.85	9.82	10.80	9.00	16.66	6.44	23.73	16.90	6.48
Jarque-Bera	1987.9	1785.9	1047.0	750.9	1085.7	617.7	3080.2	213.2	6866.3	3166.3	233.3
Median	-0.00064	-0.00047	0.00025	0.00041	-0.00006	-0.00018	0.00014	-0.00035	-0.00045	-0.00034	0.00048
Maximum	0.12041	0.09482	0.10092	0.09782	0.08436	0.08012	0.05394	0.06840	0.15934	0.13683	0.05777
Minimum	-0.10845	-0.11662	-0.07059	-0.06886	-0.06826	-0.05214	-0.12139	-0.05173	-0.11371	-0.06128	-0.04882
75th Perc.	0.00689	0.00605	0.00698	0.00757	0.00667	0.00629	0.00680	0.00577	0.00758	0.00713	0.00734
25th Perc.	-0.00711	-0.00673	-0.00760	-0.00803	-0.00683	-0.00648	-0.00573	-0.00690	-0.00729	-0.00751	-0.00533
% Positive	47.1%	47.6%	51.1%	51.3%	49.7%	49.7%	50.8%	48.7%	46.8%	49.2%	52.1%
Wilcoxon (P)	0.64 (0.26)	0.59 (0.27)	0.12 (0.45)	0.06 (0.47)	0.03 (0.48)	0.41 (0.34)	0.84 (0.19)	0.73 (0.23)	0.62 (0.26)	0.37 (0.35)	1.80 (0.03)

Notes: The P-values for the t-test and for the Wilcoxon signed-rank tests are computed for the alternative hypothesis that the mean and median abnormal returns are negative. The Jarque-Bera test rejects the null hypothesis that both the skewness and the excess kurtosis are jointly zero, rejecting that the sample is obtained from a normal distribution in all cases.

Table 5A: Statistical Parameters of Abnormal Returns for Selected Firms.

