

Chapter 2

What to Buy when Forum Shopping – Determinants of Court Selection in Patent Litigation

2.1 Introduction

To ensure local accessibility to justice, most judicial systems are characterized by the coexistence of multiple geographically dispersed entry courts. If a dispute fulfills the requirements for territorial jurisdiction at more than one of these courts, the plaintiff gains the option to conduct *forum shopping*; that is, to freely select the court of his choice to seek judicial relief.⁸ Particularly in patent litigation, forum shopping is considered common practice, since the infringing act, e.g., the manufacture or the sale of the infringing product, usually occurs at a national if not international scale (Moore, 2001b). The fact that plaintiffs actively select particular courts is initially surprising, as all courts in a judicial system are bound to the same substantive and procedural law. The legal realism literature therefore traces court differences back to the human factor in judicial decision making (cf. Posner, 1993; Stephenson, 2009). In particular, judges are assumed to differ in their expertise and ideology, leading to divergences from the legal norm that may favor one of the litigating parties. As a notable example, Atkinson *et al.* (2009) find evidence for the U.S. that plaintiffs deviate from their local district court if an alternative court seems less inclined to invalidate patents. The resulting disparity between

⁸Black's Law Dictionary defines forum shopping as "a litigant's practice of choosing the most favorable jurisdiction or court in which a claim might be heard." This definition emphasizes the litigation context, even though the notion of forum has been expanded to institutional certifiers, sponsors, and approvers (cf. Lerner and Tirole, 2006), but otherwise remains fairly broad. With help of the taxonomy by Bassett (2006), I define the kind of forum shopping dealt with in this study as domestic, horizontal forum shopping; that is, the deliberate selection of a particular court from a range of courts at the same instance with no differences regarding the applied substantive law and choice-of-law principles.

economic and litigious activity in some U.S. districts has triggered a steady stream of empirical legal literature that tries to link observable information on courts, such as average duration or win, settlement, and appeal rates, to their respective caseloads (see, e.g., McKelvie, 2007; Lemley, 2010; Lemley *et al.*, 2013; Lii, 2013). However, by relying on aggregated court level data, these studies disregard dispute-specific factors and their possible interactions with court characteristics, and fall short of fully explaining the popularity of particular venues among plaintiffs.

This study provides an initial analysis of the specific determinants of plaintiffs' court selection in patent litigation. Building upon the asymmetric information (*AI*) model of litigation and settlement by Bebchuk (1984), I depict court selection as an optimization problem for the plaintiff and derive predictions about his preferences. Even though theoretical economists are highly active in modeling disputes⁹, the proceeding before court is mostly seen as failure in bargaining and denoted by an exogenous cost constant. Expanding the basic *AI* model, I implement court- and dispute-specific factors of the proceeding, such as opportunity costs due to delay in judgment and spatial distance, and analyze how these affect the plaintiff's expected utility of going to a particular court.

I test the propositions on the plaintiff's preferences using a comprehensive dataset on patent litigation in Germany. Providing fast and relatively cheap patent enforcement, German regional courts hear by far the largest share of patent litigation cases in Europe (Cremers *et al.*, 2013; Graham and van Zeebroeck, 2014).¹⁰ The data cover all proceedings filed at three of the twelve available regional courts – namely, the regional courts in Düsseldorf (*DU*), Mannheim (*MA*), and Munich (*MU*) – between 2003 and 2008. These three courts account for approximately 80 to 90% of all patent infringement proceedings in Germany. Besides procedural details, the data also contain information on the identity of the litigants and the litigated patent at hand. In contrast to prior studies, I refrain from using aggregated case outcomes as indications of court heterogeneity, because a meaningful comparison of win, appeal, and settlement rates among courts is bound to the assumption of a random distribution of cases. This assumption can hardly be aligned with the premise of forum shopping, where the population of each court is conditional on the plaintiffs' self-selection. I therefore infer the main differences at each court exogenously from local procedural practices and the appointed judges. I derive the plaintiff's ex ante expected length of proceeding from each court by accounting for probabilities of two delaying events that may or may not occur during the proceeding. In particular, I predict the

⁹For surveys on the theoretical literature, see Spier (2007) and Daughety and Reinganum (2012).

¹⁰The German patent litigation system has gained global attention, particularly in the context of the ongoing *smartphone war* (cf. O'Brien, "German Courts at Epicenter of Global Patent Battles Among Tech Rivals," *New York Times*, 9 April 2012, 83).

alternative-specific likelihood of a requested expert opinion or a stay of the infringement proceeding due to a parallel validity challenge. This allows me to estimate the opportunity costs the plaintiff faces before legal enforcement of his patent. In addition, I capture the spatial distance between litigant and court as a further factor determining court selection. To recover estimates of the plaintiffs' preferences for the three courts, I use alternative-specific conditional logit models. While my focus is on the effect of variations in opportunity and transaction costs on the plaintiffs' preferences, I do not exclude court-specific differences in judicial decision making *prima facie*. The estimation models allow for court-specific biases that affect the expected utility of judgments.

In line with statements by practitioners (cf. Herr and Grunwald, 2011), I find court-specific likelihoods of delaying events. First, judges differ in their tendency to request an expert opinion depending on the patent's technology. The findings suggest that judges are specialized and have gained expertise in particular technologies from exposure to prior patent cases. I also identify differences in the judges' tendency to stay the proceeding due to a parallel validity challenge. Judges at the Düsseldorf regional court are significantly less likely to grant a stay than judges in Mannheim and Munich. Although ordinary proceedings take the longest at the Düsseldorf regional court due to its huge caseload, the low likelihood of delays often gives it the lowest expected length of proceeding.

The results of the alternative-specific conditional logit models support the theoretical predictions on the determinants of court selection. Opportunity costs due to delay in judgment have a significant negative effect on the plaintiff's court selection. This is particularly true if plaintiff and defendant are active in the same product market. Further, plaintiffs value local access to court. Transaction costs measured by distance to court have a significant negative effect on court selection. The magnitude of this effect is almost twice as large for small plaintiffs compared to large plaintiffs. I also find weak evidence that plaintiffs reach a general anti-patentee bias at the Munich regional court relative to the regional courts in Düsseldorf and Mannheim.

Even though forum shopping is considered a legitimate action authorized by law and repeatedly acknowledged by judges, scholars disagree on its welfare effects. Proponents link the welfare effect of forum shopping to the invisible hand argument. The plaintiff's free choice among multiple courts leads to efficiency gains in the market for litigation. That is, courts, facing institutional competition, have an incentive to invest in specialization, accrue experience and induce procedural innovations to attract fitting patent disputes, whereas plaintiffs are able to avoid congested dockets and courts lacking expertise in the patent's underlying technology (Moore, 2001b). Opponents of forum shopping, however, argue that forum shopping leads

to systematic partiality in judicial decision making if one side in litigation, i.e., the plaintiff, dominates the decision on court selection. Legal scholars recently coined the term *forum selling* as the supply-side equivalent to forum shopping, referring to a court's leaning to decide pro-plaintiff to attract more cases (Klerman and Reilly, 2014).

Alternative designs for judicial systems that obstruct court competition mainly rely on either centralization, i.e., a single court hears all cases, or randomization, i.e., allocation of cases to courts is out of litigants' hands. These alternatives, however, likely disadvantage small litigants, who according to the results highly value local accessibility to court. This latter factor may be of particular importance for the discussion about the design of the Unified Patent Court (UPC), where the tradeoff between centralization versus local accessibility has been an abiding theme (Wadlow, 2015).

The study is structured as follows: Section 2.2 presents a model of the plaintiff's maximization problem, which provides predictions on the determinants of court selection. Section 2.3 describes the institutional framework of patent litigation in Germany. Section 2.4 provides details on the dataset and the construction of the variables. Section 2.5 contains the descriptive statistics. Section 2.6 then presents an econometric analysis of the determinants of court selection. Section 2.7 contains the conclusion.

2.2 A Model of Forum Choice

In this section I develop a model, built upon the litigation and settlement model by Bebchuk (1984), to depict court choice as an optimization problem for the plaintiff. Most theoretical analyses in the current literature on litigation and settlement are based on the premise of asymmetric information between plaintiff and defendant (Daughety and Reinganum, 2012). Bebchuk (1984) assumes one-sided asymmetric information between the litigants; that is, only the defendant knows the likelihood of being found liable by the court during the prejudgment bargaining phase.

I extend the basic model by introducing additional sources of court-specific costs of going to court, namely opportunity costs due to delay in judgment and the distance to court, affecting the plaintiff's expected utility of litigation. As a further feature of court heterogeneity, I assume the probability distribution of being found liable to differ among courts. From the comparative statics I then derive several predictions about the preferences of the plaintiff.

2.2.1 The Model

The expected utility of legal enforcement

Patent enforcement is a costly endeavor. I distinguish between three kinds of costs that arise through a patent infringement proceeding: opportunity costs, legal costs, and distance to court.

Opportunity costs: Opportunity costs emerge from the time required until the plaintiff is able to legally enforce his patent.¹¹ Every patent litigation dispute has a litigation value L that quantifies the economic scale of the infringement. This litigation value is determined by the value of the patent, the remaining patent protection period and the scope of infringement (cf. Section 2.3.2). I model L as the discounted value of all monopolistic rents the patent holder could hypothetically gain in the respective product market between the start of the dispute and the patent's expiration, T , if there was no infringement:

$$L(M, T, \delta) = \int_0^T M(1 - \delta)^t dt$$

with M representing monopoly rents, discounted by the technology-specific factor δ ($\delta \in [0, 1]$).

The patented technology may be commercialized in multiple product markets.¹² If the plaintiff is active in a different product market, L will not reflect his actual means of appropriation in the infringer's product market. If the plaintiff is active in the product market of the infringing embodiment, he appropriates the patent through commercialization, which provides him with rent M . Alternatively, the plaintiff can license the patent to a firm active in that product market and receive rent B . I reasonably assume that $M > B$. I denote the product market proximity of the plaintiff to the infringer with the factor α ($\alpha \in [0, 1]$). At the extreme end of $\alpha = 1$, plaintiff and defendant are direct competitors in the same product market. In contrast, when $\alpha = 0$, the plaintiff is either active in a completely different product market or represents a non-producing entity (NPE).¹³ Accordingly, the plaintiff's actual value from the patent in the infringer's market can be depicted as:

$$V(M, B, T, \delta) = \int_0^T (\alpha M + (1 - \alpha)B)(1 - \delta)^t dt.$$

¹¹Opportunity costs in patent enforcement through legal means have gained little prior attention. Notable exceptions are Lanjouw and Lerner (2001) and Aoki and Hu (2003).

