

# Predicting Administrative Patent Challenges

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## ABSTRACT

*In this Article, we empirically study the use of administrative validity challenges by defendants in patent infringement suits. By requesting an administrative challenge, defendants can effectively bifurcate a patent infringement suit: staying district court proceedings while they challenge the validity of the patent at the patent office. Because of potential advantages in cost, speed, and legal standards, administrative challenge procedures like inter partes review appear facially attractive to defendants, and have been heralded by scholars as a way to reduce litigation costs and improve the patent system.*

*Despite all of the potential benefits, we find that defendants requested an administrative challenge—inter partes reexamination or inter partes review—in only about ten percent of the sixty thousand infringement cases brought between 2008 and 2015. Some of the low challenge rate can be explained by statutory ineligibility and changes in the standard for the joinder of multiple defendants. But most of the low challenge rate appears driven by speedy resolutions of the underlying dispute: over fifty percent of the cases where defendants did not use a challenge settled or otherwise terminated within one year.*

*Our results have three important implications. First, we discover trends that can inform the design and evaluation of administrative challenge procedures. We find substantial evidence that the 2011 America Invents Act reform increased the use of administrative challenges by defendants. Still, the reform had heterogenous, possibly unintended effects. Small entity patents, for example, are much less likely to be challenged after the AIA than before. We also identify areas ripe for future reform. Despite a growing policy concern over patent assertion entities (PAEs), for example, patents asserted by PAEs are currently less likely to face an administrative challenge than other similar patents. Second, we empirically test several predictions in a growing theoretical literature on the interaction between Article III courts and administrative venues. We confirm an important earlier result: a defendant's decision to request an administrative challenge appears highly sensitive to the district in which they are sued. Pushing further, we also discover sensitivity to the particular judge assigned, which is driven at least in part by each judge's docket management. Third, we caution that a growing empirical literature on the outcomes of inter partes review may be clouded by selection bias. We find some evidence that the cases where defendants use administrative challenges involve patents of particularly broad scope and high value compared to the broader pool of litigated patents. Our selection models provide a framework for future authors to consider and account for these selection effects.*

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<u>I. INTRODUCTION</u> .....	3
<u>II. THE PROS AND CONS OF ADMINISTRATIVE CHALLENGES</u> .....	7
A. THE BASELINE: DISTRICT COURT.....	7
B. INTER PARTES REEXAMINATION .....	9
C. INTER PARTES REVIEW .....	11
<u>III. SELECTION HYPOTHESES: WHO MIGHT PREFER WHAT?</u> .....	14
<u>IV. HOW MANY CASES RESULT IN CHALLENGES?</u> .....	15
A. METHODOLOGY .....	15
B. CASES WHERE CHALLENGES ARE UNAVAILABLE BY STATUTE.....	20
C. THE SKEW FROM DEFENDANT JOINDER.....	21
D. SETTLEMENTS .....	23
<u>V. HOW MUCH DOES THE INFRINGEMENT VENUE MATTER?</u> .....	25
A. VARIATION BY COURT.....	25
B. VARIATION BY JUDGE.....	27
<u>VI. HOW MUCH DOES THE PATENT AT-ISSUE MATTER?</u> .....	29
A. INTRINSIC CHARACTERISTICS .....	29
B. ACQUIRED CHARACTERISTICS.....	31
C. MULTIVARIATE REGRESSION ANALYSIS .....	32
D. SMALL ENTITY PATENTS .....	36
E. CASES BROUGHT BY PATENT ASSERTION ENTITIES .....	37
<u>VII. HAVE SELECTION PATTERNS CHANGED SINCE THE AIA?</u> .....	38
A. THE AIA AND THE RATE OF CHALLENGE .....	38
B. THE AIA AND THE TYPES OF CHALLENGES .....	41
<u>VIII. CONCLUSION</u> .....	42

## I. INTRODUCTION

Over the past two decades, Congress has created procedures that allow third parties to challenge the validity of a granted patent at the patent office instead of an Article III court.<sup>2</sup> Such administrative patent challenges can be especially useful to district court defendants, who seek to render infringement moot by proving that the asserted patent is invalid. By requesting an administrative challenge, and an associated stay of litigation, defendants can effectively bifurcate the trial<sup>3</sup> and take advantage of substantially decreased cost,<sup>4</sup> increased speed,<sup>5</sup> and more favorable legal standards at the patent office.<sup>6</sup> Scholars have trumpeted the potential of administrative challenges to “fix patent office errors”<sup>7</sup> and yield billions of dollars of welfare gains by invalidating bad patents and avoiding litigation costs.<sup>8</sup>

As the number of administrative challenges requests has increased dramatically in recent years,<sup>9</sup> a growing body of empirical work has emerged to analyze the use of the most popular administrative challenge: inter partes review.<sup>10</sup> In an important early contribution, Professors Vishnubhakat, Rai, and Kesan provided a high-level look at the use of inter

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<sup>2</sup> Congress first created inter partes reexamination (IPX) in 1999, and replaced it with inter partes review (IPR) in 2012. American Inventors Protection Act of 1999, Pub. L. No. 106-113, codified at 35 U.S.C. § 312(a); Leahy-Smith America Invents Act, Pub. L. No. 112-29 (2011), codified at 35 U.S.C. § 311.

<sup>3</sup> See generally Katrin Cremers et al., *Invalid but infringed? An Analysis of the Bifurcated Patent Litigation System*, 131 J. OF ECON. BEHAVIOR & ORG. 218 (2016) (comparing the U.K. and German systems and calling for further research to investigate the effects of bifurcation in the U.S.).

<sup>4</sup> Median civil litigation costs range from \$650,000 to \$2.5 million, which is substantially greater than the estimated costs of inter partes reexamination (\$128,000) or inter partes review (\$487,000). RATNERPRESTIA, *Economics and Logic of Patent Litigation Versus Post Grant/Inter Partes Patent Review*, <https://www.ratnerprestia.com/2012/10/03/economics-and-logic-of-patent-litigation-versus-post-grantinter-partes-patent-review/> (citing the 2011 AIPLA report); RPX, *IPRs: Reality Amid the Pyrotechnics*, <https://www.rpxcorp.com/2015/07/02/iprs-reality-amid-the-pyrotechnics/>.

<sup>5</sup> These comparisons to litigation are presented and cited in Part II, *infra*.

<sup>6</sup> Patents challenged at the patent office have no presumption of validity, meaning that invalidity need only be proven by a preponderance of the evidence vs. clear and convincing evidence in district court. *Id.*

<sup>7</sup> See e.g., Joseph Farrell & Robert P. Merges, *Incentives to Challenge and Defend Patents: Why Litigation Won't Reliably Fix Patent Office Errors and Why Administrative Patent Review Might Help*, 19 BERKELEY TECH. L.J. 943, 965 (2004)

<sup>8</sup> Stuart J.H. Graham & Dietmar Harhoff, *Separating Patent Wheat From Chaff: Would the U.S. Benefit from Adopting a Patent Post-Grant Review?* 43 RESEARCH POLICY 1649 (2014).

<sup>9</sup> Compare USPTO, INTER PARTES REEXAMINATION HISTORICAL STATISTICS (Dec. 2017), [https://www.uspto.gov/sites/default/files/documents/inter\\_parte\\_historical\\_stats\\_roll\\_up.pdf](https://www.uspto.gov/sites/default/files/documents/inter_parte_historical_stats_roll_up.pdf) (noting 168 IPX filings in fiscal year 2008), with USPTO, TRIAL STATISTICS (June 2018), [https://www.uspto.gov/sites/default/files/documents/trial\\_statistics\\_20180630.pdf](https://www.uspto.gov/sites/default/files/documents/trial_statistics_20180630.pdf) (noting 1,117 IPR filings in fiscal year 2018).

<sup>10</sup> See, e.g., Brian J. Love, Shawn P. Miller & Shawn Ambwani, *Determinants of Patent Quality: Evidence from Inter Partes Review Proceedings*, 90 COL. L. REV. 67 (2019) (looking at outcomes of inter partes review); Saurabh Vishnubhakat, Arti K. Rai & Jay P. Kesan, *Strategic Decision Making in Dual PTAB and District Court Proceedings*, BERKLEY TECH. L.J. (2016) (providing a high-level look at filings in district court and IPR for the period 2011-2015); Brian Love & Shawn Awbani, *Inter Partes Review: An Early Look at the Numbers*, 81 U. CH. L. REV. DIALOGUE (2014) (looking at statistics of the first two years of IPR).

partes review during its first three years.<sup>11</sup> They find that while a majority of inter partes review requests are filed by district court defendants, only a small minority of district court defendants file such challenges.<sup>12</sup> In this Article, we build on this foundational work by constructing a comprehensive database of all administrative challenges filed in the last decade. We thus expand the scope of the earlier study to include three more years of inter partes review requests (through 2018), and also consider earlier administrative challenges—inter partes reexamination requests—filed between 2008 and 2012. This allows us to observe broad trends in administrative challenge use over time, and any changes that occurred after the American Invents Act reform of 2011.<sup>13</sup> Importantly, we also expand the depth of the analysis to consider not just challenge filings, but also important characteristics of each case. We collect data on parties, judges, and patents in order to identify which characteristics best predict whether a defendant will use an administrative challenge in a given case.

Our comprehensive study into the use of administrative challenges by district court defendants has implications in three broad areas of policy. First, understanding how defendants actually use administrative challenge procedures can help inform the design, evaluation, and refinement of these procedures. Empirical work can identify, for example, whether cases of particular policy interest are using administrative procedures. In particular, administrative patent review systems could have substantial effects on small entity inventors, which are vital to our economy,<sup>14</sup> and may be particularly sensitive to the cost of litigation. The rise of patent assertion entities (or PAEs)—firms that profit from acquiring patents and enforcing patent rights instead of using them to make actual products—has generated significant concern.<sup>15</sup> Policymakers might want to design the system in a way that encourages defendants in suits brought by PAEs to challenge the asserted patent.

Most concretely, Congress recently passed a major reform to the administrative patent challenge system, the America Invents Act (the AIA). The AIA replaced the system of administrative challenges that had existed since 1999—inter partes reexamination—with an entirely new procedure called inter partes review.<sup>16</sup> Empirical study of the use of these procedures could determine whether this reform had its intended effects, or whether it altered the use of administrative challenges in unexpected ways. Our study informs each of these elements of policy design and evaluation: we separate out small entity patents, PAE cases, and the periods before and after the AIA for particular scrutiny.

Second, understanding a defendant's choice of venue is important in its own right.

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<sup>11</sup> Vishnubhakat et al., *supra* note 10.

<sup>12</sup> *Id.* (finding 70% of IPR requests to be of previously-litigated patents, while only 15% of litigated patents from 2011-2015 were challenged in IPR).

<sup>13</sup> Leahy-Smith America Invents Act, Pub. L. No. 112-29 (2011), codified at 35 U.S.C. § 311.

<sup>14</sup> See, e.g., Jean O. Lanjouw & Mark Schankerman, *Protecting Intellectual Property Rights: Are Small Firms Handicapped?* 47 J. OF LAW & ECON. 45 (2004).

<sup>15</sup> See, e.g., Christopher A. Cotropia et al., *Unpacking Patent Assertion Entities*, 99 MINN. L. REV. 649 (2014).

<sup>16</sup> American Inventors Protection Act of 1999, Pub. L. No. 106-113, codified at 35 U.S.C. § 312(a); Leahy-Smith America Invents Act, Pub. L. No. 112-29 (2011), codified at 35 U.S.C. § 311.

A separate literature has emerged to consider strategic decision-making between administrative challenges and Article III courts.<sup>17</sup> Some scholars and practitioners have theorized about when litigants should request an administrative challenge. Perhaps most notably, existing literature has stressed the interplay between administrative challenges and settlement negotiations, arguing that actually filing a challenge might actually reduce a defendant's leverage when the parties are looking to settle.<sup>18</sup> Scholars have suggested that defendants behave differently when before a particular court or presiding judge,<sup>19</sup> and that defendants are better off before the patent office when the patent or the prior art "involves complex technology."<sup>20</sup> However, few if any of these theories have been compared with observed behavior. In this paper, we test these hypotheses, asking how these factors are associated with challenge rates in the real world.

Third, our Article helps to provide needed context to existing empirical literature. While important, the growing body of empirical work has primarily focused on observed challenges, noting that both procedures have invalidated the vast majority of patent claims before them,<sup>21</sup> with only especially high-quality patents managing to survive.<sup>22</sup> To accurately understand the *effects* of administrative challenge procedures, we must first understand *when and how* they are used. That defendants only rarely use administrative challenges<sup>23</sup> raises the question of whether observed challenges are at all representative of the broader world of patent disputes.<sup>24</sup> Would high invalidation rates be surprising if only the lowest quality patents were challenged at the patent office?<sup>25</sup> Does the observation that certain patents fare better or worse in administrative challenges hinge on these patents being over- or underrepresented relative to district court litigation? Questions of selection bias thus pose a serious hurdle to the evaluation of administrative review procedures.<sup>26</sup> In this Article, we attempt to model these selection effects, so that future literature on the effects of inter partes review can understand and account for them.

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<sup>17</sup> We borrow this phrase from one of the most important existing studies on this topic. See Vishnubhakat et. al, *supra* note **Error! Bookmark not defined.**

<sup>18</sup> See, e.g., Shang & Chaikovsky, *supra* note **Error! Bookmark not defined.**. Note that this suggestion is based in the IPX regime, where challenges are much more difficult to terminate than in IPR. This is one of the reasons that IPR might be more appealing than IPX, which we discuss further in Part II.

<sup>19</sup> *Id.*

<sup>20</sup> *Id.*

<sup>21</sup> See, e.g., Brian Love & Shawn Awbani, *Inter Partes Review: An Early Look at the Numbers*, 81 U. CH. L. REV. DIALOGUE (2014); Roger Shang & Yar Chaikovsky, *Inter Partes Reexamination of Patents: An Empirical Evaluation*, 15 TEX. INTELL. PROP. L.J. (2006).

<sup>22</sup> See, e.g., Brian J. Love, Shawn P. Miller & Shawn Ambani, *Determinants of Patent Quality: Evidence from Inter Partes Review Proceedings*, 90 COL. L. REV. 67 (2019).

<sup>23</sup> See Section II *infra*.

<sup>24</sup> Cf. George L. Priest & Benjamin Klein, *The Selection of Disputes for Litigation*, 13 J. L. STUD. 1 (1984).

<sup>25</sup> See Colleen Chien & Christian Helmers, *Inter Partes Review and the Design of Post-Grant Patent Reviews* (Santa Clara Univ. Legal Studies Research Paper No. 10-15, Apr. 16, 2018) (arguing that "the main driver of the particularly high rate of invalidation in IPR is the selection mechanism," and that "understood in this context, the high rate of invalidation in IPR therefore should not be surprising.")

<sup>26</sup> See Love et. al, *supra* note **Error! Bookmark not defined.** at 161 ("we nonetheless acknowledge that our findings likely reflect some degree of selection bias. . . ."). A notable exception is [redacted]: a companion paper to this piece.