		-5 days	-4 days	-3 days	-2 days	-1 day	filing	+1 day	+2 days	+3 days	+4 days	+5 days
AAPL (76)	**Mean**	-0.00080	-0.00059	-0.00041	-0.00205	-0.00068	-0.00233	0.00074	0.00171	-0.00080	0.00085	0.00299
	Std. Dev.	0.01244	0.01769	0.01694	0.01738	0.01560	0.01597	0.01394	0.01621	0.01585	0.01568	0.01287
	t-stat (P-val.)	-0.55 (0.57)	-0.29 (0.77)	-0.20 (0.83)	-1.03 (0.30)	-0.37 (0.70)	-1.27 (0.20)	0.462 (0.64)	0.918 (0.36)	-0.43 (0.66)	0.470 (0.63)	2.022 (0.04)
	Skewness	0.220	0.261	0.314	-1.084	1.196	0.926	-0.231	1.103	-0.262	0.244	0.252
	Kurtosis	4.185	7.809	3.827	6.620	6.386	8.802	3.693	5.542	3.819	3.409	4.215
	Jarque-Bera (P)	5.05 (0.07)	74.1 (0)	3.41 (0.18)	56.3 (0)	54.4 (0)	117. (0)	2.19 (0.33)	35.8 (0)	2.99 (0.22)	1.28 (0.52)	5.48 (0.06)
	Median	-0.00074	-0.00086	-0.00068	-0.00087	-0.00368	-0.00303	0.00106	-0.00014	-0.00071	-0.00252	0.00240
	Maximum	0.04277	0.07280	0.05382	0.03571	0.06366	0.07280	0.03712	0.06840	0.03586	0.04277	0.04590
	Minimum	-0.03333	-0.06299	-0.04710	-0.06886	-0.03672	-0.05214	-0.04231	-0.02782	-0.04857	-0.04630	-0.03289
	% Positive	44.7%	43.4%	44.7%	46.1%	38.2%	40.8%	53.9%	50.0%	46.1%	44.7%	57.9%
	Wilcoxon (P)	0.52 (0.59)	0.64 (0.51)	0.52 (0.59)	0.80 (0.42)	1.21 (0.22)	1.66 (0.09)	0.62 (0.53)	0.38 (0.70)	0.41 (0.67)	0.08 (0.93)	1.85 (0.06)
AMZN (34)	**Mean**	-0.00725	0.00205	-0.00223	-0.00174	0.00208	-0.00232	-0.00094	0.00016	-0.00168	0.00395	0.00331
	Std. Dev.	0.02940	0.01844	0.01806	0.01223	0.01924	0.01035	0.01491	0.01449	0.02504	0.02706	0.01173
	t-stat (P-val.)	-1.43 (0.16)	0.647 (0.52)	-0.72 (0.47)	-0.83 (0.41)	0.631 (0.53)	-1.30 (0.20)	-0.36 (0.71)	0.064 (0.94)	-0.39 (0.69)	0.851 (0.40)	1.646 (0.10)
	Skewness	-0.40	1.01	-0.56	-0.18	2.37	-0.15	-0.13	0.76	-1.35	3.47	0.55
	Kurtosis	7.69	6.14	4.11	2.17	10.88	3.46	7.60	4.39	7.86	18.40	3.05
	Jarque-Bera (P)	32.1 (0)	19.6 (0.00)	3.53 (0.17)	1.16 (0.55)	119. (0)	0.43 (0.80)	30.1 (0)	6.00 (0.04)	43.6 (0)	404. (0)	1.68 (0.43)
	Median	-0.00536	0.00129	-0.00082	-0.00111	-0.00114	-0.00207	-0.00161	0.00096	-0.00339	0.00183	0.00173
	Maximum	0.08436	0.06673	0.03382	0.02241	0.08436	0.02118	0.04637	0.04637	0.05053	0.13683	0.03240
	Minimum	-0.10845	-0.03480	-0.05722	-0.02263	-0.02085	-0.02904	-0.05106	-0.02361	-0.09736	-0.03546	-0.01980
	% Positive	35.3%	50.0%	47.1%	44.1%	47.1%	35.3%	44.1%	55.9%	44.1%	55.9%	58.8%
	Wilcoxon (P)	1.77 (0.07)	0.59 (0.54)	0.63 (0.52)	0.75 (0.45)	0.11 (0.90)	1.36 (0.17)	0.54 (0.58)	0.10 (0.91)	0.10 (0.91)	0.44 (0.65)	1.40 (0.16)

Note: The P-values for the Student's t-test and for the Wilcoxon signed-rank test are estimated under a two-tailed test.

Table 5B: Statistical Parameters of Abnormal Returns for Selected Firms.