¹²For instance, the patented technology of a new aircraft braking system may also find application in the automobile industry.

¹³While I disregard the effect of third party competition, my reasoning follows in general the idea of 'rent effect' and 'dissipation effect' in the patent holder's decision to license out his patent (cf. Arora and Fosfuri, 2003). In particular, Gambardella and Giarratana (2013) show that licensing is more likely if the technology supports general purpose and the licensee is active in a different product market.

I assume the defendant continues her allegedly infringing action during the course of the patent litigation proceeding. Thus, in the time between filing the infringement action¹⁴ and judgment, l , the plaintiff receives no rents at all. However, if the court considers the defendant liable for infringing the patent, the plaintiff can enforce his patent and enjoy rent $(\alpha M + (1 - \alpha)B)$ from then on. In addition, the plaintiff can demand compensation for the economic loss caused by the infringement. As will be outlined in Section 2.3.2, German courts grant damages that typically correspond to a calculatory license fee only, equal to B . The value of legally enforcing the patent W can then be expressed as:

$$W = \int_0^l (B)(1 - \delta)^t dt + \int_l^T (\alpha M + (1 - \alpha)B)(1 - \delta)^t dt. \quad (2.2.1)$$

Due to infringement and the inevitable delay in legal enforcement, the plaintiff therefore faces an irrecoverable loss of

$$\begin{aligned} C_o &= V - W \\ &= \int_0^l (\alpha(M - B))(1 - \delta)^t dt, \end{aligned} \quad (2.2.2)$$

which I call the opportunity costs of patent enforcement through judgment. Following directly from above equation, opportunity costs increase with the length l of proceeding, the product market proximity between the litigants α , and the premium $M - B$.¹⁵

Legal costs: In Germany, legal costs, including the fees directly charged by the court and the litigants' legal fees, must be borne by the losing party. The court fees charged by the court are a function of the litigation value L ; hence, these costs do not differ among courts.

Transaction costs: I further assume there are costs due to the proceeding that each litigant has to bear on their own, independent of the outcome of the proceeding. These costs may include, for instance, the costs of occupied human capital and the inconvenience of traveling to the court. I denote these as transaction costs C_{tp} for the plaintiff and C_{td} for the infringer. I assume these costs are a function of the spatial distance between the litigant and the selected court, R , as well as the size of the litigant, s . For $i = \{p, d\}$, I assume $\frac{\partial C_{ti}(R,s)}{\partial R} > 0$ and $\frac{\partial C_{ti}(R,s)}{\partial R^2} < 0$, as well as $\frac{\partial C_{ti}(R,s)}{\partial s} < 0$ and $\frac{\partial C_{ti}(R,s)}{\partial s^2} > 0$.

With the likelihood π of a judgment that allows the plaintiff to gain W from enforcing the

¹⁴For the sake of simplicity, I assume the plaintiff goes to court immediately after the infringement starts. I neglect the possibility of delayed discovery of the infringing act or lengthy pre-trial bargaining.

¹⁵There is little prior literature on the difference in patent rents between producing and non-producing firms, with the exception of Choi and Gerlach (2013).

patent, I express the plaintiff's expected utility from a judgment as

$$U_{\text{Judgment}} = \pi W - (1 - \pi) C_c - C_{tp}. \quad (2.2.3)$$

However, the plaintiff does not know the defendant's liability π , only its distribution. I denote the density function of the liability distribution with $f(\cdot)$ and the cumulative function with $F(\cdot)$. In line with Bebchuk (1984), I assume $f(\cdot)$ is positive within the interval (a, b) , $0 < a < b < 1$, and zero outside the interval. The function is continuous and differentiable throughout. I ignore cases in which the expected utility of judgment is negative, so the threat of filing an infringement action is always credible:

$$\pi W - (1 - \pi) C_c - C_{tp} > 0.$$

The option of settlement

Despite going to court, litigants frequently settle their patent dispute without a judgment. The litigation model by Bebchuk (1984) explicitly includes the option of settlement as an outcome of the bargaining process between the litigants. The bargaining process is depicted as a screening model in which the uninformed litigant, in my case the plaintiff, proposes a take-it-or-leave-it settlement offer S which the informed defendant has the option to either accept or reject. The defendant agrees to pay the settlement offer S if and only if it is not larger than her expected utility from a judgment that forces her to pay damages and an ongoing fee equal to the plaintiff's rents to pursue her activities,

$$S \leq \pi (W + C_c) + C_{td}, \quad (2.2.4)$$

or, put differently:

$$\pi \geq \frac{S - C_{td}}{W + C_c}, \quad \text{with} \quad q(S) = \frac{S - C_{td}}{W + C_c} \quad \text{as the borderline case.}$$

The probability of the defendant accepting the settlement offer is therefore $1 - F[q(S)]$.

If the defendant is of a type lower than $q(S)$, the likelihood of her being held liable for infringement by the court is so small that she prefers to end the patent dispute through judgment. So, given the cases where she prefers to accept the settlement offer S , the conditional probability of the defendant being liable before court is $\frac{\int_a^{q(S)} x f(x) dx}{F[q(S)]}$.

The plaintiff's objective function of the patent dispute, which can either end in a settlement

with the value S or a judgment with the expected utility of U_{Judgment} , therefore equals

$$U(S) = \underbrace{(1 - F[q(S)]) S}_{\text{Expected utility of settlement}} + \underbrace{F[q(S)] \left(-(C_{tp} + C_c) + (W + C_c) \frac{\int_a^{q(S)} x f(x) dx}{F[q(S)]} \right)}_{\text{Expected utility of judgment conditional on no settlement}}. \quad (2.2.5)$$

The plaintiff maximizes his utility of the patent dispute by choosing the optimal settlement offer, S^* . Following from the first order condition, the optimal settlement amount S^* must fulfill the equality:

$$1 - F[q(S^*)] = \frac{C_{td} + C_{tp} + C_c}{W + C_c} f[q(S^*)]. \quad (2.2.6)$$

Accordingly, the settlement offer S^* is optimal if the marginal benefit due to the increase in S equals the marginal costs due to an increase in the likelihood of the need for a costly judgment. The second order condition is then:

$$f[q(S^*)] + \frac{C_{td} + C_{tp} + C_c}{W + C_c} f'[q(S^*)] > 0. \quad (2.2.7)$$

As the settlement offer S determines the settlement likelihood, or settlement rate, r , I denote the settlement rate corresponding to the optimal settlement offer S^* as

$$r^* = 1 - F[q(S^*)]. \quad (2.2.8)$$

2.2.2 Comparative Statics

Aside from the settlement offer S , I have assumed every parameter of the plaintiff's objective function above to be exogenously given. I now propose that opportunity costs and spatial distance are court-specific, and hence the plaintiff selects the court that maximizes his utility. In addition to their direct effect on the expected value of a judgment, these court-specific cost variables can also affect the settlement rate and optimal settlement offer. Determining the net effect on the utility of the dispute is therefore less straightforward. The majority of my propositions follow reasoning by Bebchuk (1984).

I first assume heterogeneity among courts emerges due to different lengths of proceeding l . This causes the opportunity costs C_o to become court-specific if the activities of the litigants are not in perfectly different markets, i.e., $\alpha > 0$.

Proposition 1 *A decrease in opportunity costs, i.e., a higher W , always increases the plaintiff's expected utility of the dispute.*

This follows from equation (2.2.3), where I can see that the value of enforcement W increases with a decrease in opportunity costs C_o . The effect of the value of enforcement on the plaintiff's expected utility from the patent dispute is threefold. Following from equations (2.2.4) and (2.2.7), the expected utility of a judgment and the optimal settlement offer S^* increase with W . In contrast, the settlement rate r^* decreases with W as the borderline case $q(S^*)$ increases.

The plaintiff's own transaction costs C_{tp} become court-specific if the plaintiff's distance to one court is different from his distance to another.

Proposition 2 *A decrease in his own transaction costs C_{tp} always increases the plaintiff's expected utility of the dispute.*

This can be shown via the line of arguments used in Proposition 1. The expected utility of a judgment and the settlement S^* is affected negatively, but the settlement rate is affected positively. Thus, the overall effect is the same as from opportunity costs C_o .

Likewise, the defendant's transaction costs C_{td} may be court-specific if the defendant's distance to one court is different from her distance to another.

Proposition 3 *A decrease in the infringer's transaction costs C_{td} has an ambiguous effect on the plaintiff's expected utility of the dispute.*

The expected utility of a judgment remains unaffected by an increase in the defendant's transaction costs C_{td} (equation (2.2.2)), whereas the optimal settlement rate increases with C_{td} (equations (2.2.6) and (2.2.8)). The effect on the optimal settlement amount, however, is ambiguous. The infringer's transaction costs directly increase the optimal settlement amount S^* , but are also part of the function $q(S^*)$, which negatively affects the optimal settlement offer. Without a more specified liability distribution $F[\cdot]$, I cannot determine which effect is largest.

I finally assume that, along with costs, the liability distribution of π is also court-specific. I consider the defendant's liability to be dependent on the selected court. If, for instance, a court has a pro-patentee bias, the liability distribution undergoes an upward shift.

Proposition 4 *An increase in the defendant's liability π increases the plaintiff's expected utility of the dispute.*

This obviously increases the plaintiff's expected utility of a judgment (equation (2.2.4)) and the optimal settlement offer. Leaving the settlement rate constant, the upward shift un-

ambiguously increases the plaintiff's expected utility of the dispute.

The results of the comparative statics are summarized in Table 2.1. As Proposition 3 is insufficient to provide clear predictions for the plaintiff's preferences, I will focus on Propositions 1, 2, and 4 in the empirical analysis.

