

How Legal Remedies Drive Patent Litigation Explosions: Evidence from the eBay Ruling

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Abstract

The 2006 *eBay Inc. v. MercExchange* decision marked a pivotal shift in U.S. patent law by replacing automatic injunctions with a more discretionary, damages-based remedy. This paper argues that the ruling catalyzed a wave of patent litigation, particularly by patent assertion entities (PAEs), by altering the bargaining environment and shifting the resolution of disputes from settlements to court judgments. Using a screening model with asymmetric information, I show that the probability of litigation increases as injunctions become harder to obtain—especially for PAEs targeting high-sales firms. Empirical evidence from a difference-in-differences analysis supports this theoretical prediction. These results highlight how legal reforms can reshape the strategic behavior of litigants and alter the landscape of patent enforcement.

1 Introduction

The explosion of patent litigation in the United States—most notably during the smartphone patent wars between 2011 and 2013—has attracted significant attention from both scholars and the public.¹ This surge has raised widespread concerns, including increased legal costs, distraction from business for individual firms, and broader issues such as judicial congestion and the inefficient use of public resources. This paper argues that the 2006 *eBay Inc. v. MercExchange* decision served as a key catalyst for this wave of litigation.

As a landmark legal reform, the *eBay* ruling transformed patent remedies from a property rule to a liability rule. Specifically, it reduced the reliance on automatic injunctions and shifted expected payoffs toward monetary compensation determined by courts. As a result, pre-litigation bargaining changed, leading to more disputes being resolved through formal litigation rather than settlement. Crucially, the ruling affected litigants differently based on their characteristics and expected payoffs, leading to heterogeneous litigation behavior.

Identifying the *eBay* ruling as the trigger for the litigation explosion is not straightforward, as commonly used metrics—such as the number of case filings—fail to capture key features of modern patent litigation. Figure 1 shows that, compared to case counts, the number of defendants sued per year began rising earlier and peaked earlier. After the *eBay* decision in 2006, the number of defendants named in infringement suits surged, and contrary to popular belief, began declining—not increasing—after the 2011 America Invents Act’s joinder provision. This suggests that plaintiffs increasingly consolidated claims against multiple defendants into single lawsuits post-*eBay*.

A closer look at the composition of plaintiffs reveals that patent assertion entities (PAEs)—rather than practicing entities (PEs)—were primarily responsible for the

¹See White House report titled “Patent Assertion and U.S. Innovation” https://obamawhitehouse.archives.gov/sites/default/files/docs/patent_report.pdf

rise in multi-defendant suits involving the same group of litigated patents. On the defendant side, firms with higher sales appeared more frequently than lower-sales firms after 2006. These shifts raise an important question: how did the eBay ruling change firms' strategic behavior in patent disputes?

To address this, I develop a screening model in which asymmetric information surrounds the court-determined damages in infringement cases. The model predicts that as the probability of obtaining an injunction declines, the likelihood of litigation increases—especially for PAEs, and particularly against firms with higher sales. The intuition is that when injunctions become harder to secure, infringement suits are more likely to end in damage awards rather than market exclusion, intensifying disagreement over litigation outcomes.

Because theoretical models cannot fully rule out alternative explanations, I complement the analysis with empirical evidence. I employ a difference-in-differences framework using a firm-year panel dataset, treating the eBay ruling as an exogenous shock and using firm sales as a proxy for treatment intensity. The results show that firms with higher sales experienced a greater likelihood of being sued after the ruling—an effect that cannot be explained by year, industry, or other firm-level characteristics. Notably, this effect is only significant in lawsuits brought by PAEs, consistent with prior findings that the ruling disproportionately affected different plaintiff types ([Seaman \(2015\)](#)).

Several robustness checks support these findings. First, to address potential confounding from technological variation across industries, I test for heterogeneous effects by technology class and find a consistently positive treatment effect across sectors. Second, to isolate the role of firm size from sales exposure, I introduce an alternative measure—Sales at Risk—which captures a firm's exposure to the specific patents involved in litigation. Using this refined variable, the effect remains significant and, in some cases, even strengthens. Importantly, I find no evidence that larger defen-

dants behave differently post-eBay, particularly with respect to litigation strategies or courtroom responses.

This study contributes to multiple strands of literature. First, it underscores the role of injunctive relief in settlement failures within the law and economics domain, which is often overlooked in prior research (Landes (1971), Gould (1973), P’ng (1983), Bebchuk (1984), Nalebuff (1987), Bebchuk (1996), Love et al. (2023)). Incorporating injunctions into litigation models is non-trivial, as they (1) enhance plaintiffs’ bargaining power, (2) introduce asymmetry in judgment outcomes, and (3) make defendants’ payoffs contingent on their own characteristics. Specifically, I show that when injunctions are more difficult to obtain, settlements are more likely to fail, particularly for defendants with high sales.

Second, my study adds to the empirical literature on patent infringement litigation (Marco and Rausser (2008), Bessen and Meurer (2013), Galasso et al. (2013), Galasso and Schankerman (2015), Marco et al. (2015)), particularly in the context of the *eBay* ruling (Mezzanotti and Simcoe (2019), Mezzanotti (2021), Bereskin et al. (2021), Antill et al. (2023)). While most of prior studies focus on the effects of patent enforceability on innovation, my research shifts the lens to its impact on dispute resolution and litigation behavior, providing complementary evidence on the broader implications of the *eBay* ruling.

The remainder of this paper is structured as follows. Section 2 provides background information on U.S. patent litigation and the *eBay* ruling. Section 3 introduces the data sources, explains sample selection, and presents the stylized facts. Section 4 develops a theoretical model explaining how the ruling alters pre-litigation bargaining and litigation propensity. Section 5 presents the empirical findings and robustness checks. Finally, Section 6 concludes.

2 Background

2.1 Patent Infringement Litigation in the US

Patent infringement litigation—referring to lawsuits formally filed in court—represents only a fraction of all patent infringement disputes. When patent holders, often called patent asserters, identify potential infringement, they typically send cease-and-desist letters to alleged infringers before initiating litigation ([Chien \(2013\)](#), [Grinvald \(2015\)](#)). These pre-litigation communications provide an opportunity for negotiation, allowing disputes to be resolved privately without resorting to the courts. As a result, many patent disputes are settled confidentially and never enter the formal legal system.

If an alleged infringer refuses to comply with the demands, the patent asserter may file a complaint in court, formally alleging infringement and seeking legal remedies. In the United States, with very few exceptions,² all patent disputes must be filed in U.S. district courts. Patent asserters generally have discretion in selecting the venue for their cases. If the alleged infringer fails to respond within the designated timeframe, the court may issue a default judgment in favor of the asserter. Otherwise, the litigation proceeds to the discovery phase, where both parties exchange evidence. If a settlement is not reached during litigation, the case advances to trial, where a court delivers a final judgment.³

When a court reaches a decision in a patent infringement case, it considers multiple factors in determining remedies. If infringement is established, damages are typically calculated based on either the patent holder’s lost profits or a reasonable royalty reflecting the fair licensing value of the patented technology. In cases of willful infringement, courts may award enhanced damages of up to three times the original amount. Additionally, courts decide whether to grant injunctive relief, which prevents

²A small fraction of cases—less than 2%, according to [unifiedpatents.com](#)—fall under the jurisdiction of the International Trade Commission (ITC) due to their international trade implications.

³Parties have the right to appeal to a higher court if they dispute the trial outcome.

the infringer from continuing to use the patented technology. Licensing fees, when applicable, are usually negotiated based on industry standards, prior agreements, and the economic significance of the patented innovation.

In recent decades, the rise of PAEs—commonly known as patent trolls—has significantly reshaped the landscape of patent litigation. These entities primarily acquire and enforce patents rather than develop technology themselves, often pursuing legal action against companies to extract licensing fees or damages. Their increasing presence in the 21st century has sparked debates over the broader impact of patent litigation on innovation and business practices. Between 2000 and 2020, lawsuits initiated by PAEs accounted for 41.1% of all patent infringement cases, second only to those filed by PEs.

