Discussion Paper No. 12-084

# Patent Litigation Settlement in Germany – Why Parties Settle during Trial

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**Non-Technical Summary**

With about 600 cases per year Germany is the most active country in Europe when it comes to patent litigation trials. These trials, usually initiated by a patentee suspecting the infringement of his patent by another firm, are aimed at delivering a judgment about whether the infringement took place. If the court rules that there is an infringement it bans future infringement and decides about appropriate damage awards to be paid to the patentee. The most striking fact about these patent litigation trials is that- even though initiated to obtain a ruling on the dispute- about 60 percent of the cases never reach a final judgment. They are either withdrawn bilaterally or unilaterally or dropped because the counterparties have reached a private settlement agreement. From a theoretical point of view this is astonishing as a settlement agreement is also possible prior to trial, without incurring any (sometimes very costly) lawyer and litigation expenses.

The purpose of this study is therefore to investigate why and under which conditions the plaintiff and defendant decide to not go for a judgment, but to deal out some private settlement arrangement after having reached out to the courts.

The study is conducted using a unique, hand-collected database compiled at the ZEW that contains detailed information about roughly 80 percent of all patent litigation cases in Germany between 2000 and 2008.

Theoretical models from the law and economics literature suggest that asymmetries in information and stakes drive parties to choose trial rather than a settlement deal. Applying this reasoning to the decision to settle or not after having filed a court case we argue that parties will deviate from their decision to obtain a judgment only if the asymmetries change during trial in a way that makes a settlement deal more attractive. Our results show that, indeed, changes in information and stakes arising after the filing of the court case can increase the likelihood of settlement. If an expert is called upon by the judges to deliver an expertise about the technical details of the infringement the informational asymmetries between plaintiff and defendant reduce, aligning their estimates about their prospect at trial and making a settlement agreement more attractive for both. If the stakes for one or both of the parties suddenly increase during trial through the setting of a very high value of the dispute by the judges or through the filing of a nullity suit by the defendant that severely threatens the monopoly right of the patentee, the parties also recalculate their expected payoff from trial. Our results show that under these new conditions they are more likely to conclude that settlement is the better option.

In addition to these changes invoked during trial proceedings we find the general willingness to settle rather than wait for a judgment to depend on overall firm specific-stakes, strategies and the firm's confidence in the case. Firms with overall higher stakes in the case, more confidence in winning and the strategy to obtain a stable judgment at a highly accepted court are generally less likely to change their mind and deal out a settlement agreement.

**Das Wichtigste in Kürze**

Mit ungefähr 600 Fällen pro Jahr ist Deutschland das Land in Europa mit den meisten Patentverletzungsprozessen. Diese Prozesse werden meist von Patentinhabern initiiert, die eine Verletzung ihres Patents durch eine andere Firma vermuten und dies gerichtlich bestätigt und sanktioniert haben wollen. Wenn das Gericht eine Verletzung des Patents bestätigt, wird diese untersagt und eine Schadensersatzzahlung an den Patentinhaber festgelegt. Unerwarteterweise kommt es bei ca. 60 Prozent der Fälle gar nicht erst zu einem Urteil, weil sich die beteiligten Parteien nach Beginn des Prozesses vergleichen oder den Fall einseitig oder beidseitig fallen lassen. Aus theoretischer Sicht ist dies überraschend, da ein Vergleich auch vor der Eröffnung eines Prozesses möglich gewesen wäre und die (oftmals teuren) Prozess- und Anwaltskosten hätten vermieden werden können.

Das Ziel dieser Studie ist daher herauszuarbeiten warum und unter welchen Bedingungen der Kläger und der Beklagte sich nach Eröffnung des Prozesses dazu entschließen auf ein Urteil zu verzichten und sich anstatt dessen zu vergleichen. Dazu werten wir einen am ZEW erstellten, einmaligen Datensatz aus, der detaillierte Informationen zu ca. 80 Prozent aller Patentverletzungsfälle in Deutschland von 2000 bis 2008 enthält.

Theoretische Modelle aus dem Bereich der ökonomischen Analyse des Rechts zeigen, dass asymmetrische Information und asymmetrische Einsätze dazu führen, dass die beteiligten Parteien einen Gerichtsprozess beginnen anstatt sich außergerichtlich zu vergleichen. Wendet man diese Argumentation auch auf die Entscheidung an einen Prozess zu Ende zu führen oder vorher durch einen Vergleich zu beenden, ergibt sich, dass im Prozess stattfindende Veränderungen der Asymmetrien dazu führen können, dass die beteiligten Parteien von ihrer ursprünglichen Strategie abweichen und sich für einen Vergleich entscheiden. Unsere Ergebnisse bestätigen dies. So führt zum Beispiel das Hinzuziehen eines Sachverständigen durch die Richter dazu, dass sich der Informationsstand der beteiligten Parteien und somit deren Erwartungen an den Ausgang des Prozesses angleichen. Dies steigert die Attraktivität und dadurch die Wahrscheinlichkeit eines Vergleiches. Auch der Einsatz einer oder beider beteiligter Parteien kann sich während des Prozesses verändern: Das Setzen eines hohen Streitwertes durch die Richter oder die Einreichung einer Nichtigkeitsklage beim Bundespatentgericht, die das Monopol des Patentinhabers gefährdet, erhöhen das Risiko im Vergleich zur vorherigen Situation. Die führt dazu, dass ein Vergleich als Möglichkeit wieder in Betracht gezogen wird und die Wahrscheinlichkeit eines Vergleichs steigt.

Zusätzlich zeigen unsere Ergebnisse, dass die generelle Neigung sich während des Prozesses doch noch für einen Vergleich zu entscheiden stark von firmenspezifischen Eigenschaften und Strategien abhängt. So sind vor allem Firmen mit insgesamt sehr hohem Einsatz, einem hohen Vertrauen in ihre Chancen vor Gericht und mit der Strategie ein stabiles Urteil zu erzielen weniger geneigt einen Vergleich in Betracht zu ziehen.

# Patent Litigation Settlement in Germany- Why Parties Settle during Trial

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**Abstract**

This paper looks at the decision to settle patent litigation in Germany from a new angle by focusing on detailed data on within-trial actions and motivations by plaintiff, defendant and the courts. Using a new dataset covering about 80% of all patent litigation cases in Germany between 2000 and 2008 we estimate the likelihood of within-trial settlement. We find that the within-trial settlement decision is to some degree driven by the proceedings that change the pre-trial setting of the negotiations in terms of information and stakes and make previously refused settlement a new option. Additionally, firm-specific stakes as measured by the relation of the involved parties to the disputed patent as well as firm-specific strategies are found to affect the general willingness to settle after the filing of a court case. The results suggest that pre-trial failure of settlement negotiations can to some extent be offset by within-trial settlement through efforts made by court and involved parties, but that the disposition to settle is to a larger degree determined by firm-specific stakes and strategies in the case.

*Key words:* Patent, Patent Litigation, Settlement
*JEL:* O34, K41

## 1. Introduction

Patent infringement disputes are an inevitable consequence of the public-good characteristics of patents and their probabilistic nature originating from fuzzy property boundaries (Merges and Nelson 1990, Ziedonis 2004, Shapiro 2001). Within such a dispute the involved parties face the decision between litigation to a court judgment or a settlement agreement. Even when choosing to go trial about 60 percent of all cases in Germany still settle during trial proceedings while only 40 percent of all cases are adjudicated to a final judgment.
Though recently disputed in economic theory regarding antitrust issues and the nullification of weak patents (Shapiro 2003) the avoidance of litigation as such through settlement deals is generally considered welfare-enhancing, as it avoids costly litigation for both the state and the involved parties.
In search of factors that may trigger the settlemet rate this paper aims at investigating how the decision to settle patent infringement suits in Germany during the court proceedings is being shaped by different forces. The decision to settle after having filed a suit at a court seems irrational at first, as settlement could have been reached beforehand without incurring any litigation expenses. This is however only true if the information available during court proceedings was already present before the court filing. During trial new information can be revealed that can lead to changes in the expectations and stakes of the involved parties and thus make a settlement decision during the court proceedings more likely. While some of the changes in information and stakes may be unobservable, other procedures revealing new information and changing stakes can be observed through entries in the court records. We find that the likelihood of settlement changes when new information is revealed in court through expert opinions. In addition to changes in the informational setting we also find changes in stakes induced by the jurisdictional value set by the judges and the filing of nullity suits at the German Patent Court during trial to increase the likelihood of settlement. We further find that parties in general differ with respect to their willingness to overthrow their previous commitment to litigate, which can be interpreted as different sensitivity in the reaction to unobservable changes in information and stakes. Parties with higher overall stakes in the case or higher confidence in winning the case are generally less willing to settle than those with only relatively little stakes involved.