Table 2.1: Comparative statics of model of forum choice

Parameter	Endogenous Variable			Overall effect on expected utility
	Expected utility of judgment	Optimal settlement amount	Likelihood of settlement	
Opportunity costs of plaintiff	—	—	+	—
Transaction costs of plaintiff	—	—	+	—
Transaction costs of defendant	0	?	+	?
Liability of defendant	+	+	0	+

2.3 Patent Litigation in Germany

2.3.1 Court Structure

Germany's court structure follows a continental style civil law system with a federal structure, which differentiates courts by both specialism and territory (Cabrillo and Fitzpatrick, 2008). Courts of general jurisdiction (*ordentliche Gerichte*) have authority over all civil disputes, including patent litigation, and constitute a four-tier hierarchy. The channel for patent litigation cases starts with the action filed at second-tier regional courts (*Landgerichte – LG*).¹⁶ The number of regional courts with subject matter jurisdiction to hear patent litigation cases has been consolidated by the federal states, and currently stands at twelve (cf. Figure 2.4 in the Appendix).¹⁷ To access any of these twelve regional courts, the plaintiff has to fulfill territorial jurisdiction requirements. The plaintiff can file his action at the jurisdiction of either the defendant's main place of business, residence, or the place of infringement. If the infringing act comprises a Germany-wide offer of the infringing embodiment¹⁸, the plaintiff gains the op-

¹⁶Decisions by the regional courts can be appealed before their respective higher regional court (*Oberlandesgericht – OLG*; in Berlin: *Kammergericht*), and may be brought before the Patent Division of the Federal Court of Justice (*Bundesgerichtshof – BGH*) for a further appeal, limited to matters of law only.

¹⁷These are the regional courts in Berlin, Braunschweig, Düsseldorf, Erfurt, Frankfurt, Hamburg, Leipzig, Magdeburg, Mannheim, Munich, Nuremberg-Furth, and Saarbrücken. As the majority of these regional courts rarely see patent litigation cases, further consolidation has been proposed (Stauder, 1989). Interestingly, for competence reasons the former German Democratic Republic had all patent cases heard by a single court in Leipzig (Keukenschrijver, 1999).

¹⁸This includes, for instance, advertising on the internet or in national publications.

tion to file his action at any of the twelve regional courts. In reality, the plaintiff is usually unrestricted in his choice.¹⁹

Each of the regional courts has at least one chamber primarily designated to patent litigation cases.²⁰ A case is heard by a panel of three judges: one presiding and two sitting judges, all fully trained legal professionals. The plaintiff's claims must ground on a German patent (*DE*) or a European patent granted with effect for Germany (*EP*). The decision on infringement is enforceable throughout Germany.

2.3.2 The Infringement Proceeding

In contrast to patent litigation proceedings in other systems, proceedings on infringement before German regional courts are streamlined and have a clear, almost rigid outline that allows little divergence from the ordinary structure.²¹ Judges usually refrain from stepped actions and instead initiate separate, adjacent proceedings for additional claims (cf. Figure 2.5 in the Appendix). In the following, I will focus on the heart of a patent dispute – the infringement main proceeding.

Structure of the main proceeding

The infringement's main proceeding is initiated by the plaintiff through filing the infringement action, in which he states his claims and estimates the litigation value (cf. Figure 2.6 in the Appendix). Several forms of legal relief are available to the plaintiff. He may claim for an order to cease and desist from further infringement, for recall and destruction of the infringing goods, for information and rendering of account to identify distribution channels and calculate damages, for compensation of damages, as well as for notification of judgment (Kühnen, 2012, pp. 266 et seqq.). Subject to the court's practice, the litigants meet in a so-called early oral hearing, where deadlines for the further exchange of statements and the date for the main oral hearing are scheduled. Alternatively, the court gives notice in written form. Subsequently, the alleged infringer states her defense. In contrast to other systems, the alleged infringer cannot challenge the patent's validity in the infringement proceeding (cf. Cremers *et al.*, 2014).

¹⁹Unlike in the U.S., the defendant has no legal means to demand a transfer if the current court's requirements for territorial jurisdiction are met. Furthermore, the prior request for a declaratory judgment by the alleged infringer does not restrict the patent holder from subsequently filing his action at another suitable regional court. Rather, the request for declaratory judgment will be terminated and become part of the proceeding initiated by the patent holder.

²⁰If the regional court has more than one chamber designated to hearing patent cases, the internal assignment of the filed action follows a transparent system specified in the court's case assignment plan. However, this system is unpredictable *ex ante* for the plaintiff.

²¹See Harguth and Carlson (2011) or Kühnen (2012) for an elaborate description of the German patent infringement proceeding.

Prior to the main oral hearing, each party exchanges between one and two written statements specifying their own reasoning and countering the opposing party's arguments. The main oral hearing takes place roughly between six to twelve months after the action was filed, primarily depending on the court's docket. The judges give written notice to the litigants about their judgment usually four to eight weeks after the main oral hearing, concluding the proceeding in the first instance.

Infringement proceedings mainly diverge from the structure described above, if the judges decide, during or after the main oral hearing, to either stay the proceeding due to a parallel invalidity proceeding or demand further evidence in the form of an expert opinion. Both events will considerably delay the judgment on infringement.

Expert opinion

Construing patent claims and analyzing the composition of the allegedly infringing embodiment requires a sophisticated understanding of the respective technology from the presiding judge (Kühnen, 2012, p. 562). Judges experienced in dealing with patent infringement cases can answer technical questions independently if they have the necessary expertise. However, if the facts are technically complex and the judges lack the technical expertise to decide on infringement, they must request an expert opinion. The decision to request an expert opinion is at the judges' discretion; however, judges are advised to rely on experts if their own expertise is insufficient.²² The litigants have very limited influence on the request for an expert opinion. The call for an expert by the judge can be neither ordered nor challenged by the litigants. The experts appointed to state their opinion for the assessment of technical questions in written form are usually professors or patent attorneys with a significant expertise in the respective field of technology. The request for an expert opinion usually delays a decision on infringement by up to two years (Kühnen, 2012, p. 562).

Stay of proceeding

The alleged infringer may request to stay the infringement proceeding until a decision concerning a parallel patent validity challenge becomes available. The effect of a validity decision on the outcome of an infringement proceeding can be significant. If the validity challenge is entirely successful, the patent will be declared *ex tunc* invalid and any pending infringement proceeding will be discontinued. If the patent is partly revoked, the subject matter in the infringement proceeding will be considered based on the amended patent. A parallel invalid-

²²In fact, it may constitute grounds for an appeal to the Federal Court of Justice if a judge clearly overestimates his understanding of certain aspects of the case (Kühnen, 2012, p. 566).

ity proceeding can arise due to an opposition filed before the European Patent Office for *EP* patents, or before the German Trade Mark and Patent Office for *DE* patents. After the opposition phase, invalidity proceedings for both kinds of patents are initiated through a revocation action filed before the German Federal Patent Court.

The delay to a judgment due to a stayed proceeding can be considerable. The German Federal Patent Court decides on validity in sixteen to twenty-four months. Including appeal, litigants have to expect a maximal length of up to five years until a final judgment on validity is given (Cremers *et al.*, 2014). Likewise, oppositions may take between three to four years.

Damages

The plaintiff may demand compensation for economic loss due to the infringement. The question of the level of damages is usually not part of the main proceeding, but answered in a separate, subsequent proceeding. Three methods of calculating damages are available: based on the plaintiff's lost profits, on the infringer's gained profits, or per license analogy. The plaintiff is free to choose the method, independent of his status or market activities (Kühnen, 2012, p. 527). The calculation method based on the plaintiff's lost profits is rarely applied in proceedings on the amount of damages. This is mainly due to the plaintiff's requirement to disclose his accounts in the proceeding and the challenge to provide evidence for causality between the infringement and unrealized profits. Likewise, plaintiffs consider compensation based on the infringer's profit an unpopular choice, as the infringer is able to minimize her profits through the inclusion of overhead costs. Accordingly, the license analogy calculation is the most widely used (Schramm and Kaess, 2010, p. 377; Kühnen, 2012, p. 547). Here, the amount of damages is calculated based on what the infringer would have had to pay as reasonable fees if she had entered a license agreement. Calculation based on license analogy is considered a simple, convenient method, but usually constitutes the lower limit of the plaintiff's economic loss due to infringement (Müller-Stoy and Schachl, 2011, p. 342).

In comparison with pro-patentee damages rules applied in other countries, such as the U.S. or France (cf. Love, 2009; Cotter, 2013), compensation claims remain a barely effective part of patent enforcement in Germany.

2.4 Data and Construction of Variables

2.4.1 Data

To empirically test my predictions regarding the determinants of court selection, I draw upon a dataset of patent litigation proceedings filed between 2003 and 2008 in Germany. I use several additional data sources to complement the dataset with respect to the characteristics of the litigants, the courts, and the patents in dispute.

Infringement proceeding

I collected the data on infringement proceedings directly from court records stored at the three regional courts covering the most patent litigation cases in Germany: the Düsseldorf, Mannheim, and Munich regional courts.²³ The dataset covers information on procedural aspects, the identity of the litigants and their legal representatives, and the patents at issue. In particular, I obtained information about when and how the proceedings ended; that is, by judgment, settlement, or withdrawal. If there was a judgment, I learned the outcome (win, partial win, loss) and whether an appeal was filed. I also acquired information on the litigation value set by the court and the claims made by the plaintiff, which helped me to identify noninfringement or adjacent proceedings (cf. Section 2.3.2).

Litigants

The data also include names and addresses of the litigants and their legal representatives. After matching the names of corporate litigants to firm level databases, including Bureau van Dijk's Orbis, Compustat, and THOMSON One, I complemented the data with information on the litigants' fundamentals (number of employees, total assets, and turnover) and industry activities (NACE Rev. 2 industry codes).²⁴ The data allow to distinguish between natural and legal entities, such as firms, research institutions, universities, etc. I also identified non-producing entities (NPEs) among corporate litigants in accordance with the methodology introduced in Helmers *et al.* (2014).

Patents

I unambiguously identified nearly all litigated patents, since they are referenced in the case records by their application (and publication) numbers. Using PATSTAT, I retrieved biblio-

²³For details on the collection process, see Cremers *et al.* (2013).