2.2 The “eBay v. MercExchange” case

The U.S. Supreme Court’s decision in *eBay Inc. v. MercExchange, L.L.C.* (2006) significantly reshaped the legal framework for granting injunctions in patent infringement cases. Prior to this ruling, courts generally issued permanent injunctions almost automatically once a patent was found to be infringed. However, the Supreme Court rejected this automatic approach and instead established a four-factor test to determine whether an injunction is warranted.

The case originated when MercExchange, a company holding patents related to online auction technology, sued eBay for patent infringement. A district court initially denied MercExchange’s request for a permanent injunction despite finding infringement. The Federal Circuit reversed this decision, applying a general rule that injunctions should be granted unless exceptional circumstances exist. The Supreme Court, in turn, rejected this rigid standard, ruling that courts must apply traditional equitable principles before granting an injunction.

Under the eBay ruling, a patent holder seeking an injunction must demonstrate that: (1) it has suffered irreparable injury; (2) monetary damages are inadequate to compensate for the harm; (3) the balance of hardships favors granting the injunction; and (4) the public interest would not be disserved by the injunction. This decision has profoundly impacted patent litigation, particularly affecting PAEs, which typically seek financial settlements rather than product exclusivity. By making injunctions less automatic, the eBay ruling has weakened the leverage PAEs hold over alleged infringers, shifting the focus toward monetary compensation rather than injunctive relief.

The ruling was issued against the backdrop of the rise of PAEs during the 1990s and early 2000s (Myers (2006)). These entities primarily generate revenue through litigation and patent licensing rather than innovation. Research on the implementation of the eBay ruling suggests that it disproportionately affects patent trolls rather than all patent asserters (Seaman (2015), Gupta and Kesan (2016)). Although injunctive relief has become increasingly difficult to obtain for both PAEs and PEs, PAEs have been particularly affected, with injunctions becoming almost unattainable by the 2010s.

However, critics argue that the *eBay* ruling has made patent enforcement more challenging and has harmed inventors—especially small innovators—by weakening their ability to protect their intellectual property. This debate has persisted for years without resolution. Recently, several legislative efforts have aimed to reverse or weaken the *eBay* ruling. For example, the STRONG Patents Act (2015) and the subsequent STRONGER Patents Act (2017) sought to restore injunctive relief for patent owners but failed. More recently, the RESTORE Patent Rights Act, introduced in 2024, is still pending in Congress.⁴

⁴<https://www.congress.gov/bill/118th-congress/house-bill/9221/text>

3 Data and Stylized Facts

3.1 Data

Patent Infringement Litigation Dockets.

My sample on patent infringement litigation is constructed using two complementary data sources: the Patent Litigation Docket Reports Data⁵ from the USPTO and the Stanford NPE Litigation Database.⁶ Both datasets provide information such as case filing dates, plaintiffs, defendants, and venues. The USPTO litigation data further includes filing dates and descriptions of documents filed in cases, offering more comprehensive information on litigated patents after 2003. The Stanford litigation data classifies plaintiffs into different categories.

To maximize the utility of both datasets, I use their intersection. My study focuses on a subset of patent-related litigation—cases where plaintiffs are patent owners suing for infringement. Consequently, in the USPTO dataset, I select cases classified as "Patent Infringement suit non-DJ"⁷, which includes 69,910 cases from 2000 to 2020. From the Stanford dataset, I select 68,603 non-DJ cases within the same period. The two samples are merged using district court names and unique case numbers, resulting in an intersection of 59,085 cases (95.38% of the USPTO sample and 97.20% of the Stanford sample).

To analyze patent infringement litigation in the U.S., I construct the following case-level variables: number of plaintiffs, number of defendants, number of litigated patents, plaintiff type (PAEs vs. PEs), whether a motion for a preliminary (or permanent) injunction is filed, and whether such an injunction is granted. Plaintiff classification follows Miller (2018): Categories 1 (acquired patents), 4 (corporate her-

⁵<https://www.uspto.gov/ip-policy/economic-research/research-datasets/patent-litigation-docket-reports-data>

⁶<https://npe.law.stanford.edu>

⁷Missing values are retained since classification only applies to cases filed after 2003.

itage), and 5 (individual inventor-started companies) are classified as PAEs, while Categories 8 (product companies) and 12 (IP subsidiaries of product companies) are classified as PEs.⁸

For injunction-related variables, I follow [Gupta and Kesan \(2016\)](#) and use keyword searches in case documents:

1. A motion for an injunction is identified if a document contains "motion" and "injunction" within three words of each other.
2. The type of injunction (preliminary or permanent) is determined by searching for "preliminary" and "permanent" in these documents.
3. Granting of an injunction is identified by searching for "grant," "support," or "consent."

Figure 3 shows the distribution of plaintiff types. Cases filed by PEs or PAEs account for 92.6% of the sample, and these two rarely file cases together. Table 1 presents summary statistics, indicating that single-plaintiff and single-defendant cases are common, though some cases involve many parties. Injunctions are rarely discussed, and granted injunctions are even rarer. However, when a motion is filed, the probability of being granted is high (e.g., 78.9% for PEs). Surprisingly, PAEs also file and sometimes receive injunctions, albeit at lower rates than PEs.

Firms' Accounting Data.

To analyze defendant characteristics, I use firm-level accounting data from Compustat (one-year lagged relative to case filing). This restricts my sample to public firm defendants. Following [Arora et al. \(2021\)](#), I use dynamic name matching (with historical names from CRSP) to identify public firms in the litigation sample, yielding 20,316 public firm defendants (13.66% of total defendants).⁹

⁸Other categories include universities, startups, individuals, and industry consortia, which are non-practising entities but not patent assertion entities.

⁹The proportion of public firms is slightly lower before 2006, at 11.91%.

The primary variable of interest is *Sales*. Control variables include *Market Capitalization*, *Cash*, *Debt*, *Tobin's Q*, *ROA*, *Capital Expenditure*, *Conglomerate Dummy*, and *HHI*. My robustness checks also include segment sales and industry classification.

Patent Data.

The litigated patents are provided by litigation data, and I further use the Technology classifications from PatentsView, which serve two purposes: (1) analyzing technology differences using technology sectors based on USPC, and (2) constructing *Sales at Risk* using CPC-NAICS industry similarity (from [Chen et al. \(2023\)](#)).

3.2 Stylized Facts

The following stylized facts provide insights for further analysis.

Fact 1: Decline in Injunctions Post-*eBay*

The *eBay* ruling made injunctions harder to obtain, but how did this affect legal practice? Figure 4 shows the proportion of cases involving injunction motions and grants over time, comparable to [Gupta and Kesan \(2016\)](#). Both PEs and PAEs saw a decline post-*eBay*, but the drop was more dramatic for PAEs, where injunctions became nearly impossible by the 2010s. This aligns with [Seaman \(2015\)](#), who notes that “operating companies obtain permanent injunctions, whereas non-practicing entities are generally denied injunctive relief.”

Fact 2: Increase in Defendants Sued by PAEs Post-*eBay*

Figure 5a plots the number of defendants sued by PEs and PAEs over time. After *eBay*, the number of defendants sued by PAEs nearly doubled by 2007 and surged until 2012, when provisions from the America Invents Act (e.g., the Joinder Rule and the Post-Grant Opposition) took effect. The rise was driven by an increase in defendants per case rather than more cases being filed. Figure 5b shows that PAEs’ average defendants per case rose from 3–4 in the early 2000s to over 7 by 2010.

Meanwhile, PEs saw no comparable increase.

