Investing in legal advice: Competition at the courthouse?

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Abstract

I study the resource spending decision of plaintiffs in patent lawsuits. I use a unique sample of US patent litigation cases and focus on an important decision of the plaintiffs; their decision to hire external counsels. I show that plaintiffs hire significantly more counsels the closer they compete with the defendants on the product market. Hence, the competitive situation on the product market is reflected in the plaintiff's enforcement strategy. Furthermore, the litigants' size is positively correlated with the number of counsels hired by the plaintiff; a result that identifies a channel for the observations that patents owned by large firms are less likely to be litigated.

Keywords: litigation, patents, strategic value, competition, litigant status

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1. Introduction

The use of intellectual property like patents is an important part of corporate strategy in an increasingly knowledge-based economy. In recent years the number of patent applications increased strongly (Kortum and Lerner, 1999; Hall, 2005). Several authors suggest that the increase is not only due to a higher dependency on technology, but caused by strategic considerations of the patent applicants (Blind et al., 2006, 2009). This environment creates challenges for the the patent strategy and patent management of innovating firms. An important part of the patent strategy is the patent enforcement because a patent is not a perfectly defined property right; it is rather a right to try to exclude others from using a technology through costly litigation (Shapiro, 2003)[1]. Similar to the increase in patent applications, the number of patent litigation cases also increased tremendously in recent years (PWC, 2014). Recent research devoted to patent litigation analyzed the determinants of a patent's litigation risk (Lanjouw and Schankerman, 2001, 2004), and the decision to settle a patent lawsuit (Somaya, 2003). However, despite an extensive theoretical literature on litigation tournaments (e.g., Katz, 1987; Plott, 1987), there exists only very few evidence on the factors that drive the resource spending on lawsuits.

This article focuses on this important part of the patent enforcement strategy. The objective of this article is to identify the main empirical factors that determine a management's decision to invest in the enforcement of patent rights. By doing so, I focus on two aspects. First, I analyze how strategic motives affect a management's decision to spend resources on a patent lawsuit. In particular, I concentrate on the degree of product market competition between the opponents and investigate whether closer product market competition leads to a more intense legal battle. Second, I study the role of the enforcement ability by analyzing differences in firm size. Thereby, I analyze the popular claim that innovating individuals and small firms are disadvantaged in protecting their innovations because they often lack the resources to enforce their intellectual property rights at court (Golden, 2006; McDonough, 2006; Ronspies, 2004).

The underlying assumption of the theoretical literature on litigation tournaments is that the

[1]These costs are not of minor importance. A survey conducted by the American Intellectual Property Law Association finds median litigation costs for patent infringement suits that last at least until the end of discovery ranging from \$0.4mn to \$ 5.0mn, depending on the amount at risk (AIPLA, 2015). However, note that the majority of patent cases settles much earlier.

resources spend by a litigant positively affect the probability of winning. In order to analyze this litigation investment decision empirically, I rely on a unique sample of US patent litigation cases filed between 2003 and 2007, and focus on an important decision of the plaintiffs; their counsel choice. In patent litigation cases the official complaint of the plaintiff provides not only information on the related litigants and the underlying patents but also the names of all external counsels hired by the plaintiff at the time of the cases filing. Legal representation plays a crucial role in litigation. Ashenfelter and Dahl (2012) and Ashenfelter et al. (2013) show that being represented by a lawyer increases the prospect of winning US arbitration cases. Chen et al. (2015) show that the strength of legal representation, measured by the number of lawyers, has a positive impact on the winning probability at Taiwan's Supreme Court. Because more counsels are likely to be related to higher spending in monetary terms, the number of counsels appears to be a natural candidate for a proxy measure of litigation investments.

However, this interpretation of the number of counsels may be misleading if the litigants substitute quantity with quality, i.e., if they hire more lawyers instead of a better lawyer. Therefore, I analyze in a first step the quantity-quality relation of the plaintiffs' decision, i.e., the relation of the number of counsel to the quality of the counsels. I observe a positive relation between the two characteristics, implying that those plaintiffs that hire more lawyers also hire the higher quality lawyers.

My further analysis reveals indeed that strategic product market considerations play an important role for the litigation spending decision, closer product market competition between the litigants leads a plaintiff to hire more legal counsels. The strategic value of the patent increases the stakes and the plaintiff spends more on legal representation. This result shows not only the strategic use of a patent but also that the competitive situation between the litigants is reflected in the enforcement strategy at court.

Furthermore, large firms, and firms with large patent portfolios, employ more counsels, whereas individual litigants employ fewer. On top of that, the plaintiffs' spendings also depend on the size of the defendants; large firm defendants lead to a significantly higher spending. These differences in firm size fit well to recent empirical evidence on the so-called patent premium and the litigation risk of patents. Arora et al. (2008) define the patent premium as the incremental value of innovations realized by patenting them. They show that the patent premium is higher for large firms

and presume that this is due to different abilities to enforce their patent rights. Furthermore, recent research has shown that patents owned by large firms are less likely to be litigated (Lanjouw and Schankerman, 2004; Galasso et al., 2013). The higher ability of large firms to enforce a patent lets other firms refrain from infringing a patent, and detected infringers are more willing to agree to a settlement agreement before going to court.

The two main results together imply an important problem for small innovators. Patent protection is most resource-intense when needed the most, i.e., if the patent protects their innovation on the product market. At the same time they can be outcompeted at court by large, financially more potent competitors. A problem that might explain the recent rise of patent intermediaries (see Hagiu and Yoffie, 2013, for an overview), and the patent troll discussion. Patent trolls might solve this problem by assisting small innovators in enforcing their patent rights (e.g., Shrestha, 2010; Myhrvold, 2010). Finally, both results imply that the value of a patent is owner-specific. The strategic dimension and the enforcement ability add an important additional aspect to the pure value of the technology.

2. Background and hypotheses

The aim of the patent system is to provide incentives for innovation by granting the patent holder a temporary monopoly over a technology. This right allows the patent holder the opportunity to sell licenses. However, a protected technology is not equivalent to a protected product market because the relevance of a technologies is usually not restricted to a single product (, and many products are based on multiple technologies). Consequently, firms interested in a license may be active in a variety of industries. For example, consider a patent on a touchscreen display patented by a smartphone producer. The touchscreen technology is not only used in the smartphone industry but also in many other electronic devices, including cars, copy machines, or even fridges. The technological value and a broad applicability of a technology are important determinants of the patent value. However, in case the interested firm is a competitor, a patent has also a strategic dimension. Strategic considerations regarding the product market are likely to influence the conditions of a license, potentially leading the patent holder to exclude product market competitors from the use of the technology.

Unfortunately for a patent holder, patents are not self-enforcing; the patent owners have to enforce their rights through costly litigation. Even worse, patents are not perfectly defined property

rights, and the patentee might lose an infringement law suit. Patents can be seen as probabilistic property rights (e.g. Shapiro, 2003; Lemley and Shapiro, 2005). A patentee might lose a lawsuit because the accused infringer might be found not infringing the product, or because the patent is declared invalid. The latter is indeed a substantial risk as roughly half of all litigated patents that go through trial are found to be invalid (Lemley and Shapiro, 2005). The imperfect character of patents makes decision-making about infringement and validity inherently difficult for courts. In a lawsuit the judge and/or jury depend on evidence and arguments provided by the litigants. This leaves scope for the litigants to influence the judgment in their favor by spending resources on legal advice or other legal services (e.g. Katz, 1987; Plott, 1987).

Any patent infringement lawsuits starts with the formal complaint of the plaintiff, who is also the patentee. Afterwards, the pretrial discovery takes place. Defendants answer the complaint, and provide information for their opponents and the court. Once the discovery phase is over, the trial takes place, ending with a judgment. If the plaintiff prevails, the court adjudges the plaintiff a certain amount for compensation of the damage. Additionally, it deters the infringer(s) from selling any product that is based on technologies protected by the patent. If the patentee loses, the court either found the patent not infringed or even invalid. In any case all litigants bear their own costs. However, a settlement may take place in every phase of the lawsuit. In fact, in patent cases, as well as in most legal areas, the majority of disputes settle. Even though, most cases do not go through all of these phases, the prospect of doing so affects the decisions of the litigants throughout the lawsuit.