Our paper is closely related to other empirical studies on patent litigation and settlement. Lanjouw and Schankerman (2001, 2004) study the determinants of US patent suits by examining the characteristics of litigated patents and their owners, finding that the value of the patent measured by forward citations and claims in-

creases the likelihood of litigation. In their 2004 paper, Lanjouw and Schankerman find that the probability of litigation is significantly higher for individual patent owners and firms with small patent portfolios. They attribute this to patentees with large portfolios being more likely to engage in trade of patents or other measures of dispute resolution. With respect to the likelihood of settlement Lanjouw and Schankerman find that the main characteristics of patents and their owners do not affect the probability of settlement after a suit is filed. Cremers (2007) follows the approach and estimates the determinants of litigation using data on two major German litigation courts between 1993 and 1995. Similar to Lanjouw and Schankerman she finds more valuable patents to be more likely to be involved in patent litigation and smaller firms more likely to be involved in litigation cases. She further finds that patents having survived an opposition procedure are more likely to be litigated and that the litigation probability decreases with the portfolio size of the patentee. Using the same database Cremers (2009) investigates the settlement decisions in patent infringement suits. She finds legal differences between the District Courts to have a significant impact on the settlement rates during trial. She further finds that at later stages of the trial the use of invalidity suits positively affects the settlement probability while the fact that a patent has survived an opposition procedure generally increases the settlement probability. Somaya (2003) uses US litigation data on suits filed between 1983 and 1993 in the computer and research medicine industry to test the influence of strategic stakes and the thread of a mutual hold-up on the settlement of patent litigation suits. Using a model incorporating the selection of disputes into litigation he finds evidence that the size of the strategic stakes of the patentee and defendant negatively affects the settlement probability. Allison, Lemley and Walker (2010) use Stanford IP Litigation data in order to test whether repeat patent plaintiffs are more likely to settle patent disputes. Assuming that these are risk averse, they find that they are settling more of their cases and take only the very best to trial to avoid getting their patents invalidated. Weatherall and Jensen (2005) collected data on the entire population of judgments at Australian courts for the period 1997-2003. They find an extremely small number of patent cases terminating by court judgment and thereby confirm that a large share of patent cases is settled before a final court ruling.

This paper builds on the above mentioned contributions, but extends the analysis by stressing both, factors changing the pre-trial setting and factors affecting the firm's general willingness to consider deviating from the litigation strategy.

The remainder of this paper is organized as follows. Section 2 gives on overview on the theoretical background relevant for this paper, linking the literature on the decision between litigation and pre-trial settlement to considerations on drivers of within-trial settlement, and discussing firm-specific characteristics and strategies

in the litigation process. Section 3 contains the empirical setup, starting with the construction of the database and the descriptive statistics and followed by the estimation setup and results in section 4. We conduct several robustness checks in section 5. Section 6 summarizes the results and concludes.

## 2. Theoretical considerations on litigation and settlement

### *2.1. The decision between litigation and settlement*

Going to court and bringing an action against an alleged infringer is the final step in a chain of actions when claiming and enforcing ones patent. When reaching this stage several selection mechanisms have already taken effect such that cases going to trial do not represent a random sample of all infringement cases. First of all the potential infringement must take place, next the potential infringement needs be detected by the patent owner in order to be considered for trial and once the potential infringement has been identified the owner can choose between trying to enforce its rights and ignoring the infringement. Once having decided on taking action, there are still two options, settlement and litigation. Differentiating between these two options is crucial, as litigation data only contains information on those cases actually going to trial - thus ignoring cases where pre-trial negotiations have succeeded and an agreement has been reached.

Much of the literature on litigation considers the existence of a dispute as given and then concentrates on the decision to settle the dispute or proceed to trial. In the theoretical literature on the economic analysis of legal disputes the two options settlement and trial are considered as the cooperative and non-cooperative solution of a bargaining game between plaintiff and defendant that is driven by various asymmetries in information settings and/ or stakes involved.(Cooter and Rubinfeld 1989). In the absence of asymmetries the cooperative solution is always superior to trial as settlement does not involve any litigation costs. The party with higher expected payoffs from litigation could then be compensated by the other party in the settlement agreement such that none of the parties would be worse off when going to trial.
The literature usually distinguishes between two types of possible asymmetries - asymmetric expectations and asymmetric information - and refers to the models by Priest and Klein (1984) and Bebchuk (1984). Priest and Klein (1984) model the decision to litigate or to settle as a rational choice based on both parties expectations of the outcome of the trial. Even if both parties possess the same information

about their stakes and the court's decision standard they may evaluate the value of the dispute differently and thus form different win probabilities leading to different expected payoff values of trial. Depending on how far the parties' expected values of the dispute differ they will either agree to settle (if difference is small) or litigate (if difference is large). The closer the true value of the dispute to the court's decision standard (and thus the more uncertain the case) the more likely the two parties estimation of the value of the case will differ - which then leads to litigation. Litigation takes place if the plaintiff's minimum settlement demand (being his expected trial payoff) exceeds the defendant's maximum settlement offer (being her expected trial payoff).

Bebchuk (1984) studies the settlement decision in a model with asymmetric information. While one of the two parties has private information about its probability of prevailing in trial, the other party only knows the distribution of win probabilities. The uninformed party now makes a take-it-or-leave-it settlement offer based on his incomplete information. As the settlement offer is only based on the distribution of win probabilities the other party may reject the offer if her actual win probability differs greatly from the estimated one used in the calculations such that the expected payoffs from litigation are larger than the settlement amount. Depending on the stakes and litigation costs of the two parties, the threshold values for settlement and litigation vary. Waldfogel (1998) summarizes the main difference between the divergent expectations (DE) and asymmetric information (AI) models as which party decides upon the selection of cases going to trial. In the DE models both parties have an incorrect estimate of the case quality and cases proceed to trial if the plaintiffs estimated win probability is by chance higher than the estimate of the defendant. Thus both contribute to the selection of cases for litigation. In AI models to the contrary the decision making is one-sided as the informed party is the one to decide whether to proceed to trial or to settle.

While these two models treat litigation in general there are some models that particularly focus on asymmetries in patent disputes: A third type of asymmetries - asymmetric stakes - is mentioned by Lanjouw and Lerner (1998) and modeled by Meurer (1989). It can be summarized to one party having more to gain than the other one has to loose. The bargaining surplus in that case would not suffice to compensate both parties and settlement negotiations would break down (Somaya 2003, p.19). Somaya (2003) generalizes asymmetric stakes as "the result of difficulties in crafting and enforcing negotiated settlement contracts, which stem from the unique advantages conferred by the litigated patent"( Somaya 2003, p. 19). Meurer (1989) develops a model of patent litigation between a patentee and a potential infringer. The parties have the choice between litigation and settlement that consists of a licensing agreement. Licensing is used as a means of avoiding litigation about the validity of the patent. The likelihood of litigation versus li-

censing in this model depends on the probability of patent invalidity, information asymmetries, antitrust policy, and the rules of litigation-cost allocation. Meurer introduces asymmetries in stakes such that monopoly profits can exceed the overall settlement profit to be shared by both parties. These differences in stakes can lead to litigation even when information is symmetric and generally settlement would be preferred to litigation.

### *2.2. The mitigation of asymmetries and the decision between within-court settlement and adjudication*

Given that the pre-trial and within-trial setting are the same in terms of stakes, expectations and information, within-trial settlement is irrational as the conditions under which a settlement deal would be made are the same, but extra court costs would have to be added to the settlement amount. Under these conditions within-trial settlement will only be rational if going to court as such is considered a value by one of the two firms e.g. as signal to the public or possible other infringers. If this is not the case and within-trial settlement does happen, it must be driven by changes in stakes, information or expectations that make parties to deviate from their original litigation strategy. The within-trial settlement decision must thus be driven by factors that change the initial setting. During trial there are different possibilities how changes in informational asymmetries affect the involved stakes and expectations such that settlement becomes an option after all. Based on these possibilities, hypotheses on the drivers of within-trial settlement can be derived.

After the plaintiff has filed the case the court decides upon the jurisdictional value of the dispute which reflects an estimation of the value at stake by the judges. Formally it is the base for the calculation of court cost to be beared by the loosing party at the end of trial. This jurisdictional value can be regarded as new information about the stakes and it should lead to a recalculation of the values involved in the dispute. The larger this value, the more likely parties will prefer a settlement to trial.

***Hypothesis 1 a):*** *The settlement probability increases with changes in stakes revealed during the court proceedings induced by the setting of a high jurisdictional value by the court.*

If a nullity procedure is filed during trial, most likely as a measure of defense by the defendant, the stakes for both plaintiff and defendant change as a nullity procedure may lead to the elimination of a patent leaving both parties without any

extra profits to exploit from the patent. The threat of losing her patent changes the patentees' expectations, making a settlement deal, from which she can obtain a reasonable settlement amount, more attractive.

***Hypothesis 1 b):*** *The settlement probability increases with changes in stakes revealed during the court proceedings through the filing of a nullity suit.*

During the court proceeding different actions are possible that change the informational setting of the case. If the judges do not feel capable of assessing the technical details of the case they can request an expert opinion of an external expert. By doing so the dissemination of new information is likely and information asymmetries can be reduced for everyone involved. The same is true if the court orders the questioning of a witness. Note that even though the burden of proof is generally on the parties, other than in regular civil suits, the judge can actively request evidence in form of expert opinions and witnesses in order to deepen his own (technical) understanding of the circumstances. The probability of settlement should thus rise if informational asymmetries between plaintiff and defendant are reduced.

***Hypothesis 2:*** *The settlement probability increases with new information obtained during the court proceedings which reduces information asymmetries between both parties. This is reflected in the use of an external expert and the questioning of a witness by order of the court.*

### *2.3. The role of firm specific stakes and strategies*

From the theoretical considerations we expect parties not to be willing to settle when entering into litigation in the first place, but the decision to nevertheless do so to be driven by changes in information and stakes arising during trial. While hypothesis 1 and 2 cover those changes observable from court records it is likely that other changes are not recorded in the court files. We expect firms to have a different baseline willingness to settle that comes into play when reacting to new information revealed in trial. Some firms may in general be more or less willing to settle due to either their relative certainty regarding the outcome of the case or due to firm specific characteristics, strategies and competitive settings. Given the large amount of information available, our database allows to control for such differences that may account for some of the variation in case outcomes not explained by observable changes in the case setting.