The remainder of this Article proceeds as follows. In Part II, we provide background information on the system of administrative patent challenges, compare these procedures with litigation, and survey existing literature. In Part III, we draw upon that background to formulate several hypotheses about the ways in which defendants use administrative challenges. We argue that the district and judge in the infringement case are likely to have a substantial effect on the decision to request an administrative challenge. Further, we expect that cases that lead to administrative challenges are those cases that are unlikely to settle early. As a corollary, we expect cases involving PAEs to result in challenges less frequently. Because the AIA introduced both changes that are appealing to potential challengers, and changes that are unappealing to challengers, we argue that certain cases should have been far more impacted by the reform than others.

In Part IV, we present the methodology of our study and a preliminary look at the rate of administrative challenge use. The base of our dataset is sixty thousand patents litigated between 2008 and 2015. Each observation is a patent-case, meaning that if a number of patents were asserted under one case number, we split them into separate observations for each asserted patent. We then match each patent-case to any inter partes reexamination or inter partes review requests of the same patent filed by one of the parties to litigation within eighteen months. We find that *less than ten percent of cases* lead to a challenge. A portion of this low rate can be explained by statutory ineligibility: removing patents litigated during the pre-AIA period that were ineligible for inter partes reexamination by statute, we find that the rate of challenges rises slightly among eligible cases, but still remains fewer than one in ten. We also find that the raw statistics are misleading due to changes in defendant joinder under the AIA, which tend to separate what would have usually been one case into multiple cases. Controlling for joinder changes, our best estimate of the challenge rate rises to just 11%, or just over one in ten. Still, the rate of challenge use appears to be increasing over the sample period. Finally, we note a simple explanation for why many cases do not lead to challenges: over half of the non-challenged cases in our sample settled or otherwise terminated early within one year.

In Part V we consider the effect of the infringement suit venue on the decision to request an administrative challenge. We find significant heterogeneity across districts. Even within the top twenty-five most common districts, challenge rates range from one in five to two out of every hundred. Importantly, these differences persist even within district, as there are significant differences in challenge rates across particular judges. Part of this effect could be explained by differences in docket management, where certain judges deter challenges by moving quickly or pushing the parties into an early settlement. We confirm this hypothesis by finding that the average speed with which a judge moves through her cases is a significant predictor of the odds that a defendant will request an administrative challenge.

In Part VI we look deeper into the patents at-issue in cases that result in administrative challenges. We find that both intrinsic and acquired characteristics of the underlying patents are important predictors of administrative challenge. In particular, we find some support for the idea that challenged patents are of especially broad scope and high value – even within the already highly-selected set of litigated patents. We find that both small entity patents and patents asserted by PAEs are less likely to be challenged administratively. However, both of these results can be explained by early settlements.

Finally, in Part VII we find some empirical evidence to support the visual observation of increased administrative challenges since the America Invents Act. Controlling for observed patent characteristics, we find that patents that were litigated after September 16<sup>th</sup> 2012, when the AIA took effect, were more likely to be challenged administratively. This suggests that parties to litigation are more willing to use inter partes review than they were to use inter partes reexamination. Further, we find evidence that not only the prevalence but also the selection of administratively challenged patents changed in the post-AIA period.

## II. THE PROS AND CONS OF ADMINISTRATIVE CHALLENGES

In this Part, we provide a background on the venues of validity challenge in the United States, from district court, to inter partes reexamination, and concluding with inter partes review. We consider the benefits and drawbacks to use of each procedure by litigants, with a particular emphasis on alleged infringers (defendants in an infringement suit). Along the way, we also survey the existing literature and note relevant empirical findings. In the Appendix, we present a summary of the information described in this Part as Table A1.

### A. *The Baseline: District Court*

Several patent systems in the world allow third parties to challenge the validity of granted patents as one measure aimed at improving patent quality.<sup>27</sup> For most of its history, the United States was not one of them. After a patent was deemed valid and issued in the original examination process, the role of the patent office was largely over.<sup>28</sup> Challenges to the validity of issued patents were instead made in the district courts.<sup>29</sup> Of course, the set of patents that are litigated in district courts is likely to be heavily selected. Earlier studies have shown that both acquired<sup>30</sup> and intrinsic<sup>31</sup> characteristics of patents are

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<sup>27</sup> The most notable example is the European Patent Office. For background and an empirical study on the use of so-called patent opposition at the EPO, see Dietmar Harhoff & Markus Reitzig, *Determinants of Opposition Against EPO Patent Grants – The Case of Biotechnology and Pharmaceuticals*, 22 INTERNATIONAL JOURNAL OF INDUSTRIAL ORGANIZATION 443 (2004).

<sup>28</sup> One notable exception was the existence of reissue patents, where the validity of the patent again became the subject of inquiry for the patent office, and third parties could submit evidence of invalidity during the reissue examination. See, e.g., *In Re Hall*, 781 F.2d 897 (Fed. Cir. 1986) (“a protest was filed during prosecution of appellant’s reissue application which included [invalidating prior art]”).

<sup>29</sup> In the typical case we consider here, the parties seeking invalidation are the defendants in an infringement suit. It is, of course, possible for these parties to be the plaintiff if they begin a lawsuit for declaratory judgment.

<sup>30</sup> Professor Chien has investigated in-depth the factors that predict whether a particular patent will be litigated. She discovers that the important predictors of litigation include so-called “acquired characteristics” of a patent that are realized after its issuance, such forward citations and assignment. Colleen V. Chien, *Predicting Patent Litigation*, 90 TEX. L. REV. 283 (2011).

<sup>31</sup> Similarly, Lanjouw and Shankerman find that significant predictors of litigation include both intrinsic characteristic, including claims, and acquired characteristics that describe the patent owner. Marco and Miller drill down more deeply on the intrinsic side, finding evidence that broader patents tend to be litigated more frequently, and also identifying several examination markers that help predict litigation. Jean O Lanjouw & Mark Shankerman, *Characteristics of Patent Litigation: A Window on Competition*, 32 RAND J. OF ECON. 129 (2001); Alan c. Marco & Richard D. Miller, *Patent Litigation and USPTO Trials: Implications for Patent Examination Quality* (Working Paper, 2016), <https://editorialexpress.com/cgi->

important in predicting litigation; these characteristics tend to suggest that litigated patents are of broader scope and higher value relative to all issued patents.<sup>32</sup>

When dragged into district court by a patent holder, a defendant may counter with a common defense to infringement: that the patent claims at-issue are invalid.<sup>33</sup> For hundreds of years, the judicial branch has been in the business of invalidating patents.<sup>34</sup> The Patent Act explicitly contemplates this defense.<sup>35</sup> Still, parties who seek to invalidate a patent in the district court face several different hurdles. First, the accusation that the patent is invalid, whether coming in the form of an affirmative defense or a more formal counterclaim, must first be well pled.<sup>36</sup> One district court, in declining to apply these higher standard, argues that “no federal circuit court of appeals has considered how the *Twombly*<sup>37</sup> and *Iqbal*<sup>38</sup> decisions apply to patent invalidity counterclaim or affirmative defense pleadings,” and that “district courts . . . have reached different results.”<sup>39</sup> By contrast, one study has found that most courts typically do apply *Iqbal* and *Twombly* in cases of counterclaims, but concedes that there is less clarity on which standards apply to defenses.<sup>40</sup> In any event, it appears clear that the standard applied will be less than or equal to *Iqbal* and *Twombly*.

Assuming the case has now survived a motion to dismiss, under whatever standard the court applies, the burden now falls on the defendant to prove invalidity.<sup>41</sup> This burden can be substantial, as patents challenged in the district court are presumed valid by statute.<sup>42</sup> Further, the standard for proof is “clear and convincing evidence” – higher than the typical preponderance of the evidence standard in civil litigation.<sup>43</sup> Still, defendants attempting to prove invalidity have ample opportunities to do so. The set of invalidating evidence at this

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bin/conference/download.cgi?db\_name=IIOC2016&paper\_id=154.

<sup>32</sup> *Id.*

<sup>33</sup> Of course, the defendant could also argue non-infringement, or allege a number of other affirmative defenses created by statute or the courts. See PETER MENELL, MARK A. LEMLEY & ROBERT P. MERGES, *INTELLECTUAL PROPERTY IN THE NEW TECHNOLOGICAL AGE* 404 (2017) (noting the existence of other court-recognized defenses such as experimental use).

<sup>34</sup> See, e.g., *The Incandescent Lamp Patent*, 159 U.S. 465 (1895) (an infringement suit for an electric light patent in broader Edison-Sawyer/Mann contest; holding a patent by Sawyer-Mann invalid because its description was too broad to enable someone to create the bulb without “painstaking experimentation”); B. Zorina Khan, *Property Rights and Patent Litigation in Early Nineteenth-Century America*, 55 J. ECON. HIST. 58 (1995).

<sup>35</sup> 35 U.S.C. § 282(b).

<sup>36</sup> See Bas de Blank & Anthony Tartaglio, *Counterclaims and Affirmative Defenses: A Tale of Two Pleadings*, ORRICK IP LANDSCAPE (Dec. 5, 2017), <http://blogs.orrick.com/iplandscape/2017/12/05/counterclaims-and-affirmative-defenses-a-tale-of-two-pleadings/>.

<sup>37</sup> *Bell Atlantic Corporation v. Twombly*, 550 U.S. 554 (2007).

<sup>38</sup> *Ashcroft v. Iqbal*, 129 S. Ct. 1937 (2009).

<sup>39</sup> *Graphic Packaging Int’l, Inc. v. C.W. Zumbiel Co.*, 2011 WL 5829674.

<sup>40</sup> Conrad Gosen & Tasha Francis, *The Confusing and Often Contradictory World of Pleading Defenses and Counterclaims in Patent Cases*, IPO L.J. (2015). But see *Twombly and Iqbal Do Not Apply to Counterclaims and Affirmative Defenses*, DOCKET REPORT (Aug. 3, 2011), <http://docketreport.blogspot.com/2011/08/twombly-and-iqbal-do-not-apply-to.html>.

<sup>41</sup> 35 U.S.C. § 282(a).

<sup>42</sup> *Id.*

<sup>43</sup> MENELL ET AL., *supra* note 33.

stage is unlimited – they can assert anything that would have been relevant to the USPTO in determining validity.<sup>44</sup> And, as in any civil action, the parties often engage in significant discovery, and can retain experts to testify.

Of course, this evidence is rarely presented at trial, because trials rarely occur. Consistent with litigation generally, the vast majority of patent suits settle before a decision on the merits can be reached.<sup>45</sup> Even when a decision on the merits is reached, it need not be at trial. Rather, the court might decide issues of validity by summary judgement. In fact, when courts do reach a decision on validity, they typically do so at an earlier procedural stage than infringement.<sup>46</sup> Still, we note that this reality does not necessarily undermine our claims regarding cost.<sup>47</sup> Kesan and Ball explicitly caution that early does not mean cheap: “obtaining a pre-trial ruling – particularly pertaining to invalidity – can be very expensive in patent cases.”<sup>48</sup>

All told, district courts appear to rarely invalidate patents – only about two percent of cases result in the invalidation of one or more patent claims.<sup>49</sup> This is largely driven by the fact that courts rarely adjudicate validity at all; Lemley and Allison find that when ruling, courts hold patents valid fifty-four percent of the time.<sup>50</sup> Because the court fails to adjudicate validity in a vast majority of cases, we might expect that many invalid patents are left in the economy.

### *B. Inter Partes Reexamination*

Aware of the tremendous cost of litigating a patent dispute in the district courts, Congress has acted over the last four decades to create a series of administrative alternatives to determine validity.<sup>51</sup> In 1999, the American Inventors Protection Act (AIPA) created inter partes reexamination (IPX), an administrative proceeding that could be used to adjudicate validity.<sup>52</sup> Compared to existing ex parte reexamination, this new procedure allowed more participation by the requesting party. While the AIPA created IPX to run alongside the ex parte system, their relative features made it likely that IPX will be the preferred mechanism for third parties, while ex parte requests would be used predominantly

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<sup>44</sup> *Id.*

<sup>45</sup> Kesan & Ball, *supra* note **Error! Bookmark not defined.**

<sup>46</sup> *Id.* at 277.

<sup>47</sup> Recall that an inordinate amount of expenses are still realized even if a case settles or ends in summary judgement immediately after discovery. See AIPLA REPORT, *supra* note **Error! Bookmark not defined.**

<sup>48</sup> *Id.*

<sup>49</sup> Kesan & Ball, *supra* note **Error! Bookmark not defined.** at 275.

<sup>50</sup> Mark A. Lemley & John R. Allison, *Empirical Evidence on the Validity of Litigated Patents*, 26 AIPLA Q.J. 185, 251 (1998).

<sup>51</sup> In 1980, Congress created ex parte reexamination to allow parties to challenge the validity of a patent in a “relatively inexpensive” way. J Farrell & Robert P. Merges, *Incentives to Challenge and Defend Patents: Why Litigation Won’t Reliably Fix Patent Office Errors and Why Administrative Patent Review Might Help*, 19 BERKELEY TECH. L.J. 943, 965 (2004) (citing congressional transcripts to show that Congress was apprised of high-cost district court litigation and its intention for reexamination to be a “relatively inexpensive” alternative to adjudicate patent validity). In 1999, this initial procedure was supplemented by the creation of inter partes reexamination (IPX). *Id.*

<sup>52</sup> See <http://www.uspto.gov/web/offices/pac/mpep/s2601.html>

by patent owners themselves seeking to test their patents.<sup>53</sup>

A party who wished to institute an IPX must first overcome the threshold question of whether they raised a “substantial new question of patentability.”<sup>54</sup> IPX was denied rarely, only about ten percent of the time.<sup>55</sup> Further, IPX petitioners could not raise the full range of grounds for invalidity, and supporting evidence. They must only rely on documentary prior art to question novelty and nonobviousness.<sup>56</sup> Professor Janis notes that this restriction practically guaranteed that IPX would “never serve as a fully effective alternative to validity litigation,” because it excludes invalidity theories like on sale and public use.<sup>57</sup>

Once an IPX was instituted, it proceeded before patent examiners, similar to the original prosecution, with third parties having a right to participate via written comments.<sup>58</sup> The patent office at this stage considered the validity of the granted claims. Once started, this train was difficult to stop. Parties were not formally able to settle an IPX midway through – once instituted, IPX challenges continued to completion.<sup>59</sup> Of course, third parties could settle and then withdraw from participation, reducing the IPX to effectively a limited ex parte request.<sup>60</sup> Over two-thirds of eventual IPX outcomes include at least some claims cancellations.<sup>61</sup> About a quarter include at least some claims confirmations, and another quarter include some form of amendment or added claims.<sup>62</sup>

All told, the IPX procedure was relatively cheap in terms of pecuniary cost,<sup>63</sup> but could still be very costly in terms of time. The median pendency of an IPX from filing to a final reexamination certificate is over three years.<sup>64</sup> Still, this measure is probably biased upwards somewhat due to the fact that the certificates are only issued after any appeals. Parties could appeal an IPX decision to the Board of Patent Appeals and Interferences, and patent owners could appeal further to the Federal Circuit.<sup>65</sup>

While IPX could be used as a standalone procedure for parties to adjudicate the validity of a patent, its potential for use alongside litigation was quickly realized. The AIPA includes a provision that states that district courts “may” obtain a stay “unless the court before which such litigation is pending determines that a stay would not serve the interests

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<sup>53</sup> Mark D. Janis, *Inter Partes Patent Reexamination*, 10 FORDHAM INTELL. PROP., MEDIA & ENT. L.J. 481, 484 (2000).