By deciding to spend resources on legal advice the plaintiff tries to maximize the payoff of the lawsuit. The plaintiff weighs up the productive effect of spending more resources with the associated costs. Strategic consideration that affect product market competition play presumably not only an important role in the patenting decision (Blind et al., 2006, 2009) but also in the enforcement strategy. The litigation series between Apple and Samsung starting in 2011 serves as an example for the importance of the strategic value of a patent and shows how patents and patent litigation are used as strategic tools.[2]

If strategic consideration are important in a patent dispute, the strategic value of a patent in a

[2]Patent litigation is not unique to these two firms but rather so common in the smartphone industry that the term "smartphone patent war" emerged.

lawsuit will be dispute specific and will depend on the relationship between the opponents. If the opponents are close product market competitors the patent implies a strategic advantage because it allows the patent holder to exclude the competitor from using the technology. This possibility results in a strategic value of the patent that is not present if the opponents do not compete on the product market.

As a consequence, a high strategic value of a patent increases, everything else equal, the payoff from winning the lawsuit. Therefore, I expect plaintiffs competing closely with the defendants to spend more resources on the lawsuit.

Hypothesis 1. *The closer the litigants compete on the product market the more resources a plaintiff devotes to a case.*

Note that this definition of a strategic value is related only to product market competitions and is not equivalent to the concept of a patent premium discussed by Arora et al. (2008) and Jensen et al. (2011). The patent premium includes all benefits of the patent as a legal document above that which could have been generated by the second best means of appropriation. In contrast, the strategic value can neither be clearly attributed to the pure technological value nor to the value generated by the legal document. The definition is also different from the notion of strategic stakes by Somaya (2003). Somaya (2003) defines strategic stakes roughly as the importance of the asserted patent to the patent portfolios of the litigants.

Another important aspect is the ability to enforce a patent. Several authors argue that innovating individuals and small firms are disadvantaged in protecting their innovations because of a lack of resources that restricts their access to high-quality legal advice (Golden, 2006; McDonough, 2006; Ronspies, 2004). If this is true we should observe that small firms and individuals devote fewer resources to a patent lawsuit than large firms. This effect might even be amplified by reputation considerations because larger firms are presumably more often involved in lawsuits, and high spending in one lawsuit may have a positive effect on other (potential) lawsuits.

For the same line of reasoning, the defendants' spending decisions should also depend on their characteristics. This has also consequence for a plaintiff's decision because she anticipate the defendants' behavior. I expect plaintiffs to invest more if they are confronted with better-abled defendants in order to counter the anticipated higher spending of the defendants.

Hypothesis 2.

1. *A plaintiff's litigation spending increases in the plaintiff's size.*
2. *A plaintiff's litigation spending increases in the defendants' size.*

3. Data and empirical setting

3.1. Data collection

My analysis relies on patent litigation data collected from the Lex Machina database. The database contains the population of all intellectual property litigation cases filed in the United States. By hand-collecting the data I obtained detailed information on each case. The information allow the identification of the litigants and their counsels, the respective court, and the asserted patents. Because of the time-consuming data collection process, a full collection of data is not realizable. Therefore, I focused on every tenth case filed between April 2004 and March 2007. This process resulted in a random sample of 779 cases.[3]

Unfortunately, I have to exclude some of the cases from the sample. For a number of cases the relevant documents (the complaints and answers) are not available. Hence, I am neither able to extract the underlying patents, the participant characteristics nor the counsels employed by the litigants. Because these characteristics are essential for the analysis, I have to exclude these cases. Furthermore, consolidated cases are dropped because it is not possible to clearly follow cases that were consolidated. Finally, for a few cases I was not able to identify the product market of either the plaintiff or any of the defendants. In that case I am not able to define the proximity of the product market[4] (see Section 3.3.1 for the details). The final cleaned data set consists of 562 cases.

Patent litigation cases can be distinguished into two types of cases. In patent infringement suits the plaintiff accuses one or several economic subjects of infringing a technology that is protected by her patent. In contrast, a declaratory judgment suit for non-infringement and potentially for patent invalidity is filed by an accused infringer. Declaratory judgment suits are structurally very similar to infringement suits because only economic subjects that were accused of patent infringement are allowed to file a declaratory judgment suit for non-infringement. The similarity is confirmed by the empirical literature that finds similar settlement patterns for both kind of cases (Lanjouw

[3] In the sampling process cases were sorted according to their filing date and information on every tenth case was collected.

[4] In 7 cases I am not able to identify the industry class of the plaintiff, and in 13 cases this is the case for the defendants.

and Schankerman, 2001). Therefore, I include both kind of patent cases in the following analysis. However, all estimations are also presented excluding declaratory judgment cases, which amount to 87 cases, roughly 15 percent of the cases in my sample.

3.2. Dependent variable

The official complaint of the plaintiff mentions all law firms, and all individual counsels employed by the plaintiff at the time of the case filing. I extracted these information and derived the number of counsels employed by the plaintiff.[5] Figure 1 shows the distribution of the number of plaintiff counsels across the cases[6]. On average a plaintiff employs 3.064 counsels. The figure shows quite some variation across the different cases (standard deviation = 1.840); the number of counsels varies between 0 and 12. Note that in the four cases for which I observe no lawyer, this was an active decision of the plaintiff, and is not a matter of missing data.

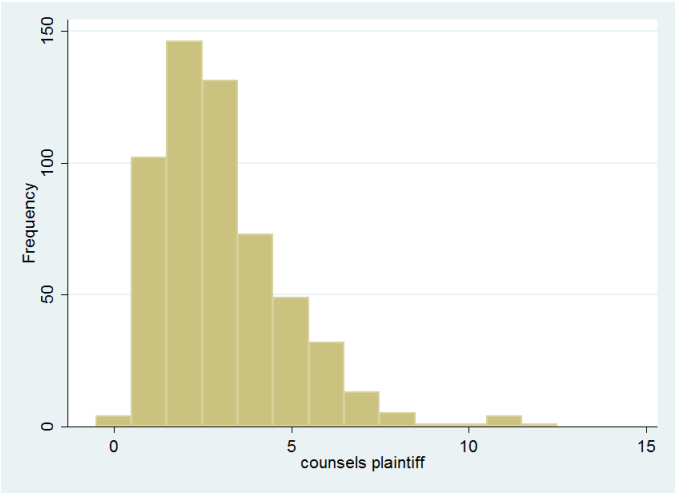

Figure 1: Distribution of the number of counsels across plaintiffs

In the following I use this number as the the measure for a plaintiff's investment in the dispute. Thereby, I assume that this number is causally linked to the monetary investment of the plaintiff. A potential concern for the interpretation of the measure, and for identification of the determinants of the spending decision, is the quantity-quality relation of the legal investment. Litigants may see quantity and quality as substitutes, i.e., that investing into one high-quality lawyer is equivalent to

[5]Note that the number of counsels is different from the number of law firms because in most cases multiple counsels are affiliated to the one law firm.

[6]This measure includes "of counsels".

investing in multiple low-quality lawyers. In order to analyze the rational of the litigants I ranked all law firms in my sample. Several publicly available rankings are potential candidates for this purpose, each with its own advantages and disadvantages. I focus my attention on three rankings, the *Vault Law 100* ranking from 2007, the *US News* ranking for intellectual property litigation from 2014 and the Lex Machina ranking from 2014. Before analyzing the relationship between the number of counsels and the ranking, I shortly describe the background and methodology of the different rankings.