This figure suggests two key points: (1) More defendants were accused of infringing the same patents post-*eBay*.¹⁰ (2) The sharp drop after the Joinder Rule suggests that many co-defendants in PAE cases were unrelated.¹¹

Fact 3: Large Firms More Likely to Be Defendants Post-*eBay*

Which defendants contributed to this increase? Among public firms, Figure 7 divides defendants into three sales-based quantiles. Figure 6a shows that larger firms were increasingly targeted, with a sharp post-*eBay* rise. Figure 6b uses 2005 as a baseline and shows that the number of large-sale defendants grew the fastest. This suggests that PAEs shifted toward suing larger firms post-*eBay*.

3.3 Sample Construction

The primary analysis in this paper is based on a firm-level panel dataset that includes all publicly traded firms headquartered in the U.S. The dependent variable is a binary indicator of whether a firm is sued in a given year. Table 2 provides summary statistics for defendants and non-defendants separately. The results show that, on average, defendants have higher sales, larger market capitalization, and higher Tobin’s Q than non-defendants.

For robustness checks, I also construct a case-defendant-level sample, summarized in Table 6. This dataset has a larger sample size than the defendant panel in Table 2 since some firms face multiple lawsuits within the same year. A comparison of the two tables reveals that firms sued multiple times in a year tend to exhibit even higher sales, larger market capitalization, and higher Tobin’s Q.

¹⁰Suing multiple defendants in a single case for different patents is typically not allowed.

¹¹The Joinder Rule requires the defendants are accused of infringing the same patent in the same transaction or occurrence, and there are common questions of fact across all claims.

4 Theoretical Analysis

In this section, I develop a theoretical model based on [Bebchuk \(1984\)](#) and [Love et al. \(2023\)](#) to examine how litigation tendencies vary with sales and the likelihood of injunctions.

4.1 Model Setup

An alleged infringer (the potential defendant) does production and obtain sales W while facing the risk of patent infringement. The patentasserter who owns the patent (the potential plaintiff) thus demands a settlement amount S under the threat of litigation. If the settlement negotiation fails and the dispute proceeds to court, the expected litigation costs for the plaintiff and defendant are C_p and C_d , respectively. The court finds the defendant guilty with probability p .

The patentasserter credibly commits to requesting an injunction at the outset. If the defendant is found guilty, the injunction is granted with probability $q \in (0, 1)$, in which case the defendant loses $L = \min\{\lambda W + \beta, W\}$. If the defendant can redesign his product, β represents the cost of redesigning and λW represents the loss between the injunction is granted and the new product is launched. If the defendant cannot redesign his product, he will lose all sales $L = W$. At the same time, the injunction benefits the plaintiff by $M > 0$ outside the court, the value of which depends on the plaintiff's type and the product market related to the patent. A practicing entity can gain more market power in a more concentrated product market caused by the injunction, while for a non-practicing entity the external benefit is usually very limited. If the injunction is denied, the defendant has to instead pay the plaintiff a compensation for ongoing usage R determined by the court. $R \leq L$ because otherwise the alleged infringer will voluntarily stop using the patent.

I normalize the payoffs without the dispute to be $(0, 0)$ for the patentasserter

and the alleged infringer respectively to simplify the calculation. I assume both the patent asserter and the alleged infringer are risk neutral. The possible payoffs are:

- $(M - C_p, -L - C_d)$ if the defendant is found guilty and the injunction is granted;
- $(R - C_p, -R - C_d)$ if the defendant is found guilty and the injunction is denied;
- $(-C_p, -C_d)$ if the defendant is not found guilty.

Litigation is driven by asymmetric information. I assume the alleged infringer knows more precise information about the infringement than the patent asserter. More specifically, the alleged infringer knows the exact compensation R that the court would set. However, the patent asserter only knows that R follows a uniform distribution $U(a, b)$ with $0 < a < b < L$.

In addition, to ensure that litigation remains a credible threat, I assume that $\exists R \in (a, b)$ s.t. the expected litigation value for the asserter is positive, *i.e.* the largest possible R should make the expected litigation value for the asserter positive:¹²

$$pqM + p(1 - q)b \geq C_p \quad (1)$$

To ensure that the alleged infringer will always choose between settlement and litigation, I assume that a voluntary injunction is always the worst choice for the alleged infringer:

$$\max\{pqL + p(1 - q)R + C_d, S^*\} < L \quad (2)$$

where S^* is the settlement amount in the equilibrium (see equation 8).

To ensure that a pre-litigation negotiation always happens, I further assume that litigation is less efficient than the negotiation. In other words, the two parties' total

¹²This condition makes sure that the settlement amount in the equilibrium is positive. (see equation 8).

gains in litigation is negative:¹³

$$pq(M - L) - C_p - C_d < 0 \quad (3)$$

4.2 The Parties' Decisions

The defendant's choice between settlement and litigation. The defendant rejects the settlement offer, and thus go to court, if and only if the settlement amount S is larger than the expected loss in litigation:¹⁴

$$S > C_d + pqL + p(1 - q)R \quad (4)$$

Rearranging the inequation, the defendant chooses litigation if and only if:

$$R < \frac{S - C_d - pqL}{p(1 - q)} \equiv \hat{R}(S) \quad (5)$$

where $\hat{R}$ represents the cutoff compensation at which the defendant is indifferent between settling and litigating.

The plaintiff's optimal settlement offer. The plaintiff knows that if he offers S , the probability of rejection (and hence litigation) is $\frac{\hat{R} - a}{b - a}$. In litigation, the plaintiff's expected payoff is:

$$E[-C_p + pqM + p(1 - q)R | R < \hat{R}(S)] = -C_p + pqM + p(1 - q)\frac{\hat{R} + a}{2} \quad (6)$$

¹³This condition makes sure that the cutoff compensation in the equilibrium is smaller than the upper bound W . See equation 9.

¹⁴It will be assumed that when a party is indifferent between a given settlement amount and a lawsuit, he will choose to settle.

Thus, the plaintiff maximizes:

$$\max_S \frac{b - \hat{R}}{b - a} S + \frac{\hat{R} - a}{b - a} \left[-C_p + pqM + p(1 - q) \frac{\hat{R} + a}{2} \right] \quad (7)$$

The optimal settlement amount is

$$S^* = pqM + p(1 - q)b - C_p \quad (8)$$

and the corresponding cutoff compensation is

$$\hat{R}^* = b + \frac{pq(M - L) - C_p - C_d}{p(1 - q)} \quad (9)$$

4.3 Comparative Statics

I concern about how the likelihood of litigation changes with respect to the likelihood of injunction q and sales W . Define the likelihood of litigation as δ^* . I have

$$\begin{aligned} \delta^* &= \text{Prob}(R < \hat{R}^*) \\ &= \frac{\hat{R}^* - a}{b - a} \\ &= 1 + \frac{pq(M - L) - C_p - C_d}{(b - a)p(1 - q)} \end{aligned} \quad (10)$$

I have the following propositions:

1. When the patent asserter's external benefit under an injunction M is sufficiently small (large), a decrease of injunction probability will increase (decrease) the likelihood of litigation. *Proof:*

$$\frac{\partial \delta^*}{\partial q} = \frac{p(M - L) - C_p - C_d}{(b - a)p(1 - q)^2} \quad (11)$$

which is negative if and only if $M < \frac{C_p + C_d}{p} + L$.