<sup>54</sup> 35 U.S.C. § 312(a) (1999).

<sup>55</sup> [redacted]

<sup>56</sup> Janis *supra* note 53, at 485.

<sup>57</sup> *Id.*

<sup>58</sup> *Id.* at 490.

<sup>59</sup> Cunning parties may be able to end an IPX indirectly by getting a consent order in district court, and then triggering the estoppel provisions of IPX. See *Settlement*, THE PTO LITIGATION CENTER, <http://ptolitigationcenter.com/2009/09/settlement/>.

<sup>60</sup> *Id.*

<sup>61</sup> [redacted], *supra* note 55.

<sup>62</sup> *Id.*

<sup>63</sup> See *supra* note 4.

<sup>64</sup> INTER PARTES REEXAMINATION HISTORICAL STATISTICS, [https://www.uspto.gov/sites/default/files/documents/inter\\_parte\\_historical\\_stats\\_roll\\_up.pdf](https://www.uspto.gov/sites/default/files/documents/inter_parte_historical_stats_roll_up.pdf).

<sup>65</sup> Janis *supra* note 53, at 492.

of justice.”<sup>66</sup> Professor Janis has noted that this provision appears unnecessary, as courts already had inherent authority to stay litigation in such cases.<sup>67</sup> In any event, this provision at least confirms the possibility of bifurcated trials: where pending infringement suits are stayed to adjudicate validity at the patent office before returning to the district court to determine infringement. Gardella and Berger discuss the use of reexamination as a strategic tool by alleged infringers to stay pending litigation.<sup>68</sup> They predict that success in the reexamination system will cause patent holders to file narrower patents that are less likely to be invalidated in these proceedings.<sup>69</sup>

Of course, adjudicating validity at the patent office would be less meaningful if the parties could then return to the district court and have a second bite at the apple. To prevent this, Congress attached an estoppel provision meant to prevent challengers from “re-litigating a validity issue in court following an unsuccessful effort to invalidate through reexamination,” or vice versa.<sup>70</sup> Rightfully, this estoppel exempts challenge grounds that were outside of IPX’s scope by limiting it to arguments the requestor “raised or could have raised during the inter partes proceedings.”<sup>71</sup> Still, Professor Janis categorizes the language of the estoppel provisions as overly broad, noting that “the estoppel provisions alone may convince many patent owners to avoid inter partes reexamination.”<sup>72</sup>

Published USPTO statistics indicate that IPX was initially slow to be used, but its use steadily grew. Only 26 inter partes reexaminations were filed in its first four years.<sup>73</sup> The next four years saw a still low 282 filings.<sup>74</sup> At least part of IPX’s slow start can be explained by statutory restrictions on its use. Parties are only able to request IPX on patents filed on or after November 29, 1999.<sup>75</sup> Therefore, for the first few years of IPX, the set of eligible patents was quite small. Filings appeared to be on an upward climb before IPX was discontinued in 2012 by the AIA. There were 1,081 IPX filings between 2008 and 2011, and 530 in 2012 alone.<sup>76</sup>

### C. *Inter Partes* Review

In 2011, Congress took another shot at reforming the administrative challenge procedures with the Leahy-Smith America Invents Act.<sup>77</sup> First, the AIA changed the

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<sup>66</sup> 35 U.S.C. § 318 (1999); Janis *supra* note 53, at 497.

<sup>67</sup> *Id.*

<sup>68</sup> Greg H. Gardella & Emily A. Berger, *United States Reexamination Procedures: Recent Trends, Strategies and Impact on Patent Practice*, 8 J. MARSHALL REVIEW OF INTELLECTUAL PROPERTY LAW 381 (2009).

<sup>69</sup> *Id.*

<sup>70</sup> Janis *supra* note 53, at 492.

<sup>71</sup> *Id.*

<sup>72</sup> *Id.*

<sup>73</sup> <http://uspto.gov/learning-and-resources/statistics>

<sup>74</sup> *Id.*

<sup>75</sup> 2609 INTER PARTES REEXAMINATION, <http://www.uspto.gov/web/offices/pac/mpep/s2609.html>.

<sup>76</sup> Statistics, *supra* note 73.

<sup>77</sup> P.L. 112-29. Note that this law also had many other effects besides those recounted for administrative

standard for granting a request for reexamination, raising the bar from a “substantial new question of patentability” to “a reasonable likelihood that the requester will prevail with respect to at least one claim,” which is expected to increase the rate of reexamination denials.<sup>78</sup> This standard took effect for the final year of IPX and remains in effect for IPR.

Most notably for our purposes, the AIA discontinued IPX effective September 16, 2012.<sup>79</sup> In its place, the AIA created a tripartite system of Inter Partes Review, Post-Grant Review, and Covered Business Method Patent Review.<sup>80</sup> For this study, we focus on IPR, as the primary successor to IPX.<sup>81</sup>

Compared to IPX, IPR appears closer to litigation and farther from original patent prosecution. Unlike IPX, IPR allows for the deposition of witnesses and other associated discovery, as well as an oral hearing with administrative patent judges.<sup>82</sup> Stahl and Heckenberg explain that the “new review proceedings may also be more enticing to a patent challenger since they make available to the accused infringer more procedures analogous to those available in patent litigation.”<sup>83</sup> Most notably, the AIA has mandated that IPR proceed expediently, with an expected overall timing of 18 months, half the time expected of IPX.<sup>84</sup> Additionally, in IPX only patents filed after November 29, 1999 could be reexamined while in IPR this restriction was lifted, expanding the set of patents that can be challenged.<sup>85</sup> Finally, parties can seek to settle their dispute and formally end the IPR process.<sup>86</sup>

However, not all changes are beneficial to the requestor. Challenges under the AIA have become substantially more expensive.<sup>87</sup> Furthermore, the estoppel described above has become more restrictive under IPR. Estoppel now binds earlier (before appeals), and

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challenge systems, such as changing to a first-to-file regime.

<sup>78</sup> Phillips, Matthew and Laurence, Kevin. 2011. “Changes to Reexamination Under the America Invents Act.” Available at [http://www.stoel.com/files/Changes\\_to\\_Reexamination\\_under\\_the\\_America\\_Invents\\_Act\\_November\\_2011\\_IP\\_Today.pdf](http://www.stoel.com/files/Changes_to_Reexamination_under_the_America_Invents_Act_November_2011_IP_Today.pdf)

<sup>79</sup> *Id.*

<sup>80</sup> P.L. 112-29.

<sup>81</sup> The vast majority of cases in our later-constructed sample are filed more than 9 months after the patent’s issuance, and are thus ineligible for PGR. In some of our analysis, we match on patent class, which should somewhat obviate the possibility of CBM within our non-challenged group.

<sup>82</sup> IPX vs. IPR: A Cheat Sheet, <http://ptoligitationcenter.com/wp-content/uploads/2009/08/ipx-v-ipr.pdf>.

<sup>83</sup> Stahl, Lawrence A. and Donald H. Heckenberg. 2011. “The Scope and Ramifications of the New Post-Grant and Inter Partes Review Proceedings at the USPTO.” Available at: <http://www.fitzpatrickcella.com/publication/the-scope-and-ramifications-of-the-new-post-grant-and-inter-partes-review-proceedings-at-the-uspto/>. Last accessed, October 15, 2016.

<sup>84</sup> IPR is given statutory time restrictions: 6 months to reach an institution decision (grant or deny), split into a 3-month period for patent owner response (37 C.F.R. § 42.107) followed by another 3-month period for USPTO decision (35 U.S. Code § 314). Then another 12 months to reach a final determination (cancel, confirm, etc.) (35 U.S. Code § 316). Limited 6-month extensions can be granted “for good cause shown”. Thus, we would expect most IPRs to reach a final decision within 18 months, or 1.5 years.

<sup>85</sup> Cheat sheet, *supra* note 79.

<sup>86</sup> *Id.* For an examination of IPR settlements, which are often used to delay rival entry, see Erik Hovenkamp & Jorge Lemus, *Delayed Entry Settlements at the Patent Office*, ITN’L REV. OF LAW & ECON. (2018).

<sup>87</sup> *See supra* note 4.

restricts both district court and future PTO actions.<sup>88</sup>

Perhaps even more so than IPX, Congress appears to have contemplated IPR as a way to bifurcate litigation. The Act prohibits parties from filing an IPR if they were served with an infringement complaint more than one year ago.<sup>89</sup> This incentivizes parties to avoid redundancy between the district court and the patent office by requiring them to quickly file an IPR before the district court proceedings has moved too far along.

In one early empirical contribution, Professors Chien and Helmers trace the path of a typical Inter Partes Review.<sup>90</sup> They note, importantly, that the headline number of invalidations in IPR must be understood “in context,” as many challenged claims are denied review before reaching a final decision.<sup>91</sup> In another recent contribution, Professors Vishnubhakat, Rai, and Kesan provide an important study on the strategic use of IPR by parties in litigation.<sup>92</sup> They find that the majority (70%) of inter partes review validity challenges are brought by district court defendants.<sup>93</sup> They also note that the Eastern District of Texas has a reluctance to grant stays, but that parties from there (as well as the District of Delaware and Northern District of California) see a disproportionate number of IPR petitions. In our study, we attempt to improve on this foundational work in three ways: (i) by focusing explicitly not just on the court cases that led to IPR, but also those that chose not to use it; (ii) by using patent characteristics to predict which cases will use IPR, and (ii) by including not just IPR filings but IPX filings which allows us to examine whether the AIA policy change affected the use of administrative proceedings to challenge patent validity.

Finally, we note as a measure of stakes that the IPR process has already generated significant controversy. Its very constitutionality was questioned before the Supreme Court, though it eventually survived.<sup>94</sup> Likewise, it has been criticized on policy grounds, having been referred to as a patent “death squad,” accused of having anti-patent slant and harming innovators.<sup>95</sup> Still, some early research investigating the effect of the policy change has found no evidence that the policy change introduced a negative bias against the patentee in reexamination.<sup>96</sup> Controversy aside, IPR seems to be becoming increasingly more popular. IPR surpassed 3,000 requests in its first three years – over 1,000 more than IPX in its entire 13-year tenure.<sup>97</sup>

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<sup>88</sup> Cheat sheet, *supra* note 79.

<sup>89</sup> 35 U.S.C. § 315(b).

<sup>90</sup> Colleen Chien & Christian Helmers, *Inter Partes Review and the Design of Post-Grant Patent Reviews*, [https://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=2601562](https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2601562).

<sup>91</sup> *Id.* This important insight, however, has no bearing at this study, as we look at the filing of an IPR and not its final conclusion.

<sup>92</sup> Vishnubhakat et al., *supra* note **Error! Bookmark not defined.**

<sup>93</sup> *Id.*

<sup>94</sup> *Oil States Energy Services, LLC v. Greene’s Energy Group, LLC*, \_\_ S. Ct. \_\_ (2018).

<sup>95</sup> *See, e.g.*, Paul Morinville, *How the Patent Trial and Appeal Board Harms Inventors*, IPWatchdog, <http://www.ipwatchdog.com/2016/09/13/how-the-patent-trial-and-appeal-board-harms-inventors/id=72554/> (comments describing the patent death squad view).

<sup>96</sup> *See* [redacted], *supra* note 55.

<sup>97</sup> AIA trial statistics through 9/2015, <http://www.uspto.gov/patents-application-process/appealing-patent->

### III. SELECTION HYPOTHESES: WHO MIGHT PREFER WHAT?

In the last Part, we have shown that litigation, IPX, and IPR differ in important respects. Here, we summarize the key differences and hypothesize why parties in certain cases may or may not choose to use administrative review.

First, we expect that the rates of administrative challenge will vary considerably by district. Other work has shown that there is significant evidence of “court shopping” going on in patent cases.<sup>98</sup> If plaintiffs select into districts depending on their litigation strategies, plaintiffs that select into a particular district may litigate in particular ways that would push defendants toward or away from using an administrative challenge. Of course, particular tendencies of the courts might also have an effect on defendants’ willingness to request administrative challenge. Districts that are especially hostile to stay requests or especially proficient in patent litigation, for example, might deter use of an administrative challenge.<sup>99</sup> This latter effect might also persist with respect to individual judges. Even within a certain court, a particular judge might have a penchant for speedy docket management, or an aversion toward granting stays.<sup>100</sup> We test for differential effects of courts and judges in Part V.

Of course, while particular districts and judges can provide constraints on case management, there is still room for substantial heterogeneity in litigating strategies. Certain classes of plaintiffs might be able to deter administrative challenges. Put another way, defendants might be more or less willing to use an administrative challenge depending on the type of party accusing them on infringement. One obvious factor is the desire of parties to reach quick settlements. Cases that settle quickly do not meaningfully challenge validity in any venue. And, on the other side of the coin, parties that intend to settle quickly might actually not request an administrative challenge, preferring instead to hold it in front of the plaintiff’s nose as leverage.<sup>101</sup> Therefore, we might expect that a substantial portion of our non-challenged cases were those that simply settled quickly. We test this finding in Section V.D.

A corollary is that we might expect plaintiffs who wish to settle early to deter the filing of an administrative challenge. Patent Assertion Entities immediately come to mind, as they have been theorized in other work to potentially have “a greater willingness . . . to settle litigation.”<sup>102</sup> The same might be true of small entity patents, but for a different reason. Small entity patentees are those who qualified for reduced filing fees at the time of examination, and thus might be particularly poorly able to bear the costs of litigation. They might also, therefore, seek early settlement, and the litigation might cease prior to the filing of an administrative challenge by defendants. Of course, this presumes that the plaintiff

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decisions/statistics/aia-trial-statistics.

<sup>98</sup> See J. Jonas Anderson, *Court Competition for Patent Cases*, 163 U. PENN. L. REV. 631 (2015).

<sup>99</sup> See Shang & Chaikovsky, *supra* note **Error! Bookmark not defined.**

<sup>100</sup> *Id.*

<sup>101</sup> See Shang & Chaikovsky, *supra* note **Error! Bookmark not defined.**

<sup>102</sup> Mazzeo et al., *Do NPEs Matter? Non-Practicing Entities and Patent Litigation Outcomes*, 9 J. COMP. L. & ECON 879 (2013).

asserting the patent was the original patentee – in Section V we test for the small entity and PAE effects alongside an indicator for patent re-assignment prior to litigation.

There is also good reason to expect that characteristics of the patent-at-issue might affect the decision to challenge the patent's validity in district court versus at the patent office. One paper suggests that the patent office would be preferred when the patent or the relevant prior art “involves complex technology.”<sup>103</sup> While certain inventions in any technology area can of course be very complex, or very simple, this advice would tend to suggest differences across technology categories in the rate of administrative challenge use. A defendant might find it easier to explain, for example, a mechanical invention to a generalist judge or lay jury rather than a complex algorithm. By contrast, areas that might fit particularly well to jury nullification – such as invalidating the patent for an expensive drug – might seem more favorable to challenge in the district court. In Section V, we test for differential challenge rates across patent technology categories.