²⁴For firms without an entry in any firm level database, I manually added information from online sources.

graphic and procedural information on the patents, such as application and examination dates, IPC classifications, equivalents, and patent as well as nonpatent references. In addition, legal status information from PATSTAT helped me to identify post-grant oppositions against the litigated patents. In particular, I have acquired information on the filing and ruling dates and the binding outcome of the opposition. Data on revocation proceedings for the litigated patents had to be collected separately. I extracted information from judgments by the Federal Patent Court and its appeal court, the Federal Court of Justice.²⁵ I also gained information on the filing dates and withdrawals of revocation actions in both instances from the the German Patent and Trademark Office register. This allowed me to reconstruct the course of the revocation proceedings even without access to the respective court records.

Court

I complemented the dataset with further information about the three regional courts, based on the regional courts' annual case assignment plans. The case assignment plan defines the subject matter each chamber will hear and how cases are allocated if more than one chamber can hear the case. The case assignment plan also designates each chamber's presiding judge and the pool of sitting judges. I obtained biographical data on the presiding judges, i.e., age, current and prior positions, and courts of employment. This information is publicly available via the various editions of the handbook on Germany's judicial system (*Handbuch der Justiz*), which is published biennially by the German association of judges.

2.4.2 Construction of Variables

In the following, I briefly describe the variables constructed from the dataset. I distinguish between variables which capture characteristics of the patent, the court, and the dispute.

Patent characteristics

As discussed in Section 2.3.2, infringement proceedings may be subject to delay due to a stay of proceedings or the request for an expert opinion. The request for an expert opinion largely depends on the intricacy²⁶ of the litigated patent, while the grant of a stay of proceedings depends primarily on the legal quality²⁷ of the litigated patent. Earlier literature uses indicators constructed from patent information primarily as determinants of patent value. Although I am

²⁵Both courts publish all their decisions on validity since 2000 on their websites.

²⁶The technological *complexity* of a patent commonly refers to the cumulative nature of the invention (Cohen *et al.*, 2000). I therefore use the term *intricacy* to avoid confusion.

²⁷I disregard the techno-economic aspects of the patent's underlying invention and focus on the legal quality of the patent's certainty in terms of scope and enforceability (cf. Thomas, 2002; Burke and Reitzig, 2007).

aware of the potential lack of discriminatory power, I also capture two other patent characteristics: intricacy and patent (cf. Table 2.2 for an overview).

Table 2.2: Indicators for intricacy, quality and value of patents

Patent indicators	Intricacy	Quality	Value	Basic references
Bibliographical				
Backward citations (patents)			✓	Harhoff <i>et al.</i> (2003)
Backward citations (nonpatent literature)	✓		✓	Carpenter <i>et al.</i> (1981); Harhoff <i>et al.</i> (2003); Cassiman <i>et al.</i> (2008)
Forward citations		✓	✓	Trajtenberg (1990); Harhoff <i>et al.</i> (1999); Lanjouw and Lerner (2001)
No. of claims	✓		✓	Lanjouw and Schankerman (2001); Harhoff <i>et al.</i> (2003); Harhoff and Wagner (2009)
IPC count	✓		✓	Lerner (1994); Harhoff <i>et al.</i> (2003); Harhoff and Wagner (2009)
Family size		✓	✓	Lanjouw <i>et al.</i> (1998); Harhoff <i>et al.</i> (2003)
PCT filing			✓	Guellec and van Pottelsberghe de la Potterie (2000)
EP bundle patent		✓	✓	Guellec and van Pottelsberghe de la Potterie (2000)
Age of patent (since filing)	✓	✓	✓	Lanjouw <i>et al.</i> (1998); Lanjouw and Lerner (2001)
Procedural (pre-grant)				
Accelerated examination requested			✓	Harhoff and Reitzig (2004); Harhoff and Wagner (2009)
Grant lag	✓		✓	Harhoff and Wagner (2009); Régibeau and Rockett (2010)
Procedural (post-grant)				
Patent solidified through opposition proc.		✓	✓	Harhoff <i>et al.</i> (2003); Cremers <i>et al.</i> (2014)
Patent challenged through revocation proc.		✓	✓	Cremers <i>et al.</i> (2014)
Patent solidified through revocation proc.		✓	✓	Harhoff <i>et al.</i> (2003); Cremers <i>et al.</i> (2014)

Intricacy: The intricacy of a patent is primarily derived from two sources. The first is the depth and specificity of the patented technology. The second is the degree of originality and detachment of the patented technology from established technologies. Both characteristics make it hard for laypersons, such as judges, to comprehend the patent at issue and define its scope. For judges lacking the appropriate academic background, understanding the technical aspects of a patent based on science rather than established technologies is more demanding. Accordingly, I capture the intricacy of a patent via the ratio between nonpatent literature citations, which consist primarily of scientific literature (Callaert *et al.*, 2006), and total citations.

As granting of a patent requires novelty and an inventive step compared to the current state of art, technologies underlying recently granted patents are less likely to have already entered the domain of common knowledge. I therefore include the age of the patent as a further measure of intricacy. Likewise, Régibeau and Rockett (2010) argue that grant lag is largest for patents at an early stage of their innovation cycles and decreases as technologies mature. I include the grant lag normalized to the average length of examination at the respective patent office as a further measure of intricacy. Aside from technology, the intricacy of a patent may also derive from the breadth of patent scope. The breadth of a patent is commonly operationalized as the number of claims and the number of assigned IPC subclasses (Novelli, 2015). Harhoff and Reitzig (2004) argue that the number of claims reflects the scope, and thus, intricacy of a patent. Likewise, Lerner (1994) draws on the number of IPC subclasses to capture patent scope. I therefore include these two measures as well.

Quality: A patent's quality is best measured by how well it fulfills the statutory requirements of patentable subject matter, novelty, nonobviousness and disclosure. Unfortunately, I am unable to analyze these criteria to determine the likelihood of invalidity and must therefore rely on the outcomes of prior invalidity proceedings. In line with Cremers *et al.* (2014), I assume that patents that survived an opposition or revocation proceeding have solidified their validity. In fact, infringement courts base their assessment of the likelihood of validity on the outcomes of prior invalidity proceedings and rarely stay a proceeding if the prior art used in the validity challenge has been referenced in prior invalidity proceedings (Kaess, 2009; Scellato *et al.*, 2011). I also distinguish patents by application authority, since scrutiny in examining patents can differ between the EPO and DPMA. I further include forward citations and the age of the patent as measures for legal quality, because both variables capture the social diffusion of the patent (Lanjouw and Lerner, 2001) and potential validity challenges.

Value: According to Cremers *et al.* (2014), the value of a patent correlates with the likelihood of a validity challenge, but is not supposed to be part of a judge's consideration to stay the proceeding or request an expert opinion. To capture value, I rely on established indicators such as backward citations to patents (Harhoff *et al.*, 2003) and nonpatent literature, forward citations, and the number of assigned IPC subclasses (Harhoff *et al.*, 2003). The value of a patent is also reflected in the costs the patent holder is willing to bear to gain and maintain protection. The costs of a patent are determined by the number of claims, the decision to file the patent via the PCT route and apply for an *EP* bundle patent (Lanjouw *et al.*, 1998; Guellec and van Pottelsberghe de la Potterie, 2000). In line with this, the geographical (family size) and temporal (age) scope of protection serve as additional measures of patent value (Lanjouw *et al.*, 1998).

Technology area: Patent intricacy, quality and value likely differ across technology areas. I therefore map the IPC codes assigned to the patents in line with the concordance table developed by the *Fraunhofer ISI* and the *Observatoire des Sciences et des Technologies* in cooperation with the French patent office (cf. Schmoch, 2008). The IPC codes are clustered into five primary technology areas: (a) electrical engineering, (b) instruments, (c) chemistry, (d) mechanical engineering, (e) other fields.

Court characteristics

Expertise of judges: According to Ann (2009), German judges are mostly self-educated in technical matters. Moore (2001a) argues that judges gain technical expertise primarily from frequent exposure to the technology. I follow the general approach of Kesan and Ball (2011), who measure expertise by the prior caseload and seniority of a judge. Formally speaking, I define the expertise of a judge g in a certain technology x in year y of his tenure as the judge's prior exposure to that technology area since the beginning of his presidency. I operationalize this exposure as the sum of all prior patent infringement disputes I with a patent of technology x that required the judge's involvement:

$$\text{Prior exposure}_{gxy} = \log \left(\sum_{y=0}^{Y-1} \sum_{i=1}^I \text{Case}_{gixy} + 1 \right).$$

Since judges may also benefit from their general experience in patent litigation, I include the tenure of the presiding judge in years as an additional variable. I also take into account whether the judge can draw on prior infringement decisions based on the same patent.

Dispute characteristics

In his court selection problem, the plaintiff has to consider the opportunity costs he faces at each court. These costs are a function of the time the alleged infringer is able to continue her activities, the product market proximity, and the litigation value.

Expected length of proceeding: The length of proceeding ex ante expected by the plaintiff is a latent variable for several reasons. On account of this, I predict the expected length for each proceeding at all three courts (cf. Section 2.6.1 for methodological details).

Product market proximity: The plaintiff's opportunity costs also depend on the litigants' product market proximity to each other.²⁸ I use the overlap of the corporate litigants' market

²⁸In the patent literature, competition between two parties is commonly measured as the overlap of their patent portfolios or a derivative of it. I refrain from using this method, because it is not applicable to litigants with no patents on their own and captures technological rather than product market proximity.

activities captured by industry codes available from firm level databases. The constructed product market proximity variable is discretized with distinct values between 0 and 1, with 1 reflecting perfect overlap of market activities. Natural persons as well as nonpracticing entities, including research institutions, universities and patent assertion entities, are by definition not active in any product market. Therefore, their product market proximity is always 0.²⁹

Litigation value and legal costs: The litigation value as set by the court is referenced in the case files. In the few cases where the litigation value was adjusted during the proceeding, I choose the most recent one. Although the data partly include details on the exact legal costs, I determine legal costs for all cases as a function of the litigation value stated in the court records. With the help of a legal costs calculator,³⁰ I calculate the approximate costs for any litigation value of the proceedings.

Transaction costs: I operationalize transaction costs as the spatial distance between the litigant's (business) address and the court's address. In case of multiple plaintiffs or defendants, I choose the one with the shortest distance to the court. I calculate the variable by retrieving longitudinal and latitudinal data through the Google Maps API (Ozimek and Miles, 2011). For litigants from outside of Continental Europe, travel distance is not calculable. Here, I use an approximate distance based on the flight distance between the courts and each of the litigants' countries.