2007 Vault Law 100:

The Vault Law 100 is a yearly ranking of the most prestigious law firms based on the perceptions of currently practicing lawyers at peer firms. The survey asked attorneys to score each of the 156 proposed law firms on a scale from 1 to 10 based on how prestigious it is to work for the firm. Associates were not allowed to rank their own firm. In total 15,350 attorneys returned anonymous surveys to Vault. Based on the answers Vault creates a ranking of the 100 most prestigious law firms.[7] The advantage of this ranking is its reputation and it's availability for the year 2007. However, it covers only 100 law firms and some high-quality law firms specializing on intellectual property may be missing.[8]

2014 US News intellectual property litigation ranking:

Best Lawyers, a provider of a peer-reviewed lawyer ranking, and *U.S.News & World Report*, a leading rankings publication in the US, jointly created this ranking. It is based on an evaluation process that includes the collection of client and lawyer evaluations, peer review from attorneys in their field, and review of additional information provided by law firms as part of the formal submission process.[9] According to this evaluation process, 615 law firms are categorized into 3 national tiers. This ranking is more comprehensive, which makes a lack of more specialized firms less likely. Unfortunately, only the 2014 version was accessible. This is a relatively long time lag, potentially causing problems of comparability to the time the litigants made their decisions. Furthermore, the ranking into 3 tiers implies only few variation.

[7]For the detailed methodology, see: `http://www.vault.com/company-rankings/law/vault-law-100/RankMethodology?sRankID=2&rYear=2007&pg=1`

[8]There exists also a ranking that focuses on Intellectual Property. Unfortunately, the earliest version in 2010 ranked only 15 firms, and the most current one only 25 firms.

[9]For the detailed methodology, see: `http://bestlawfirms.usnews.com/methodology.aspx`

2014 Lex Machina ranking:

Lex Machina ranks the 300 most frequent law firms in patent cases since 2011. This makes the ranking very comprehensive and also specific with respect to patent law. Unfortunately, the ranking is only available from 2011 on.[10]

I match the rankings to the respective law firms in my sample.I then calculate the minimum rank among all law firms that are hired by a plaintiff for the respective case. Table 1 presents the results of the matching. The third column ("Ranked") shows the number of plaintiffs for which at least one legal counsel shows up in the ranking. The coverage of the ranking is as expected important for the likelihood that a law firm from my sample is part of the ranking. The last column presents the related mean and standard deviations of the minimum rank of all law firms employed by the plaintiffs.

Variable	**Obs.**	**Ranked**	**Mean rank (Std. Dev.)**
Vault Law 100	562	127	51.386 (26.647)
US News	562	304	1.191 (0.441)
Lex Machina	562	253	86.664 (71.572)

The number of plaintiffs for which at least one counsel is part of the respective ranking is given in column 3. Column 4 summarizes the minimum rank of all counsels employed by a plaintiff.

Table 1: Summary statistics - rankings

Table 2 relates the number of counsels employed to the likelihood that at least one of the law firms is ranked, and to the associated minimum rank by presenting the correlation coefficients. The second column shows a highly significant positive correlation between the number of counsels and the likelihood that at least one of the law firm is ranked for all rankings (all p-values are smaller than 0.001).[11] Furthermore, it shows a significant negative correlation between the number of counsels and the minimum rank of the associated law firms for the Vault 100 (p-value=0.029) and the Lex

[10]The ranking used in the study was downloaded on December 31, 2014. Therefore, it covers the years 2011-2014.

[11]The same pattern can be observed using the percentage of ranked lawyers. The likelihoods that a law firm is part of the different rankings are themselves also correlated: Vault/US News 0.438, Vault/Lex Machina 0.529 and US News/Lex Machina 0.697.

Machina ranking (p-value=0.004).[12] The US News ranking shows no such correlation. This is due to the design of the ranking with three tiers only. Most of the law firms in my sample are part of the first tier (see also Table 1) leaving too few variation to identify a correlation.

This evidence leads me to conclude that there exists a non-negative relationship between the number counsels and their quality. The correlations rather suggest that those litigants who employ more lawyers employ also the higher quality lawyers. An alternative interpretation for that observation is that a litigant chooses the quality of the law firm rather than the number of lawyers. A high quality law firm then assigns more lawyers to the case. In this interpretation, the number of counsels serves as a proxy variable for the quality of the law firm which is itself likely to be correlated with the intended investment. As a consequence of this non-negative quantity-quality relation, the number of lawyers can be interpreted as a proxy variable for the investment in legal advice in monetary terms; though, it is likely to underestimate the full effect.

Note that using the number of lawyers at the time of the case filing is also structurally different than the ex-post analysis by Trubek et al. (1983). Trubek et al. (1983) is one of the few exceptions providing evidence on the drivers of litigation costs in general by identifying drivers of the expenditure of lawyer time. The authors use survey data that asked lawyers about their time allocation in specific cases. Even though this ex-post approach delivers valuable insights on the time allocation of lawyers, it is not directly related to the client's decision in the beginning of the lawsuit. The majority of cases settle, usually at different stages of the process. Hence, the total time lawyers spent on a case is not only affected by their effort to produce arguments and evidence but also whether and when the litigants reach a settlement agreement.

3.3. Independent variables

3.3.1. Product market competition

I rely on the North American Industry Classification System (NAICS) to define the proximity of the product markets. My main source of information for the industry classification of each litigant is the *Bureau van Dijk Orbis* database. The *Orbis* database provides NAICS codes for all industries the firm is active in.[13] The NAICS system employs a six-digit code system. The first two digits

[12] Note that a lower rank implies a higher quality law firm.

[13] Whenever a firm could not found in the *Orbis* database, I performed an intensive web search to complement the data.

Ranking	Correlation ranked	Cond. correlation rank
Vault Law 100	0.220***	-0.194**
US News	0.322***	-0.037
Lex Machina	0.342***	-0.183***

The second column shows the correlation coefficient of the number of counsels and a dummy variable indicating whether at least one of the law firms is part of the ranking. The third column describes the correlation coefficient of the number of counsels and the minimum rank conditional that at least one law firm is part of the ranking.

Table 2: Correlation coefficients of the number of counsels and the associated minimum rank

define the industry sector, the third digit designates the subsector, the fourth digit the industry group, the fifth digit defines the industry, and the sixth digit accounts for national differences between the North American countries. The system can be summarized by:

$$\underbrace{a_1 a_2}_{sector} \quad \underbrace{a_3}_{subsector} \quad \underbrace{a_4}_{industry\ group} \quad \underbrace{a_5}_{industry} \quad \underbrace{a_6}_{national\ industry}$$

The structure of the industry codes offers a straightforward definition of the proximity of the companies activities. Whenever the codes are exactly the same, the opponents share the same product market. If only the first few digits are the same, the product markets are imperfectly related. I define the measure for the proximity of the industries as following:[14]

$$proximity = \frac{\alpha}{5} \quad \text{with } \alpha = \begin{cases} 5 & if\ a_{iD} = a_{iP}\ \forall i \in [1,6] \\ 4 & if\ a_{iD} = a_{iP}\ \forall i \in [1,5] \\ 3 & if\ a_{iD} = a_{iP}\ \forall i \in [1,4] \\ 2 & if\ a_{iD} = a_{iP}\ \forall i \in [1,3] \\ 1 & if\ a_{iD} = a_{iP}\ \forall i \in [1,2] \\ 0 & otherwise \end{cases}$$

where a_{iP} denotes the digits of the plaintiff's NAICS code of the plaintiff, and a_{iD} the digits of the NAICS code of a defendant. Whenever I observe multiple NAICS codes for the plaintiff or defendant I chose the combination that provides the highest product market proximity.

[14]Recent research derives product market proximity measures based on market shares (Branstetter and Sakakibara, 2002), or sales (Bloom et al., 2013) in different industry classes. Unfortunately, these information are not available in *Orbis*. Bloom et al. (2013) also derive a measure of technological proximity using patent data. Because I observe no patents for roughly 50 percent of our defendants (because firms own no patents, not because of missing information), I refrain from deriving this measure.

Note that I observe multiple defendants in 105 (roughly 19 percent) of the cases.[15][16] Because the measure describes the relationship between the plaintiff and one defendant, I calculate average values for each plaintiff. Figure 2 displays the distribution of the product market proximity across the 562 plaintiffs; the mean equals 0.387, and the standard deviation is 0.400.