As we have seen, there are several benefits and drawbacks to IPR as compared with IPX. In particular, IPR is more advantageous to parties sensitive to the cost of time, but less preferred by parties particularly sensitive to pecuniary costs. Clearly, the bar for instituting an administrative challenge is higher than the low bar for alleging invalidity in the district court; this difference is even more pronounced post-AIA. Parties who seek to challenge validity simply to leverage a settlement, without strong grounds of actual invalidity, may prefer to remain in district court, rather than apply for IPX/IPR and get denied. Further, parties who expect to settle may have been unlikely to request IPX, as it restricted the ability of settlement to end the dispute. This concern is limited in IPR, which allows settlements. All else equal, we would expect this shift to increase the number of parties requesting IPR compared with IPX.

Clearly, though, one takeaway is that IPR is not universally beneficial to all defendants relative to IPX. Parties may be especially sensitive to one of its beneficial or detrimental provisions. Therefore, we might expect to see highly heterogeneous effects of the AIA: with certain parties and types of cases more quickly flocking to IPR than others.

#### IV. HOW MANY CASES RESULT IN CHALLENGES?

##### *A. Methodology*

The base of our dataset is patent litigation filings. We collected data on litigation from DocketNavigator,<sup>104</sup> searching for all U.S. district court cases that involve a complaint for infringement.<sup>105</sup> DocketNavigator compiles data on every electronically available

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<sup>103</sup> See Shang & Chaikovsky, *supra* note **Error! Bookmark not defined.**

<sup>104</sup> DOCKETNAVIGATOR, <http://docketnavigator.com>.

<sup>105</sup> Specifically, we searched for all cases that contained document types “complaint – infringement” “complaint – infringement - ANDA” or “complaint – infringement – BPCIA”. Of course, the patents involved in any particular case were not necessarily raised in the original infringement complaint. They may have been brought up, for example, in a counterclaim for infringement. But, we expect such cases to be somewhat uncommon, and further when they are present, they should fit well into our mold. They themselves are patent assertions, and would be separated out into separate patent-case observations, to be matched with any IPX or IPR that is filed by a litigation party (in this case, the original plaintiff).

patent complaint dating back to 2008.<sup>106</sup> Our dataset therefore starts with cases filed on 1/1/2008; we extend the analysis through 12/31/15.<sup>107</sup> Our unit of analysis is patent-case, meaning that each observation is one case filed in district court for a unique patent. Put another way, each observation in our database is a single litigated patent. If the same patent is subject to two different lawsuits, we will have two observations in our dataset. Likewise, if one lawsuit involves multiple patents, we will have a separate observation for each patent involved in the suit.<sup>108</sup>

Next, we construct a dataset of administrative patent challenges. For the purposes of this study, we focus only on inter partes reexamination and inter partes review. IPX filings are identified via the PatEx database,<sup>109</sup> where they are coded as children in the “Continuity Data” dataset, with the prefix “95”. This source gives us the filing date of each IPX and its associated patent. We collected data on IPRs from DocketNavigator, in a similar method to that used by Vishnubhakat et al.<sup>110</sup> This provides us with the patent number and filing date for each IPR challenge. Our available data spans all IPX and IPR challenges filed between 1/1/2008 and 12/31/2018.

The core question we seek to answer is which litigation cases led to the filing of an IPX or IPR challenge, and which did not. Therefore, for each district court patent-case we look to see if we can match it with an IPX or IPR involving the same parties. This matching process may not always be one-to-one. A single district court case may well lead to several administrative challenges – perhaps each defendant files her own challenge. On the other hand, defendants in multiple cases might band together to file one IPR. To handle this complexity, we first generate each pairwise match of district court and IPX/IPR based on the patent at issue. For example, imagine patent A was litigated three times – cases 1, 2 and 3 – and was challenged twice, once each in IPX and IPR. Our pairwise matching would first generate six “potential matches”: case1 – IPX, case1 – IPR, case2 – IPX, case2 – IPR, case3 – IPX, and case3 – IPR. Therefore, we identify every possible match combination of

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<sup>106</sup> PATENT LIBRARY SCOPE OF DATA, <http://brochure.docketnavigator.com/datascope/>. DocketNavigator has some data all the way back to 2000, but we use variables for which they only have comprehensive data from 2008-on.

<sup>107</sup> Technically, DocketNavigator has cases much more recently than 2015, but our end date was set by two constraints. First, as detailed later, we needed to stop collection of litigation cases at some point earlier than our IPR end date to avoid truncation. That is, we wanted every litigation case in our sample to have sufficient time to observe whether an IPR was filed. Second, the dataset on patent assertion entities - a core part of our analysis - only spans through 2015, meaning we would have dropped any litigation cases past 2015 in our eventual analysis anyway.

<sup>108</sup> When splitting a single case into multiple observations for every patent at issue, our dataset imputes the date of the initial complaint on each patent. Because patents may be added to one case at different times, this date might not be representative of the actual date that each particular patent was asserted in litigation. We noticed that in a few percent of our cases, the attributed litigation date was earlier than the issue date of the patent. Looking at a sample of docket sheets, this tended to happen when a patent was under review when the litigation was filed, but added to the litigation shortly after it was issued. We correct for this by replacing the case “filing date” with the issue date of the patent whenever the issue date is later than the case filing date.

<sup>109</sup> PatEx is a comprehensive database with a range of bibliographic data on public patents. Public patents are those released in Public PAIR, a subset of the private PALM. This is a dataset of over nine million patents, through December 2014. Alan C. Marco, Amanda F. Myers, Stuart J.H. Graham, Paul A. D’Agostino & Kirsten Apple, The USPTO Patent Assignment Dataset: Descriptions and Analysis (USPTO Economic Working Paper No. 2015-2, July 2015), <http://ssrn.com/abstract=2636461>.

<sup>110</sup> Vishnubhakat et al, *supra* note 92. We further collapse any IPR filings that were filed on the same date, requesting the review of the same patent, and filed by the same party to one observation. This eliminates double counting of any challenges that were split up into separate filings, for example, to skirt the page limit.

district court cases and administrative challenges.

Of course, not every possible combination is a true match that we care about. Instead, we want to limit to the case where one party asserts a patent in district court, and a defending party then challenges the patent in IPX or IPR. As a preliminary matter, we drop any possible matches where the administrative challenge in question was filed prior to the matched district court case.<sup>111</sup> Next, we compare the parties in each case directly. For IPX, data on challengers are not electronically available. Instead, we examine over 1,000 potential matches by hand, reading the IPX docket to identify the challengers. IPR parties, by contrast, are electronically available in the DocketNavigator data, so we can make use of electronic matching.<sup>112</sup> In either case, we code a match whenever *at least one* of the parties requesting an administrative challenge is also a party to the district court litigation. In total, we were able to positively identify 7,755 potential matches where the parties overlapped in this way.

Figure 1 plots the lag between the filing date of the district court case<sup>113</sup> and the filing date of the administrative challenge for cases with matched parties.<sup>114</sup> Unsurprisingly, we see large spikes in the days leading up to 365, or one year. IPR challenges, by statute, must be filed within one year of a party being sued in district court. Still, approximately fifty percent of our matches have a lag greater than 365 days. As Vishnubhakat et al. note, some of this is likely due to parties requesting IPR later than one year by virtue of latching on to an earlier case. In our dataset, though, most of this is likely due to IPX matches, which have no such one-year restriction. Still, nearly ninety percent of our matches had lags of eighteen months or fewer.

*Figure 1: Lag Between District Court and IPX/IPR Filing for Cases with Matched Parties*

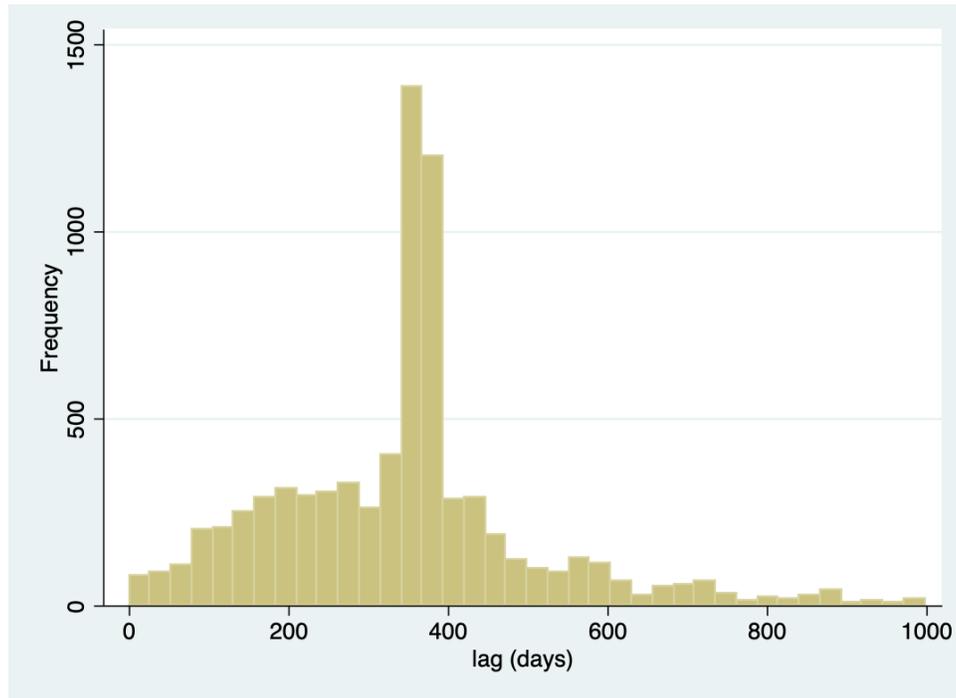
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<sup>111</sup> While it is possible that sometimes in one unique dispute the IPX or IPR could come first – by an alleged infringer anticipating or prompting a later infringement suit - Vishnubhakat et al. suggest that such cases are exceedingly rare. More often, cases where the administrative challenge precedes the litigation case are likely to simply be false positive matches – unrelated cases.

<sup>112</sup> We use exact matches, under the theory that party names are consistently written in the DocketNavigator database, which is also the source of our litigation data. To test this, we also perform a “fuzzy match” by identifying a subset of cases that have partial character matches, and then matching those by hand. In our test, we identify an extremely small false negative match rate- around two percent – so we use the exact matching for the whole set.

<sup>113</sup> We make one small modification to the case filing date when we move from case to patent-case observations. The case filing date is constant for each patent within a case number, even though patents might be added to the case at varying times. In the unlikely case where a case was filed prior to the issuance of the patent, we know that the patent was not actually asserted in district court until after it was issue, so we recode the effective case filing date to be the patent issue date.

<sup>114</sup> A small number (about 10%) of matches had extremely high lags – over 1,000 days. We omitted these observations from the histogram to get a better view of the shape of most of the distribution – but we discuss those observations with high lags in the following sentences.



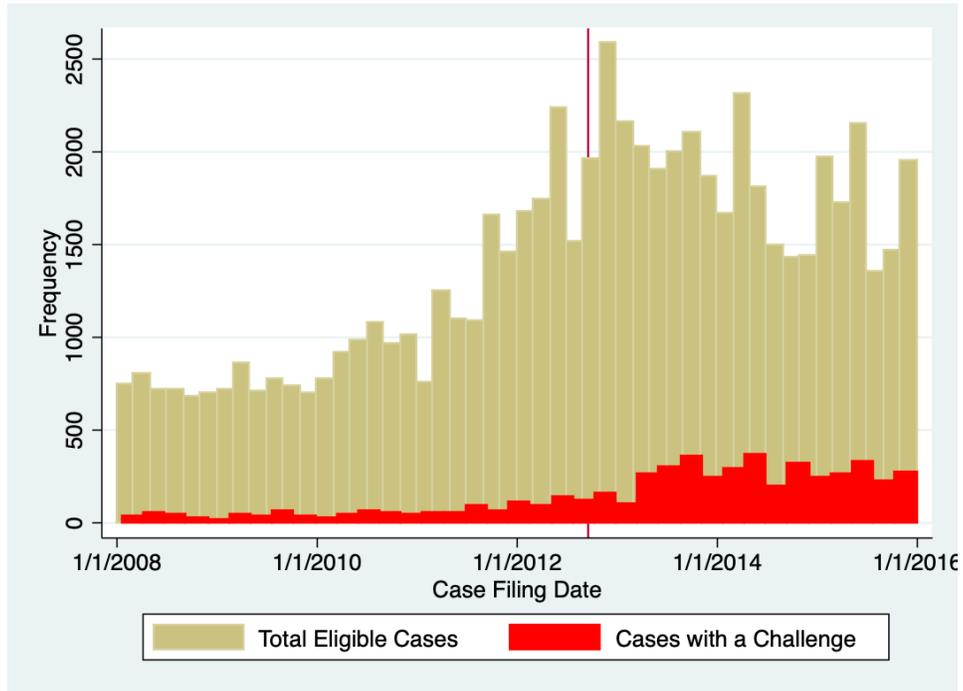
At some point, of course, lags become so high that it is hard to consider the litigation case and the administrative challenge part of the same dispute, even if they involve the same parties. Parties may litigate one case to completion, and then years later may request an administrative challenge as part of another case, or in the absence of a case. In one extreme case, we found that parties to litigation requested an administrative challenge nearly ten years after the litigation complaint was filed. To increase our confidence that the administrative challenge is part of the same dispute, we restrict to matches with lags equal to or less than eighteen months, which allowed us to retain eighty-seven percent of our matches as occurring within the same dispute.

Next, we merge our identified matches back with our broader litigation sample.<sup>115</sup> As constructed, there are 66,406 patent-case observations in our dataset. In total, 7.9% of district court patent-cases actually led to an administrative challenge filing. Figure 1 plots the frequency of cases in our sample over time.<sup>116</sup> Overlaid on this chart is the frequency of cases where we determined that an administrative challenge was filed by the parties (a confirmed match). The vertical line indicates the date of the AIA policy change: the switch from IPX to IPR.

<sup>115</sup> Recall, some litigation cases may have led to more than one confirmed IPX or IPR match. Because we care about litigation level data for this study, we collapse these to a binary indicator of whether or not the case led to at least one administrative challenge.

<sup>116</sup> Note that this figure is limited to the sample we constructed earlier that excludes cases time-ineligible for IPX or IPR. Therefore, this figure can be interpreted as a histogram of all patent litigation cases that were eligible for an administrative challenge at the time they were filed.

*Figure 2: Litigation Filings with and without an Administrative Challenge Over Time*



The number of litigation cases increased dramatically in our sample period. The shape of administrative challenge curve appears to loosely follow the litigation curve, with a lag – as expected given the observed lags between the filings in Figure 1. The fraction of cases where an administrative challenge is used over the entire period is about eight percent. We are interested to see whether this fraction is about even over the period, or changes over time. Table 1 breaks down the rate of administrative challenge by year. We test the difference between the fraction of challenges each year, and the fraction in 2008.

*Table 1: Rate of Administrative Challenge by Year*

Year	Percent of Cases with an Administrative Challenge	Total Cases
2008	3.83%	4357
2009	4.27%	4492
2010	3.97%	5715
2011	4.22%	7301
2012	4.95% **	11720

2013	9.90% ***	12176
2014	13.00% ***	10133
2015	12.06% ***	10512
2008-2015	7.92%	66406

\*\*, \*\*\* indicates a significant difference from 2008 at  $p < .05$ ,  $p < .01$  respectively

The rate of administrative challenge remains between three and four percent of cases between 2008 and 2012, but then nearly doubles in 2013. The stars in Table 1 indicate statistical significance of tests of proportion equality between 2008 and each subsequent year. While no significant differences are observed for 2009, 2010, or 2011, the IPR transition year<sup>117</sup> and each IPR year is significantly different from 2008. Indeed, at least facially, the use of administrative challenges seems to have increased dramatically in recent years. Still, we hesitate to tell any sort of causal story based solely on this graph. These results could be driven by changes in other determinants of administrative challenge - that is, the types of patents litigated after 2012 could be somehow systematically different from those litigated before. We attempt to separate these underlying characteristics from the AIA regime switch using multivariate regression in Part VI, *infra*.