Control variables

Size and residence of litigants: To account for the litigant's stress due to the occupation of financial and human resources in the proceeding, I include a variable capturing the size of each litigant. The size categories follow the EU definition and rest upon the litigant's number of employees, turnover, and total assets. I assume natural persons as having one employee. Fundamentals of research institutions and universities were manually researched and added to the data. In case of multiple plaintiffs or defendants, I give the largest party priority.³¹ I take the residence of the litigants into account and distinguish between German, European and non-European litigants.

Legal representatives: While court selection is an essential part of pretrial strategy (Stieger, 2004), legal representatives likely have different information on court-specific characteristics available to them. In particular, small law firms or self-employed attorneys probably

²⁹Further details on how I derive product market proximity from the industry codes can be found in Section 2.8.3 in the Appendix.

³⁰The legal costs calculator I used in this study can be accessed online: <http://foris-prozessfinanzierung.de/Prozesskostenrechner> [accessed: 22 July 2015].

³¹As an alternative measure, I gathered the fundamentals for all parties on one side. The results did not change significantly.

lack the resources and knowledge to identify the optimal court. I include a dummy variable indicating whether the plaintiff or defendant's legal representative is considered a top law firm for patent litigation in Germany. I use the annual ranking published by the professional journal *JUVE Rechtsmarkt* in 2009.³²

Multijurisdictional litigation: The rationale for court selection in patent disputes where the litigants have encountered each other before court in multiple countries is very likely to differ. I therefore identify multijurisdictional litigation by matching patent numbers and litigants from my data with available litigation data for the UK (England and Wales), France, and the Netherlands (cf. Cremers *et al.*, 2013).

2.5 Descriptive Analysis

Sample description

The data from the Düsseldorf, Mannheim and Munich regional courts during the period 2003 to 2008 contain 4,060 proceedings. Most of these cases were filed before the Düsseldorf regional court (2,534 cases). The Mannheim regional court is next with 1,196 and followed by the Munich regional court with 330 cases. With few exceptions, these cases are all patent litigation cases in the broadest definition.

For the purpose of this study, I want to achieve a homogeneous sample of patent infringement main proceedings with complete information on all essential procedural features (cf. Table 2.3). I therefore identified and removed cases in which the subject matter suggests that the litigants were previously in a contractual relationship. This includes cases on employee invention disputes, licensing, assignment, and patent transfer disputes.³³ I also dropped infringement actions based on utility models. As my focus is on patent infringement main proceedings, I removed single preliminary injunctions and adjacent proceedings, such as cost or damages proceedings (cf. Section 2.3.2). The resulting sample consists of patent infringement main proceedings, which I merged with additional information on patent characteristics and litigants. I then identified several cases where the patent was either not yet granted or not in force at the time the infringement action was filed. Excluding those left 2,599 infringement proceedings. Eventually, I regress the court selection only on cases without a prior preliminary injunction. Considerations for forum shopping in preliminary injunction requests likely differ from those in patent infringement proceedings. Moreover, the infringing act can be halted

³²As an alternative measure, I classified top legal representatives as those law firms that represent more cases than the average law firm in the data. The two measures were highly correlated.

³³I assume that with any prior contractual relationship, the main issue is unlikely to be the patent itself.

through the granting of a preliminary injunction, to the effect that the plaintiff is relieved of most opportunity costs.

Table 2.3: Overview and definition of subsamples

Sample definition	Regional court			Total
	LG DU	LG MA	LG MU	
All proceedings				
N	2,534	1,196	330	4,060
% of subsample / full sample	65.38	26.78	7.83	100.00
– with patent infringement				
N	1,773	695	198	2,666
% of subsample / full sample	66.50	26.07	7.43	65.67
– based on patents in force				
N	1,719	692	188	2,599
% of subsample / full sample	66.14	26.63	7.23	64.01
– without prior preliminary injunction				
N	1,353	621	137	2,111
% of subsample / full sample	64.09	29.42	6.49	52.00

Notes: The unit of observation is the (infringement) proceeding. Patents in force are defined as patents that are granted, yet neither expired nor bindingly invalidated at the point of filing.

Descriptive statistics

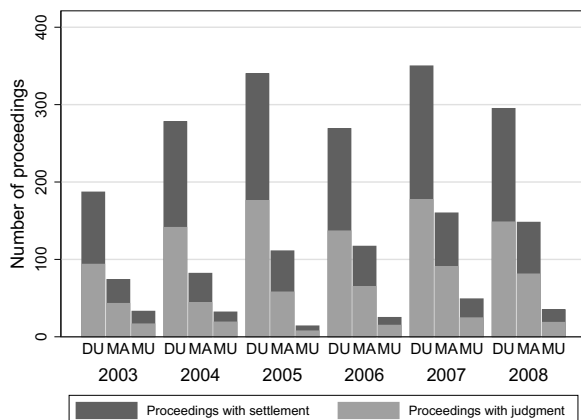
In the following I present aggregated court data. First, Figure 2.1 illustrates the distribution of proceedings filed between 2003 and 2008 across the three regional courts. Düsseldorf comfortably leads the field with Mannheim and Munich as the second and third busiest courts, respectively. Neither the distribution nor the settlement rate shows heavy fluctuation for the time frame. Notably, the caseload in Mannheim increases significantly after the establishment of the second chamber in 2005.³⁴

Comparing the outcomes of proceedings across court, Table 2.4 implies that the Düsseldorf regional court rules that patents have been infringed more often than Mannheim. Taking into account the varying settlement rates, Mannheim has the highest win-rate for patent holders.

Looking at the densities of the length of proceeding by court in Figure 2.2, I observe that the three courts significantly differ in the time needed until judgment. The length of ordinary

³⁴A causal relationship between the establishment of the second chamber in Mannheim and the drop in cases at the Düsseldorf regional court in 2006 is in line with statements made by interviewed practitioners.

Figure 2.1: Number of proceedings with judgment and settlement by court and year



Source: own data and calculation

Notes: The sample consists of all patent infringement proceedings based on patents in force. The unit of observation is the infringement proceeding. Judgments include judgments by contention and by default decree. Settlements include withdrawals as well as (out-of-court) settlements.

Table 2.4: Outcomes of infringement main proceedings by regional court

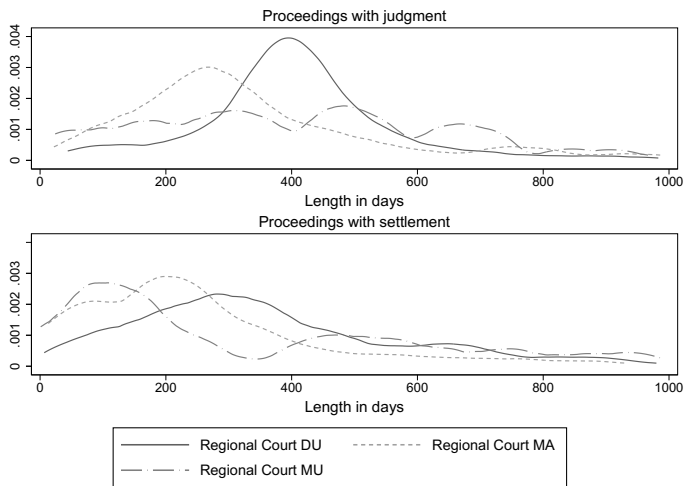
Outcome	Regional court						Total	
	LG DU		LG MA		LG MU			
	N	%	N	%	N	%	N	%
infringed	487	28.6%	142	20.6%	49	26.5%	678	26.3%
partly infringed	146	8.6%	26	3.8%	17	9.2%	189	7.3%
not infringed	273	16.0%	66	9.6%	33	17.8%	372	14.4%
settlement	795	46.7%	455	66.0%	86	46.5%	1,336	51.9%
Total	1,701	100.0%	689	100.0%	185	100.0%	2,575	100.0%

Notes: The sample consists of all patent infringement proceedings based on patents in force. The unit of observation is the infringement proceeding. 24 observations without information on outcome. Judgments include judgments by contention and by default decree. Settlements include withdrawals as well as (out-of-court) settlements. The outcome is defined from the plaintiff's perspective.

proceedings can be easily identified for the Düsseldorf and Mannheim regional courts. The high density of 400 days indicates the average length of an ordinary main proceeding with judgment in Düsseldorf. Ordinary main proceedings in Mannheim end on average after 280 days. The relatively fat tail to the right for proceedings in Mannheim, however, indicates a higher likelihood of delaying events compared to Düsseldorf. At all three courts, a considerable share of settlements occurs in the first 100 days. Despite having early oral hearings, most settlements at Düsseldorf occur later than at Mannheim and Munich. As I observe frequent

settlements after the point when ordinary proceedings usually end, I conclude that not all proceedings with a granted stay or a requested expert opinion eventually result in a judgment.³⁵

Figure 2.2: Length of infringement main proceedings with judgment and settlement by court (densities)



Source: own data and calculation

Notes: The sample consists of all patent infringement proceedings based on patents in force. The unit of observation is the infringement proceeding. Judgments include judgments by contention and by default decree. Settlements include withdrawals as well as (out-of-court) settlements. Truncated at 1,000 days.

Overall, I am not able to explain why the regional court in Düsseldorf attracts considerably more plaintiffs than the regional courts in Mannheim and Munich using court level data alone.

I now turn to a brief description of the summary statistics of the main variables in Table 2.5. Several significant differences are observable across the regional courts. Most notably, the litigation value is over twice as high in Düsseldorf on average than at the other two courts. This difference persists across all technology main areas (cf. Table 2.11 in the Appendix). I observe a parallel invalidity proceeding in about 50% of all proceedings at the Düsseldorf regional court. The rate is even higher in Mannheim, at 60%, but under 40% in Munich. Conditional on such a parallel invalidity proceeding, the rate of a granted stay is lower for Düsseldorf and Mannheim, at 18% compared to 30% in Munich. Likewise, expert opinions are requested about twice as often in Munich (20%) as in Düsseldorf (8%) or Mannheim (12%). Multijurisdictional litigation, where the litigants also face each other before court in another

³⁵I broke down the lengths of proceedings with settlements and judgments for each year and found fluctuations but no clear time trend among the courts (cf. Figure 2.7 and Figure 2.8 in the Appendix).

European jurisdiction, is a relatively rare event and shows little difference in frequency among the courts.