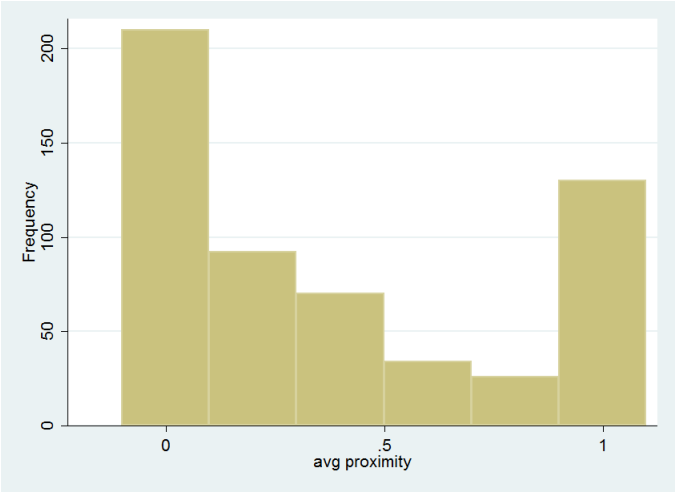

Figure 2: Distribution of the proximity measure across plaintiffs

A downside of the measure is that I cannot identify NAICS codes for individuals.[17] Hence, for individuals the measure for the proximity of the product market equals zero by definition, even though they may produce and sell products on their own behalf. In order to take that problem into account I always control for litigant characteristics. Furthermore, I present robustness checks that exclude these cases.

3.3.2. Litigants' size

I create two categories for the plaintiffs and the defendants. First, by investigating the case documents, I am able to distinguish individuals from firms. Some cases involve individuals that are key employees of the plaintiff or one of the defendants. In these cases, the respective parties are grouped and treated as a firm. I create a dummy variable that equals one whenever the litigant is an individual.

[15] Note that all observation are cleaned for double counts, i.e., subsidiaries of a company, exclusive licensees or the co-owner of a patent that are involved in the same case are not considered individually.

[16] A few cases involve also multiple plaintiffs. These are typically the patent owner and a (exclusive) licensee of the patent. However, both litigants do not act independently. In these cases, I treated the licensee similar to a subsidiary of the plaintiff. Controlling for the presence of an exclusive licensee does not change any of the following results.

[17] In 45 cases the plaintiff is an individual, and in 14 cases an individual is the only defendant.

Second, in order to create a measure for firms size of the non-individual plaintiffs and defendants I rely on two lists published by the Forbes magazine. I create a dummy variable equal to one whenever the litigant is part of either the Forbes "Global 2000 Leading Companies" list published in the case filing year, or the respective Forbes "America's Largest Private Companies" list. The global edition of the list ensures that I capture foreign firms. In order to take also large private companies into account, I use the Forbes "America's Largest Private Companies" list.

As an alternative measure of firm size, I identify the set of the litigant's patents within a five-year window in either direction of the filing year of the case. I rely again on the information published by the US Patent and Trademark Office and Lai et al. (2011).

Table 3 summarizes the litigants' characteristics.

Variable	**Obs.**	**Mean** **Std. Dev.**	**Min.** **Max.**	**Variable**	**Obs.**	**Mean** **Std. Dev.**	**Min.** **Max.**
no of defendants	562	1.539	1				
		(2.060)	27				
individual	562	0.085	0	percent defendant	562	0.030	0
		(0.276)	1	individual		(0.162)	1
forbes	562	0.110	0	percent defendant	562	0.190	0
		(0.312)	1	forbes		(0.374)	1
portfolio size	562	170.763	0	avg defendant	562	409.043	0
		(767.273)	8717	portfolio size		(2099.395)	27437

Table 3: Litigant characteristics

The plaintiffs sue on average 1.539 defendants. More defendants than plaintiffs are part of the Forbes lists, and the average portfolio size of the defendants is also more than twice as high. Hence, the plaintiffs tend to sue stronger opponents.

3.3.3. Patent characteristics

In order to control for, and analyze the effect of the value of a patent's underlying technology, I use a variety of patent characteristics in my analysis. I rely on information published by the US Patent and Trademark Office and Lai et al. (2011). These characteristics include the related industry, and a variety of value measures. These value measures are based on the number of citations and citation patterns. Previous research has shown the connection of these measures and the value of a patent (e.g. Hall et al., 2005; Harhoff et al., 2003; Trajtenberg, 1990). The patent characteristics used in the analysis are described in the following and summarized in Table 6.

Technology classification: In a first step, I differentiate between utility and design patents.[18] In a second step, I differentiate the utility patents further. I use the primary USPC class to categorize the utility patents to the five broad technology fields defined by Hall et al. (2001). The utility patents are classified into the technology fields *Chemical*, *Computers and Communication*, *Drugs and Medical*, *Electrical and Electronic*, *Mechanical*, and *Other*.

Forward and backward citations: Each patent application has to cite all related prior US patents, and a patent examiner ensures that all relevant patents are cited. From these citation patterns one can derive the backward citations, i.e., the number of patents the respective patent cites, and the number of forward citations, i.e., the number of patents that cite the respective patent. Harhoff et al. (2003) argue that the number of backward citations are used to back the claims of the patent application; therefore indicating a broad scope of the patent. The number of forward citations, indicate the importance of the patent for future innovations, and are used as a standard measure for the patent value. Several studies confirm this assumption and show that the measure is related to the actual value and importance of a patent (Trajtenberg, 1990; Albert et al., 1991; Harhoff et al., 1999; Hall et al., 2005).

Additionally, I determine the number of citations that the patent received from patents belonging to the same patent owner. A higher number of forward self-citations indicates that the patent protects the basis of a cumulative innovation developed by the patentee (Lanjouw and Schankerman, 2004); increasing the importance and therefore the value of the patent. Consistent with this view Somaya (2003) and Somaya and McDaniel (2012) interpret forward self-citation as strategic stakes of the owner. Hall et al. (2005) show that forward self-citations are even more valuable than external citations. In contrast, a more backward self-citations indicate that a later stage is protected, potentially implying a lower value. I refrain from calculating the number of citations a patent received from patents owned by the defendants because roughly half of the potential infringers do not own patents.

In order to take different citation patterns across time and across technology fields (Hall et al., 2001) into account, I calculate measures that relate the number of citations of a patent in technology

[18]The distinction between design and utility patents is the following: "In general terms, a utility patent protects the way an article is used and works, while a design patent protects the way an article looks" (US Patent and Trademark Office, *Manual of Patent Examining Procedure (MPEP)*, Chapter 1502.01).

class τ (the 36 two-digit categories as defined in Hall et al. (2001)) with application year t to the average number of citations of all patents in τ with the same application year. Specifically, I define the measure as

$$Relative\ citations_{\tau t} = \frac{C_{\tau ti}}{\frac{1}{n}\sum_{j}^{n} C_{\tau tj}}.$$

$C_{\tau ti}$ denotes the number of backward (forward) citations of patent i with application year t and technology class τ, excluding self citations. The sum in the denominator denotes the average backward (forward) citations of all patents in τ that have the same application year. Hence, the average of this relative measure for all patents with the same application year in τ equals one.

Generality and Originality index: The "generality" and "originality" indexes proposed by Trajtenberg et al. (1997) are additional citation based value indicators. The bias adjusted "generality" index is defined as follows:

$$Generality_i = \frac{C_i}{C_i - 1}\left(1 - \sum_{\tau}\left(\frac{C_{i\tau}}{C_i}\right)^2\right),$$

where $C_{i\tau}$ denotes the number of patents cited by patent i that belong to technology class τ, excluding self-citations, and C_i denotes the sum of all backward citations, excluding self-citations. The factor $\frac{C_i}{C_i - 1}$ removes the downward bias of the Herfindahl-index as recommended by Hall et al. (2001) "Generality" measures the variety of other technologies that rely on the patent. "Originality" is similarly defined, except that it uses the percentage of patents belonging to technology class j that cite patent i. Originality measures the variety of technologies on which the patent relies. Both measures serve as an indicator for the importance and hence the value of the patent. However, Harhoff and Wagner (2009) also argue that the originality measure, as well as the simple backward citation count, increase the complexity of the examination process at the patent office; an argument that should be important for courts, too.

Claims: The claims described in the patent application define the boundaries of patent rights. The more claims a patent has, the broader is the scope of the patent.