### B. Cases Where Challenges are Unavailable by Statute

Because we care about the *choice* to use post-grant administrative challenges, we also separate out cases where an administrative challenge was legally unavailable. During the IPX regime, patents that were filed before 11/29/1999 could not be challenged. These patents could, however, be challenged in the newer IPR regime. Therefore, we isolate cases where lawsuit was filed before the IPR regime (9/16/2012) and the patent at-issue was filed before 11/29/1999. In these cases, at the time that the defendant was hauled into court, she was not able to request an administrative challenge.<sup>118</sup> Over seventeen percent of cases in our sample meet these criteria. That means that in nearly one-fifth of cases where patent defendants did not request an administrative challenge, *they were statutorily ineligible to do so*.

Table 2 presents a revised yearly challenge rate restricting only to eligible cases. When considering only cases that were eligible for an administrative challenge, the use of

<sup>117</sup> The difference in the IPR transition year might be driven by increased challenges in IPR, but in fact there were few IPR challenges in 2012. In fact, the rate of IPX appears to have increased in this year, perhaps because parties were aware of the switch from IPX to IPR, and some desired to request IPX before the policy change.

<sup>118</sup> Of course, there is a nuance here: If a party was sued between 9/16/2011 and 9/15/2012, the party would not have been eligible for any existing administrative challenge at the time of the complaint, but would have become eligible for IPR within the one-year time bar once IPR became effective. Still, we treat these cases as those in which an administrative challenge was practically unavailable. Without having the challenge tool at your disposal at the start of the lawsuit, you might start down a different path that makes it irrelevant if that tool appears later on. Further, we observe that IPR was barely used at all in its first few months of operation, meaning that litigants actually in this position did not flock to IPR once it popped up. Of the over 1,000 cases that meet this criteria, only 121 actually had an administrative challenge – a fraction much smaller than the usual challenge rate for the surrounding years.

administrative challenges appears slightly larger: 9.4% of eligible cases involved an administrative challenge. Still, the general trend remains: the fraction of eligible cases with an administrative challenges nearly doubles between 2008 and 2015.<sup>119</sup> For the remainder of this analysis, we restrict to only cases where defendants were statutorily eligible to request an administrative challenge at the time of the case filing.

*Table 2: Rate of Administrative Challenge by Year for Eligible Cases*

Year	Percent of Eligible Cases with an Administrative Challenge	Total Eligible Cases
2008	7.07%	2233
2009	7.51%	2503
2010	6.17%	3581
2011	6.04%	4649
2012	5.52% ***	9146
2013	9.90% ***	12176
2014	13.00% ***	10133
2015	12.06% ***	10512
2008-2015	9.36%	54933

\*\*, \*\*\* indicates a significant difference from 2008 at  $p < .05$ ,  $p < .01$  respectively

### *C. The Skew from Defendant Joinder*

When looking at “case-level” data, one other wrinkle bears noting. The patent-case observations are defined as a unique patent litigated in a unique case number. That is, if a patent is simultaneously litigated against five defendants under one case number, it is treated as one observation. On the other hand, if that same patent is simultaneously litigated against those same six defendants – but under six different case numbers – it will be treated as six observations. This technical change can yield very different case numbers and challenge rates for situations that are actually quite similar. If one defendant in the first example requests an IPR, then the challenge rate for that patent is 1/1, or 100%. If the same defendant requests a challenge in the second situation, the challenge rate is only 1/5, or 20%. This difference is particularly pronounced given one change in the America Invents

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<sup>119</sup> Interestingly, the rate of administrative challenges is actually slightly lower in 2012 than 2008. One possible explanation is that once the IPR effective date (9/16/12) was hit, the denominator – the number of eligible litigation cases – increased due to the removal of the statutory restriction. But, at the beginning of IPR there was a period of slow adoption where only a small number of IPRs were requested until 2013.

Act. Section 299 of the Act requires a higher standard to join multiple defendants in one case than that they are simply accused of infringing the same patent.<sup>120</sup> This raises the bar from the earlier, often loosely interpreted, standard for joining defendants under Rule 20 of the Federal Rules of Civil Procedure.<sup>121</sup> The expected effect, of course, is more case numbers after the AIA.

The challenge behavior of codefendants may well affect the behavior of a particular defendant. That is, if another defendant in a swatch of simultaneous infringement actions decides to request an IPR, you may benefit from their challenge, and decide not to request your own. There are positive externalities to administrative challenges for codefendants – if one defendant manages to invalidate a patent at the PTO, it is invalid and thus unenforceable against all defendants. In the pre-AIA system, defendants tended to be clumped together under one case number, while post-AIA each defendant more likely appears under a separate case number. Therefore, to compare challenge rates more meaningfully, we ask whether at least one defendant in the case requested a challenge.

In Table 2, we attempt to control for this change by collapsing together cases with simultaneous defendants. That is, any cases where the same patent is asserted on the same day and in the same court are treated as one case. In the earlier example, this means that the patent asserted simultaneously against five defendants would count as one case, regardless of whether each defendant was assigned her own case number. Administrative challenge by any of the five defendants would yield a 100% challenge rate for that case. Table 2 also presents the deflation from this change – i.e., the percent by which our observations dropped when collapsing simultaneous patent assertions.<sup>122</sup>

*Table 3: Rate of Administrative Challenge by Year Collapsing Simultaneous Defendants*

Year	Percent of Eligible Cases with an Administrative Challenge	Total Eligible Cases	Percent Case Deflation
2008	7.31%	2119	5.11%
2009	7.68%	2421	3.28%
2010	6.85%	3225	9.94%
2011	6.86%	3966	14.69%
2012	7.41%	5845	36.09%

<sup>120</sup> <https://www.jdsupra.com/legalnews/multi-defendant-joinder-under-the-ameri-97136/>.

<sup>121</sup> *Id.*

<sup>122</sup> Note that deflation is calculated relative to the dataset just before patent assertions on the same day and in the same court are collapsed. Thus, it is the percent difference between the case numbers in Table 2 and Table 3.

2013	13.55% ***	6995	42.55%
2014	16.03% ***	6371	37.13%
2015	15.57% ***	6210	40.92%
2008-2015	11.31%	37152	32.37%

\*\*, \*\*\* indicates a significant difference from 2008 at  $p < .05$ ,  $p < .01$  respectively

The differences are staggering. Overall, the size of the dataset decreases by nearly one third. While a full causal evaluation of the effect of the AIA switch from the Rule 20 standard is beyond the scope of this paper, the composition of the caseload is consistent with its expected effect. Treating simultaneous assertions as one case only reduced the general caseload in 2008 by about five percent; in 2013 this change decreased the caseload by over forty percent. Indeed, the incidence of simultaneous assertion under separate case numbers appears much greater post-AIA than before. Still, the general rise of administrative challenges – while elevated in magnitude when collapsing cases – follows roughly the same pattern. The difference from 2008 becomes statistically significant one year earlier (in 2011), but in general we see the largest rise – a doubling – from 2012 to 2013.

Because we seek in part to compare pre- and post-AIA periods, we maintain this collapsed level of observations for the remainder of our analysis. Further, this level of analysis seems the best way to control for the externality effects described above – making sure the non-challenged case numbers of a challenged patent do not mask its status as a challenged patent. To be clear: for the remainder of the analysis, we no longer refer to a case as a unique patent-case combination. Instead, when we say “case,” we refer to a unique patent, litigated in one court, against any number of parties, on a unique date. Along the way, though, we run robustness checks to see whether elements of our analysis hinge on this change in the level of analysis.

#### *D. Settlements*

Cases that result in an administrative challenge might be different from other cases because they chose an administrative challenge rather than a court challenge, or because the defendants attempted to adjudicate validity *at all* as opposed to settling early. As established in other literature, most patent cases do not reach a final determination on the merits.<sup>123</sup> Therefore, cases with an administrative challenge occupy a portion of a special subset of cases that proceed meaningfully toward a validity challenge.<sup>124</sup> As a next step, it

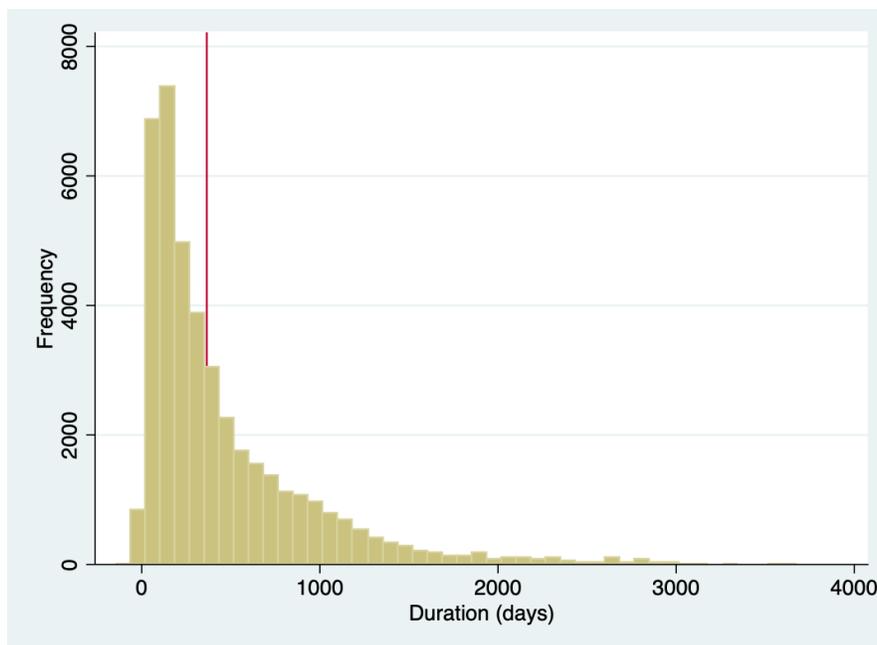
<sup>123</sup> See literature on litigation, *supra*, Kesan & Ball specifically.

<sup>124</sup> Note that the filing of an IPX challenges nearly always results in a validity determination. By contrast, an IPR petition may itself settle, and may not always lead to a decision on validity. Still, parties who chose to file an IPR clearly took some steps towards adjudicating the validity of a patent, while parties who settle very

is important to ask whether cases with administrative challenges differ further from cases that did move meaningfully toward adjudication, but remained in the district court.

We look now to each case's duration: the distance between a case's filing date and the date of its eventual termination. While we aren't able to identify the precise outcome for our cases – settlement, dismissal, or otherwise – we can compare those cases that ended quickly, versus those that lasted longer. Figure 3 presents a histogram of the case duration for our non-challenged but eligible cases.

*Figure 3: Time Between Case Filing and Termination for Non-Challenged Cases*



Any attempt to draw a line between “early” and “non-early” termination is inevitably somewhat arbitrary, but we use one year as the divider for a key reason. Because IPR requests must be filed within one year of the litigation date, cases that continue on beyond one year have presumably chosen to continue the case in district court, instead of requesting an administrative challenge. By contrast, cases that terminate in one year – without requesting an administrative challenge – settled or otherwise resolved the case before a decision had to be made on requesting an administrative challenge. For IPX, the lines are less clear cut, but the general principle of quick-resolving vs. cases that proceed meaningfully in the district court remains.

The results are staggering. Over half (58%) of our cases that did not lead to an administrative challenge were resolved early. That is, many cases do not lead to a challenge request simply because the cases are not long in dispute – they settle quickly or resolve quickly. Because only a minority of cases continue beyond one year to even begin to

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early may have taken none at all.

seriously adjudicate validity, the proportion of cases that use administrative challenges, conditional on attempting to adjudicate validity at all, is higher than the unconditional proportion.

In the remainder of this piece, we seek to identify how various characteristics are associated with the decision to request an administrative challenge in litigation. Along the way, we check for robustness of results within this narrower-defined subset of cases that did not terminate quickly. That is, for some future analyses, we restrict our “non-challenged” set to only those cases that proceeded on in the district court for longer than one year.

## V. HOW MUCH DOES THE INFRINGEMENT VENUE MATTER?

### A. Variation by Court

Our data on litigation filings includes the district that the lawsuit was filed in. The distribution of cases among districts is highly concentrated. There are ninety-two unique districts represented in our sample. If cases were uniformly distributed, we would expect to see just over one percent of the total cases occurring in each district. This is not the case. The vast majority of districts in our sample see an extremely small fraction of patent cases. Only twenty-four districts see greater than one percent of the cases. Two districts alone hear over one quarter of all challenge-eligible patent cases; the and the District of Delaware and the Eastern District of Texas each heard about fourteen percent of the cases in our sample.

An interesting question, of course, is whether there are substantial differences in administrative challenge rates across districts. Table 3 presents the challenge rate for each of the twenty-five most common districts in our sample.

*Table 4: Rate of Administrative Challenge by District*

Court	Number of Cases	Challenge Rate
DED	5,498	14.95%
TXED	5,194	15.83%
CACD	2,898	8.66% ***
NJD	2,312	8.17% ***
CAND	1,971	18.77% ***
ILND	1,899	8.06% ***
NYSD	1,222	4.91% ***
FLSD	1,000	2.60% ***
CASD	998	9.52% ***

VAED	788	12.82%
MAD	772	15.80%
UTD	690	7.25% ***
FLMD	615	7.97% ***
MND	591	14.55%
MIED	549	10.56% ***
TXND	544	10.11% ***
GAND	485	8.25% ***
COD	471	4.03% ***
NVD	470	9.15% **
MOWD	439	1.82% ***
OHND	411	8.03% ***
WAWD	393	5.34% ***
TXWD	373	17.43%
NYED	350	7.14% ***
WIWD	346	13.87%
National Average	37,152	11.31%

\*\*, \*\*\* indicates a significant difference from DED at  $p < .05$ ,  $p < .01$  respectively

The variation in administrative challenge use across districts is substantial. While the Northern District of California sees administrative challenges in nearly one out of every five cases, the Western District of Missouri sees challenges in fewer than two out of every hundred. The District of Delaware and the Eastern District of Texas – by far the two most common districts in our sample – have statistically indistinguishable rates of administrative challenges, but ones that are slightly higher than the national average. Using Delaware as a baseline, all but six districts have challenge rates that are significantly different. In an unreported model, we regress all ninety-two districts on whether or not each case involved a challenge. Using an F-test, we can strongly reject the hypothesis that all court coefficients are jointly equal to zero. That is, we find evidence of heterogeneity in challenge rates across courts.

But who would really expect differences across courts to be driven by random chance? On the contrary, a growing body of scholarship has documented the phenomenon

of “court shopping.”<sup>125</sup> Therefore, the parties and cases that select into a particular court might be quite different from those who select another. For example, patentees who choose to bring their infringement suits in district X might be particularly eager to settle the case, preempting any administrative challenge. These differences in selection might lead to a higher or lower challenge rate not because of anything the court did, but simply by virtue of the types of cases the court attracts.