Table 2.5: Summary statistics grouped by regional court

	Regional court								
	LG DU			LG MA			LG MU		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Courts									
Judgment (at first instance) (d)	0.54	0	1	0.34	0	1	0.54	0	1
– plaintiff wins (d)	0.54	0	1	0.61	0	1	0.49	0	1
– plaintiff partly wins (d)	0.16	0	1	0.11	0	1	0.17	0	1
– plaintiff loses (d)	0.30	0	1	0.28	0	1	0.33	0	1
– appealed (d)	0.39	0	1	0.30	0	1	0.34	0	1
Judgment by consent/default decree (d)	0.12	0	1	0.36	0	1	0.24	0	1
Litigation value (in thousand €)	1,093.41	1	30,000	419.86	0	16,500	333.64	5	3,500
Court fees (in thousand €)	13.52	0	274	6.36	0	153	5.63	0	36
Total legal costs (in thousand €)	42.42	1	928	21.45	0	456	19.34	2	107
Length of proceeding (in months)	13.18	0	123	10.70	0	88	12.20	0	78
Parallel opposition proceeding (d)	0.17	0	1	0.12	0	1	0.09	0	1
Parallel revocation proceeding (d)	0.32	0	1	0.49	0	1	0.28	0	1
– infringement proceeding stayed (d)	0.18	0	1	0.18	0	1	0.30	0	1
Expert opinion (d)	0.08	0	1	0.12	0	1	0.20	0	1
Preliminary injunction (d)	0.21	0	1	0.10	0	1	0.27	0	1
Multijurisdictional litigation (d)	0.03	0	1	0.01	0	1	0.02	0	1
Judges									
Tenure as judge (in years)	11.80	7	16	15.68	2	25	22.05	15	30
Prior exposure to technology area	5.10	3	6	4.04	1	5	2.77	0	4
Judge 1 (LG DU) (d)	0.50	0	1	0.00	0	0	0.00	0	0
Judge 1 (LG MU) (d)	0.00	0	0	0.00	0	0	0.44	0	1
Judge 1 (LG MA) (d)	0.00	0	0	0.21	0	1	0.00	0	0
Judge 2 (LG DU) (d)	0.41	0	1	0.00	0	0	0.00	0	0
Judge 2 (LG MU) (d)	0.00	0	0	0.00	0	0	0.56	0	1
Judge 2 (LG MA) (d)	0.00	0	0	0.43	0	1	0.00	0	0
Judge 3 (LG MA) (d)	0.00	0	0	0.36	0	1	0.00	0	0
Judge 3 (LG DU) (d)	0.09	0	1	0.00	0	0	0.00	0	0
Patent holder									
Nonpracticing entity (d)	0.11	0	1	0.46	0	1	0.27	0	1
Micro (d)	0.09	0	1	0.13	0	1	0.24	0	1
Small (d)	0.10	0	1	0.08	0	1	0.11	0	1
Medium (d)	0.16	0	1	0.14	0	1	0.18	0	1
Large (d)	0.65	0	1	0.65	0	1	0.47	0	1
Germany (d)	0.47	0	1	0.40	0	1	0.62	0	1
Europe (excl. Germany) (d)	0.28	0	1	0.53	0	1	0.29	0	1
World (excl. Europe) (d)	0.25	0	1	0.07	0	1	0.09	0	1
Distance to court (in thousand km)	2.13	0	17	0.92	0	9	1.13	0	9
Top legal representative (no. of cases) (d)	0.89	0	1	0.79	0	1	0.61	0	1
Top legal representative (JUVE) (d)	0.84	0	1	0.27	0	1	0.42	0	1
Alleged infringer									
Micro (d)	0.09	0	1	0.24	0	1	0.18	0	1
Small (d)	0.15	0	1	0.17	0	1	0.27	0	1
Medium (d)	0.25	0	1	0.25	0	1	0.24	0	1

Continued on next page

Table 2.5 – continued from previous page

	LG DU			LG MA			LG MU		
Large (d)	0.51	0	1	0.33	0	1	0.31	0	1
Germany (d)	0.72	0	1	0.81	0	1	0.66	0	1
Europe (excl. Germany) (d)	0.19	0	1	0.09	0	1	0.19	0	1
World (excl. Europe) (d)	0.08	0	1	0.10	0	1	0.14	0	1
Distance to court (in thousand km)	0.94	0	17	1.12	0	15	1.65	0	12
Top legal representative (no. of cases) (d)	0.78	0	1	0.63	0	1	0.70	0	1
Top legal representative (JUVE) (d)	0.51	0	1	0.28	0	1	0.33	0	1
Product-market proximity	0.70	0	1	0.47	0	1	0.60	0	1
Patent characteristics									
No. of patents in proceeding	1.10	1	9	1.06	1	7	1.15	1	4
EP bundle patent (d)	0.81	0	1	0.79	0	1	0.75	0	1
PCT filing (d)	0.28	0	1	0.16	0	1	0.25	0	1
Forward citations (in first 5 years)	3.14	0	51	6.66	0	41	3.22	0	15
Backward citations (patents)	5.12	0	32	5.78	0	33	5.12	1	27
Backward citations (nonpatent literature)	0.88	0	41	1.94	0	21	1.03	0	21
Nonpatent literature ratio	0.11	0	1	0.18	0	1	0.10	0	1
No. of claims	14.34	1	158	16.30	1	48	14.01	1	75
IPC subclass count	2.05	1	11	4.31	1	9	2.69	1	9
Family size (INPADOC)	10.96	1	183	28.54	1	69	14.31	1	69
Year of application/priority	1993.75	1980	2005	1993.01	1983	2004	1994.61	1981	2004
Year of patent grant	1998.21	1982	2008	1997.28	1986	2007	1998.26	1985	2007
Grant lag (difference from mean in days)	99.40	-1,303	4,338	40.33	-1,162	3,972	-136.49	-1,045	2,411
Accelerated examination requested (d)	0.19	0	1	0.12	0	1	0.21	0	1
Age of patent (in years)	11.86	2	25	12.86	2	23	11.04	2	22
Prior infringement decision on patent (d)	0.10	0	1	0.07	0	1	0.12	0	1
Patent technology area									
Chemistry (d)	0.18	0	1	0.07	0	1	0.10	0	1
Electrical engineering (d)	0.25	0	1	0.49	0	1	0.24	0	1
Instruments (d)	0.12	0	1	0.08	0	1	0.07	0	1
Mechanical engineering (d)	0.30	0	1	0.21	0	1	0.30	0	1
Other (d)	0.16	0	1	0.14	0	1	0.29	0	1
Patent invalidation history									
Patent solidified (opposition proc.) (d)	0.15	0	1	0.09	0	1	0.16	0	1
Patent challenged (revocation proc.) (d)	0.08	0	1	0.34	0	1	0.16	0	1
Patent solidified (revocation proc.) (d)	0.02	0	1	0.02	0	1	0.03	0	1
N	1,719			692			188		

Notes: The sample consists of all patent infringement proceedings based on patents in force. The unit of observation is the infringement proceeding. Judgments include judgments by contention and by default decree. Settlements include withdrawals as well as (out-of-court) settlements.

While the average size of patent holders is significantly smaller at the Munich regional court compared to the other two courts, the share of large alleged infringers is greatest at the Düsseldorf regional court. Notably, the Mannheim regional court attracts by far the largest share of nonpracticing entities.³⁶ I broke down the nationalities of the litigants at each court and found strong concentrations of patent holders from certain countries at the courts (cf. Table 2.12 in the Appendix). For instance, Japanese patent holders file their action almost

³⁶Nonpracticing entities are primarily active in the field of electrical engineering technologies.

exclusively in Düsseldorf, while the majority of Italian patent holders go to Mannheim.

Patents subject to an infringement proceeding in Düsseldorf appear to be the most international with the highest share of *EP* bundle patents and PCT filings. While I found that patents in Mannheim are cited relatively more frequently in the first five years, I did not observe any significant difference in backward citations to patents. Citations to nonpatent literature are more prevalent for patents in Mannheim. Equally, the number of claims, assigned IPC subclasses, and equivalents is highest for patents in Mannheim. The average length of examination is longest for patents in Düsseldorf, even though an acceleration of the examination was requested in almost 20% of cases. In contrast, patent age shows little variance across the three courts. Examining the invalidation history of the patents, I found that patents in Mannheim have faced the least prior oppositions but by far the most prior revocation proceedings. Still, these validity challenges ended mostly in withdrawals, so an equally low share of patents can be considered solidified at each court.

The distribution of technology areas is quite remarkable. The regional court in Mannheim predominantly hears disputes on patents in the field of electrical engineering, while Düsseldorf hears the most cases on chemistry patents. I plotted the litigants with German residency on a country map to visualize the spatial distribution by court and technology main area (cf. Figures 2.9 and 2.10 in the Appendix). Although the concentration of patent holders and alleged infringers in west and southwest Germany mirrors the location of important industrial regions, neither the existence nor the proximity of industrial clusters can adequately explain the number of cases and the disproportionate representation of technology areas at the three regional courts. For instance, the Mannheim regional court sees very few cases on chemistry patents, even though the surrounding *Rhein-Neckar-Gebiet* is host to a large cluster of chemical firms.

2.6 Empirical Model and Results

2.6.1 Empirical Model

Modeling court selection

The primary goal of the econometric model of court selection is to recover estimates of the plaintiffs' preferences. To do so, I draw on an additive random-utility model. For the plaintiff of dispute i and chosen court j among J courts with $J = \{DU, MA, MU\}$, the utility U_{ij} is the sum of deterministic component V_{ij} and the unobserved random term ϵ_{ij} . I observe the outcome $y_i = j$ if $U_{ij} > U_{ik} \quad \forall \quad k \neq j$. Accordingly, I specify the alternative-specific conditional logit

model with the error terms as *iid* extreme value distributed:

$$U_{ij} = \beta X'_{ij} + \gamma_j Z'_i + \epsilon_{ij} \quad (2.6.1)$$

so that

$$p_{ij} = \Pr(y_i = j) = \frac{\exp(\beta X'_{ij} + \gamma_j Z'_i)}{\sum_{k=1}^n \exp(\beta X'_{ik} + \gamma_k Z'_i)} \quad \text{with } j = DU, MA, MU,$$

where the vector X'_{ij} represents alternative-specific regressors and vector Z'_i covers case-specific regressors. The alternative-specific regressors X'_{ij} include the opportunity costs OPC_{ij} , and the distance to court of both the plaintiff, TCP_{ij} , and the defendant, TCD_{ij} . The case-specific regressors Z'_i include year, technology and litigant (size and residence) controls as well as dummies indicating a multijurisdictional dispute and whether the plaintiff had any prior experience with the court.