Patent scope: Each patent is assigned to all related technology classes of the USPC system. The more patent classes are assigned to the patent the broader is the technological use of the patent. The number of patent classes is used as an indicator of its technological scope (Lerner, 1994). Patent scope and the generality index are important control variables because the likelihood of

unrelated product markets might increase in the broadness of patent. However, patent scope also serves regularly, similar to the number of claims, as complementary measures for the value of a patent.

Ownership concentration of patent rights: The ownership concentration within specific technological areas may affect the value of patent for two reasons. First, it increases the market power for a technology because fewer substitutes are available. Second, if patents complement each other the value of a patent increases with its portfolio size (e.g. Galasso and Schankerman, 2010). I compute the share of patents with an application year within five years in either direction of the suit accounted for by the top four patentees for the related technology class τ.[19]

Variable	Obs.	Mean Std. Dev.	Min. Max.	Variable	Obs.	Mean Std. Dev.	Min. Max.
no of patents	562	2.021	1	avg generality	562	0.379	0
		(2.091)	29			(0.283)	1
avg patent age	562	5.908	0	avg C4	562	0.174	0.031
		(4.627)	20.964			(0.101)	0.625
avg fwd citations	562	27.275	0	avg patent scope	562	4.069	1
		(38.599)	263			(2.740)	19
avg fwd self citations	562	1.775	0	percent design	562	0.092	0
		(5.783)	67			(0.272)	1
avg relative fwd citations	562	2.233	0	percent chemical	562	0.067	0
		(2.851)	39.118			(0.241)	1
avg bwd citations	562	20.748	0	percent computer	562	0.218	0
		(34.213)	472	and communication		(0.405)	1
avg bwd self citations	562	0.738	0	percent drugs	562	0.132	0
		(2.173)	23	and medical		(0.335)	1
avg relative bwd citations	562	1.867	0	percent electric	562	0.102	0
		(2.641)	29.693	and electronic		(0.288)	1
avg claims	562	22.572	1	percent mechanical	562	0.151	0
		(22.760)	300			(0.344)	1
avg originality	562	0.373	0				
		(0.287)	1				

Table 4: Patent characteristics

Table 4 provides the summary statistics for all patent characteristics. Because a plaintiff may

[19]Because I do not observe any patent in the relevant time window for 50 percent of the infringers (compared to 25 percent in Galasso and Schankerman (2010)), I focus on the ownership concentration within the technology class of the asserted patent instead of the fragmentation measure proposed by Galasso and Schankerman (2010) that is based on information from the infringers' portfolios.

assert multiple patents in his complaint, the respective measures are averaged. The table confirms a well-known result from the literature that litigated patents are on average cited more often. The mean of the average relative forward citations amounts to 2.233; the patents in my sample are cited more than twice as often as a comparable patent with the same application year from the same technology class. The same is true for the average relative backward citations which mean amounts to 1.867. Both means are significantly different from 1. However, the skewness of the distribution has a large effect on the mean. The median of the average relative forward (backward) citations equals 1.281 (1.084) only.

Table 7 summarizes the patent and defendant characteristics calculated as the maximum of the patents and defendants respectively.

3.3.4. Other control variables

I create a dummy variable that differentiates between infringement and declaratory judgment cases in order to take potential differences into account.

Furthermore, I define dummy variables for each district court in order to control for local specialties. Out of the 94 existing district courts 64 districts show up in my sample. However, cases are not distributed uniformly across these districts but is concentrated on a few, roughly 50 percent of the cases are handled by the 10 largest district courts. Table 8 summarizes the distribution of cases across the different district courts. These numbers roughly represent the distribution of the population of patent cases.

Finally, I create dummy variables for the filing year of the lawsuit.

4. Results

4.1. Empirical results

My following analysis is based on a simple OLS regression model with heteroscedasticity robust standard errors. Table 5 presents the results. The table shows a significantly positive effect of the proximity measure on the plaintiffs' legal investment in specification 1. The closer the product markets of the litigants are related, the more the plaintiff invests. The effect is robust to controlling for all patent characteristics, and the dummy variables for the filing year and the district court. Specification 5 focuses on infringement suits only, excluding declaratory judgment cases. In line with the observation that the dummy variable for declaratory judgment cases is close to zero in

specifications 1-4, the coefficient remains nearly unchanged. Specification 6 analyzes only those cases for which NAICS codes for the plaintiff and for at least one of the defendants are observed; hence, excluding cases with individual plaintiffs and unique individual defendants. Again, the effect is qualitatively robust, though it differs slightly in size.

The effect of close product market competition on the number of legal counsels is also economically significant. According to the most comprehensive specification 4, plaintiffs that are active on exactly the same market as the defendants hire on average 0.674 more counsels than plaintiffs that are active on unrelated markets. This effect represents an increase of more than 20 percent from the mean.

As an additional robustness check, Table 9 presents the same specifications using the maximum of the patent and litigant characteristics instead of the average. The point estimate is slightly smaller in size but also significantly different from zero at the one percent level in all specifications.

I refrain from interpreting the role of the litigants' size on the plaintiffs' litigation spendings in specifications 1-6 for two reasons. First, the presence of individuals as plaintiffs clearly correlates with the proximity measure. Secondly, the individual and Forbes dummy variables highly correlate with the patent portfolio size of the respective party, giving rise to multicollinearity concerns. Therefore, I provide two additional specifications that estimate the effect of the size indicators separately in columns 7 and 8. Both specifications control for the full set of control variables.

The results in Table 5 show that the litigants' characteristics indeed play an important role for the number of counsels employed. Small firms hire significantly fewer, Forbes firms significantly more counsels. The difference amounts to 1.801 counsels, which translates to approximately 60 percent of the mean. Plaintiffs also react partially to the size of the defendants. Whenever a plaintiff faces only Forbes firms, she hires 0.868 more counsels.

In specification 8 I rely on the patent portfolio size as an alternative measure of litigant size. I find a non-linear effect of the number of the patents owned by the plaintiff. The number of counsels increase at a diminishing rate in the portfolio size.[20] The same pattern can be observed for the average portfolio size of the defendants.[21] Note also that all of the effects of the litigant character-

[20]Because the marginal effect of the average patent portfolio size is non-linear, it is not significantly larger than zero at the 5 percent level for plaintiffs who own more than 2900 patents (see Brambor et al., 2006). In my sample this is the case for 10 cases (1.8 percent).

[21]The marginal effect of the average defendants' portfolio size is not significantly larger than zero at the 5 percent

Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
avg proximity	0.663***	0.804***	0.742***	0.674***	0.614***	0.734***		
	(0.201)	(0.198)	(0.202)	(0.210)	(0.235)	(0.214)		
individual	-1.066***	-0.742***	-0.743***	-0.729***	-0.741***		-1.004***	
	(0.229)	(0.210)	(0.210)	(0.232)	(0.256)		(0.221)	
forbes	0.667**	0.498	0.458	0.472	0.533	0.441	0.797***	
	(0.333)	(0.324)	(0.323)	(0.351)	(0.443)	(0.364)	(0.304)	
portfolio size ($\cdot 10^{-4}$)	10.113***	7.716**	8.166**	7.984**	6.433*	7.830**		11.643***
	(3.443)	(3.262)	(3.202)	(3.631)	(3.856)	(3.584)		(3.154)
portfolio size^2 ($\cdot 10^{-8}$)	-15.222***	-12.530***	-12.938***	-12.660**	-10.730*	-12.434**		-16.355***
	(4.697)	(4.374)	(4.323)	(5.286)	(5.586)	(5.175)		(4.898)
perc. defendant	-0.492	-0.151	-0.172	-0.107	-0.296	-0.620	-0.298	
individual	(0.354)	(0.356)	(0.363)	(0.342)	(0.521)	(1.276)	(0.325)	
perc. defendant	0.984***	1.004***	1.019***	0.783***	0.702**	0.792***	0.868***	
forbes	(0.282)	(0.275)	(0.271)	(0.265)	(0.273)	(0.291)	(0.227)	
avg defendant	1.610	1.413	1.376	1.071	0.862	1.510		2.073**
portfolio size ($\cdot 10^{-4}$)	(1.073)	(0.996)	(1.005)	(1.032)	(1.029)	(1.142)		(0.955)
avg defendant	-0.697	-0.645	-0.639	-0.566	-0.471	-0.729		-0.865*
portfolio size^2 ($\cdot 10^{-8}$)	(0.440)	(0.438)	(0.438)	(0.476)	(0.475)	(0.499)		(0.447)
no of defendants	0.153***	0.117**	0.116**	0.100**	0.091*	0.111*	0.067*	0.083*
	(0.057)	(0.052)	(0.050)	(0.050)	(0.050)	(0.057)	(0.039)	(0.048)
declaratory	-0.071	-0.069	-0.049	0.006		0.034	-0.013	0.031
	(0.158)	(0.159)	(0.161)	(0.189)		(0.207)	(0.195)	(0.197)
no of patents		0.015	0.009	-0.013	-0.022	-0.020	-0.015	-0.015
		(0.042)	(0.042)	(0.050)	(0.051)	(0.050)	(0.045)	(0.053)
avg relative		0.093**	0.096**	0.076*	0.110	0.075	0.070	0.069
fwd citations		(0.042)	(0.042)	(0.045)	(0.088)	(0.049)	(0.046)	(0.046)
avg relative		-0.003**	-0.003**	-0.002*	-0.008	-0.002	-0.002	-0.002
fwd citations^2		(0.001)	(0.001)	(0.001)	(0.007)	(0.001)	(0.001)	(0.001)
avg fwd self-citations		0.026**	0.027**	0.022*	0.023**	0.024**	0.025**	0.023**
		(0.012)	(0.011)	(0.012)	(0.011)	(0.011)	(0.011)	(0.010)
avg relative		-0.061	-0.051	-0.043	-0.036	-0.050	-0.031	0.010
bwd citations		(0.059)	(0.058)	(0.060)	(0.061)	(0.062)	(0.060)	(0.060)
avg relative		0.000	0.000	0.000	0.000	0.000	0.000	-0.002
bwd citations^2		(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
avg bwd self-citations		0.050	0.044	0.029	0.024	0.030	0.046	0.024
		(0.034)	(0.032)	(0.036)	(0.036)	(0.037)	(0.038)	(0.039)
avg claims ($\cdot 10^{-2}$)		1.398**	1.390**	1.500**	1.596**	1.450*	1.600**	1.496**
		(0.699)	(0.699)	(0.723)	(0.785)	(0.762)	(0.713)	(0.732)
avg claims^2 ($\cdot 10^{-4}$)		-0.705***	-0.715***	-0.744***	-0.802***	-0.711***	-0.753***	-0.749***
		(0.212)	(0.215)	(0.232)	(0.246)	(0.242)	(0.232)	(0.239)
avg patent scope		0.014	0.016	0.028	0.061*	0.033	0.028	0.026
		(0.028)	(0.027)	(0.030)	(0.033)	(0.034)	(0.031)	(0.034)
avg originality		0.208	0.189	0.117	0.224	0.101	-0.020	-0.030
		(0.311)	(0.310)	(0.327)	(0.368)	(0.361)	(0.336)	(0.328)
avg generality		-0.193	-0.163	-0.094	-0.293	-0.168	-0.007	-0.004
		(0.275)	(0.281)	(0.286)	(0.316)	(0.314)	(0.287)	(0.293)
avg C4		-1.357*	-1.424*	-1.242	-1.296	-1.281	-1.109	-1.085
		(0.737)	(0.738)	(0.817)	(0.976)	(0.904)	(0.815)	(0.824)
perc. design		-0.279	-0.293	-0.162	-0.177	-0.320	-0.143	-0.206
		(0.285)	(0.287)	(0.321)	(0.360)	(0.357)	(0.320)	(0.335)
perc. chemical		0.119	0.094	0.085	0.169	0.048	0.175	0.188
		(0.298)	(0.296)	(0.343)	(0.406)	(0.370)	(0.359)	(0.363)
perc. computer		1.016***	0.955***	0.728***	0.749**	0.668**	0.583**	0.630**
and communication		(0.240)	(0.243)	(0.268)	(0.308)	(0.289)	(0.264)	(0.272)
perc. drugs		0.435*	0.447*	0.524*	0.661**	0.375	0.611**	0.765***
and medical		(0.241)	(0.239)	(0.269)	(0.302)	(0.296)	(0.273)	(0.282)
perc. electric		0.474*	0.449	0.277	0.384	0.151	0.351	0.216
and electronic		(0.284)	(0.282)	(0.292)	(0.318)	(0.341)	(0.296)	(0.299)
perc. mechanical		0.141	0.148	0.084	0.040	0.060	0.063	0.011
		(0.187)	(0.188)	(0.211)	(0.240)	(0.238)	(0.209)	(0.226)
Intercept	2.315***	1.747***	1.934***	1.896***	1.647***	2.007***	2.404***	2.235***
	(0.147)	(0.294)	(0.370)	(0.481)	(0.531)	(0.521)	(0.494)	(0.510)
filing year dummies	no	no	yes	yes	yes	yes	yes	yes
district court dummies	no	no	no	yes	yes	yes	yes	yes
Observations	562	562	562	562	475	505	562	562
R^2	0.207	0.314	0.321	0.434	0.461	0.424	0.406	0.386

Significance levels: $*: 10\%$ $**: 5\%$ $***: 1\%$
Heteroscedasticity-consistent standard errors in parentheses.

Table 5: Estimation of the plaintiffs' counsel choices

istics can be observed in Table 9, where I use the maximum of the respective variables across the different litigants.

Some of the value indicators that are based on a patent's characteristics also show significant effects. The average number of claims show a robust positive but declining effect on the plaintiffs' investments.[22] The average number of forward self-citations, the measure that was used by Somaya (2003) as an indicator for strategic stakes, has a positive and significant influence on the number of counsels. The average relative forward citations of the patents[23] show a positive but declining effect in specifications 2-4. All of these observations are in line with the expectation that the investment in legal advice increases in the value at stake.

There also exist some differences across technology fields. A plaintiff hires significantly more counsels the more patents from the *Computers and Communication* and *Drugs and Health* technology fields are involved (the baseline are patents that fit not in any of the technology fields).

Finally, note that the variables used in the analysis explain 43.4 (44.1) percent of the variation in the preferred specification 4 of Table 5 (Table 9).

4.2. Discussion

The results show that the competitive situation between the litigants indeed affects the intensity of a patent dispute at court. The closer the litigants compete on the product market, the higher is the strategic value of a patent and the more beneficial it becomes winning the case. Patent litigation is used as a strategic device to influence the competitive situation on the product market. The closer the litigants compete, the more they spend on legal representation in order to fight for the patent rights.

The analysis also shows that the litigant characteristics play an important role for the number of counsels employed. Differences in the enforcement ability might explain why the patent premium is higher for large firms (Arora et al., 2008), and why small firms are handicapped in protecting their patent rights (Golden, 2006; McDonough, 2006; Ronspies, 2004). Lanjouw and Schankerman (2004) show that patents owned by individuals, small firms and firms with small patent portfolios

level anymore if the average defendants' portfolio size exceeds 6300. This can be observed for 9 cases (1.6 percent).

[22]The marginal effect of the average number of claims is not significantly larger than zero at the 5 percent level anymore if the average number of claims exceeds 40 in specification 4. This is the case for 76 cases (13.5 percent).

[23]A similar pattern can be observed by using the absolute number of forward citations instead of the normalized measure.

are more likely to be involved in patent litigation. Galasso et al. (2013) establish even a causal link by showing that the transfer of patents owned by individual inventors to firms with large patent portfolios reduces litigation risk. Lanjouw and Schankerman (2004) argue that a large patent portfolio allows trading of technologies and that large firms are more likely to be involved in repeated interaction. These two factors may facilitate cooperative resolutions of disputes. However, their observations may also be explained by differences in litigation spending. Large firms can afford a better legal representation, and invest more in legal advice, giving them an enforcement advantage compared to small firms and individuals. Because potential infringer anticipate the legal battle, the advantage leads to two effects. First, the advantage leads to a deterrence effect because the costs for a potential infringer increase. Second, because lawsuits become more expensive for actual infringers, they are more willing to accept a settlement agreement before going to court. Both effects lead finally to a lower observed litigation probability.