2. Given a decrease of injunction probability, a patent assertor with smaller (larger) external benefit under an injunction M will experience a larger (smaller) increase of litigation likelihood. *Proof*:

$$\frac{\partial^2 \delta^*}{\partial q \partial M} = \frac{1}{(b-a)(1-q)^2} > 0 \quad (12)$$

3. Given a decrease of injunction probability, a defendant with higher (lower) sales will experience a larger (smaller) increase of litigation likelihood. *Proof*:

$$\frac{\partial^2 \delta^*}{\partial q \partial W} = \frac{-\min\{\lambda, 1\}}{(b-a)(1-q)^2} < 0 \quad (13)$$

5 Litigation Likelihood by Sales

5.1 Baseline

To test whether firms with larger sales are more frequently targeted as defendants after the *eBay* ruling, I estimate the following specification using a difference-in-differences (DID) approach:

$$I(\text{Sued})_{i,t} = \alpha + \beta I(\text{Post})_{i,t} \times \log(\text{Sales})_{i,t-1} + \gamma X_{i,t-1} + \delta_t + \eta_i + \varepsilon_{i,t} \quad (14)$$

where $I(\text{Sued})_{i,t}$ indicates whether firm i is sued in year t , $\log(\text{Sales})_{i,t-1}$ represents sales in year $t-1$, $I(\text{Post})_{i,t}$ is an indicator for years after the *eBay* ruling, and $X_{i,t-1}$ includes firm-level characteristics. The model controls for year fixed effects (δ_t) and firm or industry fixed effects (η_i). The key coefficient of interest, β , captures the impact of the *eBay* ruling. Since firms with larger sales are expected to face a greater

treatment effect than their smaller counterparts, I anticipate a positive β .

Table 3 presents the estimation results. Columns (1) and (2) include all cases filed in district courts, with firm and industry fixed effects controlled separately. The findings indicate that a 10% increase in sales corresponds to a more than 0.1% rise in the likelihood of being sued post-*eBay*. Given that defendants comprise only about 10% of public firms, this effect is economically significant.

Columns (3)-(6) break down the results by plaintiff type. When focusing on lawsuits filed by PAEs, the coefficient is larger and statistically significant, suggesting a stronger impact. However, when examining cases filed by PEs, the effect is not significant. This plaintiff-type heterogeneity aligns with Stylized Facts 1 and 2, which indicate that cases filed by PAEs are more affected than those filed by PEs.

To verify the parallel trends assumption for PAE litigation likelihood, I conduct an event study using the following specification:

$$I(Sued)_{i,t} = \alpha + \sum_{s=2000, s \neq 2005}^{2020} \beta_s I(s=t)_{i,t} \times \log(Sales)_{i,t-1} + \gamma X_{i,t-1} + \delta_t + \eta_i + \varepsilon_{i,t} \quad (15)$$

where year dummies interact with $\log(Sales)_{i,t-1}$, and their coefficients are denoted as β_s . Figure 7 plots β_s , demonstrating parallel pre-treatment trends. In the post-treatment periods, while the effect fluctuates over time, it remains statistically significant throughout the sample period. The impact gradually rises in the initial post-treatment years before declining after 2011, which is consistent with the gradual decrease of injunction issue shown in Figure 4. The decline after 2011 may be related to other reforms which will not be discussed in this paper.

Finally, I analyze the effect by technology class, as patent litigation can stem from various technological differences for different reasons. For instance, Bessen and

Meurer (2009) emphasize disparities in patent notice clarity. Following Hall et al. (2001), I classify litigated patents and redefine the dependent variable as an indicator of whether firm i is sued for patents in a specific technology class. Table 4 presents the results by technology class, revealing a positive effect across nearly all categories. However, the magnitude is smaller than the main result since firms have a lower probability of being sued within a specific technology class. The sole exception is drug, where the coefficient is not statistically significant.

5.2 Exclude Size Advantage

Although the analysis has shown that firms with higher sales are more likely to be sued after the *eBay* ruling, alternative explanations exist. The *eBay* decision grants courts greater flexibility in issuing injunctions, which could make rulings more susceptible to influence from large firms with substantial resources. To rule out this alternative explanation, I conduct several tests.

First, instead of using total firm-level sales as the explanatory variable, I construct a new variable, *Sale at Risk* $_{i,t}$, representing the portion of sales exposed to litigation risk. The following steps outline its construction:

1. In year t , I collect and count all unique litigated patents at the technology class level. For patents classified under multiple technology classes (n), I allocate equal weight ($\frac{1}{n}$) to each class. I calculate the proportion of litigated patents in each class, denoted as $w_{c,t}$.
2. Industries at risk of litigation in year t are identified based on the litigated technology classes from step 1, using the CPC-to-NAICS mapping from Chen et al. (2023). An industry is considered at risk if its similarity to a litigated technology class exceeds 10%.

3. For firm i in year t , I consider only the segments operating in industries identified in step 2, weighted by the proportion of litigated patents in step 1. These weighted sales are aggregated at the firm-year level to construct *Sale at Risk* $_{i,t}$:

$$Sale\ at\ Risk_{i,t} = \sum_{c,s} w_{c,t} \times I\{sim(c,s) \geq b\} \times Sales_{s,i,t} \quad (16)$$

where $w_{c,t}$ represents the proportion of litigated patents in technology class c , $I\{sim(c,s) \geq b\}$ is an indicator function equal to 1 if the similarity between technology class c and industry segment s exceeds threshold b , and $Sales_{s,i,t}$ is the sales revenue of segment s in firm i in year t .

This alternative explanatory variable isolates sales not targeted by patent asserters, mitigating the potential confounding effect of firm size advantage. If a firm has high total sales but a small proportion at litigation risk, or the sales are only exposed to very low litigation risk, the positive coefficient on $Sales_{i,t}$ could reflect either size advantage or a higher treatment effect. However, by using *Sale at Risk* $_{i,t}$, I can disentangle these effects: if my explanation holds, the coefficient on *Sale at Risk* $_{i,t}$ should be larger than when using $Sales_{i,t}$.

Table 5 presents regression results replacing $Sales_{i,t}$ with *Sale at Risk* $_{i,t}$. The findings indicate that the effect is stronger, particularly when examining the likelihood of being sued by PAEs.

Additionally, I investigate potential evidence of size advantage post-*eBay*. To explore whether larger firms influence litigation outcomes, I focus on public firms as defendants and construct a cross-sectional sample at the defendant-case level. I examine two legal actions:

1. Jury trial demand: If larger firms can leverage greater resources and social influence to shape jury perceptions, they should be more likely to request jury trials.

2. Litigation duration: If larger firms face fewer financial constraints in funding litigation, they may insist longer time, or even extend case durations to outlast their financially weaker opponents.

I first do OLS to show if large firms are more likely to demand jury trials and have longer litigation durations. Then I estimate a DID model similar to Equation 14:

$$Y_{i,c,t} = \alpha + \beta I(Post)_{c,t} \times \log(Sales)_{i,t-1} + \gamma X_{i,t-1} + \delta_t \times \eta_i + \varepsilon_{i,c,t} \quad (17)$$

where $Y_{i,c,t}$ is either an indicator for jury trial demand or the logarithm of case duration (in days). $I(Post)_{c,t}$ denotes cases filed after the *eBay* ruling, $\log(Sales)_{i,t-1}$ captures firm sales in $t - 1$, $X_{i,t-1}$ includes firm characteristics, δ_t controls for case filing year fixed effects, and η_i accounts for industry fixed effects.

To further test this, I implement a triple difference (DDD) model incorporating plaintiff type:

$$\begin{aligned} Y_{i,c,t} = & \alpha_0 + \alpha_1 I(PAEs)_{c,t} + \alpha_2 I(Post)_{c,t} \times \log(Sales)_{i,t-1} \\ & + \alpha_3 I(PAEs)_{c,t} \times \log(Sales)_{i,t-1} + \alpha_4 I(Post)_{c,t} \times I(PAEs)_{c,t} \\ & + \beta I(Post)_{c,t} \times \log(Sales)_{i,t-1} \times I(PAEs)_{c,t} \\ & + \gamma X_{i,c,t} + \delta_t + \eta_i + \varepsilon_{i,c,t} \end{aligned} \quad (18)$$

where $I(PAEs)_{c,t}$ is an indicator for cases filed by PAEs. Since the *eBay* ruling had a stronger effect on PAE-initiated cases, firms' litigation strategies may differ in these cases.