Regarding firm specific characteristics there are several factors that might affect a firm's baseline willingness to settle during trial. First of all the plaintiffs and defendants relationship to the patent and the resulting stakes at trial need to be controlled for. The plaintiff can be either the patentee himself, the exclusive licensee or one of several simple licensees. While usually only the patentee or unique licensee are allowed to file suit, other licensees can ask the patent holder for permission to sue as well if they feel sufficiently affected by the infringement. We expect patentees and unique licensees to be less likely to settle compared to normal licensees. While normal licensees may be satisfied with a settlement deal that ensures their business, patentees or unique licensees have a larger interest in securing their monopoly right.
The defendant in an infringement case is usually a producer or trader, or both. Given that producers have most likely based their production facility on the disputed technology they will be less likely to settle than traders that can relatively easy switch to selling different products. The higher the general stakes for the plaintiff and defendant, the less likely they will deviate from their litigation strategy. We therefore expect the settlement likelihood to decrease if a patentee or a unique licensee sues instead of a simple licensee and if the defendant is a producer rather than a trader.
If one party is very optimistic regarding the outcome of the case finding an acceptable settlement deal for both becomes more difficult as they will request a higher settlement amount when their win probability is high. This confidence in the outcome of the case may be reflected in the voluntary provision of evidence by plaintiff or defendant. The provision of documents or making available a product for inspection is voluntary as in German patent litigation the burden of proof is on the plaintiff and defendant.

***Hypothesis 3:*** *The settlement probability decreases if one of the parties voluntarily choses to present evidence.*

Interviews with IP lawyers suggest another factor which possibly affects the decision to settle patent litigation. In Germany and the US there are opportunities for the plaintiffs to chose the forum for litigation. A plaintiff seeking a robust and stable judgment on the case will thus chose a court with a high reputation that will deliver a stable judgment. As it is common knowledge among experienced lawyers in the field of patent litigation that in Germany the District Court in Düsseldorf is regarded as a pro-patent court with a high reputation of fast and well-recognized judgments the choice to go to Düsseldorf rather than to Munich or Mannheim is expected to be correlated with a lower settlement probability.

***Hypothesis 4:*** *The settlement probability is lower if the plaintiff chooses Düssel-*

*dorf as forum.*

## 3. Data and Variables

Our dataset covers about 80% of all patent litigation cases dealt with in Germany between 2000 and 2008. These cases comprise all patent litigation cases handled at the district courts in Mannheim, Munich, and Düsseldorf that are widely recognized as the most experienced courts in Germany.[1] As there is no centralized register of patent cases, the data has been collected by going into the archives of German district courts and manually copying each court record into our database. Basing the court data collection on a comprehensive template we collected data on the proceedings of the suit, the parties, and the patent at issue. We gathered information on the characteristics of the plaintiff and defendant, the date and duration of trial, the subject of the dispute, the claims of the plaintiffs, the evidence presented and the relationship of the parties to the patent involved in the case.
Our dataset contains 3786 court cases for which we were able to retrieve the patent numbers of the patents involved. These cases cover 2988 patents. We conduct our analysis in this paper at the case level, which treats each case as one observation. When multiple patents are involved in the case we only include patent information of the patent that receives the highest number of forward citations into our analysis as we suppose this patent to be of major interest. After dropping those cases dealing with preliminary injunctions only and those in which the defendant is the patent owner, 2517 observations remain which constitute our sample for the analysis in this paper.[2]
The patent number allows to add patent information to our database, using data from the German Patent Office (DPMA) and the European Patent Office (EPO) as reported in PATSTAT. Patent information includes information on application dates, international patent classifications (IPC), the number of countries the patent has been applied for as well as forward references. For a subsample of our cases we were able to match firm information from the firm databases Amadeus and Mannheim Enterprise Panel for both plaintiffs and defendants. We added firm size as measured by employees and the NACE revision 2 industry code.

[1] The remaining 20% are cases spread over the nine remaining district courts responsible for patent litigation. As these courts are of minor importance and reputation, we chose to abstain from collecting data at those courts for cost reasons.
[2] Cases with the defendant being the patent owner are not classical infringement suits, but counter suits asking for a declaration of non-infringement.

### *3.1. Variables*

*Dependent variable*

The dependent variable takes one for settlement and zero otherwise. Cases that settled within or out of court after trial has started as well as dropped cases are defined as settlement. Dropped and withdrawn cases are included because interviews with IP lawyers have revealed that parties often drop the case, but do not notify the court of a private settlement. As a robustness check we repeat the analysis with a more strict definition of settlement that only considers those cases as settled that actually report a settlement. The results are not affected by this choice.

*Main Explanatory variables*

Changing information and stakes are represented by several variables: **external expert** takes the value one when the judges order the expertise of an external expert, **witness** takes the value one when judges chose to hear a witness, **value at stake** fixed by the judges during suit, and the filing of a **nullity suit** during trial.[3]

Firm-specific stakes and strategies are measured by the following variables: **Plaintiff patentee or exclusive licensee** indicates that the plaintiff is the patentee or an exclusive licensee, compared to the other option being a simple licensee. **Defendant producer** indicates that the defendant is a producer, compared to the other option being a trader. **Evidence document** takes the value one when parties chose to provide a document to support their case and exhibit evidence on the infringing activities. **Evidence inspection** takes the value one when parties voluntarily brought an object for inspection to prove their case. Three court variables **Mannheim, Munich** and **Düsseldorf court** stand for the district courts at which the trial took place.

*Control variables*

In order to make sure we do not omit important factors that might drive the settlement decision during trial we include a set of control variables, covering information on trial, parties and the involved patent. As trial information we include the **age of the patent at trial** measured as difference between application data and trial date, the **number of previous trials involving the patent as observed in the period 2000-2008**, and **the number of patents involved in**

[3] The variable takes the value one when the court record reveals that a nullity suit has been filed during trial. Note that these numbers may not be exhaustive. We are currently working on obtaining data on all nullity suits at the German Patent Court in order to double check the information from the court records. Therefore we cannot include the decision of the Federal Patent Court on the merits of the annulment.

**the case**. The variable **missing value at stake** indicates that for that particular case no value at stake has been named. The reason for this is most likely that these cases deal with claims not aimed at damage payments, but rather other claims such as the disclosure of information about potential infringing activities. We expect a missing value at stake to be correlated with a higher settlement likelihood as it indicates that the stakes the parties have in this particular trial are rather low compared to those cases dealing with damage awards. Regarding the involved parties we control for the **relative EPO patent stock of plaintiff and defendant** calculated with a depreciation rate of 15%, **the number of plaintiffs firms** and **the number of defendant firms** as well as 4 dummies indicating **individuals suing individuals, individuals suing firms, firms suing individuals** and **firms suing firms**. The **number of previous trials involving plaintiff and defendant** is included as a measure of their experience in court. We further include variables for **Germans vs. Germans** cases, those cases involving only **non Germans vs. non Germans** and those involving **Germans vs. non Germans**. For the subsample of cases for which we were able to match both plaintiffs and defendants to the Amadeus database we control for the **number of employees of plaintiff and defendant** as measured in 1000 employees and the **relative size of the plaintiff** compared to the defendant as measured by number of employees of the plaintiff divided by the number of employees of the defendant. The variable **same industry** indicates whether plaintiff and defendant are active in the same industry as measured by a 21 industry classification derived from NACE revision 2 codes that can be found in the appendix.

We expect that the within-trial settlement probability is not related to the direct value of the patent as information on patent value is already available prior to trial. Since all publicly available information about the patent and the involved products are known and used for the decision to settle prior to filing a litigation suit, we expect the likelihood of litigation as such to positively depend on the value correlates of the patent, but not the decision to settle once having entered trial.[4] We nevertheless include established patent value measures into the estimation. The **application type** can be an application at the German Patent Office (**DPMA**), an international application filed at the DPMA (**DPMA -PCT**), an application at the European Patent Office (**EPO**), or an international application filed at the EPO (**EPO -PCT**). The **forward citations** of the litigated patent are calculated by summing up all non-self citations to the patent received[5]. If a patent receives citations from subsequent patents it can be seen as an indicator of

[4] Lanjouw and Schankerman (2004).

[5] We do not constrain the citations to the date of litigation as we use this measure for both the litigated patents and a control group of non litigated patents used in the robustness checks.

the patent's contribution to the existing stock of knowledge. Several studies have shown that the monetary value of a patent can to some extent explained by its forward citations (Trajtenberg 1990, Lanjouw and Schankerman 2001)). Following Graham and Harhoff (2006) we measure the citing patents at the patent family level, such that two patents sharing the exact same set of priority documents are counted as one patent family.[6] The **share of self-forward citations** is calculated by summing up all self citations to the patent received and calculating the share of self-citations in all forward citations. This measure indicates the patents' importance for further research of a patentee and thus how much he builds on his own inventions.[7] The **family size** denotes the number of countries for which the patent has been applied for. The **patent breadth** denotes the number of unique 3-digit IPC-classes covered by the patent. The more unique classes covered the broader the possible application of the patent. In order to capture differencec across technology classes we include the ISI-classification of the IPC-classes that results in six general **technology areas**. One patent can appear in several technology areas.