The plaintiff of dispute i goes to court y_i that corresponds to the highest value function, i.e.,

$$y_i = \arg \max_{j \in \{DU, MA, MU\}} U_{ij}.$$

Using cross-sectional data with each observation representing a dispute, the main empirical specification is as follows:

$$U_{ij} = \beta_1 OPC_{ij} + \beta_2 TCP_{ij} + \beta_3 TCD_{ij} + \gamma_{1j} PRIOR_i + \gamma_{2j} STAKE_i + \\ + \gamma_{3j} TOP_i + \gamma_{4j} MULTI_i + \gamma_{5j} TECH_i + \gamma_{6j} LIT_i + \gamma_{7j} YEAR_i + \epsilon_{ij}. \quad (2.6.2)$$

Following from the theoretical model, I anticipate that $\beta_1 < 0$ and $\beta_2 < 0$; i.e., an increase in the plaintiff's opportunity and transaction costs at one court increases the probability of selecting an alternative court. If I find that $\gamma_{2j} \neq \gamma_{2k} \quad \exists \quad k \neq j$, I can infer that plaintiffs assume court-specific probabilities to win their case. For instance, if $\gamma_{2j} < \gamma_{2k}$, the plaintiffs perceive court j as less patent-friendly than court k . Thus, the higher the value at stake (*STAKE*), which is the sum of the litigation value and all legal costs, the more likely a plaintiff is to select the alternative court k , where the expected liability of infringement is higher.

I estimate the model on a sample of all infringement proceedings based on patents in force and without a prior preliminary injunction. I also regress court selection on several subsamples defined by the plaintiffs' size and product market proximity to show robustness. Since one

of the regressors, the opportunity costs OPC_{ij} , is a function of an endogenous variable, the predicted length of proceeding, I correct the standard errors through bootstrapping.³⁷

Predicting the ex ante expected length of proceeding

Prior to estimating the plaintiff's court selection, I first need to estimate his opportunity costs due to delay in judgment. I construct the alternative-specific measure for opportunity costs, OPC_{ij} , in line with the theoretical model in Section 2.2.1. For the sake of simplicity, I consider opportunity costs a direct function of the litigation value L (cf. Section 2.8.4 in the Appendix for an elaborate derivation). The opportunity costs are operationalized as

$$OPC_{ij} = \alpha_i \frac{L_i ((1 - \delta_i)^{l_{ij}} - 1)}{(1 - \delta_i)^T - 1}. \quad (2.6.3)$$

Unfortunately, the ex ante expected length of proceeding l_{ij} , which determines the amount of opportunity costs, remains unobserved in the data for multiple reasons. First, I only observe the actual length of proceeding at the selected court, not at alternative courts. Second, most proceedings end prematurely in settlement. Third, the actual length of the proceeding is chamber-specific. This length diverges from the court-specific ex ante expected length if the court has two chambers and the respective judges differ, e.g., in terms of expertise.³⁸ For all these reasons, I am left with an unclear picture of the time the plaintiff initially expects a particular court to take until judgment.

I make use of the fact that the German patent infringement main proceeding is characterized by a very structured process that offers *de facto* only two discrete events as cause for considerable delay (cf. Section 2.3.2). I construct the ex ante expected length of proceeding until judgment at each court j for each case i with the following equation:

$$\begin{aligned} \hat{l}_{ij} = & \hat{l}_j^{ord} + \Pr_{ij}(\widehat{\text{stay}} = 1 | \widehat{\text{inv. proc.}} = 1) \cdot \hat{l}^{stay} + \Pr_{ij}(\widehat{\text{expert}} = 1) \cdot \hat{l}^{expert} - \\ & - \Pr_{ij}(\widehat{\text{stay}} = 1 | \widehat{\text{inv. proc.}} = 1) \cdot \Pr_{ij}(\widehat{\text{expert}} = 1) \cdot \min(\hat{l}^{stay}, \hat{l}^{expert}). \end{aligned} \quad (2.6.4)$$

This equation makes the following simplifying assumptions: the expected length of any ordinary proceeding is the median length of all proceedings with judgment at a specific court in a given year (year indices omitted). Further, the probabilities of the two delaying events, namely stay and expert opinion, are predicted based on the results of parametric models estimating the probabilities of either event (cf. Table 2.6 for an overview). Here again, the dependent

³⁷I drew 133 random samples with replacement equal in size to the original sample.

³⁸As noted earlier, the plaintiff cannot foresee which chamber his case will be assigned to.

variables, i.e., the delaying events, are incompletely observed, because many proceedings end in settlement prior to the main oral hearing, which usually reveals how the court decides on a stay and the need for an expert opinion.

The most straightforward way would be to estimate the factors determining the length of proceedings directly; however, this approach reduces the estimation sample to proceedings with judgment.³⁹ By estimating the probability that delaying events will occur, I can extend the sample to all proceedings that did not end in a settlement prior to the main oral hearing.⁴⁰ This approach increases the sample size considerably while minimizing selection problems.

Besides the probabilities of the two delaying events, I also need to define how long a judgment will be deferred if the court decides to stay the proceeding (l^{stay}) or request an expert opinion (\bar{l}^{expert}). The general term l^{stay} can be either dispute-specific, l_{ij}^{stay} , if an invalidity proceeding is already pending at the time of the plaintiff's court selection, or a general estimation, \bar{l}_j^{stay} , if no invalidity action is pending at the time of the plaintiff's court selection. The length of the stay \bar{l}_j^{stay} is determined exogenously as the difference between the median lengths of all first instance revocation/opposition proceedings filed in that year plus the observed time difference (median time difference) between the filing of the invalidity proceeding and the filing of the infringement proceeding Δ_i ($\bar{\Delta}$) plus the court-specific expected length of the ordinary proceeding \bar{l}_j^{ord} .⁴¹ I fix the delay caused by an expert opinion, \bar{l}^{expert} , at twenty-four months across all three courts, which is in line with estimates by Kühnen (2012) and interviewed practitioners.

I estimate the probability for each event independently. Certain characteristics associated with the patent in dispute (PAT_i), the litigants (LIT_i), the proceeding ($PROC_i$), and the judges (JUD_j), comprise the regressors in the estimations. Table 2.6 gives an overview of which characteristics are used in which model to regress the respective delaying event.

I predict the probability of the request for an expert opinion with the following probit model:

$$\begin{aligned} \Pr(\text{expert} = 1) = & \Phi(\beta_1^{expert} PAT^{expert} + \beta_2^{expert} JUD^{expert} + \\ & + \beta_3^{expert} PROC^{expert}). \end{aligned} \quad (2.6.5)$$

³⁹Settlements may occur at any time during the proceeding; for instance, I also observe settlements months after the main oral hearing if a stay or an expert opinion occurred (cf. Figure 2.2).

⁴⁰As the data were collected directly from the court case files with transcripts of the main hearing and written court orders, I have data on the court's decision to stay or to call in an expert even if the proceeding ended in a settlement shortly after.

⁴¹For a year-by-year overview of \bar{l}_j^{stay} , see Table 2.13 in the Appendix.

Table 2.6: Estimation models for delaying events in infringement proceeding

Model	Expert opinion (E)	Stay of proceeding (S)		
	Probit	Probit	Probit with sample selection ^a	
Dependent variable				
Discrete event	Expert opinion	Stay	Stay	Invalidity proceeding
Independent vectors/variables				
Patent characteristics (PAT_i)				
Patent intricacy	✓			
Patent quality		✓	✓	✓
Patent value				✓
Patent technology	✓	✓	✓	✓
Litigant characteristics (LIT_i)				
Size of litigants				✓
Residence of litigants				✓
Legal representation				✓
Judicial characteristics (JUD_i)				
Judicial expertise	✓			
Judge-/court-specific idiosyncrasy	✓	✓	✓	✓
Procedural characteristics ($PROC_i$)				
Litigation value	✓	✓	✓	✓
Multinational litigation	✓	✓	✓	✓
Timing of inv. proc.		✓	✓	
Decision on noninfringement		✓	✓	
Caused delay ^b	\bar{l}^{expert}	$\bar{l}_t^{inv} + \Delta_i - \bar{l}_{jt}^{ord} = l_{ijt}^{stay}$	$\bar{l}_t^{inv} + \bar{\Delta} - \bar{l}_{jt}^{ord} = \bar{l}_{jt}^{stay}$	

^a For cases with no invalidity proceeding pending at time of court selection.

^b Ex ante likelihood of stay of proceeding predicted on basis of average delay of invalidity proceeding $\bar{\Delta}$ and average rate of decision on noninfringement (conditional on no settlement). Values used for the median lengths \bar{l} can be found in Table 2.13 in the Appendix.

As the stay of a proceeding is conditional on a parallel invalidity proceeding, I need to distinguish between two cases: whether an invalidity proceeding is already pending at the time of the plaintiff's court selection or not. In the latter case the probability of a stay is predicted by a probit model with sample selection (Van de Ven and Van Praag, 1981). I specify the selection equation as

$$\begin{aligned} \Pr(\text{inv. proc.} = 1) = & \Phi(\beta_1^{inv} PAT^{inv} + \beta_2^{inv} LIT^{inv} + \\ & + \beta_3^{inv} JUD^{inv} + \beta_4^{inv} PROC^{inv}), \end{aligned} \quad (2.6.6)$$

and the resultant binary outcome equation as

$$\Pr(\text{stay} = 1 | \text{inv. proc.} = 1) = \Phi(\beta_1^{\text{stay}} \text{PAT}^{\text{stay}} + \beta_2^{\text{stay}} \text{JUD}^{\text{stay}} + \beta_3^{\text{stay}} \text{PROC}^{\text{stay}}). \quad (2.6.7)$$

I draw on characteristics of the patent and the litigants as exclusion restrictions. That is, I include the corresponding variables in the selection equation, but exclude them from the binary outcome equation. The value of the patent as well as the size and residence of the litigants should play a role in the likelihood of the filing of an invalidity proceeding, but should not have any effect on the decision of the court to actually grant a stay. As the event of an accelerated examination request serves as a sole patent value indicator (cf. Table 2.2), I particularly focus on this variable as an exclusion restriction.