Table 7 presents the regression results. While I do not find a significant relationship between firm size and jury trial demand, the results indicate that larger firms experience significantly longer litigation durations. However, when examining the impact of the *eBay* ruling, I find no significant evidence—across both depen-

dent variables and specifications—that larger firms manipulate litigation outcomes in patent infringement cases.

6 conclusion

The *eBay* ruling introduced a fundamental shift in the patent litigation landscape by restricting the availability of injunctive relief, thereby altering the strategic incentives of both plaintiffs and defendants. Contrary to initial expectations, litigation increased following the ruling, primarily due to heightened activity by PAEs. This paper demonstrates that the reduction in injunction availability changed settlement dynamics, leading to a higher probability of disputes escalating to court, particularly for firms with high sales.

Empirical analysis using a difference-in-differences framework confirms that post-*eBay*, firms with greater sales face an increased risk of being sued, with the effect driven by PAEs rather than practicing entities. Further robustness checks confirm that this result is not simply an artifact of industry-specific differences or firm size effects.

These findings contribute to multiple strands of literature, including patent enforcement, litigation economics, and firm strategy. By highlighting the role of injunctions in shaping dispute resolution, this study offers new insights into the unintended consequences of legal reforms. Future research could further explore how changes in litigation risk affect innovation and firm behavior across different industries. Additionally, while my textual similarity analysis does not provide evidence that firms intentionally increase infringement probability, this may be due to limitations in the algorithm used for textual analysis. Future studies could refine these methods to better capture strategic changes in firms’ patent-related behavior. Understanding these dynamics is crucial for policymakers seeking to balance patent protection with

economic efficiency in an evolving legal environment.

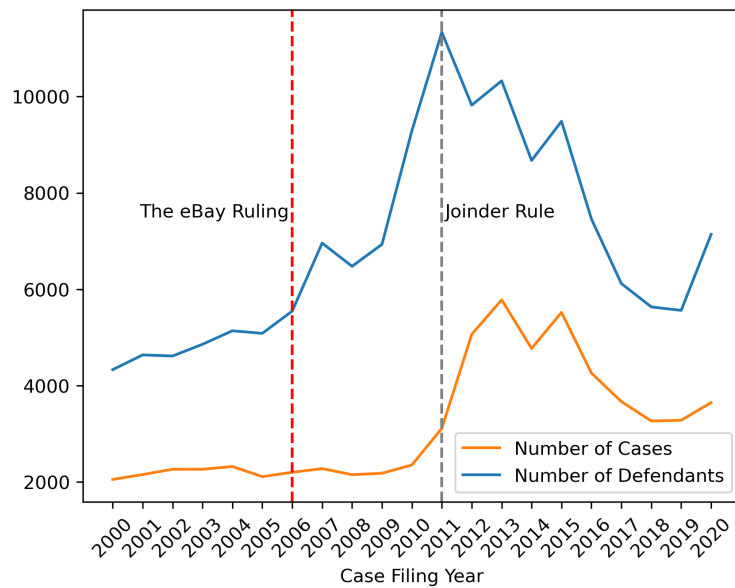
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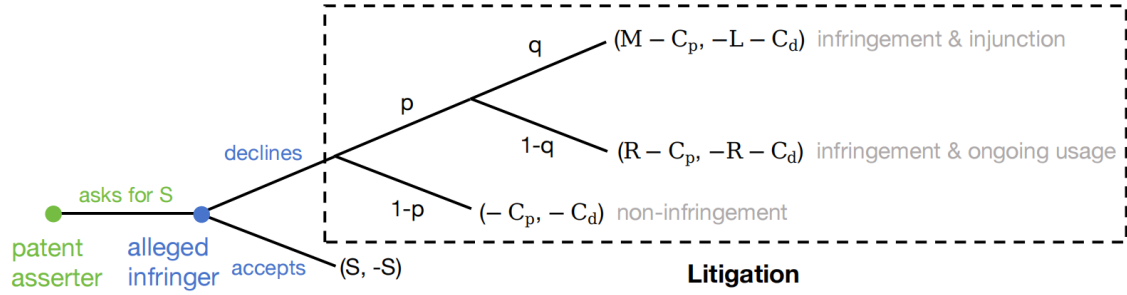
Figures

Figure 1: The Patent Litigation Explosion by Different Measures



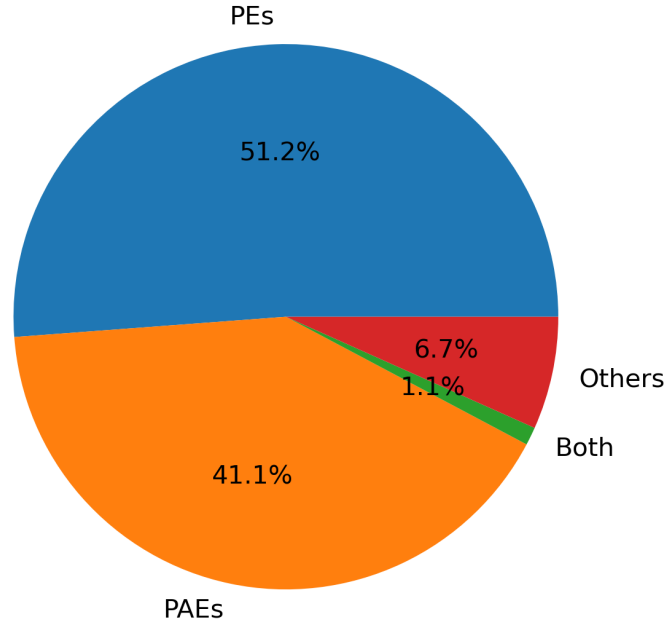
This figure displays the difference of the patent litigation explosion by different measures.

Figure 2: Patent Dispute Game



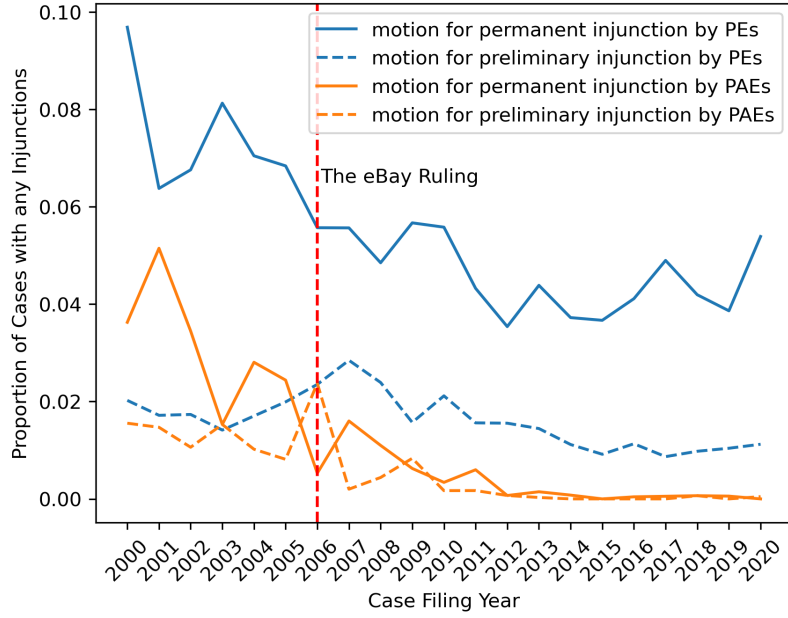
This figure illustrates the patent dispute game outlined in the theoretical model. The patent holder determines the settlement amount, denoted as S , while the alleged infringer decides whether to accept or reject the offer. If the alleged infringer rejects the offer, the dispute proceeds to litigation, and the final payoffs for both parties are determined by the court.