### *3.2. Descriptive Statistics*

We start by comparing the settled and non-settled court cases in table 2. The overall settlement rate is 62.3 percent. With respect to factors expected to change the pre-trail setting of the case we find the jurisdictional value of the case set by the judges to be significantly higher for settled cases and the filing of a nullity suit during trial to coincide with a significantly higher settlement rate. With respect to evidence requested by the judges to improve their knowledge of the case we find settled cases other than expected to exhibit a lower share of cases using a witness (at the 10% significance level) and we observe no difference with respect the the use of an external expert. Regarding firm specific stakes and strategies we see that settled cases exhibit a significantly lower share of plaintiffs with high stakes as measured by a dummy taking the value if the plaintiff is a patentee or an exclusive licensee. The same can be observed for defendants. Settled cases exhibit a significantly lower share of defendants classified as producers. These results indicate support for the hypothesis that parties with higher stakes are less willing to settle compared to lower stakes parties. Looking at the firms confidence in winning a court case as measured by voluntary providing evidence in form of an object or a document we find support for the hypothesis that high confidence coincides with a lower settlement rate. In 21.8 percent of the cases that do not settle during trial parties make use of a document as evidence, compared to only 7.1 percent of the

[6] This correction is done using the table "docdb family" in PATSTAT.
[7] We use the "docstd name" of the patentee to identify self-citations.

cases that settle. In 9.5 percent of the adjudicated cases the parties make use of an object inspection as evidence, compared to only 2.4 percent of the settled cases. Regarding the choice of forum by the plaintiff we find significant differences in the settlement rate across courts as displayed in table 1. The lowest settlement rate can be found in Düsseldorf with 59.8 percent of all cases settling, followed by Mannheim with a settlement rate of 66.5 percent and Munich with a rate of 70.1 percent. The control variables indicate that settled cases involve more claims, more patents per case and patents that are litigated significantly more often than non-settled cases. With respect to the involved firms we find that the share of frequent litigators is significantly higher for settled than non-settled cases and that cases involving foreign firm on one or both sides settle more often. In the rare event of individuals suing each other the settlement rate is significantly lower than in cases involving one or more firms. We further find the relative patent stock of the plaintiff to the defendant to be significantly higher for settled than non- settled cases. The patent value indicators family size, patent breadth and number of forward citations are significantly higher for the settled cases, raising the question whether more valuable patents settle more often.

Table 1: Settlement rate across courts

| **Court** | **Observations** | **Settlement rate** |
|---|---|---|
| Düsseldorf | 1661 | 59.84% |
| Mannheim | 719 | 66.48% |
| Munich | 137 | 70.07% |

Table 2: Descriptives

| | No Settlement (N=949) | | Settlement (N=1568) | | |
|---|---|---|---|---|---|
| | **Mean** | **Std. Dev.** | **Mean** | **Std. Dev** | **ttest** |
| **Trial Characteristics** | | | | | |
| Nr. claims trial | 3.69 | 1.17 | 3.78 | 1.21 | * |
| Nr. trials involving patent | 7.38 | 29.18 | 12.92 | 39.97 | *** |
| Nr. patents in trial | 1.13 | 0.47 | 1.22 | 0.83 | *** |
| ln(value at stake) | 10.67 | 4.86 | 11.70 | 4.07 | *** |
| Missing value at stake | 16.12% | 36.79% | 9.31% | 29.07% | *** |
| Nullity suit | 33.83% | 47.34% | 37.37% | 48.39% | * |
| Evidence: Witness | 4.00% | 19.62% | 2.42% | 15.38% | ** |
| Evidence: External Expert | 5.69% | 23.18% | 5.87% | 23.51% | |
| Evidence: document | 21.81% | 41.32% | 7.14% | 25.76% | *** |
| Evidence: Inspection | 9.48% | 29.31% | 2.36% | 15.18% | *** |
| **Firm Characteristics** | | | | | |
| Plaintiff patentee (baseline: simple licensee) | 97.68% | 15.06% | 95.54% | 20.66% | *** |
| Defendant producer (baseline: trader) | 54.79% | 49.80% | 43.88% | 49.64% | *** |
| Only German parties involved | 51.00% | 50.02% | 40.18% | 49.04% | *** |
| German and Foreign parties involved | 39.41% | 48.89% | 45.85% | 49.84% | *** |
| Only Foreign parties involved | 9.59% | 29.46% | 13.97% | 34.68% | *** |
| Nr. of previous trials of plaintiff | 12.97 | 40.65 | 22.11 | 54.08 | *** |
| Nr. of previous trials of defendant | 1.47 | 4.91 | 3.09 | 8.83 | *** |
| Firm vs. firm | 84.93% | 35.79% | 87.05% | 33.58% | |
| Firm vs. Individual | 5.06% | 21.93% | 4.85% | 21.48% | |
| Individual vs. Firm | 7.69% | 26.66% | 6.89% | 25.33% | |
| Individual vs. Individual | 2.32% | 15.06% | 1.21% | 10.94% | ** |
| Nr. plaintiffs | 0.95 | 0.38 | 0.98 | 0.49 | ** |
| Nr. defendants | 1.17 | 0.65 | 1.26 | 0.82 | *** |
| Patent stock plaintiff/defendant | 1.49 | 25.06 | 15.57 | 246.70 | ** |
| **Patent Characteristics** | | | | | |
| Family size | 10.22 | 15.87 | 12.92 | 19.14 | *** |
| Patent breadth | 1.83 | 1.19 | 2.01 | 1.33 | *** |
| Forward citations | 6.27 | 13.44 | 8.40 | 16.50 | *** |
| Share self-forward citations | 7.87% | 23.36% | 7.94% | 23.04% | |
| DPMA | 30.87% | 46.22% | 27.87% | 44.85% | |
| DPMA-PCT | 0.74% | 8.56% | 0.32% | 5.64% | |
| EPO | 51.00% | 50.02% | 53.51% | 49.89% | |
| EPO-PCT | 17.39% | 37.92% | 18.30% | 38.68% | |
| ElectricalEng | 38.15% | 48.60% | 47.32% | 49.94% | *** |
| Instruments | 25.08% | 43.37% | 26.34% | 44.06% | |
| Chemistry | 9.06% | 28.72% | 12.31% | 32.86% | *** |
| ProcessEng | 24.24% | 42.87% | 19.58% | 39.69% | *** |
| MechanicalEng | 24.55% | 43.06% | 17.73% | 38.20% | *** |
| Consumption | 14.44% | 35.16% | 11.67% | 32.12% | ** |
| Age of patent at trial | 11.21 | 4.84 | 11.64 | 5.16 | ** |

## 4. Econometric Analysis

We estimate the likelihood of within trial settlement using a probit model that distinguishes between settlement and adjudication of a litigation case. As the decisions to litigate a patent and to settle litigation may be affected by unobserved heterogeneity reflected in the correlation of the error terms of the latent litigation decision and the latent settlement decision both decisions might be correlated. Using a probit model with sample selection we try to take into account this unobserved heterogeneity and correct the estimation procedure. Using patent value indicators for explaining a likely selection we did not find that the selection into litigation and the selection into settlement are significantly correlated. This result justifies the use of a simple probit model and reflects both theoretical considerations and empirical evidence stating that general measures of patent value are already taken into account when choosing to not settle but to go to court. Therefore patent value indicators no longer matter for the within-trial settlement decision. The results of the selection model can be found in the robustness checks.

### *4.1. Full sample*

Table 4 displays the results of the probit estimation of settlement as average marginal effects. We have controlled for trial years, but do not display them in the regression output due to limited space. We start by considering the first column. The first block of variables shows the effect of trial characteristics on the settlement likelihood, the second block focuses on party characteristics and the third block contains patent value measures.
Starting with the first set of hypotheses, focusing on how within-trial changes in stakes and information affect the settlement likelihood, we find the following: A one percent increase in the value at stake set by the judges leads to a 2.8 percentage point increase of the settlement likelihood. This result provides evidence for hypothesis 1, stating that new information about stakes coming up during trial reduces uncertainty and leads to a reevaluation of the case by the involved parties. The same argument holds for the filing of a nullity suit during trial which increases the settlement likelihood by 5.6 percentage points. The change in stakes coming up during trial leads the parties to recalculate their litigation payoff and to come to the conclusion that settlement might be the better option. On the contrary we see that cases with a missing value at stake, indicating that these cases feature generally low stakes for plaintiffs and defendants, settle significantly more often than cases with a value at stake reported. This provides support for our conjec-

ture that parties with generally low stakes are more likely to deviate from their litigation strategy and agree upon a settlement deal.
The disclosure of new information invoked by the ordering of an external expert by the judges significantly increases the settlement likelihood by ten percentage points. The use of a witness does not have a significant effect. These results provide support for hypothesis 2 regarding the effect of new information coming up during trial on the likelihood of settlement. The reduction in information asymmetry induced by the expert leads the two parties' levels of information to converge and thus makes settlement more attractive.
Turning to the second set of hypotheses, dealing with firm-specific stakes and strategies that influence the general willingness to settle or not, we find the following: For cases involving plaintiffs being the patent owner or the exclusive licensee settlement is 12.4 percentage points less likely than in cases involving simple licensees. Parties with higher stakes are less willing to deviate from their original litigation strategy. The same holds for defendants: If the defendant is a producer rather than a trader the settlement likelihood reduces by 6.7 percentage points. This is consistent with our conjecture that stakes for producers are higher than for traders as their production facility is adopted to a particular product line that would have to be changed in case of a loss in trial. We further find that evidence voluntarily presented by plaintiff or defendant in form of a document or an object presented for inspection decreases the likelihood of settlement by 37 and 15 percentage points. Interpreting voluntarily providing evidence as signal of the confidence of the parties we conclude that, if confidence is high, compensation via settlement becomes more difficult and consequently cases are more likely to result in a final judgment. This result provides evidence in favour of hypothesis 3. With respect to the choice of forum we find that cases heard in Düsseldorf are 31 percentage points less likely to settle than cases heard at the remaining 2 district courts. As the choice of court is made by the plaintiff we interpret this as support for hypothesis 5 stating that the plaintiffs determination to obtain a judgment on the case makes settlement significantly less likely. Plaintiffs chosing the Düsseldorf courts are less willing to deviate from their litigation strategy.
The control variables reveal the expected results. An increase in the number of claims in trial reduces the settlement likelihood which can be attributed to increased complexity of the case. Cases involving at least one foreign party settle more likely than cases involving only German parties, which can be explained by foreigners wanting to escape the complicated German jurisdiction. The number of previous trials involving the defendant slightly increases the settlement probability. We find most common patent value indicators not to affect the settlement likelihood. Cases involving patents originally filed at the DPMA however settle more likely than cases originally filed at the EPO. We further find cases involv-

ing instruments and mechanical engineering components to settle less likely and chemistry patents to settle more likely than cases not located in these particular technology areas.