The two main results show that the value of the patent depends on the patent holder. First, because patents offer a source for competitive advantage on the product market, the value of the patent depends on the competitive situation of the patent holder. Second, the value of a patent depends on the ability to enforce them. Both factors add an additional dimension to the pure value of a technology; a dimension that is not covered by citation-based patent characteristics.

Furthermore, the two results together imply an important problem for small innovators. Patent protection is most resource-intense when needed the most, i.e., if the patent protects their innovation on the product market. At the same time they can be outcompeted at court by large more financially potent competitors. This problem might lead to a decrease in innovation activity by small firms. It is also related to the recent rise of patent intermediaries (see Hagiu and Yoffie, 2013, for an overview), and the patent troll discussion. Several authors argue that specialized patent trolls might solve this problem by assisting small innovators in enforcing their patent rights (e.g., Shrestha, 2010; Myhrvold, 2010).

My empirical analysis focuses on determinants of the resource spending decision. A straightforward follow-up question is to analyze the performance effect of this decision similar to Chen et al. (2015). Unfortunately, more than 90 percent of the cases in my sample (and the population) settle out of court, and the settlement conditions remain unobserved. This implies a too low number of judgments to identify effects.

The possibility of settlements raises also an additional concern for my analysis. A settlement, i.e., a cooperative resolution of a dispute, might even occur before the plaintiff files the lawsuit. Hence, my analysis might be similar to any other litigation study affected by selection issues. However, I am confident that I already take the vast majority of concerns into account by including an extensive set of patent characteristics in my analysis.

Finally, using the number of counsels as a proxy variable for the resources devoted to litigation comes with two short-comings. First, the match of the number of counsels with the rankings showed a positive relation between quality and quantity. Hence, it is likely that the identified effects are underestimated in quantitative terms. Second, the measure does not include internal counsels. Because especially large firms employ additional lawyers in-house, large firms might even spend more resources on a specific case than my results imply.

5. Conclusion

The enforcement of intellectual property is an important aspect of a firm's patent strategy. I analyze the effect of the strategic value of patents and litigant characteristics on the willingness to pay for the enforcement of the patents. In order to do so, I focus on an important decision of the plaintiffs, their counsel choice. Using a sample of US patent litigation cases I find that competition on the product market between the litigants plays an important role for the number of counsels employed by the plaintiffs. Close product market activities imply that the patent serves as a source for competitive advantage, which leads the plaintiff fighting more intensely for the patent rights. The competitive situation on the product market is reflected in the behavior at court.

Furthermore, litigant characteristics play an important role in determining the investment in legal advice. Large firms hire more, and individuals hire fewer counsels. Measuring firm size in terms of the patent portfolio also shows that firms with a larger patent portfolio hire more counsels. This result increases concerns that small firms are less able to protect their intellectual property.

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Variable	Definition
No of patents	The number of patents.
Design patent	Dummy variable equal to one if a patent is a design patent.
Patent technology fields	Dummy variable equal to one if a patent is categorized according to Hall et al. (2001) as a *Chemical*, *Computers and Communication*, *Drugs and Medical*, *Electrical and Electronic*, or *Mechanical* patent respectively.
Forward citations	The number of citations a patent received from other patents, excluding self-citations
Relative fwd citations	The number of citations a patent received relative to the average citations received by all patents in the same technology class (the 36 two-digit categories as defined in Hall et al. (2001)) with an application year within five years in either direction of the suit, excluding self-citations.
Backward citations	The number of other patents cited by a patent, excluding self-citations
Relative bwd citations	The number of other patents cited relative to the number of patents cited by all patents in the same technology class (the 36 two-digit categories as defined in Hall et al. (2001)) with an application year within five years in either direction of the suit, excluding self-citations.
Generality	The "Generality" measure proposed by Trajtenberg et al. (1997). It measures the range of technology classes of patents that cite the asserted patent.
Originality	The "Originality" measure proposed by Trajtenberg et al. (1997). It measures the range of technology classes of patents that are cited by the asserted patent.
Patent claims	The number of claims stated in the patent document.
Patent scope	The number of US technology classifications assigned to the patent.
C4 - Ownership concentration	The share of patents with an application year within five years in either direction of the suit accounted for by the top four patentees for the related technology class (the 36 two-digit categories as defined in Hall et al. (2001)).
Patent age	Age of the patent at the filing date of the case

Table 6: Patent characteristics - Description

Variable	Obs.	Mean Std. Dev.	Min. Max.	Variable	Obs.	Mean Std. Dev.	Min. Max.
max proximity	562	0.420	0	max claims	562	28.874	1
		(0.414)	1			(32.012)	300
defendant individual	562	0.036	0	max originality	562	0.431	0
		(0.185)	1			(0.309)	1
defendant forbes	562	0.222	0	max generality	562	0.450	0
		(0.416)	1			(0.312)	1
max defendant	562	534.639	0	max C4	562	0.187	0.031
portfolio size		(2546.696)	27437			(0.115)	0.678
max patent age	562	6.923	0	max patent scope	562	4.817	1
		(5.245)	24.148			(3.770)	25
min patent age	562	4.953	0	design	562	0.110	0
		(4.675)	20.964			(0.314)	1
max fwd citations	562	36.416	0	chemical	562	0.080	0
		(53.744)	383			(0.272)	1
max fwd self citations	562	2.407	0	computer and	562	0.235	0
		(8.874)	117	communication		(0.424)	1
max relative fwd citations	562	2.946	0	drugs and medical	562	0.141	0
		(4.313)	55.465			(0.348)	1
max bwd citations	562	26.568	0	electric and electronic	562	0.123	0
		(43.512)	472			(0.328)	1
max bwd self citations	562	0.996	0	mechanical	562	0.174	0
		(2.978)	23			(0.380)	1
max relative bwd citations	562	2.449	0				
		(3.926)	42.869				

Note that calculating the maximum implies that the variables defendant individual and forbes and the technology field classifications of the patents become dummy variables, indicating whether such a defendant or patent is present.

Table 7: Summary statistics of the maximum across defendants/patents

	District Court	Percent	Cumul.		District Court	Percent	Cumul.
1	Eastern District of Texas	0.089	0.089	33	District of Columbia	0.007	0.888
2	Northern District of California	0.064	0.153	34	Southern District of Iowa	0.007	0.895
3	Northern District of Illinois	0.059	0.212	35	District of South Carolina	0.007	0.902
4	District of Delaware	0.055	0.267	36	Eastern District of Kentucky	0.005	0.907
5	Southern District of New York	0.052	0.319	37	Eastern District of Louisiana	0.005	0.913
6	District of New Jersey	0.048	0.367	38	District of Maryland	0.005	0.918
7	Central District of California	0.039	0.406	39	Western District of Michigan	0.005	0.923
8	Northern District of Georgia	0.030	0.436	40	District of New Hampshire	0.005	0.929
9	District of Massachuesettes	0.028	0.464	41	Western District of New York	0.005	0.934
10	District of Minnesota	0.028	0.493	42	Northern District of Oklahoma	0.005	0.940
11	District of Oregon	0.025	0.518	43	Western District of Oklahoma	0.005	0.945
12	Northern District of Texas	0.025	0.543	44	Eastern District of Arkansa	0.004	0.948
13	Southern District of California	0.023	0.566	45	District of Arizona	0.004	0.952
14	Middle District of Florida	0.023	0.589	46	Eastern District of California	0.004	0.956
15	Western District of Washington	0.023	0.612	47	District of Idaho	0.004	0.959
16	Eastern District of Pennsylvania	0.021	0.633	48	District of Kansas	0.004	0.963
17	Eastern District of Michigan	0.020	0.653	49	Western District of Missouri	0.004	0.966
18	Southern District of Texas	0.020	0.673	50	Eastern District of Nebraska	0.004	0.970
19	Southern District of Florida	0.018	0.690	51	Western District of Pennsylvania	0.004	0.973
20	Eastern District of Missouri	0.018	0.708	52	Western District of Tennessee	0.004	0.977
21	Northern District of Ohio	0.018	0.726	53	Western District of Wisconsin	0.004	0.980
22	Eastern District of Wisconsin	0.018	0.744	54	Northern District of Florida	0.002	0.982
23	District of Connecticut	0.016	0.760	55	Middle District of Georgia	0.002	0.984
24	District of Nevada	0.016	0.776	56	Northern District of Iowa	0.002	0.986
25	Southern District of Indiana	0.014	0.790	57	Central District of Illinois	0.002	0.988
26	Middle District of North Carolina	0.014	0.804	58	Southern District of Illinois	0.002	0.989
27	Eastern District of New York	0.014	0.819	59	Northern District of Indiana	0.002	0.991
28	Southern District of Ohio	0.014	0.833	60	Eastern District of Maine	0.002	0.993
29	Western District of North Carolina	0.012	0.845	61	District of Montana	0.002	0.995
30	Western District of Texas	0.012	0.858	62	Eastern District of North Carolina	0.002	0.996
31	District of Utah	0.012	0.870	63	Northern District of New York	0.002	0.998
32	District of Colorado	0.011	0.881	64	Eastern District of Washington	0.002	1.000