Still, characteristics of a particular court may well be affecting a defendant’s decision to bring suit. In IPR the decision of whether to grant a stay of the district court action is discretionary. Courts that are particularly hostile to stays might see fewer administrative challenges filed for their cases. Likewise, courts that are known to have a particular competency or speed for handling patent cases might obviate the need to go to the patent office to get a fair and speedy validity decision. In any event, the effects of the court’s policies from the selection effects are difficult to disentangle. We tackle this problem by focusing in the next subsection not on courts but on particular judges – where there is likely high heterogeneity in practices but lower selection bias.

### *B. Variation by Judge*

While “court shopping” in patent litigation is substantial, “judge shopping” appears to be largely nonexistent. As Professor Anderson has noted, most districts have put in place some procedures to reduce or eliminate a party’s ability to select a particular judge.<sup>126</sup> With the possible exception of the Eastern District of Texas – where procedures may actually *encourage* judge shopping – litigants file an infringement suit without knowing who their judge is going to be.<sup>127</sup> Therefore, we are relatively less worried that observed differences in administrative challenge rates across judges are driven by differences in the cases to which they are assigned. Of course, this is conditional on the court – we are interested in differences in judges within the same court; differences in judges from different courts would be marred by the same “court shopping” selection bias as before.

We operationalize this test by running a logistic regression with the dependent variable being challenge outcome, that is, whether a particular case will result in at least one defendant requesting an administrative challenge. In the model, we control for all ninety-two courts, and the most prevalent 100 judges.<sup>128</sup> Using a joint F-test, we can strongly reject the hypothesis that all judge coefficients are jointly equal to zero. That is, even when controlling for district, the judge assigned appears to have an effect on the likelihood of a defendant requesting an administrative challenge. Many of the judges that come up individually significant in the model sit in the Eastern District of Texas – lending

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<sup>125</sup> See, e.g., Anderson, *supra* note 98.

<sup>126</sup> J. Jonas Anderson, *Judge Shopping in the Eastern District of Texas*, 48 LOY. U. CHI. L.J. 539 (2016).

<sup>127</sup> *Id.*

<sup>128</sup> Technically, our dataset contains over twelve hundred unique judges, but running a model with this many predictors would be untenable. In fact, because many judges see only a handful of cases, oftentimes none with challenges, a great many of these judge dummies would be dropped anyway, as they perfectly predict the outcome in the logistic regression.

questions as to whether or not selection plays a role. Some patentees who are particularly opposed to administrative challenges, for example, might file in the Eastern District and select the judge most opposed to stays.

Still, many judges in other districts – presumably those who were assigned to the parties at random – have differences in the rate at which their cases use administrative challenges that are unlikely to be explained by random variation. These differences could be explained by the broad power judges have over their cases, and the many different ways they might push litigation defendants into particular strategies. As Professor Anderson notes, experienced trial litigators know that the judge assigned is extremely important.<sup>129</sup> Now, we dig deeper to test potential sources of this observed heterogeneity among judge assignment. Put simply, we seek to shed light on the following question: why does the particular judge assigned matter to defendants?

One explanation could be the judge’s propensity to grant stays. If a certain judge is especially hostile toward granting a stay, we might expect that defendants would be less likely to request an administrative challenge, for fear of having to incur duplicate costs as both proceedings move forward. It is difficult to empirically test for the effect of a judge’s stay propensity for two reasons. First, there is data sparsity: because administrative challenges are rare, motions for stay pending IPX or IPR are also relatively rare, and thus many judges would see few if any such motions. Second, such analysis would likely suffer from a reverse causality problem: higher stay grant rates might imply higher challenge rates, but the request of each challenge could drive up the judge’s grant rate.

Still, much of the difference might not be specific to administrative challenge stays, or even to patent law. Instead, whether a defendant chooses to request an administrative challenge might be informed by the judge’s general docket management. A particular judge might move extremely quickly, pushing parties into quick settlements, or resolving key issues on early motions to dismiss. Such judges might not take kindly to delays of any kind, including stays pending patent office review of validity. To more closely get at this effect, separate from other areas of judge influence, we define a new judge-level variable called “judge speed.”

For each case number, we observe the filing date of the case, as well as a date of the case’s eventual disposition. We then calculate the speed to a case’s disposition as the difference (in days) between those two dates. We then average the speed over all of a particular judge’s cases to determine each judge’s average speed. We also correct for one potential source of endogeneity. Because judges who grant stays will see those cases take longer to reach a disposition, the grant of a stay might cause longer judge speeds, rather than the other way around. To account for this, we remove from our averages any cases in which a party requested an administrative challenge. Thus, our judge speed variable represents the true speed of the judge, in cases without an administrative challenge. We expect that judges with relatively higher speeds might be those who push parties to quickly settle cases, rule quickly, or push back against delays and stays.

Judge speed is a statistically significant predictor of challenges by itself or alongside courts and judge dummies. Judges who take longer on average to conclude their

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<sup>129</sup> See, e.g., Anderson, *supra* note 98.

cases, are more likely to have their cases result in an administrative challenge. This provides some support to the idea that at least part of the heterogeneity in judges – and perhaps the heterogeneity in districts – is driven by differences in docket management speed, or pushes toward early settlement. Still, this judge speed variable provides benefits and costs over judge dummies. Compared to complete judge dummies, it only captures a portion of the possible judge effects on administrative challenge filings. Still, it provides substantial benefit as an easy one variable proxy for judge effects as a predictor of challenges, and is more parsimonious to use in selection equations.<sup>130</sup>

## VI. HOW MUCH DOES THE PATENT AT-ISSUE MATTER?

Most variables of interest to us are patent-specific; we make use of several other datasets to gain information on the patent at-issue in each observation. To obtain data on each patent, we combine data from a variety of databases, each of which is put out by the USPTO. For example, Patent Examination Research Dataset (PatEx)<sup>131</sup> provides basic information such as filing date, patent grant date, and patent class.<sup>132</sup> We separate out two characteristics for future analysis: patents issued to small entities, and patents owned by Patent Assertion Entities.

### A. *Intrinsic Characteristics*

First, we focus on characteristics that are present at the time of a patent’s issuance, and that do not change throughout a patent’s life. These are often referred to as “intrinsic characteristics” in the literature.<sup>133</sup> Table 5 describes the intrinsic characteristics of the patents at-issue in our constructed challenged and non-challenged case samples. We also perform tests comparing the means between the challenged and non-challenged subsets.<sup>134</sup> In every observable category, the patents at-issue in cases that led to an administrative challenge are significantly different from those in non-challenged cases.

*Table 5: Intrinsic Characteristics of Challenged Patents*

	Non-Challenged	Challenged	p-value
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<sup>130</sup> We use a variant of this judge speed variable to help predict selection into administrative challenges (with outcomes) in our companion paper. [redacted]. For the remainder of this analysis, we use 100 judge dummies as controls for judge effects in subsequent models.

<sup>131</sup> Marco et al., *supra* note 109.

<sup>132</sup> We collapse patent class data to the more manageable six NBER technology categories for some of our analysis. To account for changes in patent classes, we use an updated version of the (Hall, Jaffe, and Trajtenberg 2001) mapping provided by the NBER Patent Data Project, available online at <https://sites.google.com/site/patentdataprotect/Home/downloads/patn-data-description>

<sup>133</sup> *See, e.g.*, Chien, *supra* note 30.

<sup>134</sup> More specifically, we perform two-sample two-tailed t-tests of equality for continuous variables (e.g. citations), and similar tests of proportion equality for binary variables (e.g. small entity status).

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Total claims	27.830	30.254	0.000 ***
Independent claims	3.901	4.280	0.000 ***
Min. word in ind. claims	125.248	129.369	0.003 ***
Back citation per claim	2.704	2.937	0.017 ***
Prosecution per claim (days)	79.681	68.086	0.000 ***
Chemical	0.045	0.039	0.056 *
Computer & Comm.	0.422	0.515	0.000 ***
Drugs & Medical	0.208	0.133	0.000 ***
Electrical & Electronic	0.096	0.165	0.000 ***
Mechanical	0.095	0.061	0.000 ***
Others	0.133	0.106	0.000 ***

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We obtain data on patent claims from the Patent Claims Research Dataset.<sup>135</sup> This dataset provides the number and word count statistics for both independent and dependent claims. Following the researchers who created this dataset, we focus primarily on the number of independent claims and the minimum word count in independent claims.<sup>136</sup> Their theory is that patents with more independent claims and a smaller minimum word count should be of broader scope.<sup>137</sup> This makes intuitive sense. We would expect additional claims to add additional scope of protection. Likewise, there is good reason to believe that claims with few words are broader than claims with more words. Just as “a paper” is a broader description than “a law review paper”. For completeness, we also use a measure of total claims in some of our analysis, which we generate by summing the dependent and independent claim counts. Challenged cases involve patents with, on average, three more claims and .3 more independent claims. While this tends to imply patents of greater breadth, challenged patents tend to also have a greater minimum number of words in their independent claims, which might conversely signify a narrower scope.

The USPTO Patentsview Database<sup>138</sup> allows us to find the number of backward citations. These variables are commonly used as proxies for patent value.<sup>139</sup> From this

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<sup>135</sup> See Marco, Sarnoff, and deGrazia (October 2016).

<sup>136</sup> *Id.*

<sup>137</sup> *Id.*

<sup>138</sup> PATENTSVIEW, <http://www.patentsview.org/web/#viz/comparisons>.

<sup>139</sup> See, e.g., Dietmar Harhoff, Federic M. Scherer & Katrin Vopel, *Citations, Family Size, Opposition and the Value of Patent Rights*, 32 RESEARCH POLICY 1343 (2003); Lanjouw and Schankerman, *supra* note 31.

database, we extract files detailing every time one patent cites another patent. Backward citations are generated similarly by tabulating, for a particular patent, the number of other patents it cites.<sup>140</sup> Following Lanjouw and Shankerman,<sup>141</sup> we generate per-claim variants for backward citations, as well as for prosecution time. Challenged patents spend less time in their initial examination – eight fewer days per claim – but also cite a greater number of prior art patents in the examination process.

The breakdown of technology categories is also quite different between the two groups. Challenged cases involve a greater fraction of computer & communication patents, and electrical & electronic patents. The opposite is true for chemical, drugs & medical, mechanical, and other patents.

### *B. Acquired Characteristics*

In Table 6, we present similar a similar analysis for “acquired” characteristics of the patent at the time of litigation.

*Table 6: Acquired Characteristics of Challenged Patents*

	Non-Challenged	Challenged	p-value
Age (days)	1917.17	1963.06	0.101
Annual forward citations per claim	0.206	0.227	0.029 **
Assigned	0.503	0.550	0.000 ***

First, we define age as the number of days between the date that a patent is issued and the date it is litigated. There is no significant difference in age between patents in cases with or without an administrative challenge. Next, we create a measure of forward citations by summing the number of times a particular patent is cited by another patent.<sup>142</sup> Forward citations are recorded as the total citations that accrued as of a particular date (12/26/2017). This creates a truncation issue with forward citations since older patents have had more time to accrue citations. To alleviate this problem we normalize the number of citations by the number of years between the patent’s issue date and the date we collected forward citations.<sup>143</sup> The combination of these two transformations results in the new forward

<sup>140</sup> Again, we manually set the value of backward citations to zero for any patent with no record of citations.

<sup>141</sup> See Lanjouw & Shankerman, *supra* note 31 **Error! Bookmark not defined.**

<sup>142</sup> We manually set the value of forward citations for any patent with no record of citations, as this database is comprehensive for patents issued from the 1970’s through the end of 2015.

<sup>143</sup> There seems to be no perfect way to correct for truncation. See Bronwyn H. Hall, Adam B Jaffe & Manuel Trajtenberg, *The NBER Patent Citation Data File: Lessons, Insights, and Methodological Tools* (NBER Working Paper No. 8498, 2001) for limitations different methods, including the “fixed window”

citations variable “Annual citations per claim”. Challenged patents have, on average, slightly higher forward citations. This might indicate that they are of particularly high value.

Finally, we seek to determine whether or not a patent was assigned prior to litigation. In earlier work, Professor Chien found that assignment was an important predictor of litigation.<sup>144</sup> We seek here to see whether it is also an important predictor of administrative challenge. We merge our existing dataset with the Patent Assignment Dataset which records the assignment dates for patents.<sup>145</sup> Our ability to determine the identity of the assignee is very limited. We narrow down as best we can to those assignments that appear to most closely resemble a true sale of a patent to another entity. We exclude any assignments tagged as name changes, government or security interests, corrections, and mergers. Likewise, we exclude any assignment that the PTO has flagged as likely from an individual inventor to her employer. Over half of all cases in our sample dealt with patents that had been assigned prior to litigation. Cases where there was an administrative challenge dealt with a greater share of patents that were assigned.

### *C. Multivariate Regression Analysis*

While the t-tests for comparisons of means presented in this and the previous section offer some insights for how these groups differ, each of the variables in that table is compared independently of other variables. Now we perform more rigorous analysis using multivariate regression that accounts for possible correlations between the variables. Specifically, we use these regressions to identify the variables that predict whether a particular litigated patent will also be administratively challenged. The dependent variable takes the value 1 for our challenged group (patent-cases that are matched to an administrative challenge within 18 months) and 0 for the control patents (patent-cases eligible for an administrative challenge but with no such challenge filed within 18 months).

Unlike some previous literature that looks at the characteristics of litigated patents,<sup>146</sup> we are able to make use of our full sample without needing to resort to matching techniques. Matching is needed in cases where a binary outcome is exceedingly rare, which could introduce bias in logistic regression, as well as making data gathering and computation costly.<sup>147</sup> When comparing litigated patents to the millions of unlitigated patents, the former dwarfs the latter: indicating that matching is necessary.<sup>148</sup> By contrast, we compare challenged cases to other litigated cases, which are decidedly less rare. About

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approach. Our data only includes total citations on a specific date, which is why we correct for truncation by finding the annual average. If citations increase at an increasing rate, we might be somewhat underestimating annual citations for younger patents. This concern is alleviated in our analysis because we later match patents using filing date and patent class.

<sup>144</sup> Chien, *supra* note 30.

<sup>145</sup> See Marco, Alan C., Graham, Stuart J.H., Myers, Amanda F., D’Agostino, Paul A and Apple, Kirsten, *The USPTO Patent Assignment Dataset: Descriptions and Analysis* (July 27, 2015).

<sup>146</sup> See, e.g., Lanjouw & Shankerman, *supra* note 31; Chien, *supra* note 30.

<sup>147</sup> See generally Gary King and Langche Zeng. 2001. “[Logistic Regression in Rare Events Data](http://j.mp/2oSEnmf).” *Political Analysis*, 9, Pp. 137–163. Copy at <http://j.mp/2oSEnmf>.

<sup>148</sup> See Chien, *supra* note 30 (“I used these sets, rather than a random sample drawn from patents generally, because the application of statistical analysis to rare events like patent litigation tends to distort and understate the probability that the events will occur.”) (citing King, *supra* note 149 ).

eleven percent of the cases in our sample are challenged, which is nearly ten times greater than the proportion of patents that are litigated, and over double the level that Professors King and Zeng would suggest requires matching techniques.<sup>149</sup> Therefore, we are able to use the entire litigated control sample in our analysis, without needing to resort to matching. Where the previous authors also used their matching technique to control for cohort and class effects,<sup>150</sup> we instead use fixed effects to control for these effects over the entire sample.