So far we have applied a rather broad definition of settlement, defining all cases as settlements that are not adjudicated. This definition also includes cases dropped unilaterally by the plaintiff as well as cases dropped in agreement of the parties. Given that interviews with specialized IP lawyers have revealed that parties often drop the cases without notifying the court about a settlement deal, we can justify this assumption. Nevertheless we conduct a robustness check that excludes the dropped cases from our analysis and only keeps explicitly stated settled and adjudicated cases. This reduces the full sample to 2077 cases. The results can be found in the second column of the regression output. The results are stable and vary only little in magnitude. This makes us confident that our definition of settlement is correct.

Table 3: Probit full sample

| | Settle | | Settle strict | |
|---|---|---|---|---|
| | Marg. effect | Std. Err. | Marg. effect | Std. Err. |
| **Trial characteristics** | | | | |
| Düsseldorf court (baseline: Munich) | −0.309*** | (−6.66) | −0.276*** | (−5.05) |
| Mannheim court (baseline: Munich) | −0.044 | (−0.96) | −0.004 | (−0.08) |
| Nr. of claims in trial | −0.023*** | (−2.69) | −0.019* | (−1.96) |
| Nr. of previous trials involving patent | 0.000 | (0.20) | 0.000 | (0.37) |
| Nr. of patents in trial | 0.040** | (2.49) | 0.045*** | (2.59) |
| ln(Value at stake) | 0.028*** | (3.37) | 0.029*** | (3.21) |
| Missing value at stake | 0.301*** | (2.76) | 0.327*** | (2.65) |
| Nullity suit | 0.056*** | (2.87) | 0.046** | (2.10) |
| Evidence: Witness | 0.061 | (1.09) | 0.061 | (0.94) |
| Evidence: External expert | 0.101** | (2.50) | 0.092** | (2.03) |
| Evidence: Document | −0.368*** | (−10.46) | −0.372*** | (−9.33) |
| Evidence: Inspection | −0.150*** | (−2.93) | −0.200*** | (−3.26) |
| **Firm characteristics** | | | | |
| Plaintiff patentee (baseline: simple licensee) | −0.124** | (−2.35) | −0.142** | (−2.42) |
| Defendant producer (baseline: trader) | −0.067*** | (−3.42) | −0.046** | (−2.04) |
| German and Foreign parties involved (baseline: only Germans) | 0.065*** | (2.93) | 0.067*** | (2.73) |
| Only Foreign parties involved (baseline: only Germans) | 0.083** | (2.46) | 0.085** | (2.25) |
| Nr. of previous trials of plaintiff | 0.000 | (0.27) | −0.000 | (−0.19) |
| Nr. of previous trials of defendant | 0.004** | (2.33) | 0.006*** | (2.87) |
| Firm vs. firm | 0.063 | (0.76) | 0.026 | (0.27) |
| Firm vs. individual | 0.070 | (0.78) | 0.023 | (0.22) |
| Individual vs. firm | 0.089 | (1.12) | 0.042 | (0.45) |
| Nr. of plaintiff firms | 0.018 | (0.54) | 0.037 | (1.02) |
| Nr. of defendant firms | 0.034** | (2.13) | 0.039** | (2.26) |
| Relative patent stock plaintiff/defendant | 0.000 | (0.82) | 0.000 | (0.91) |
| **Patent characteristics** | | | | |
| Family size | −0.000 | (−0.37) | −0.000 | (−0.25) |
| Patent breadth | 0.013 | (0.85) | 0.015 | (0.85) |
| Forward citations | −0.000 | (−0.18) | 0.001 | (0.45) |
| Share self forward citations | 0.019 | (0.48) | 0.025 | (0.58) |
| DPMA-PCT (baseline: DPMA) | −0.226* | (−1.74) | −0.260* | (−1.67) |
| EPO (baseline: DPMA) | −0.070*** | (−2.85) | −0.036 | (−1.28) |
| EPO-PCT (baseline: DPMA) | −0.055* | (−1.78) | −0.036 | (−1.04) |
| ElectricalEng | 0.004 | (0.13) | −0.010 | (−0.28) |
| Instruments | −0.066** | (−2.08) | −0.078** | (−2.14) |
| Chemistry | 0.070* | (1.89) | 0.075* | (1.81) |
| ProcessEng | −0.046 | (−1.48) | −0.060* | (−1.72) |
| MechanicalEng | −0.082*** | (−2.59) | −0.076** | (−2.15) |
| Consumption | −0.043 | (−1.27) | −0.045 | (−1.17) |
| Age of patent at trial | −0.004** | (−2.06) | −0.005** | (−2.12) |
| Observations | 2517 | | 2077 | |

Significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

### *4.2. Robustness Check: Firm subsample*

In order to check the robustness of our main findings we control for firm size and the relationship of the parties to each other. For this purpose we have matched both plaintiffs and defendants to the firm databases Amadeus and Mannheim Enterprise Panel. This allows us to control for the size of the plaintiff and defendant, the relative size of the plaintiff compared to the defendant and for the firms being active in the same or a different industry. Controlling for firm size might matter as the firm's ability and willingness to settle is likely to depend on their size: Large firms, for example, might have more interesting settlement agreements to offer than smaller firms, such as cross-licesing deals. Industry overlap may be an indicator of the counterparties' relationship to each other. Theoretical considerations point in both directions: Some game theoretical models (Bernheim and Whinston 1990, Tirole 1994) predict that the expectation of repeated interaction increases the incentive to settle disputes in a cooperative way. Given that being active in the same industry increases the potential of repeated interaction one would expect an increase in the settlement probability. At the same time an industry overlap may indicate a higher degree of competition between the two parties as they are both active in the same industry and deal with the same technology. This could lead to a general tendency to be less willing to settle in order to hurt and discredit the other party.

The subsample of cases for which at least one plaintiff and defendant could be matched to the firm databases comprises 877 case observations. These cases feature at least one German or European firm at both the plaintiff and defendant side. This subsample is not a representative subsample of our database, as it excludes both cases involving individuals and and non-European firms. The following results are thus not directly comparable to the results of the full sample, but are intended to evaluate the robustness of our previous findings.

We observe a settlement rate of 59.75 percent. Summary statics for the settled and non-settled cases analoguosly to table 2 can be found in the appendix.

The estimation results provide support for most, but not all of our hypotheses. When controlling for size and size differences we still find a positive and significant effect of an increase in the value at stake set by the judges. We no longer find significant effects of the filing of a nullity suit. This result hints at the possibility that European firms might be better acquainted with the German judicial system and particularly the drawbacks associated with nullity suits in Germany than foreigners. We do find changes in the informational setting induced by the ordering of an expert opinion and even the questioning of a witness to significantly increase the settlement likelihood by 19.8 percentage points. With respect to firm

characteristics and strategies we find, as for the full sample, voluntarily presented evidence to negatively affect the settlement likelihood. Presenting a document reduces the settlement likelihood by 49 percentage points and bringing an object for inspection reduces the settlement likelihood by 15.4 percentage points. This robust result provides strong evidence for hypothesis 3. Furthermore the settlement likelihood is significantly reduced by 43.4 percentage points when the case has been filed in Düsseldorf compared to the other two courts, providing strong support for the hypothesis of strategic forum choice by the plaintiff in order to obtain a final judgment. This effect is much stronger for our subsample of European firms than for the entire sample which may hint at these firms being particularly aware of forum shopping possibilities. This strong effect may be an additional reason why the filing of a nullity suit does no longer have a significant effect in the settlement decision.

As effects of the control variables for firm size we find the number of employees of the plaintiff firm to positively affect the settlement likelihood, but the relative size of the plaintiff to negatively affect settlement. The larger the plaintiff the more likely he will be interested in a settlement deal as he can offer more in a settlement agreement. This effect may additionally be due to the fact that smaller plaintiffs are particularly attached to their patent while larger firms rationally consider the settlement option and might thus be more willing to deviate from their original strategy. The larger the plaintiff compared to the defendant however the less likely they will settle, which may be due to a large assymetry in stakes: If the plaintiff knows that the settlement options are limited he might prefer an adjudication and appropriate damages and will not reconsider settlement as a option. With respect to plaintiff and defendant being active in the same industry we find no significant effect on the settlement decision. We do not find support for either of the two possible effects which may be due to the fact that these consideration have already taken place in the pre-trial negotiations and now no longer matter.