Figure 3: The Proportions of Cases Filed by Different Types of Plaintiffs

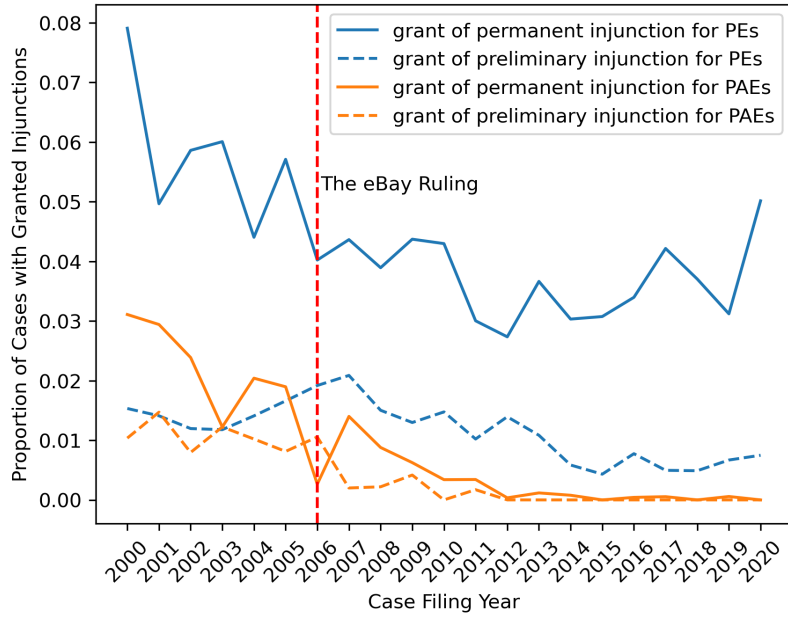


This pie chart displays the distribution of cases filed by four categories of plaintiffs: (1) practicing entities (PEs), (2) patent assertion entities (PAEs), (3) a combination of both PEs and PAEs (Both), and (4) other types of plaintiffs (Others).

Figure 4: The Proportion of Injunctions to Total Cases Filed



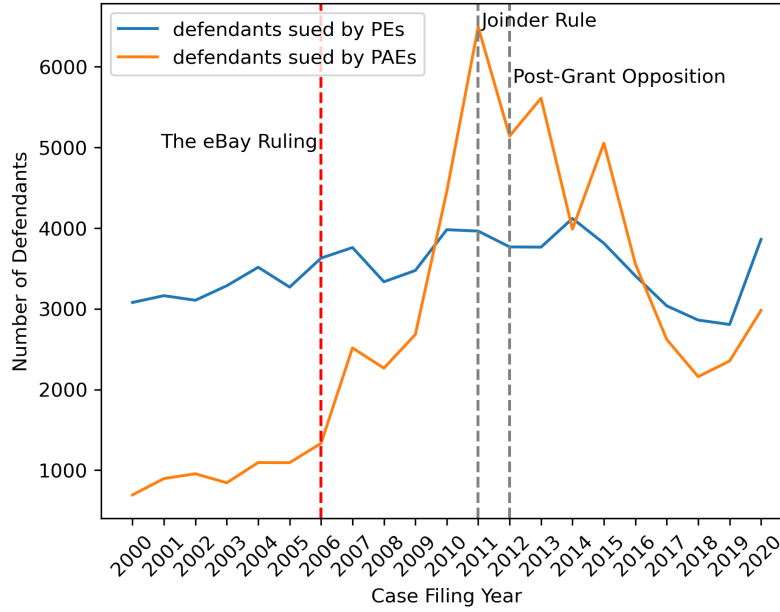
(a) Motion for Injunction Filed



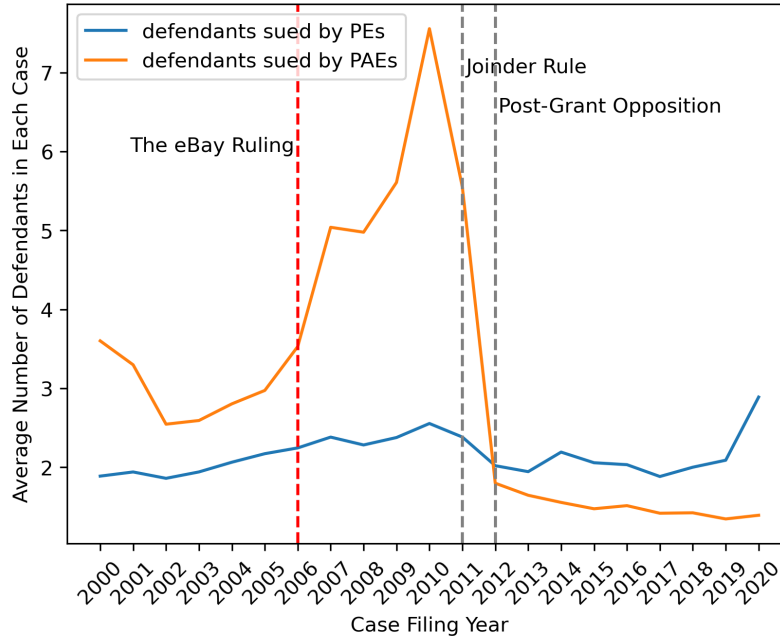
(b) Injunction Granted

This figure illustrates the trend of injunctions in patent infringement litigation over the years. Each data point represents the proportion of cases containing a specific document relative to the total number of cases filed in a given year. Subfigure 4a highlights motions for injunctions, while Subfigure 4b focuses on granted injunctions. In each subfigure, four variables are plotted separately, distinguishing between permanent and preliminary injunctions, as well as between practicing entities (PEs) and patent assertion entities (PAEs).

Figure 5: The Number of Defendants



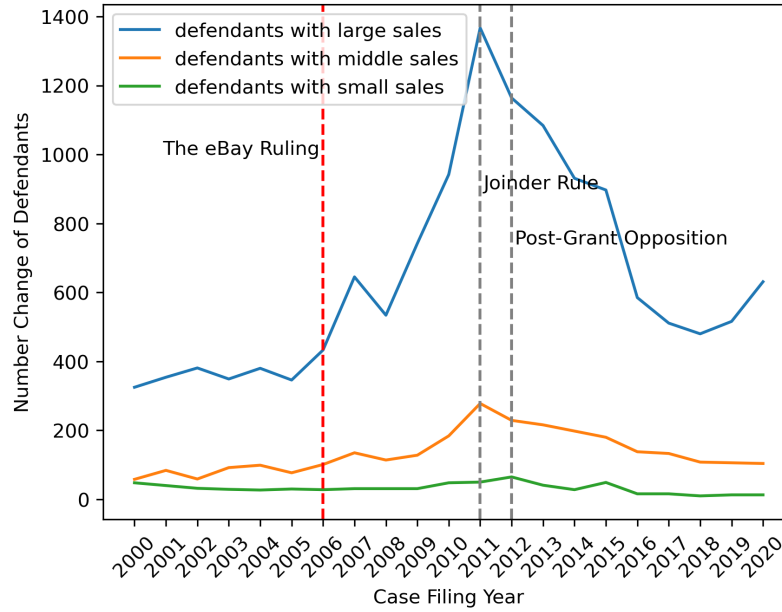
(a) Total Number of Defendants



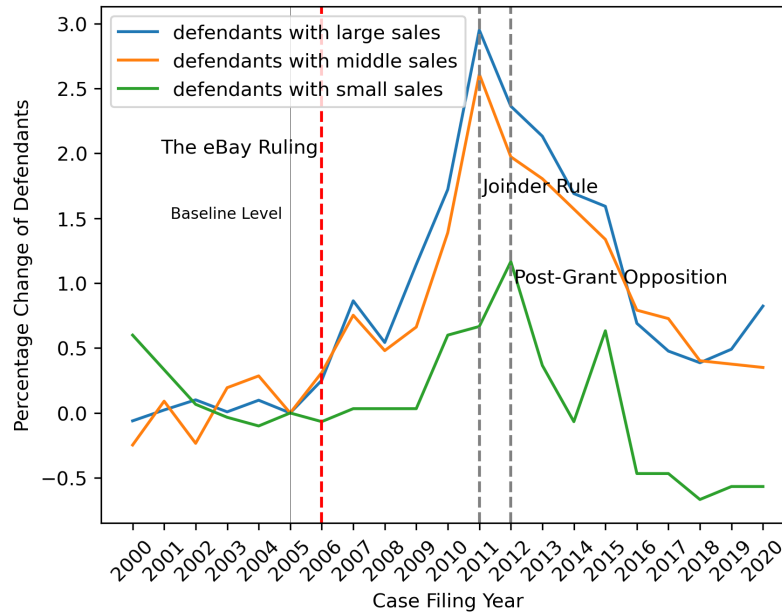
(b) Average Number of Defendants in Each Case