Table 8: Case distribution across District Courts

Variable	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
max proximity	0.605***	0.686***	0.632***	0.579***	0.559***	0.629***		
	(0.188)	(0.182)	(0.184)	(0.190)	(0.215)	(0.196)		
individual	-1.062***	-0.751***	-0.755***	-0.692***	-0.677***		-0.967***	
	(0.227)	(0.202)	(0.203)	(0.222)	(0.246)		(0.211)	
forbes	0.723**	0.620*	0.580*	0.574*	0.665	0.542	0.891***	
	(0.330)	(0.318)	(0.317)	(0.337)	(0.409)	(0.353)	(0.293)	
portfolio size ($\cdot 10^{-4}$)	9.608***	7.660**	8.095***	7.705**	5.845	7.289**		21.277***
	(3.414)	(3.188)	(3.138)	(3.568)	(3.638)	(3.578)		(2.262)
portfolio size^2 ($\cdot 10^{-8}$)	-14.350***	-12.081***	-12.397***	-11.936**	-9.512	-11.202**		-20.445***
	(4.672)	(4.586)	(4.595)	(5.626)	(5.844)	(5.685)		(2.363)
defendant	-0.378	-0.101	-0.126	-0.083	-0.223	0.153	-0.210	
individual	(0.281)	(0.289)	(0.296)	(0.288)	(0.426)	(0.546)	(0.279)	
defendant	0.923***	0.887***	0.899***	0.665***	0.614**	0.647**	0.766***	
forbes	(0.247)	(0.236)	(0.233)	(0.233)	(0.248)	(0.258)	(0.203)	
max defendant	1.177	1.176	1.181	0.876	0.723	1.209		1.720**
portfolio size ($\cdot 10^{-4}$)	(0.958)	(0.847)	(0.863)	(0.870)	(0.860)	(0.960)		(0.813)
max defendant	-0.477	-0.518	-0.531	-0.464	-0.415	-0.567		-0.712**
portfolio size^2 ($\cdot 10^{-8}$)	(0.401)	(0.355)	(0.362)	(0.377)	(0.368)	(0.403)		(0.338)
no of defendants	0.104**	0.072	0.073*	0.065	0.061	0.055	0.054	0.055
	(0.051)	(0.046)	(0.044)	(0.047)	(0.048)	(0.052)	(0.039)	(0.040)
declaratory	-0.073	-0.133	-0.107	-0.045		-0.033	-0.057	-0.124
	(0.161)	(0.165)	(0.167)	(0.195)		(0.213)	(0.200)	(0.201)
no of patents		-0.050	-0.055	-0.082	-0.084	-0.086	-0.088*	-0.094*
		(0.051)	(0.050)	(0.056)	(0.058)	(0.058)	(0.052)	(0.051)
max relative		0.049	0.055*	0.048	0.030	0.046	0.042	0.047
fwd citations		(0.033)	(0.033)	(0.036)	(0.042)	(0.039)	(0.037)	(0.038)
max relative		-0.001	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
fwd citations^2		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
max fwd self-citations		0.009	0.010	0.005	0.005	0.006	0.006	0.009**
		(0.010)	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.010)
max relative		-0.047	-0.040	-0.038	-0.022	-0.040	-0.032	-0.004
bwd citations		(0.037)	(0.037)	(0.041)	(0.043)	(0.042)	(0.043)	(0.043)
max relative		0.001	0.001	0.001	0.001	0.001	0.001	0.000
bwd citations^2		(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
max bwd self-citations		0.023	0.019	0.016	0.014	0.018	0.031	0.037
		(0.023)	(0.023)	(0.027)	(0.032)	(0.027)	(0.028)	(0.030)
max claims ($\cdot 10^{-2}$)		1.355**	1.339**	1.416**	1.529**	1.337**	1.515**	1.368**
		(0.575)	(0.573)	(0.597)	(0.638)	(0.628)	(0.597)	(0.595)
max claims^2 ($\cdot 10^{-4}$)		-0.584***	-0.595***	-0.563***	-0.633***	-0.518**	-0.608***	-0.554**
		(0.205)	(0.204)	(0.234)	(0.236)	(0.249)	(0.226)	(0.235)
max patent scope		0.008	0.008	0.023	0.040	0.029	0.028	0.028
		(0.025)	(0.025)	(0.025)	(0.027)	(0.027)	(0.027)	(0.027)
max originality		0.451	0.442	0.372	0.474	0.336	0.307	0.278
		(0.292)	(0.293)	(0.303)	(0.343)	(0.340)	(0.310)	(0.311)
max generality		-0.278	-0.268	-0.168	-0.319	-0.217	-0.117	-0.092
		(0.240)	(0.244)	(0.251)	(0.285)	(0.281)	(0.251)	(0.263)
max C4		-1.351**	-1.425**	-1.313*	-1.553*	-1.269	-1.131	-1.017
		(0.654)	(0.663)	(0.733)	(0.883)	(0.800)	(0.741)	(0.742)
design		-0.215	-0.234	-0.017	-0.057	-0.145	0.002	-0.032
		(0.203)	(0.202)	(0.232)	(0.278)	(0.258)	(0.231)	(0.233)
chemical		0.242	0.226	0.287	0.425	0.256	0.353	0.436
		(0.296)	(0.291)	(0.339)	(0.411)	(0.370)	(0.346)	(0.361)
computer		1.081***	1.021***	0.856***	0.898***	0.824***	0.731***	0.742***
and communication		(0.220)	(0.221)	(0.237)	(0.273)	(0.258)	(0.236)	(0.240)
drugs		0.583**	0.584**	0.720***	0.806***	0.597**	0.781***	0.884***
and medical		(0.230)	(0.228)	(0.262)	(0.294)	(0.293)	(0.266)	(0.274)
electric		0.481**	0.457**	0.340	0.374	0.250	0.454*	0.428*
and electronic		(0.229)	(0.227)	(0.230)	(0.258)	(0.259)	(0.232)	(0.237)
mechanical		0.204	0.202	0.209	0.103	0.187	0.181	0.176
		(0.179)	(0.180)	(0.197)	(0.226)	(0.224)	(0.196)	(0.201)
Intercept	2.374***	1.870***	2.020***	1.925***	1.756***	2.066***	2.268***	2.127***
	(0.133)	(0.225)	(0.327)	(0.427)	(0.479)	(0.466)	(0.435)	(0.438)
filing year dummies	no	no	yes	yes	yes	yes	yes	yes
district court dummies	no	no	no	yes	yes	yes	yes	yes
Observations	562	562	562	562	475	505	562	562
R^2	0.205	0.318	0.324	0.441	0.469	0.426	0.417	0.394

Significance levels: $*: 10\%$ $**: 5\%$ $***: 1\%$
Heteroscedasticity-consistent standard errors in parentheses.

Table 9: Estimation of the plaintiffs' counsel choices