Column 2 displays the result when applying the more strict definition of settlement. Again, the main results stay robust.

Table 4: Probit settlement firm database subsample

| | Settle | | Settle strict | |
|---|---|---|---|---|
| | Marg. effect | Std. Err. | Marg. effect | Std. Err. |
| **Trial characteristics** | | | | |
| Düsseldorf court (baseline: Munich) | −0.434*** | (−3.94) | −0.551*** | (−4.53) |
| Mannheim court (baseline: Munich) | −0.151 | (−1.39) | −0.213* | (−1.79) |
| Nr. of claims in trial | −0.024 | (−1.62) | −0.008 | (−0.53) |
| Nr. of previous trials involving patent | 0.002 | (1.12) | 0.004 | (1.62) |
| Nr. of patents in trial | 0.077* | (1.96) | 0.063 | (1.46) |
| ln(Value at stake) | 0.027* | (1.85) | 0.039** | (2.39) |
| Missing value at stake | 0.283 | (1.42) | 0.482** | (2.17) |
| Nullity suit | 0.049 | (1.51) | 0.030 | (0.82) |
| Evidence: Witness | 0.221** | (2.28) | 0.259** | (2.39) |
| Evidence: External expert | 0.198*** | (3.06) | 0.179*** | (2.61) |
| Evidence: Document | −0.493*** | (−8.80) | −0.519*** | (−8.12) |
| Evidence: Inspection | −0.154* | (−1.80) | −0.239** | (−2.36) |
| **Firm characteristics** | | | | |
| Plaintiff Patentee (baseline: simple licensee) | −0.116 | (−1.29) | −0.159 | (−1.64) |
| Defendant producer (baseline: trader) | −0.050 | (−1.51) | −0.038 | (−1.06) |
| German and Foreign parties involved (baseline: only Germans) | 0.098** | (2.56) | 0.101** | (2.46) |
| Only Foreign parties involved (baseline: only Germans) | 0.186* | (1.89) | 0.212** | (2.07) |
| Nr. of previous trials of plaintiff | −0.001 | (−0.79) | −0.003 | (−1.57) |
| Nr. of previous trials of defendant | −0.003 | (−0.60) | −0.001 | (−0.25) |
| Firm vs. firm | 0.176 | (1.57) | 0.223* | (1.71) |
| Firm vs. individual | 0.165 | (0.96) | 0.181 | (0.92) |
| Nr. of plaintiff firms | 0.000 | (0.01) | 0.038 | (0.73) |
| Nr. of defendant firms | 0.031 | (1.25) | 0.039 | (1.45) |
| Relative patent stock plaintiff/defendant | 0.003 | (0.80) | 0.002 | (0.79) |
| Employees defendant (in 1000) | −0.000 | (−0.04) | −0.000 | (−0.09) |
| Employees plaintiff (in 1000) | 0.002** | (2.45) | 0.003*** | (2.80) |
| Relative size plaintiff/defendant | −0.000** | (−1.98) | −0.000** | (−2.10) |
| Same industry | −0.019 | (−0.61) | 0.000 | (0.00) |
| Family size | 0.001 | (0.18) | 0.001 | (0.44) |
| Patent breadth | −0.020 | (−0.67) | −0.020 | (−0.62) |
| **Patent characteristics** | | | | |
| Forward citations | −0.002 | (−0.70) | 0.000 | (0.11) |
| Share self forward citations | −0.023 | (−0.36) | −0.041 | (−0.58) |
| DPMA-PCT (baseline: DPMA) | −0.249 | (−1.50) | −0.128 | (−0.74) |
| EPO (baseline: DPMA) | −0.095** | (−2.46) | −0.074* | (−1.76) |
| EPO-PCT (baseline: DPMA) | −0.082 | (−1.58) | −0.076 | (−1.33) |
| ElectricalEng | 0.038 | (0.74) | 0.017 | (0.30) |
| Instruments | −0.018 | (−0.35) | −0.015 | (−0.26) |
| Chemistry | 0.112* | (1.67) | 0.112 | (1.56) |
| ProcessEng | 0.018 | (0.36) | 0.010 | (0.17) |
| MechanicalEng | 0.002 | (0.04) | 0.040 | (0.71) |
| Consumption | 0.018 | (0.34) | 0.040 | (0.68) |
| Age of patent at trial | −0.005 | (−1.37) | −0.006 | (−1.64) |
| Observations | 876 | | 737 | |

Significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

### *4.3. Robustness Check: Controlling for Selection into Litigation*

As another robustness check we estimate a probit model with sample selection for estimating the determinants of within-trial settlement in order to control for the fact that the cases going to trial are not a random sample of all patents in force.[8] This model represents the settlement decision as a two-stage decision. The first stage models the decision to take a particular patent to court while the second stage then models the decision to settle during court proceedings or to adjudicate the case. Litigation and within-trial settlement may be affected by unobserved heterogeneity reflected in the correlation of the error terms of the latent selection equation and the latent settlement equation. In that case both equations might contain some common omitted variable and the error terms would be correlated. Using a probit model with sample selection we can take into account this unobserved heterogeneity and correct the estimation procedure. In order to compare the sample of litigated patents to the overall population of non-litigated patents valid in Germany we construct a control group using case cohort sampling. We stratify the control group by application filing year and application type, distinguishing between applications at the German Patent Office and the European Patent Office and between PCT-route applications and non-PCT- applications. We make sure only granted patents are included as non-granted patents have a probability of zero of ever being litigated in an infringement case. Our sampling method guarantees a coverage of the same time and application type structure as in the sample of litigated patents. We purposely do not draw the control group by IPC classes as has been done in the literature in order to be able to identify litigation and settlement differences by technology areas.[9] However, over sampling by a factor of ten ensures that all 4-digit IPC classes contained in the sample of litigated patents appear at least once in the control group.[10] For the analysis we used a control sample of 22451 non-litigated patents. Table 5 displays the estimation results of the probit model with sample selection. The dependent variable is settlement in the outcome equation and litigation in the selection equation.

As with the regular Heckman model we need an exclusion restriction that has a significant effect in the first stage of the regression (litigation), no significant effect in the second stage (settlement) and that is correlated with the error term of the second stage. We choose the two patent value indicators family size and

[8] This type of model is well explained e.g. in Dubin and Rivers (1989).

[9] See Lanjouw and Schankerman (2004) and Cremers (2007) for different control group approaches.

[10] The coverage of all four digit IPC classes contained in the litigation data has been verified.

patent breadth as exclusion restrictions in our selection equation as theoretical considerations suggest that the patent value as such should have an impact on the patent's likelihood of litigation, but not on the decision to settle a court case. The problem here is that settlement is conditional on litigation so that a direct test cannot be conducted. We therefore conduct a test that can serve as indicator of the appropriateness of the exclusion restrictions. We run a regular probit model for settlement and include the two exclusion restrictions. The exclusion restrictions are both jointly and separately insignificantly different from zero at the usual significance levels. We therefore use these two variables as exclusion restrictions. The results of the selection model can be found in table 6 and 7. The Wald test of independence of the selection equation and settlement equation does not reject independence at any common significance level. The use of the selection model is thus not necessary. The fact that we find no selection bias supports previous results that suggest that within trial settlement can not be explained by simple patent value indicators, but rather by factors representing the value of the patent for the very firms involved.

Table 5: Outcome equation selection model : Settlement

| | Coefficient | Std. Err. |
|---|---|---|
| **Trial characteristics** | | |
| Düsseldorf court (baseline: Munich) | −0.931*** | (−6.52) |
| Mannheim court (baseline: Munich) | −0.136 | (−0.98) |
| Nr. of claims in trial | −0.068*** | (−2.65) |
| Nr. of previous trials involving patent | 0.000 | (0.10) |
| Nr. of patents in trial | 0.120** | (2.50) |
| ln(Value at stake) | 0.083*** | (3.37) |
| Missing value at stake | 0.908*** | (2.76) |
| Nullity suit | 0.168*** | (2.85) |
| Evidence: Witness | 0.183 | (1.09) |
| Evidence: External Expert | 0.303** | (2.49) |
| Evidence: Document | −1.103*** | (−9.81) |
| Evidence: Inspection | −0.454*** | (−2.94) |
| **Firm characteristics** | | |
| Plaintiff patentee (baseline: simple licensee) | −0.380** | (−2.40) |
| Defendant producer (baseline: trader) | −0.202*** | (−3.40) |
| German and Foreign parties involved (baseline: only Germans) | 0.197*** | (2.99) |
| Only Foreign parties involved (baseline: only Germans) | 0.258** | (2.53) |
| Nr. of previous trials of plaintiff | 0.001 | (0.42) |
| Nr. of previous trials of defendant | 0.013** | (2.42) |
| Firm vs. firm | 0.183 | (0.74) |
| Firm vs. individual | 0.206 | (0.76) |
| Individual vs. firm | 0.268 | (1.12) |
| Nr. of plaintiff firms | 0.056 | (0.55) |
| Nr. of defendant firms | 0.101** | (2.12) |
| relative patent srtock plaintiff/defendant | 0.000 | (0.82) |
| **Patent characteristics** | | |
| Forward citations | 0.002 | (0.23) |
| Share self forward citations | 0.074 | (0.57) |
| DPMA-PCT (baseline: DPMA) | −0.650* | (−1.66) |
| EPO (baseline: DPMA) | −0.210*** | (−2.86) |
| EPO-PCT (baseline: DPMA) | −0.163* | (−1.74) |
| ElectricalEng | 0.069 | (0.90) |
| Instruments | −0.158** | (−2.00) |
| Chemistry | 0.239** | (2.19) |
| ProcessEng | −0.088 | (−1.15) |
| MechanicalEng | −0.201** | (−2.57) |
| Consumption | −0.075 | (−0.74) |
| Age of patent at trial | −0.012* | (−1.95) |
| Constant | 0.307 | (0.58) |
| athrho | 0.056 | (0.33) |
| Observations | 24967 | |