		-5 days	-4 days	-3 days	-2 days	-1 day	filing	+1 day	+2 days	+3 days	+4 days	+5 days
MSFT (41)	**Mean**	-0.00075	0.00082	0.00376	0.00205	-0.00097	0.00014	-0.00104	0.00144	-0.00183	-0.00039	0.00167
	Std. Dev.	0.02039	0.00852	0.01367	0.01085	0.01250	0.01108	0.02302	0.01265	0.01187	0.01375	0.00966
	t-stat (P-val.)	-0.23 (0.81)	0.617 (0.54)	1.760 (0.08)	1.209 (0.23)	-0.49 (0.62)	0.078 (0.93)	-0.28 (0.77)	0.729 (0.47)	-0.98 (0.32)	-0.17 (0.85)	1.107 (0.27)
	Skewness	1.46	0.59	1.28	1.17	-0.67	-0.97	-3.21	0.30	0.68	0.82	0.40
	Kurtosis	8.26	3.90	4.21	5.37	7.37	6.58	20.11	3.09	4.28	4.20	2.88
	Jarque-Bera (P)	61.8 (0)	3.79 (0.14)	13.7 (0.00)	18.9 (0.00)	35.6 (0)	28.2 (0.00)	570. (0)	0.62 (0.73)	5.97 (0.05)	7.00 (0.03)	1.10 (0.57)
	Median	-0.00315	-0.00074	0.00041	0.00058	-0.00107	0.00113	-0.00011	-0.00038	-0.00200	-0.00263	0.00144
	Maximum	0.07832	0.02490	0.04280	0.04078	0.03225	0.02277	0.05394	0.03092	0.03674	0.03778	0.02542
	Minimum	-0.04825	-0.01714	-0.01586	-0.01584	-0.04825	-0.04112	-0.12139	-0.02357	-0.02204	-0.03199	-0.01705
	% Positive	34.1%	46.3%	56.1%	51.2%	41.5%	53.7%	46.3%	46.3%	41.5%	39.0%	56.1%
	Wilcoxon (P)	0.99 (0.31)	0.37 (0.70)	0.93 (0.35)	0.77 (0.43)	0.75 (0.45)	0.47 (0.63)	0.11 (0.90)	0.25 (0.79)	1.38 (0.16)	1.04 (0.29)	0.79 (0.42)
SNE (64)	**Mean**	0.00222	0.00180	-0.00002	-0.00486	0.00268	0.00246	0.00040	0.00348	-0.00232	-0.00291	0.00090
	Std. Dev.	0.01611	0.02027	0.01636	0.01937	0.01854	0.01782	0.02056	0.01577	0.02135	0.01882	0.01770
	t-stat (P-val.)	1.103 (0.27)	0.709 (0.48)	-0.00 (0.99)	-2.00 (0.04)	1.155 (0.25)	1.103 (0.27)	0.153 (0.87)	1.763 (0.08)	-0.86 (0.38)	-1.23 (0.22)	0.405 (0.68)
	Skewness	0.60	1.82	1.50	-0.22	0.92	1.27	-0.26	0.76	-1.91	-0.30	0.90
	Kurtosis	3.28	8.17	9.35	2.88	6.12	7.47	5.68	3.93	13.08	3.61	3.66
	Jarque-Bera (P)	4.04 (0.13)	106. (0)	131. (0)	0.55 (0.75)	34.8 (0)	70.4 (0)	19.8 (0.00)	8.46 (0.01)	309. (0)	1.99 (0.36)	9.76 (0.00)
	Median	0.00031	-0.00084	-0.00229	-0.00745	0.00244	0.00129	-0.00103	0.00145	-0.00288	-0.00165	-0.00428
	Maximum	0.04734	0.08431	0.07678	0.03592	0.07678	0.08012	0.05007	0.04890	0.04848	0.04159	0.05391
	Minimum	-0.03019	-0.02811	-0.04179	-0.06000	-0.03657	-0.03142	-0.07763	-0.03019	-0.11371	-0.06060	-0.03225
	% Positive	50.0%	48.4%	45.3%	42.2%	62.5%	54.7%	46.9%	56.3%	43.8%	45.3%	43.8%
	Wilcoxon (P)	0.57 (0.56)	0.18 (0.85)	0.67 (0.49)	1.79 (0.07)	1.12 (0.25)	0.89 (0.37)	0.09 (0.92)	1.32 (0.18)	0.87 (0.38)	1.11 (0.26)	0.30 (0.76)

Note: The P-values for the Student's t-test and for the Wilcoxon signed-rank test are estimated under a two-tailed test.

Table 5C: Statistical Parameters of Abnormal Returns for Selected Firms.