This figure depicts the yearly trend in the number of defendants sued by practicing entities (PEs) and patent assertion entities (PAEs) separately. Subfigure 5a presents the total number of defendants, where the same defendant is counted multiple times if involved in different cases. In contrast, Subfigure 5b shows the average number of defendants per case by dividing the total number of defendants by the number of cases filed.

Figure 6: Number of Defendants Categorized by Sales Level



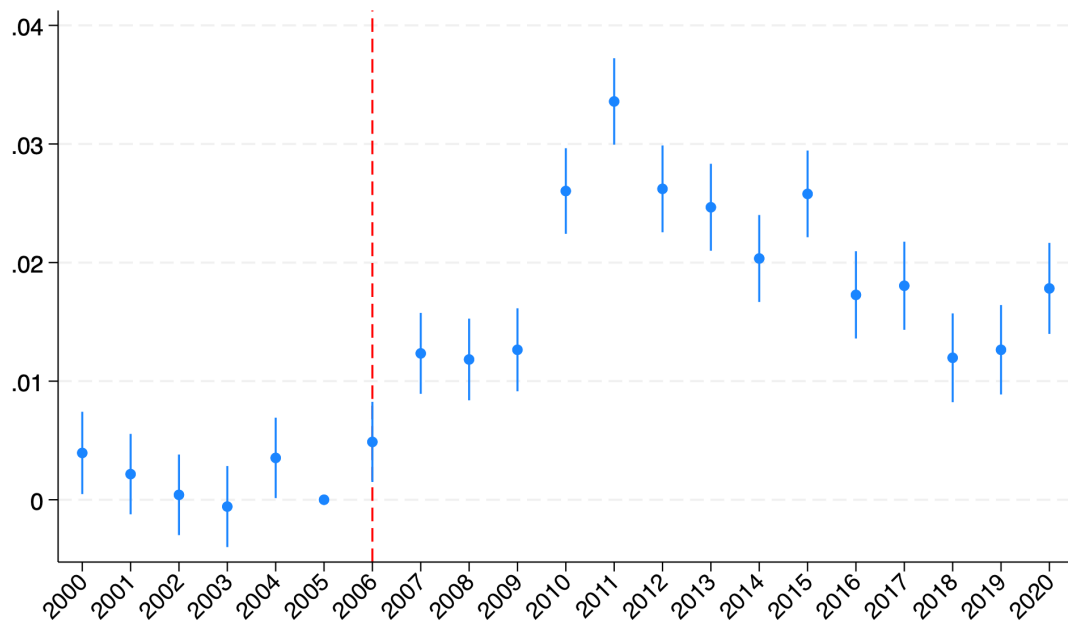
(a) Number of Defendants



(b) Proportion Change of Defendants

This figure shows the number of defendants categorized by sales level. Three groups are defined based on sales percentiles among all public firms in a given year. Subfigure 6b uses the number of defendants in 2005, one year before the *eBay* ruling, as the baseline. The defendant counts for other years are then normalized by dividing them by the baseline level.

Figure 7: The Effect of the *eBay* Ruling on Likelihood of Litigation by PAEs



This figure presents the parallel trend of the treatment effect of the eBay ruling based on specification 15. Each point represents the coefficient of the interaction term between $\log(\text{Sales})$ and a year dummy. The year 2005, one year before the *eBay* ruling, is the baseline.

Tables

Table 1: Summary Statistics of Patent Infringement Cases

	N	Mean	Std	Min	P.25	Median	P.75	Max
<i>Cases filed by PAEs</i>								
Num. of Plaintiffs	27379	1.09	0.32	1	1	1	1	8
Num. of Defendants	27366	2.15	3.76	1	1	1	2	78
Num. of Patents	26145	2.33	2.79	1	1	1	3	56
Motion for Injunction is Filed	27379	0.0053	0.0728	0.0	0.0	0.0	0.0	1.0
Motion for Permanent Injunction is Filed	27379	0.0017	0.0414	0.0	0.0	0.0	0.0	1.0
Motion for Preliminary Injunction is Filed	27379	0.0036	0.06	0.0	0.0	0.0	0.0	1.0
Injunction is Granted	27379	0.0037	0.0606	0.0	0.0	0.0	0.0	1.0
Permanent Injunction is Granted	27379	0.0011	0.0331	0.0	0.0	0.0	0.0	1.0
Preliminary Injunction is Granted	27379	0.0027	0.0516	0.0	0.0	0.0	0.0	1.0
<i>Cases filed by PEs</i>								
Num. of Plaintiffs	34131	1.4	0.82	1	1	1	2	32
Num. of Defendants	34102	2.14	2.88	1	1	1	2	57
Num. of Patents	29217	2.66	2.89	1	1	2	3	62
Motion for Injunction is Filed	34131	0.0683	0.2523	0.0	0.0	0.0	0.0	1.0
Motion for Permanent Injunction is Filed	34131	0.0159	0.1252	0.0	0.0	0.0	0.0	1.0
Motion for Preliminary Injunction is Filed	34131	0.0541	0.2263	0.0	0.0	0.0	0.0	1.0
Injunction is Granted	34131	0.0541	0.2262	0.0	0.0	0.0	0.0	1.0
Permanent Injunction is Granted	34131	0.0116	0.107	0.0	0.0	0.0	0.0	1.0
Preliminary Injunction is Granted	34131	0.043	0.2028	0.0	0.0	0.0	0.0	1.0

This table summarizes all the patent infringement cases filed by producers (practising entities or PEs) and Trolls (patent assertion entities or PAEs) separately. The variables at case level include the number of plaintiffs, the number of defendants, the number of litigated patents filed in a case, and dummies related to injunctions.

Table 2: Summary Statistics of Public Firms

	N	Mean	Std	Min	P.25	Median	P.75	Max
<i>Defendants (10%)</i>								
log(Sales)	7877	7.29	2.12	0.00	5.93	7.46	8.82	10.59
log(SaleatRisk)	7877	1.70	2.20	0.00	0.00	0.17	3.20	10.47
log(Market Capitalization)	7501	7.66	2.15	0.35	6.25	7.78	9.27	11.09
Tobin's Q	7868	14088.67	24473.86	2.02	909.78	3346.19	12795.84	92382.43
R&D Intensity	7610	0.08	0.13	0.00	0.01	0.04	0.10	2.07
ROA	7877	0.09	0.24	-5.53	0.06	0.12	0.18	0.42
Leverage	7877	0.24	0.28	0.00	0.03	0.18	0.34	4.15
Cash	7877	0.22	0.20	0.00	0.05	0.15	0.32	0.98
Capital Expenditure	7877	0.05	0.04	0.00	0.02	0.03	0.06	0.37
I(Conglomerate)	7877	0.34	0.47	0.00	0.00	0.00	1.00	1.00
HHI	7877	465.45	1367.08	0.00	0.12	4.89	172.77	10000.00
<i>Non-Defendants (90%)</i>								
log(Sales)	78256	4.70	2.58	0.00	2.90	4.88	6.62	10.59
log(SaleatRisk)	78256	0.64	1.25	0.00	0.00	0.00	0.65	10.51
log(Market Capitalization)	72166	5.17	2.31	0.35	3.46	5.23	6.83	11.09
Tobin's Q	78234	2910.95	9106.80	2.02	67.67	422.10	2087.95	92382.43
R&D Intensity	74360	0.14	0.28	0.00	0.01	0.04	0.15	2.07
ROA	78256	-0.16	0.79	-5.53	-0.12	0.08	0.14	0.42
Leverage	78256	0.31	0.55	0.00	0.01	0.18	0.39	4.15
Cash	78256	0.25	0.27	0.00	0.03	0.13	0.38	0.98
Capital Expenditure	78256	0.05	0.07	0.00	0.01	0.03	0.06	0.37
I(Conglomerate)	78256	0.24	0.43	0.00	0.00	0.00	0.00	1.00
HHI	78256	156.22	843.33	0.00	0.00	0.05	4.27	10000.00