Significance: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Selection equation selection model: Litigation

| | Coefficient | Std. Err. |
|---|---|---|
| **Patent characteristics** | | |
| Forward citations | 0.060*** | (23.70) |
| Share self forward citations | 0.414*** | (8.32) |
| DPMA-PCT (baseline: DPMA) | −0.044 | (−0.27) |
| EP (baseline: DPMA) | −0.048* | (−1.75) |
| EP-PCT (baseline: DPMA) | −0.007 | (−0.18) |
| ElectricalEng | −0.012 | (−0.32) |
| Instruments | −0.168*** | (−4.44) |
| Chemistry | −0.590*** | (−12.97) |
| ProcessEng | −0.019 | (−0.51) |
| MechanicalEng | −0.139*** | (−3.55) |
| Consumption | 0.230*** | (5.25) |
| Family size | 0.025*** | (11.56) |
| Patent breadth | 0.101*** | (5.22) |
| Constant | −1.588*** | (−45.05) |
| Observations | 2517 | |

Significance: * p < 0.1, ** p < 0.05, *** p < 0.01

## 5. Conclusion

In this paper we conducted an analysis of patent litigation settlement after trial has been initiated, focusing on within-trial changes in information and stakes and taking into account the case-specific stakes and strategies of the plaintiff and defendant.

We were able to identify three events during trial that change the pre-trial informational basis of the involved parties and the corresponding stakes in the case. These are the emergence of new information about the stakes revealed through the setting of the jurisdictional value of the case by the judge, changes in stakes induced by the filing of a nullity suit as an act of defense of the defendant, and the availability of new information on win probabilities through the ordering of an expert opinion by the judges.

The setting of the jurisdictional value of the case by the judges generally informs parties about the judge's estimation of the importance and value of their dispute. The higher the value of the case the higher the potential costs to be paid when losing in trial, which makes settlement even more attractive. As court costs only reflect the tip of the iceberg of the direct trial costs, of which lawyer costs make up the lion's share, the relatively small influence of this effect (3 percentage points) is not surprising.

More importantly, the filing of a nullity suit is an event changing the stakes in the

case that have been assumed by plaintiff and defendant prior to trial. Suddenly, the plaintiff faces the possibility of losing his monopoly right. This severe threat induces him to reconsider settlement as an option that enables him to secure his monopoly right and share the market with the defendant instead of potentially having to share his technology with everyone else. As expected the settlement likelihood increases with the filing of a nullity suit.

Third, the sheer availablity of detailed new information through an expert's perspective on the case makes the counterparties' estimates of their chances in trial converge, thereby increasing the settlement rate by about ten percentage points. These findings stress how trial proceedings, aimed at helping the judges to deliver a reasonable judgment, can trigger settlement agreements by promoting the disclosure of information not only valuable to the judges, but also to the involved parties. This result is robust across all different specifications. Given that experts opinions seem to have a positive impact on settlement our results suggest that permanently available experts at the district courts would lead to more predictable judgments and thus to more settlement in the long run. Given that settlements are desirable from a welfare point of view the enhanced training of judges and experts should be forced and considered in creating the new European patent court.

In addition to analyzing trial-specific actions that trigger settlement we are also able to shed light on firm's general willingness to consider settlement during trial. Given the availability of data on the relation of the plaintiffs and defendants to the patent and indicators of their strategies in the case, we find parties with high stakes, high confidence and the determination to obtain a stable judgment to be less likely to deviate from their litigation strategy than less determined parties with a lower interest in a clear judgment. Higher stakes of plaintiff and defendant, measured by the plaintiff being patentee or exclusive licensee and the defendant being a producer rather than trader, lead the parties to stick to their adjdication strategy. A high confidence as measured by the voluntary provision of evidence in court makes parties settle less likely as compensation in a settlement agreement becomes more difficult with one party being quite certain about their prevailing in trial: They will demad a high settlement amount that the other party might not be willing to pay. Finally the choice of Düsseldorf as forum for litigation significatly reduces the settlement likelihood. Given that this court is widely recognized as delivering very stable and reiable judgments parties wanting to obtain such a judgment will choose this forum. This type of plaintiffs, that might for example need to obtain a judgment to clarify their competitive standing, will not easily deviate from their strategy to obtain a judgment.

These results confirm conjectures that it is not simple patent value measures, but rather the firm's particular interest in a setting that can explain why parties do or do not settle after all. Further research should therefore try to gather even more

information about the constellation of plaintiffs and defendants in litigation cases. Regarding the robustness of our results we find that the results remain stable when adopting a more strict definition of settlement that disregards dropped cases. This indicates that the definition of settlement applied and supported by patent lawyers is correct.

When considering firm size and size differences between plaintiff and defendant (which can be done only for German and European firms) most, but not all of or hypotheses still receive support. We no longer find a significant effect of the filing of a nullity suit on the settlement likelihood. One possible reason for this may be that European and German firms are more familiar with the nullity procedures in Germany and know that a patent is declared invalid in only a very small share of cases. This might make this thread less effective. We also no longer find a significant effect of the variables trying to capture the stakes of plaintiff and defendant. Plaintiff patentees and defendants being producers are no longer significantly less likely to settle than other firms. This may be because other factors are more important for European firms such that this effect perishes. We find that particularly the forum choice by the plaintiff matters a lot more for this firm subsample: While the choice of the Düsseldorf court increases the settlement likelihood by 31 percentage points in the full sample the effect is 43 percentage points in the subsample of European firms. All other relevant effects remain stable across all specifications and samples.

Finally, the use of a probit model with sample selection incorporating the selection into litigation through measures of patent value is shown to not be necessary as the litigation and settlement equation are not significantly correlated.

There are of course shortcomings to this paper. Our findings that the litigation and settlement decision are not related is only true for the patent-related factors that we observed. The ideal approach would be to look at both, the litigation and settlement decision, from a firm-level constellation approach. This would require firm level data for all pairs of firms that could potentially end up in litigation with each other, which is a very difficult undertaking. A further improvement could concern including the timing of the different events during the trial proceedings, such that the updating of information and changes in stakes can be analyzed in more detail. Further projects aimed at gathering trial data on litigation suits are encouraged to go into more detail. Research on the firm level could reveal whether there exist strategies within firms which would lead to more settlement for some firms and less for others. Furthermore, analyzing the unique form of alleged infringement in certain technologies could explain different litigation strategies.

# 6. Appendix

## *6.1. Appendix A: The patent litigation system in Germany: Legal rules and procedures*

For a granted patent a first possibility to be involved in a dispute is an opposition procedure right after the grant of the patent. This procedure takes place if a third party, usually a competitor, argues that the patent should not have been granted (Article 99 EPC, Paragraph 59 PatG). Opposition procedures take place at the DPMA or EPO opposition divisions. A granted patent, coming from a German Patent application or from a Germany-designated EPO application, becomes national law. The German system separated validity and infringement proceedings. While invalidity decisions are rendered by the German Patent Court, infringement are cases are dealt with by the district courts. In Germany there are twelve District courts qualified for dealing with patent infringement cases. The legal procedures are set in the Code for Civil Procedures (ZPO). Other than in most types of actions in patent infringement cases the involved parties are relatively free to choose the venue. The plaintiff can choose between either the jurisdiction of the defendant or the court in the jurisdiction where the potential infringement has taken place. Once suspecting an infringement and having obtained some evidence the patentee can send an official warning to the infringer (caution), asking him to stop infringing the patented invention and to provide a legally binding "cease and desist" declaration. If the defendant does not react, the plaintiff may file a suit. The defendant may however file a counterclaim asking for the declaration of non-infringement in order to have his position confirmed. In order to avoid such an action for a negative declaratory judgment, the patentee can chose to send an inquiry asking the other party about the legitimacy of their actions. In some urgent cases, a preliminary injunction is applied for when the suspected infringing party is about to start selling a product involving the disputed technology and when substantial losses for the patent owner may result. There will be a defense plea and then a reply to the defense plea, which may again be followed by a rejoinder. These proceeding then lead to an oral hearing before court and may be continued as written procedures or followed by further oral hearings until the publication of the final judgment. It is the responsibility of the parties to provide evidence in favor or against the case, and the court does not conduct any investigations on its own. If the three judges decide that they are unable to assess technical questions, they will appoint a technical expert, who submits a report and is present at the oral hearings. Both parties may then comment on the expert's opinion. The appointment of an expert opinion usually delays the procedure by about 9 to 12 months. A common defense

procedure of the defendant is to file nullity procedure at the German Patent court. While in other countries nullity issues are dealt with by the same court as infringement issues, the German bifurcation system separates these issues. A nullity suit as such therefore does not directly interfere with the infringement suit. If however the district court does suspect an infringement of the patent, but at the same time suspects the patent to be judged invalid by the German Patent court, it will defer the infringement action until the nullity case has been resolved. In the majority of cases however the decision regarding nullity is rendered after the termination of the infringement proceedings. Patent infringement procedures can terminate with a judgment, a judgment by default, a within- court or out-of-court settlement or with a withdrawal of the case. The losing party is obliged to pay the attorney fees of the winning party, the court costs and any further expenses. The attorney and court fees are being calculated according to a formula based on the estimated value of the dispute. [11]

### *6.2. Appendix B: 21 industry codes derived from the 2-digit revision 2 NACE codes*

A - Agriculture, forestry and fishing
B - Mining and quarrying
C - Manufacturing
D - Electricity, gas, steam and air conditioning supply
E - Water supply, sewerage, waste managment and remediation activities
F - Construction
G - Wholesale and retail trade, repair of motor vehicles and motorcycles
H - Transporting and storage
I - Accommodation and food service activities
J - Information and communication
K - Financial and insurance activities
L - Real estate activities
M - Professional, scientific and technical activities
N - Administrative and support service activities
O - Public administration and defense; compulsory social security
P - Education
Q - Human health and social work activities
R - Arts, entertainment and recreation

[11] In an appeal case court costs increase about 15% and appeals at the Federal Supreme court are twice as high as the first instance proceedings (Bardehle Pahlenberg 2010, p. 13).