		-5 days	-4 days	-3 days	-2 days	-1 day	filing	+1 day	+2 days	+3 days	+4 days	+5 days
T (78)	Mean	0.00060	-0.00034	0.00157	0.00255	0.00033	-0.00151	-0.00001	-0.00176	0.00051	0.00071	0.00080
	Std. Dev.	0.01097	0.00990	0.00746	0.00829	0.00652	0.00860	0.00627	0.00664	0.00976	0.01037	0.00755
	t-stat (P-val.)	0.479 (0.63)	-0.29 (0.76)	1.862 (0.06)	2.719 (0.00)	0.441 (0.66)	-1.55 (0.12)	-0.01 (0.98)	-2.33 (0.02)	0.457 (0.64)	0.601 (0.54)	0.935 (0.35)
	Skewness	-0.50	-0.25	1.28	0.58	-0.32	-1.49	-0.46	-0.14	-1.73	2.48	0.32
	Kurtosis	9.12	8.16	7.12	4.71	3.15	6.82	2.93	3.02	12.08	16.11	6.40
	Jarque-Bera (P)	125. (0)	87.5 (0)	76.3 (0)	13.8 (0.00)	1.40 (0.49)	76.2 (0)	2.75 (0.25)	0.24 (0.88)	306. (0)	638. (0)	38.9 (0)
	Median	0.00122	0.00042	0.00117	0.00260	0.00071	0.00031	0.00060	-0.00127	-0.00012	0.00066	0.00062
	Maximum	0.03976	0.03211	0.03109	0.03341	0.01402	0.01773	0.01213	0.01472	0.02117	0.06107	0.02836
	Minimum	-0.04276	-0.04276	-0.01268	-0.01553	-0.02021	-0.03692	-0.01440	-0.01819	-0.05159	-0.01844	-0.02684
	% Positive	56.4%	52.6%	61.5%	66.7%	53.8%	52.6%	52.6%	41.0%	48.7%	52.6%	51.3%
	Wilcoxon (P)	0.84 (0.39)	0.59 (0.55)	1.72 (0.08)	2.62 (0.00)	0.64 (0.52)	0.62 (0.53)	0.39 (0.69)	2.19 (0.02)	0.81 (0.41)	0.09 (0.92)	0.81 (0.41)
VZ (63)	Mean	0.00019	-0.00127	0.00011	0.00117	-0.00052	0.00065	0.00047	-0.00100	0.00081	-0.00023	0.00047
	Std. Dev.	0.01021	0.01105	0.00792	0.01016	0.00842	0.00893	0.00885	0.00794	0.00672	0.00865	0.00758
	t-stat (P-val.)	0.149 (0.88)	-0.91 (0.36)	0.112 (0.91)	0.912 (0.36)	-0.49 (0.62)	0.575 (0.56)	0.421 (0.67)	-1.00 (0.32)	0.954 (0.34)	-0.20 (0.83)	0.492 (0.62)
	Skewness	0.96	-2.58	-0.41	0.49	0.71	0.33	0.54	0.29	0.49	-0.44	-0.31
	Kurtosis	5.71	15.74	4.30	4.41	5.44	3.47	4.52	3.87	3.35	4.26	4.57
	Jarque-Bera (P)	29.0 (0)	496. (0)	6.14 (0.04)	7.77 (0.02)	20.8 (0.00)	1.73 (0.41)	9.13 (0.01)	2.84 (0.24)	2.80 (0.24)	6.25 (0.04)	7.49 (0.02)
	Median	-0.00053	-0.00053	0.00012	0.00113	-0.00005	0.00004	-0.00052	0.00005	0.00016	0.00004	-0.00038
	Maximum	0.03821	0.02016	0.02095	0.03682	0.03114	0.02413	0.03167	0.02096	0.01959	0.02413	0.01972
	Minimum	-0.02060	-0.06197	-0.02385	-0.02060	-0.02149	-0.01889	-0.02041	-0.02041	-0.01264	-0.02420	-0.02580
	% Positive	49.2%	47.6%	52.4%	57.1%	49.2%	52.4%	47.6%	50.8%	52.4%	50.8%	44.4%
	Wilcoxon (P)	0.21 (0.82)	0.42 (0.66)	0.44 (0.65)	0.80 (0.42)	0.70 (0.47)	0.29 (0.76)	0.19 (0.84)	1.18 (0.23)	0.59 (0.54)	0.20 (0.83)	0.35 (0.72)

Note: The P-values for the Student's t-test and for the Wilcoxon signed-rank test are estimated under a two-tailed test.

Table 6A: Filings in Eastern District of Texas Post-AIA.

	AAPL	AMZN	GOOG	MSFT	S	SNE	T	VZ	Total
9/16/2011–end Lawsuits	61	25	34	32	18	44	94	79	387
Eastern District of Texas	29	11	14	17	7	19	45	41	183
	47.54%	44.00%	41.18%	53.13%	38.89%	43.18%	47.87%	51.90%	47.29%

Table 6B: Filings in Eastern District of Texas Pre-AIA.

	AAPL	AMZN	GOOG	MSFT	S	SNE	T	VZ	Total
2003–9/15/2011 Lawsuits	28	15	24	22	7	32	22	18	168
Eastern District of Texas	13	9	12	13	2	17	11	6	83
	46.43%	60.00%	50.00%	59.09%	28.57%	53.13%	50.00%	33.33%	49.40%