This table summarizes firm-year panel data categorized by defendants and non-defendants in a case filing year. *log(Sales)* and *log(Sales at Risk)* are the key independent variables, and all other variables are controls.

Table 3: The Effect of the *eBay* Ruling on Likelihood of Litigation

	I(Sued)		I(Sued by PAEs)		I(Sued by PEs)	
	(1)	(2)	(3)	(4)	(5)	(6)
log(Sales)	0.0289*** (39.74)	0.00900*** (6.59)	0.0132*** (22.41)	0.000518 (0.46)	0.0214*** (37.99)	0.00855*** (7.88)
I(Post) $\times$ log(Sales)	0.0112*** (12.54)	0.0105*** (12.85)	0.0174*** (23.91)	0.0160*** (23.88)	-0.000813 (-1.17)	-0.000967 (-1.49)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	No	Yes	No	Yes	No	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year $\times$ Industry FEs	Yes	No	Yes	No	Yes	No
Number of Obs.	85891	85089	85891	85089	85891	85089
Adj. R^2	0.174	0.335	0.188	0.333	0.0832	0.224

t statistics in parentheses

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

This table shows the regression results of specification 14. In Column (1) and (2), the dependent variable is a dummy indicating if the firm is sued in a given year. In Column (3) and (4), the dependent variable is a dummy indicating if the firm is sued by patent assertion entities (PAEs) in a given year. In Column (5) and (6), the dependent variable is a dummy indicating if the firm is sued by practising entities (PEs) in a given year.

Table 4: Technology Difference of the *eBay* Ruling

	(1)	(2)	(3)	(4)	(5)	(6)
	chemical	computer	drug	electrical	mechanical	other
log(Sales)	0.00168** (3.19)	-0.00321** (-2.99)	0.00279*** (5.29)	-0.000471 (-0.69)	-0.000380 (-0.56)	0.00109 (1.58)
I(Post) $\times$ log(Sales)	0.00169*** (5.36)	0.0186*** (28.93)	0.000895** (2.85)	0.00567*** (13.93)	0.00440*** (10.89)	0.00326*** (7.92)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Number of Obs.	85089	85089	85089	85089	85089	85089
Adj. R^2	0.142	0.339	0.271	0.206	0.116	0.163

t statistics in parentheses

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

This table shows the regression results of specification 14 by technology. The dependent variable is a dummy indicating if the firm is sued for a specific technology (or litigated patents classified in the technology) in a given year.

Table 5: The Effect of the eBay Ruling on Likelihood of Litigation (Alternative Measure)

	I(Sued)		I(Sued by PAEs)		I(Sued by PEs)	
	(1)	(2)	(3)	(4)	(5)	(6)
$\log(\text{SaleatRisk})$	0.0338*** (19.83)	-0.000926 (-0.52)	0.0137*** (9.99)	-0.00648*** (-4.40)	0.0251*** (19.21)	0.00254 (1.78)
$I(\text{Post}) \times \log(\text{SaleatRisk})$	0.0116*** (6.10)	0.0124*** (7.08)	0.0222*** (14.49)	0.0195*** (13.56)	-0.000287 (-0.20)	0.000115 (0.08)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Firm FEs	No	Yes	No	Yes	No	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes
Year $\times$ Industry FEs	Yes	No	Yes	No	Yes	No
Number of Obs.	85891	85089	85891	85089	85891	85089
Adj. R^2	0.133	0.334	0.161	0.329	0.0592	0.223

t statistics in parentheses

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

This table shows the regression results of specification 14 using *Sales at Risk* as the independent variable, which is defined in equation 16. In Column (1) and (2), the dependent variable is a dummy indicating if the firm is sued in a given year. In Column (3) and (4), the dependent variable is a dummy indicating if the firm is sued by patent assertion entities (PAEs) in a given year. In Column (5) and (6), the dependent variable is a dummy indicating if the firm is sued by practising entities (PEs) in a given year.

Table 6: Summary Statistics of Public Defendants

	N	Mean	S.D.	Min	P.25	Median	P.75	Max
I(Jury)	20001	0.49	0.50	0.00	0.00	0.00	1.00	1.00
log(#Days)	19654	5.80	1.16	0.00	5.04	5.90	6.66	8.64
log(Sales)	19026	8.26	2.12	0.00	6.92	8.54	10.38	10.59
log(Market Capitalization)	18220	8.65	2.15	0.35	7.22	9.02	10.63	11.09
Tobin's Q	18966	27891.69	35139.17	2.02	1882.65	7943.47	51592.93	92382.43
R&D Intensity	18438	0.07	0.10	0.00	0.01	0.04	0.10	2.07
ROA	19026	0.12	0.20	-5.53	0.08	0.13	0.19	0.42
Leverage	19026	0.23	0.25	0.00	0.05	0.18	0.32	4.15
Cash	19026	0.23	0.19	0.00	0.06	0.17	0.34	0.98
Capital Expenditure	19026	0.05	0.04	0.00	0.02	0.03	0.06	0.37
I(Conglomerate)	19026	0.39	0.49	0.00	0.00	0.00	1.00	1.00
HHI	19026	829.61	1685.10	0.00	0.92	54.31	702.19	10000.00

This table summarizes the public defendants in patent infringement litigation. *I(Jury)* is a dummy indicating if the defendant demand a jury trial, and *log(#Days)* is the litigation duration. All the other variables are accounting data used as controls.

Table 7: Evidence of Size Advantage After the *eBay* Ruling

	OLS		DD		DDD	
	(1)	(2)	(3)	(4)	(5)	(6)
	I(Jury)	log(#days)	I(Jury)	log(#days)	I(Jury)	log(#days)
log(Sales)	-0.000881 (-0.15)	0.0295* (2.15)	0.00247 (0.35)	0.0304 (1.87)	0.00150 (0.20)	0.0193 (1.14)
I(Post)× log(Sales)			-0.00485 (-0.89)	-0.00120 (-0.10)	-0.00682 (-1.07)	-0.00101 (-0.07)
I(Post)× I(PAEs)× log(Sales)					0.00451 (0.43)	0.00680 (0.28)
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes
Year × Industry FEs	Yes	Yes	Yes	Yes	Yes	Yes
Number of Obs.	17039	16720	17039	16720	17039	16720
Adj. <i>R</i> ²	0.133	0.148	0.133	0.148	0.133	0.150

t statistics in parentheses

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

This table shows the regression results investigating the relationship between firm size and some actions in litigation. *I(Jury)* is a dummy indicating if the defendant demand a jury trial, and *log(#Days)* is the litigation duration. Column (1) and (2) present the results of OLS regressions, Column (3) and (4) present the results of a difference-in-difference design in Specification 17, and Column (5) and (6) present the results of a triple difference in Specification 18.