S - Other services activities

T - Activities of households as employers; undifferentiated goods - and services

U - Activities of extraterritorial organisations and bodies

### *6.3. Appendix C: Descriptives of the firm subsample*

| | No Settlement (N=353) | | Settlement (N=524) | | |
|---|---|---|---|---|---|
| | Mean | Std. Dev. | Mean | Std. Dev | ttest |
| **Trial characteristics** | | | | | |
| Nr. claims trial | 3.65 | 1.13 | 3.73 | 1.25 | |
| Nr. trials involving patent | 4.42 | 25.45 | 9.06 | 37.87 | ** |
| Nr. patents in trial | 1.10 | 0.33 | 1.23 | 0.69 | ** |
| ln(value at stake) | 10.56 | 4.92 | 11.59 | 4.13 | *** |
| Missing value at stake | 17.00% | 37.61% | 10.11% | 30.18% | *** |
| Nullity suit | 35.69% | 47.98% | 39.69% | 48.97% | *** |
| Evidence: Witness | 3.40% | 18.15% | 3.05% | 17.22% | |
| Evidence: External Expert | 4.53% | 20.83% | 8.02% | 27.18% | ** |
| Evidence: document | 26.35% | 44.11% | 7.44% | 26.27% | *** |
| Evidence: Inspection | 10.48% | 30.68% | 2.67% | 16.14% | *** |
| **Firm characteristics** | | | | | |
| Same industry | 44.19% | 49.73% | 41.03% | 49.24% | |
| Employees plaintiff | 5865.06 | 25543.43 | 11618.93 | 37947.45 | *** |
| Employees defendant | 2053.54 | 12903.42 | 2417.86 | 14701.03 | |
| Employees plaintiff/defendant | 1110.16 | 11045.29 | 1493.74 | 12733.11 | |
| Plaintiff patentee (baseline: simple licensee) | 97.17% | 16.61% | 96.37% | 18.71% | |
| Defendant producer (baseline: trader) | 60.34% | 48.99% | 53.44% | 49.93% | ** |
| Only German parties involved | 71.95% | 44.99% | 59.35% | 49.16% | *** |
| German and Foreign parties involved | 25.78% | 43.80% | 35.50% | 47.90% | *** |
| Only Foreign parties involved | 2.27% | 14.90% | 5.15% | 22.13% | ** |
| Nr. of previous trials of plaintiff | 9.36 | 33.96 | 16.95 | 51.28 | *** |
| Nr. of previous trials of defendant | 1.18 | 3.45 | 1.82 | 4.80 | ** |
| Firm vs. firm | 94.05% | 23.69% | 96.76% | 17.73% | * |
| Firm vs. Individual | 1.42% | 11.83% | 1.53% | 12.27% | |
| Individual vs. Firm | 4.25% | 20.20% | 1.72% | 13.00% | ** |
| Individual vs. Individual | 0.28% | 5.32% | 0.00% | 0.00% | |
| Nr. plaintiffs | 1.00 | 0.32 | 1.11 | 0.62 | *** |
| Nr. defendants | 1.26 | 0.62 | 1.31 | 0.70 | |
| Patent stock plaintiff/defendant | 0.49 | 2.57 | 2.58 | 27.20 | * |
| **Patent characteristics** | | | | | |
| Family size | 6.76 | 10.04 | 8.44 | 13.27 | ** |
| Patent breadth | 1.66 | 0.96 | 1.75 | 1.10 | |
| Forward citations | 4.67 | 9.79 | 5.69 | 12.03 | |
| Share self-forward citations | 8.55% | 24.35% | 7.69% | 23.66% | |
| DPMA | 38.24% | 48.67% | 38.93% | 48.81% | |
| DPMA-PCT | 1.70% | 12.94% | 0.57% | 7.55% | |
| EPO | 43.34% | 49.63% | 43.13% | 49.57% | |
| EPO-PCT | 16.71% | 37.36% | 17.37% | 37.92% | |
| ElectricalEng | 35.13% | 47.80% | 40.27% | 49.09% | |
| Instruments | 23.80% | 42.64% | 22.14% | 41.56% | |
| Chemistry | 7.65% | 26.62% | 11.07% | 31.40% | * |
| ProcessEng | 24.36% | 42.99% | 23.85% | 42.66% | |
| MechanicalEng | 29.46% | 45.65% | 25.19% | 43.45% | |
| Consumption | 15.01% | 35.77% | 13.93% | 34.66% | |
| Age of patent at trial | 10.48 | 4.92 | 10.65 | 5.36 | |

## 7. References


Allison, J. R., Lemley, M. A. & Walker, J. (2010), Patent Quality and Settlement Among Repeat Patent Litigants', Second Annual Research Roundtable on the Empirical Studies of Patent Litigation.

Bardehle & Pagenberg (2010), Patent Infringement Proceedings.
URL: http://www.bardehle.com/en/publications/detail/document/patentinfringement-proceedings.html

Bebchuk, L. A. (1984), Litigation and Settlement under Imperfect Information, RAND Journal of Economics 15(3), 404-415.

Berheim, B. D. & Whinston, M. D. (1990), Multimarket Contact and Collusive Behavior, The RAND Journal of Economics. 21(1), 1-26.

Cooter, R. D. & Rubinfeld, D. L. (1989), Economic Analysis of Legal Disputes and Their Resolution, Journal of Economic Literature 27(3), 1067-1097.

Cremers, K. (2007), Incidence, Settlement and Resolution of Patent Litigation Suits in Germany, PhD thesis, University of Mannheim. 121 p.
URL: http://madoc.bib.uni-mannheim.de/madoc/volltexte/2007/1405/

Cremers, K. (2009), Settlement during Patent Litigation Trials. An Empirical Analysis for Germany, Journal of Technology Transfer 34(2), 182-195.

Dubin, J. A. & Rivers, D. (1989), Selection Bias in Linear Regression, Logit and Probit Models, Sociological Methods and Research 18, 361-391.

Graham, S. J. H. & Harhoff, D. (2006), Can Post-Grant Reviews Improve Patent System Design? A Twin Study of US and European Patents, Discussion Papers in Economics 38, Free University of Berlin, Humboldt University of Berlin, University of Bonn, University of Mannheim, University of Munich.

Lanjouw, J. O. & Lerner, J. (1998), The Enforcement of Intellectual Property Rights: A Survey of the Empirical Literature', Annales d' Economie et de Statistique Issue 49/50, 223- 246.

Lanjouw, J. O. & Schankerman, M. (2001), Characteristics of Patent Litigation: A Window on Competition, RAND Journal of Economics 32(1), 129-151.

Lanjouw, J. O. & Schankerman, M. (2004), Protecting Intellectual Property Rights: Are Small Firms Handicapped?, Journal of Law and Economics 47(1), 45-74.

Merges, R. P. & Nelson, R. R. (1990), On the Complex Economics of Patent Scope, Columbia Law Review 90(839).

Meurer, M. J. (1989), The Settlement of Patent Litigation, RAND Journal of Economics 20(1), 77-91.

Priest, G. L. & Klein, B. (1984), The Selection of Disputes for Litigation, Journal of Legal Studies 13(1), 1/ 55.

Shapiro, C. (2001), Navigating the Patent Thicket: Cross Licenses, Patent Pools, and Standard Setting, NBER Chapters, in: Innovation Policy and the Economy, Volume 1, pages 119-150 National Bureau of Economic Research, Inc.

Shapiro, C. (2003), Antitrust Limits to Patent Settlements, RAND Journal of Economics 34(2), 391-411.

Somaya, D. (2003), Strategic Determinants of Decisions not to Settle Patent Litigation, Strategic Management Journal 24(1), 17-38.

Tirole, J. (1994), The Theory of Industrial Organization, MIT Press, Cambridge, MA.

Trajtenberg, M. (1990), A Penny for Your Quotes: Patent Citations and the Value of Innovations, RAND Journal of Economics 21(1), 172-187.

Waldfogel, J. (1998), Reconciling Asymmetric Information and Divergent Expectations Theories of Litigation, Journal of Law and Economics 41(2), 451-476.

Weatherall, K. G. & Jensen, P. H. (2005), An Empirical Investigation into Patent Enforcement in Australian Courts, Federal Law Review 32.

Ziedonis, R. H. (2004), Don' t Fence Me In: Fragmented Markets for Technology and the Patent Acquisition Strategies of Firms, Management Science 50(6), 804-820.