In Table 7, we present the results of this exercise, using a logit model because our measured outcome is binary.<sup>151</sup> All columns use fixed effects for the district court and the one hundred most common judges. Column (1) uses the intrinsic patent characteristics as well as dummies for the patent filing year to control for possible cohort effects. Column (2) adds in the acquired patent characteristics. In the Appendix, Table A1 repeats this analysis but removes from the set of non-challenged cases those cases that terminated early.

Older patents are much more likely to be selected into an administrative challenge. Litigated patents with a greater number of independent claims are also more likely to be challenged administratively. This result is consistent with litigated patents of especially broad scope being more likely to be administratively challenged. One interpretation of this could be that these patents are of especially questionable validity due to their breadth. The flip side of this coin, of course, is that these patents are of higher value – their claims stake out greater property rights. The latter interpretation might be consistent with our result that litigated patents with greater forward citations are more likely to be challenged. These characteristics are typically taken to indicate patent value.<sup>152</sup>

Our results that might speak to patent quality do so ambiguously. On the one hand, we find that patents with a greater number of backward citations – perhaps indicating a more diligent search effort – are more likely to be challenged. On the other hand, the amount of time (per claim) that a patent spent being prosecuted at the patent office appears negatively associated with challenges. If we believe that more time at the patent office is associated with a more thorough examination of the patent, we might expect that the patents with higher prosecution times are of higher quality. Indeed, our other work suggests that patents with higher prosecution times are significantly less likely to suffer a significant loss (first claim cancellation) in administrative challenge.<sup>153</sup> Still, when acquired characteristics are added to the model, the effect of prosecution time is no longer significant.<sup>154</sup>

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<sup>149</sup> King & Zeng, *supra* note 149 (recommending their method to be especially helpful in cases where the outcome occurs in fewer than five percent of observations).

<sup>150</sup> See, e.g., Lanjouw & Shakerman, *supra* note 31.

<sup>151</sup> This table presents robust standard errors. The results remain qualitatively similar if we instead cluster standard errors at the patent level.

<sup>152</sup> See, e.g., John R. Allison, Mark A. Lemley & Joshua Walker, *Extreme Value or Trolls on Top? The Characteristics of the Most-Litigated Patents*, 158 U. PENN. L. REV. (2009); Harhoff et al., *supra* note 139.

<sup>153</sup> [redacted], *supra* note 55 (updated working paper on file with authors).

<sup>154</sup> Note that this result is somewhat consistent with an earlier result in the literature, that examination time is not a significant predictor of federal circuit patent validity decisions. See Ronald J. Mann & Marian Underweiser, *A New Look at Patent Quality: Relating Patent Prosecution to Validity*, J. EMP. L. STUDIES (2012).

We also see strong differences between various technology classes. Compared to other patents, litigated drugs & medical patents are significantly less likely to be challenged, as are mechanical patents. On the other hand, litigated computers/communications and electrical/electronic patents are significantly more likely to be challenged. This might indicate that norms have been established in various industries – or their respective bars – for how patent disputes will play out. Another important factor could be differences in the original patent examination process by technology class. Certain areas might have differences in how likely prior art is to be found during the examination process. This result might also indicate the perceived incremental benefit of Administrative Patent Judges (APJs) as decision makers in various contexts. Defense attorneys might worry more about the prospect of explaining a computer or electronic invention to a generalist district court judge or jury than the same for a drug or mechanical patent. Or, on the flipside, APJs in the former two fields might be perceived as especially fair or skilled.

Our NBER measures are fairly broad as a measure of technology class effects, compared to some of the more granular measures used in earlier studies.<sup>155</sup> As a robustness check, we replace our NBER categories with NBER subcategories. Our data spans thirty-seven unique subcategories. In unreported models, all of our previously reported results remain qualitatively unchanged, with the exception of the coefficient on forward citations, which loses significance.

Importantly, Table A1 shows that *every single one of these results still holds* when comparing challenged cases to only cases that did not terminate early. In other words, the effects of various patent characteristics cannot be explained by differences in settlement rates. Even compared to cases that proceed meaningfully toward adjudication in the district court, patents involved in challenged cases tend to be older, broader in scope, cite more prior art, and are more frequently cited themselves.

In summary, while earlier work has shown that litigated patents are of broader scope and higher value compared to the overall population of U.S. patents, our analysis here further suggests that patents concurrently challenged at the patent office tend to be even more valuable than other litigated patents. This could have several interesting implications for policymakers. The increased value of these patents likely also indicates that there is more “at stake” in the dispute.<sup>156</sup> On its face, if policymakers hoped to push the validity challenges in especially high-stakes disputes from the courts to the patent office, they appear to be succeeding. And, as the costs of litigation increase with the amount at stake,<sup>157</sup> having the highest value patents bifurcating their trials to utilize the lower cost validity determination procedure could maximize the cost differential, and thus the cost

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<sup>155</sup> See, e.g., Lanjouw & Shankerman, *supra* note 31. This study matches on patent filing month and detailed patent classes, because it has millions of unlitigated patents to pull from. As noted before, we are unable to control at quite this level of granularity in our smaller dataset, whether by matching or otherwise. Instead, we control for class and cohort effects using NBER classes (alternatively subclasses) and filing year fixed effects.

<sup>156</sup> Bar and Kalinowski (2018) theoretically show that when an infringer expects higher damages she would exert more effort searching for prior art in an attempt to invalidate a patent. One possible explanation for our observation that challenged patents are more likely to have more claims and forward citations than other litigated patents is that a patent’s increased value is an indication of higher expected damages.

<sup>157</sup> *Supra* note **Error! Bookmark not defined.**

savings, from these procedures.<sup>158</sup>

Further, our results suggest important implications for overall patent quality. If we believe that the patent office is a more accurate judge of patent quality than the district courts, it might be comforting to know that the most valuable patents are being reviewed there. In addition, because evidence suggests that administrative review results in more decisions on validity than in the district court,<sup>159</sup> we might expect the overall quality of the granted patent pool to rise. In short, policymakers might be relieved to discover that our findings lend some support to the idea that administrative patent procedures may be diverting especially high value patents away from the district court.

*Table 7: Patent Determinants of Administrative Challenge*

	(1)	(2)	(3)	(4)
	Intrinsic Patent Characteristics	Add Acquired Characteristics	Add Small Entity	Add PAE
Independent claims	0.016*** (0.004)	0.018*** (0.004)	0.017*** (0.004)	0.019*** (0.004)
Min. word in ind. Claims/100	-0.019 (0.022)	-0.008 (0.022)	0.003 (0.021)	-0.003 (0.021)
Back citations per claim	0.011*** (0.003)	0.011*** (0.003)	0.009*** (0.003)	0.011*** (0.003)
Prosecution per claim (years)	-0.158** (0.066)	-0.114* (0.064)	-0.087 (0.063)	-0.108* (0.065)
Chemical	-0.084 (0.106)	-0.083 (0.106)	-0.125 (0.108)	-0.142 (0.108)
Computer & Comm.	0.297*** (0.061)	0.309*** (0.062)	0.271*** (0.063)	0.390*** (0.065)
Drug & Medical	-0.312***	-0.311***	-0.375***	-0.409***

<sup>158</sup> This, of course, depends on the counterfactual of those cases which were selected into these challenges. It is possible that had administrative review not been available, the parties might have not adjudicated validity in the district courts at all, but rather settled. In this case, use of patent office challenges might be increasing the dispute costs borne on the parties. Further investigation into settlements is needed to shed light on this question.

<sup>159</sup> See Chien & Helmers, *supra* note 90.

	(0.079)	(0.080)	(0.081)	(0.082)
Electrical & Electronic	0.488***	0.487***	0.449***	0.487***
	(0.073)	(0.073)	(0.073)	(0.073)
Mechanical	-0.271***	-0.283***	-0.291***	-0.253***
	(0.089)	(0.089)	(0.089)	(0.089)
Age (years)		0.068***	0.070***	0.071***
		(0.009)	(0.009)	(0.009)
Forward Citations per year per claim		0.062**	0.057**	0.059**
		(0.027)	(0.027)	(0.027)
Assigned		0.026	0.025	0.126***
		(0.039)	(0.039)	(0.041)
Small entity indicator			-0.288***	-0.291***
			(0.042)	(0.042)
PAE				-0.386***
				(0.050)
Constant	-0.002	0.255	0.459	0.640
	(1.295)	(1.234)	(1.217)	(1.221)
Filing Year FE	Yes	Yes	Yes	Yes
District Court FE	Yes	Yes	Yes	Yes
Judge FE	Yes	Yes	Yes	Yes
Observations	32,281	32,281	32,281	32,281

Notes: Dependent variable is “challenged”; challenged cases are those where the litigated patent was matched to an IPX or IPR occurring within 18 months. “Non-challenged” cases are those that could not be matched (i.e. had no such IPX or IPR within 18 months). All models are logit models. Standard errors in parenthesis; \*, \*\*, \*\*\* indicate statistical significance at 10%, 5%, and 1% respectively.

#### *D. Small Entity Patents*

Small-scale inventors make a significant contribution to innovation. Earlier studies have shown, however, that small patentees are disadvantaged when it comes to patenting and to asserting their patents. Professors Lanjouw and Schankerman (2004) find that patentees with small patent portfolios run a higher risk of litigation. Professors Schankerman and Gallaso (2015a)<sup>160</sup> show that invalidation of patents owned by large

<sup>160</sup> Alberto Galasso & Mark Schankerman, *Patents and Cumulative Innovation: Causal Evidence from the*

firms triggers more follow-on innovation by small firms, and further<sup>161</sup> show that a loss of patent rights significantly increases the likelihood of exit for small firms.

In Column (3) of Table 7, we add to the model a dummy variable that indicates whether the patentee claimed small entity status. We find that cases involving small entity patents are significantly less likely to see concurrent administrative challenges. It is interesting that the patents that are shown to have a higher risk of litigation still have a lower risk of administrative challenge. We must also remember that the small entity patentees are likely to be the plaintiff in the district court litigation. Therefore, defendants may be making strategic decisions to challenge small entity patents in the district court instead of at the patent office. Perhaps this implies that the types of challenges made to small entity patentees are those more amenable to district court challenge (i.e. challenges other than novelty or nonobviousness). Or, perhaps defendants prefer to exploit the limited resources of small entity patentees by dragging out costly civil litigation instead of using the cheaper and faster administrative alternative so as to incentivize them to settle in terms favorable to the alleged infringers.

We find that small entity patents are less likely to be challenged by defendants. This result on small entity patents is curious in light of a result in other work: small entity patents are more likely to be invalidated at the patent office.<sup>162</sup> If small entity patents are easier to invalidate at the patent office than other patents, we might expect defendants to be challenging them much more frequently at the patent office. We could perhaps reconcile these results by the existence of settlements. Knowing that they face poor outcomes in administrative challenges, small entity patentees may be more likely to settle early and avoid the patent office altogether.

Indeed, Column (3) of Table A1 is consistent with this hypothesis. When comparing challenged cases to those that did not challenge but did not terminate early, small entity status is no longer a significant predictor of challenge requests. That is, the difference in challenge rates for small entity patents appears to be driven by those cases that terminate early, likely often by settlement. This result adds to our understanding of how small entity patentees behave in patent disputes.

#### *E. Cases Brought by Patent Assertion Entities*

Significant work has been published in academic journals in recent years on the question of patent assertion entities, or PAEs.<sup>163</sup> PAEs are often viewed to have different litigation strategies than other patent infringement plaintiffs.<sup>164</sup> These strategies might lead to a different rate of administrative challenge use for defendants.

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*Courts*, 130 Q. J. OF ECON. 317 (2015).

<sup>161</sup> Alberto Galasso & Mark Schankerman, Patent Rights, Innovation and Firm Exit (NBER Working Paper No. 21769, 2015).

<sup>162</sup> See [redacted], *supra* note 55.

<sup>163</sup> See *supra* note 102.

<sup>164</sup> *Id.*

We make use of the Stanford PAE dataset<sup>165</sup> to identify cases where the plaintiff was a patentasserter. We follow Miller et. al's coding scheme and define PAE as a plaintiff that is categories one, four, or five. Because the data provided to us is a ninety percent sample of the total caseload over our period, we make one additional assumption to maximize our data availability. We code patents that are missing for one of our cases in the PAE dataset but asserted by a PAE at some other time in that dataset as PAE asserted. Likewise, we assume that patents never asserted in the dataset – that is, patents that were never asserted over a fifteen-year period – are not owned by PAEs.

As a preliminary matter, cases brought by patent assertion entities made up nearly one-third (31.2%) of all cases with challenges. This number is slightly greater than the proportion of PAE patents in non-challenged cases (29.67%). Thus, administrative challenges seem to be handling a significant number of PAE cases, and perhaps even at a slightly greater rate than Article III courts are. To the extent that policymakers hoped for administrative challenges to serve as a second look at patents being asserted by PAEs, these tribunals appear to certainly be fulfilling that function.

That said, these number don't tell us if these cases are challenged with a greater frequency because they are PAE patents. Rather, PAEs may own patents that are unrepresentative of the overall pool. The patents they hold may be more likely to be challenged simply by nature of, for example, having more claims or being in a certain art category. In Column (4) of Table 7, we attempt to separate out these effects by adding in a dummy for PAE status alongside our other covariates. Controlling for other patent and case characteristics, cases that involve PAE assertors are actually *less likely* to lead to an administrative challenge.

One obvious explanation for this result is that PAE asserters might be more likely to force a quick settlement before adjudication proceeds at all. That is, defendants in PAE cases might settle before they even consider whether to request an administrative challenge. The results in Column (4) of Table A1 are consistent with this theory. When restricting non-challenged cases to only those that last for longer than one year, the effect of PAE is no longer statistically significant. That is, like with small entities in the previous subsection, the difference in the PAE litigation rate appears primarily driven by cases that settle or otherwise terminate early.

## VII. HAVE SELECTION PATTERNS CHANGED SINCE THE AIA?

### A. *The AIA and the Rate of Challenge*

The figures and descriptive tables in Section II.A, *supra*, appear to show a significantly increased use of administrative review procedures in the latter half of our sample period. This begs an important question: did the America Invents Act and the shift to inter partes review make challenges more appealing to defendants? In the roughest of tests, we first divide our sample into two parts. First, cases that were filed prior to September 16, 2012 had inter partes reexamination available as a tool, but not inter partes

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<sup>165</sup> We are grateful to Shawn Miller for sharing this data. Shawn P. Miller et al., *Introduction to the Stanford NPE Dataset*, <https://law.stanford.edu/wp-content/uploads/2017/10/Introduction-to-the-Stanford-NPE-Litigation-Dataset-10.23.2017.pdf>.

review.<sup>166</sup> Cases filed after that date, however, were no longer eligible for IPX, but could make use of IPR. The rate of administrative challenge is 7.06% in the earlier period, and 14.3% in the later period – signifying a doubling of the challenge rate. Table A3 Column (1) presents the equivalent test in regression form, using an AIA dummy (IPR) and the usual court and judge fixed effects.

Of course, this two-period comparison is far from sufficient to establish a causal story for a number of reasons. First, the tables in Section II.A seem to indicate that the challenge rate was increasing over the entire sample period. Therefore, dividing the sample into two halves might simply reduce a continuous trend to a “high” and “low” period. That is, the latter years would have been significantly greater following a growing trend of challenge use, regardless of whether the AIA was put into effect.

Further, litigation strategies can change over time. Indeed, the nature of our judicial system promotes changes in the backdrop of litigation over time as caselaw develops. Landmark cases may make it more difficult for challengers to introduce evidence of invalidity, or may make it more difficult to obtain stays. Therefore, there is good reason to believe that the decision to file for an administrative challenge depends on elements of the judicial system that are orthogonal to any particular case. In other words, the time at which a patent is litigated may affect the likelihood that an administrative challenge is filed. This could cast particular doubt on the interpretation of our IPR variable, since it is the only variable that changes with litigation timing. The variable, in particular, could just be capturing changes in baseline rates of administrative challenge, rather than any effect of the AIA in particular.

To dig into this issue further, Column (2) adds to the model a set of fixed effects for the quarter of the litigation filing. This allows for non-linear trends in the rate of challenge filing over time. Even allowing for these trends, the effect of the AIA dummy is positive and significant.

The other main issues with identifying an AIA effect can be broadly categorized under the heading of omitted variable bias. That is, the switch to AIA might have been correlated with changes in the set of patents or cases that were litigated. If, for example, the patents litigated after 9/16/2012 coincidentally had greater claims, the effect of greater claims (which is excluded in our first two columns) might be biasing the AIA effect upwards. This problem would be particularly pronounced if, for example, the AIA also changed the overall quality of the set of patents filed or patents litigated.

To at least partially correct for this problem, in Column (3) we control for the same observable patent characteristics as in Column (4) of Table 7. Even simultaneously controlling for observable patent characteristics, court and judge effects, and quarterly non-linear time effects, we still find a positive and significant effect of the AIA dummy.

Further, most main results from Table 7 hold even when controlling for time fixed effects and the AIA effect over the entire period. The effects of forward and backward

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<sup>166</sup> As mentioned in Section II.A, cases filed before but close to this date in theory could have still used IPR before the one-year statutory bar took effect. Still, the vast majority of cases in the first sample would be unable to do so, and only an extremely small fraction of IPR cases came from litigation cases filed before the AIA policy change date.

citations, small entity status, PAE status, technology categories, and breadth all appear robust to background changes in the litigation climate over time. There are, however, two changes. First, prosecution time becomes negative and significant, implying that additional time in patent prosecution is associated with less administrative challenges. Second, the effect of age flips completely, suggesting that when controlling for the time of litigation, older patents are actually less likely to be litigated. One possible explanation is that patent age in the earlier models was in effect proxying for the AIA shift – as patents challenged under the AIA regime can be older due to the change in pre-1999 patent eligibility.

Of course, we only control for a small number of observed covariates: the AIA policy effect might still be biased based on changed characteristics of cases post-AIA that are unobservable. In one last attempt to falsify the AIA effect, we again employ a matching procedure similar to that employed in Section II.D. In Table 8 presents the results from nearest neighbor matching where observations after the AIA policy change are matched to observations before the policy change. Exact matches are forced on USPC class, and a distance metric determines the closest match on other observed covariates. The full sample effect is estimated at a 6.2% increase in the odds of administrative challenge, with a 95% confidence interval between 5.1% and 7.3%.

Finally, we attempt to exploit some quasi-randomness in the issuance of patents to further tease out the AIA effect. First, we restrict our sample to just those patents under review at the patent office on 9/16/2011 – the date the AIA was signed. Therefore, for the entire set of patents, patentees were unable to know with certainty if their patent would be issued in time to be challenged under IPX or only eligible for challenge under IPR. Of course, the quasi-randomness here is extremely limited – patentees can control the timing of their infringement suits, so patents that issue prior to the AIA change could still be held back, litigated only after the switch to the IPR. Still, it provides at least some uncontrollable constraint: patentees whose patents are not issued until after 9/16/2012 cannot litigate under the IPX regime; they are forced into the IPR regime whether they like it or not. Under this modified test, the average treatment effect is estimated at 4.2%, with a 95% confidence interval range between 1.2% and 7.1%.

*Table 8: Nearest Neighbor Matching for AIA Effect*

	ATE	[95% Conf. Interval]	p-value
AIA – Full sample	0.062	[0.051, 0.073]	0.00 ***
AIA – Under Review	0.042	[0.012, 0.071]	0.006 ***

One important aspect of our results is the comparison between the IPX regime prior to the America Invents Act and the IPR regime that replaced it. As discussed in Part II, the IPX regime differs from the IPR regime in many ways. These changes were motivated at least in part by a desire to make administrative challenges more appealing to litigants. The data presented in this Part suggests that this goal has been achieved. Rates of administrative patent challenges are much higher for patents litigated after to the AIA took

effect.

When subjected to more rigorous analysis, the visual observation of increasing filings post-AIA holds up to scrutiny. Patent litigation cases filed after the AIA took effect were significantly more likely to see concurrent administrative challenge, even controlling for other variables that predict these challenges. To the extent that policymakers hoped that the AIA would increase the use of administrative challenges, they appear to have succeeded.

### *B. The AIA and the Types of Challenges*

A more interesting question for policymakers is whether the AIA increased the use of administrative procedures evenly across the board, or if it instead made these challenges more attractive for certain types of patents. That is, the effects of patent-level variables may be different within the IPR regime compared to the IPX regime. Characteristics that predict administrative challenge overall may be better or worse predictors within the IPR or IPX regime. This could suggest that the AIA's changes to these procedures changed the type of patents that were selected into IPR vs. IPX.

To investigate these effects, we generate new variables that interact our AIA dummy with the other characteristic variables. This results in a set of interaction terms, which take their usual values if the litigation was filed post-AIA, but are set to zero if the litigation was filed pre-AIA. The model with these interaction terms is included as Column (4) in Table A3.

When including interaction terms, most of our core variables retain their sign and statistical significance. In particular, litigated patents with broader scope are associated with a greater odds of administrative challenge, as are those with greater forward and backward citations. Interestingly, the small entity indicator loses its significance, but its interaction term is negative and significant. This implies that the small entity effect – that small entity patents are less likely to be challenged administratively – is driven primarily by the IPR subsample. As one possible explanation, we consider the changes in the structure from IPX to IPR. While the small entity patent holders do not pay the increased pecuniary costs like filing fees, the IPR process involves significant discovery and other trial-like expenses. To the extent that small entities might settle early to avoid the costs of administrative challenge, where they face poor outcomes, this effect might be more pronounced in IPR if it is relatively more costly overall.

By contrast, the PAE indicator retains its negative sign and significance in the main model, and its interaction term is not significant. Thus, we find no evidence that cases involving PAEs are any more or less likely to use administrative challenges after the AIA.

While older patents are overall less likely to face an administrative challenge, this effect is much smaller in IPR subsample. This underscores again our caution with interpreting age, as the effects are likely different due to the lifting of the pre-1999 restriction after the AIA.

While the effect of drug patents persists with the inclusion of the interaction terms, other technology categories show heterogeneous effects. Electrical/Electronic patents are only significant when interacted with the AIA policy indicator. The effects of computer

and mechanical patents disappear entirely.

Taken together, these results suggest that the AIA may have altered the selection of patents into administrative challenge. To the extent policymakers did not intend to change the composition of patents that are administratively challenged in this way, they should carefully investigate the mechanisms that led to this change.

#### VIII. CONCLUSION

The use of administrative validity challenges, while still low relative to litigation, has been on the rise. Use of these procedures by district court litigants may have significant private benefits in the form of reduced cost and increased speed. Likewise, these procedures promise substantial public benefits by fixing patent office errors, and increasing the quality of granted patents. If policymakers seek to increase the use of administrative patent challenges or to evaluate their effects, they must first understand how they are currently used.

Other literature has well established that certain intrinsic and acquired characteristics of patents can predict litigation. Because the vast majority of administrative challenges occur alongside litigation, it would not be surprising to find that these same characteristics predict administrative challenges compared to the overall pool of patents. Instead, we show that the same intrinsic and acquired characteristics are good predictors of administrative challenge *even within the pool of already litigated patents*. Litigated patents that are associated with an administrative challenge may be of even higher value and even broader scope than other litigated patents; are less likely to have been issued to small entities or held by PAEs; and are more likely to be computer or electronic patents than drug or mechanical ones. And finally, we confirm quantitatively the obvious visual observation: litigated patents are more likely to be challenged at the patent office after the AIA, and the switch to IPR, than before. But, the full story is more nuanced than an across-the-board increase: selection patterns appear to have changed in meaningful and heterogenous ways.

*Table A1: Comparing Litigation, IPX, and IPR<sup>167</sup>*

	Litigation	IPX	IPR
In Force	Entire Period	11/29/1999- 9/15/2012	9/16/2012 - present
Venue	Various district courts	USPTO	USPTO PTAB
Who decides?	District court judges or juries	Patent examiners	Administrative Patent Judges
Standard to institute review	<i>Iqbal / Twombly</i> to overcome motion to dismiss	Substantial new question of patentability (pre- 2011); reasonable likelihood of prevailing on the merits (2011-end)	reasonable likelihood of prevailing on the merits
When can a patent be challenged?	Anytime	Anytime	≥9 months post- issuance, and ≤1 year post- litigation
Restrictions on patent filing date?	None	Only patents filed after Nov. 1999	None
Presumption of validity?	Yes	No	No
Standard to prove invalidity	Clear and convincing evidence	Preponderance of the evidence	Preponderance of the evidence
Permissible invalidity grounds	Any	Novelty and nonobvious on printed publications only	Novelty and nonobvious on printed publications only
Settlement possible?	Yes	No	Yes
Appeals?	Federal Circuit	Board of Patent Appeals; Federal Circuit	PTAB; Federal Circuit
Estoppel	Usual Civil Litigation	Binds after appeals	Binds before appeals

<sup>167</sup> The information in this table is presented in Part II, and each fact is cited appropriately when it is first presented. For clarity of the table, we do not include supra citations to each source again. This table was constructed by the authors. Still, it was inspired by similar tables constructed by other sources to compare these or different procedures. See [http://www.ryuka.com/home/uploads/pdf/Reexam\\_presentation.pdf](http://www.ryuka.com/home/uploads/pdf/Reexam_presentation.pdf); <http://ptoliticationcenter.com/wp-content/uploads/2009/08/ipx-v-ipr.pdf>.

	Estoppel		
Cost	High	Low	Medium
Time to decision on the merits	Lengthy	Lengthy	1.5 years by statute (2 years in exceptional cases)

*Table A2: Patent Determinants of Administrative Challenge; Excluding Non-Challenged Cases that Terminated Early*

VARIABLES	(1) Intrinsic Patent Characteristics	(2) Add Acquired Characteristics	(3) Add Small Entity	(4) Add PAE
Independent claims	0.006 (0.005)	0.012** (0.005)	0.011** (0.005)	0.012** (0.005)
Min. word in ind. Claims/100	-0.057** (0.025)	-0.030 (0.024)	-0.029 (0.024)	-0.030 (0.024)
Back citations per claim	0.010*** (0.003)	0.011*** (0.003)	0.011*** (0.004)	0.011*** (0.004)
Prosecution per claim (years)	-0.173*** (0.067)	-0.090 (0.066)	-0.088 (0.066)	-0.090 (0.066)
Chemical	-0.381*** (0.118)	-0.370*** (0.119)	-0.374*** (0.120)	-0.377*** (0.120)
Computer & Comm.	0.221*** (0.071)	0.241*** (0.073)	0.238*** (0.073)	0.248*** (0.075)
Drug & Medical	-0.624*** (0.088)	-0.615*** (0.089)	-0.621*** (0.090)	-0.625*** (0.091)
Electrical & Electronic	0.329*** (0.085)	0.295*** (0.086)	0.291*** (0.086)	0.294*** (0.086)
Mechanical	-0.347*** (0.099)	-0.376*** (0.100)	-0.376*** (0.100)	-0.374*** (0.100)
Age (years)		0.130*** (0.011)	0.130*** (0.011)	0.130*** (0.011)
Forward Citations per year per claim		0.080** (0.035)	0.079** (0.035)	0.079** (0.035)
Assigned		0.212*** (0.043)	0.212*** (0.043)	0.223*** (0.045)
Small entity indicator			-0.026 (0.048)	-0.026 (0.048)
PAE				-0.044

					(0.055)
	Constant	1.266	1.397	1.424	1.415
		(0.909)	(0.921)	(0.922)	(0.922)
	Filing Year FE	Yes	Yes	Yes	Yes
	District Court FE	Yes	Yes	Yes	Yes
	Judge FE	Yes	Yes	Yes	Yes
Observations		15,599	15,599	15,599	15,599

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*Table A3: Patent Determinants of Administrative Challenge with AIA Indicator and Interactions*

VARIABLES	(1) AIA Indicator	(2) Add Quarterly Dummies	(3) Add Patent Characteristics	(4) Add Interactions
IPR	0.756*** (0.041)	0.523** (0.233)	0.534** (0.240)	0.036 (0.298)
pat_clm_ct			0.013*** (0.004)	0.020** (0.009)
pat_wrd_min			-0.018 (0.022)	-0.069 (0.045)
back_citations_perclaim			0.013*** (0.003)	0.016*** (0.005)
prosecution_perclaim_years			-0.394*** (0.099)	-0.374*** (0.144)
cat1			-0.178 (0.109)	-0.054 (0.187)
cat2			0.310*** (0.066)	0.195* (0.113)
cat3			-0.473*** (0.084)	-0.407*** (0.144)
cat4			0.488*** (0.075)	0.168 (0.128)
cat5			-0.209** (0.090)	-0.232 (0.147)
age_years			-0.031*** (0.011)	-0.142*** (0.018)
citations_peryear_perclaim			0.120*** (0.029)	0.180*** (0.053)
assigned			0.088** (0.041)	-0.023 (0.074)
small_entity_indicator			-0.301*** (0.043)	-0.110 (0.082)
pae			-0.398***	-0.285***

			(0.051)	(0.096)
	IPRxp <sub>at</sub> _clm_ct			-0.010
				(0.010)
	IPRxp <sub>at</sub> _wr <sub>d</sub> _min			0.060
				(0.052)
	IPR <sub>xback</sub> _citations_perclaim			-0.006
				(0.006)
	IPR <sub>xprosecution</sub> _perclaim_y ears			-0.034
				(0.183)
	IPR <sub>xcat</sub> 1			-0.194
				(0.229)
	IPR <sub>xcat</sub> 2			0.164
				(0.136)
	IPR <sub>xcat</sub> 3			-0.083
				(0.169)
	IPR <sub>xcat</sub> 4			0.498***
				(0.158)
	IPR <sub>xcat</sub> 5			0.043
				(0.186)
	IPR <sub>xage</sub> _years			0.134***
				(0.016)
	IPR <sub>xcitations</sub> _peryear_percl aim			-0.091
				(0.064)
	IPR <sub>xassigned</sub>			0.171*
				(0.089)
	IPR <sub>xsmall</sub> _entity_indicator			-0.274***
				(0.095)
	IPR <sub>xpae</sub>			-0.160
				(0.111)
	Constant	-1.220	-1.129	-0.603
		(1.455)	(1.563)	(1.758)
	Observations	35,925	35,925	32,281

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Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