When regressing the decision to request an expert opinion, I can reject equal propensities among the courts (cf. Table 2.7). With the Düsseldorf regional court as baseline, I observe a positive effect of the remaining two courts on the likelihood of an expert opinion. Patent intricacy, captured by the count of nonpatent literature backward citations and IPC subclasses, shows a significant positive effect as well. The constructed measures of the judges' expertise appear significant. I turn to judge controls in the fourth specification (E4). These controls and their technology interaction terms are partly significant (cf. Table 2.14 in the Appendix). In particular, electrical engineering patents appear less likely to be subject to expert opinions at the Mannheim regional court, which hears a disproportional share of cases in this technology area. I can conclude that the regional courts in Mannheim and Munich are in general more likely to request expert opinions than the Düsseldorf regional court, with Munich even more likely to do so than Mannheim, while the magnitude differs at a technology level.

Table 2.8 shows the results of regressing the decision to grant a stay of the infringement proceeding conditional on a parallel invalidity proceeding. The assumption that the value of the patent has no effect on the judge's tendency to grant a stay is supported by the nonsignificant effect of litigation value on the grant of a stay. This supports my decision to use sole patent value indicators as an exclusion restriction. The results of the selection equation show that the identity of the judge hearing the infringement proceeding has little effect on the likelihood of a validity challenge. In contrast, the results of the outcome equation show highly significant judge effects. I find that the Mannheim and Munich regional courts are more likely to stay a proceeding compared to Düsseldorf. This result may be due to the differing ordinary lengths of proceeding; i.e., the regional court in Düsseldorf stays the proceeding less often because a

Table 2.7: Probit model results: incidence of expert opinion

	(E1) Expert opinion	(E2) Expert opinion	(E3) Expert opinion	(E4) Expert opinion
Court effects				
LG Mannheim (d)	0.136*** (0.031)	0.113*** (0.026)	0.342*** (0.094)	
LG Munich (d)	0.243*** (0.050)	0.238*** (0.049)	0.652*** (0.117)	
Patent intricacy				
Nonpatent literature ratio		0.073 (0.040)	0.074 (0.042)	0.082* (0.041)
No. of claims		0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
IPC subclasses count		0.014** (0.004)	0.015** (0.005)	0.015** (0.005)
Age of patent		-0.003 (0.002)	-0.002 (0.002)	-0.003 (0.002)
Grant lag (difference from mean in days)		0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
Prior infringement decision on patent (d)			-0.038 (0.027)	-0.033 (0.027)
Procedural characteristics				
Litigation value (in thousand €, log)	0.004 (0.010)	0.007 (0.009)	0.008 (0.008)	0.005 (0.008)
Multijurisdictional litigation (d)			0.054 (0.061)	0.041 (0.059)
Judicial expertise				
Tenure as judge (in years)			-0.008*** (0.002)	0.012 (0.007)
Prior exposure to technology area			0.068*** (0.019)	0.037 (0.048)
Judge effects	No	No	No	Yes***
Technology effects	No	No	Yes	Yes
Court x Technology effects	No	No	Yes	No
Judge x Technology effects	No	No	No	Yes
Year effects	Yes	Yes	Yes*	Yes
Pseudo R^2	0.047	0.062	0.080	0.103
Observations	1,690	1,690	1,690	1,645

Marginal effects; Standard errors in parentheses

(d) for discrete change of dummy variable from 0 to 1

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

Notes: The sample consists of all patent infringement proceedings based on patents in force that did not end in settlement prior to the call for an expert opinion ($\bar{t}_{jt}^{ord} - 50$ days). Proceedings with judgment by consent/default decree excluded. The unit of observation is at the case level. 45 observations in regression (E4) dropped due to perfectly predicted failure. Base line regional court: LG Düsseldorf (DU). Judge effects, technology effects, and judge x technology interaction effects displayed in Table 2.14 in the Appendix. Standard errors clustered by patent.

decision on the invalidity proceeding is more likely to be available in time. I therefore control for the lag of the invalidity proceeding relative to the court-specific length of an ordinary proceeding and find the judge effects remain robust.

Having identified the determinants of the likelihood of delaying events, I am now able to predict the expected length of proceeding for each case at each court. I adjust judge-specific variables to court-specific variables where necessary, and impute ex ante unknown variables (lag of invalidity proceeding and the decision on noninfringement) with average values. I then perform out-of-sample predictions of the likelihood for delaying events for all cases at each court (cf. Table 2.9). With these values I calculate the ex ante expected lengths of proceeding according to equation (2.6.4). The densities of the court-specific lengths can be found in Figure 2.3 for all proceedings and in Figure 2.11 in the Appendix broken down by technology area.⁴²

The densities differ among the regional courts; however, in contrast to Figure 2.2, the Düsseldorf regional court now appears to be faster than the Mannheim and Munich regional courts. Although the Mannheim regional court may still be faster than the regional court Düsseldorf, the majority of cases seem to take considerably longer. This is because the probability of delaying events weighs heavier on the ex ante expected length of proceedings in Mannheim and Munich than in Düsseldorf for most cases within the overall population.

⁴²I also compare the densities of both conditional and unconditional samples in Figure 2.12 in the Appendix.

Table 2.8: Probit model with sample selection results: incidence of stay of proceeding

	(S1)		(S2)		(S3)		(S4)		(S5)	
	INF stayed	INF filed	INF stayed	INF filed	INF stayed	INF filed	INF stayed	INF filed	INF stayed	INF filed
Procedural characteristics										
Decision on noninfringement (d)	-0.956*** (0.160)		-0.914*** (0.174)		-0.984*** (0.154)		-0.984*** (0.153)		-0.984*** (0.153)	
Lag of invalidity proc. (in months)							0.003 (0.003)		0.003 (0.003)	
Litigation value (in thousand €, log)	0.115 (0.063)	0.252*** (0.039)	0.125 (0.065)	0.298*** (0.040)	0.057 (0.062)	0.201*** (0.042)	0.056 (0.062)	0.201*** (0.042)	0.056 (0.062)	0.201*** (0.042)
Multijurisdictional litigation (d)	0.742*** (0.213)	1.107*** (0.284)	0.780*** (0.218)	1.054*** (0.327)	0.668** (0.231)	0.933*** (0.293)	0.674** (0.232)	0.934** (0.293)	0.674** (0.232)	0.934** (0.293)
Judge effects										
Judge 1 (LG DU) (d)	0.626* (0.276)	-0.027 (0.240)	0.604* (0.275)	-0.093 (0.214)	0.687* (0.319)	0.038 (0.320)	0.655* (0.224)	0.038 (0.320)	0.655* (0.224)	0.038 (0.320)
Judge 2 (LG DU) (d)	0.742** (0.279)	0.059 (0.241)	0.722** (0.282)	-0.033 (0.214)	0.846* (0.341)	0.067 (0.236)	0.809* (0.340)	0.067 (0.236)	0.809* (0.340)	0.067 (0.236)
Judge 1 (LG MA) (d)	1.265*** (0.393)	-0.064 (0.304)	1.241*** (0.391)	-0.106 (0.287)	1.337** (0.416)	0.137 (0.289)	1.308** (0.416)	0.137 (0.289)	1.308** (0.416)	0.137 (0.289)
Judge 2 (LG MA) (d)	1.385*** (0.301)	0.290 (0.253)	1.356*** (0.317)	0.117 (0.236)	1.485*** (0.372)	0.305 (0.262)	1.447*** (0.373)	0.306 (0.262)	1.447*** (0.373)	0.306 (0.262)
Judge 3 (LG MA) (d)	1.154*** (0.317)	0.328 (0.272)	1.184*** (0.322)	0.233 (0.252)	1.245*** (0.351)	0.374 (0.264)	1.208*** (0.351)	0.374 (0.264)	1.208*** (0.351)	0.374 (0.264)
Judge 1 (LG MU) (d)	1.099** (0.362)	0.045 (0.293)	1.049** (0.365)	0.042 (0.273)	1.161** (0.418)	0.216 (0.290)	1.126** (0.417)	0.216 (0.290)	1.126** (0.417)	0.216 (0.290)
Judge 2 (LG MU) (d)	1.479*** (0.424)	-0.258 (0.305)	1.371*** (0.434)	-0.372 (0.289)	1.631*** (0.446)	-0.074 (0.301)	1.620*** (0.445)	-0.074 (0.301)	1.620*** (0.445)	-0.074 (0.301)
Exclusion restriction										
Accelerated examination requested (d)		0.547*** (0.103)		0.333** (0.108)		0.284* (0.114)		0.284* (0.114)		0.284* (0.114)
Patent characteristics	No	No	No	No	Yes***	Yes***	Yes***	Yes***	Yes***	Yes***
Invalidation history	No	No	No	No	Yes**	Yes**	Yes**	Yes**	Yes**	Yes**
Litigant characteristics	No	No	No	No	No	No	No	No	No	No
Technology effects	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	No	No	No	No	No	No	Yes	Yes	Yes*	Yes*
Observations	1617		1617		1617		1617		1617	

Marginal effects; Standard errors in parentheses; (d) for discrete change of dummy variable from 0 to 1; * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: INF: infringement proceeding. INV: invalidity proceeding. The sample consists of all patent infringement proceedings based on patents in force that did not end in settlement prior to the decision on a stay of proceeding ($t_{ji} - 50$ days). Proceedings with judgment by consent/default decree excluded. Proceedings based on patent *EP0402973* ($N > 50$) excluded. The unit of observation is at the case level. Base line regional court: LG Düsseldorf (DU). Base line judge: Judge 3 (LG DU). Patent characteristics: Forward citations in first 5 years, backward citations, nonpatent backward citations (ratio), no. of claims, age of patent (squared), IPC count, *BP* (d), *PCT* (d), family size, grant lag (difference from mean in days). Invalidation history: Patent solidified through opp. proc. (d), patent challenged through rev. proc. (d), patent solidified through rev. proc. (d). Litigant characteristics: Size categories (d), background categories (d), top legal representative (d). Standard errors clustered by patent.

Table 2.9: Predicted likelihoods of delaying events by court and technology main area

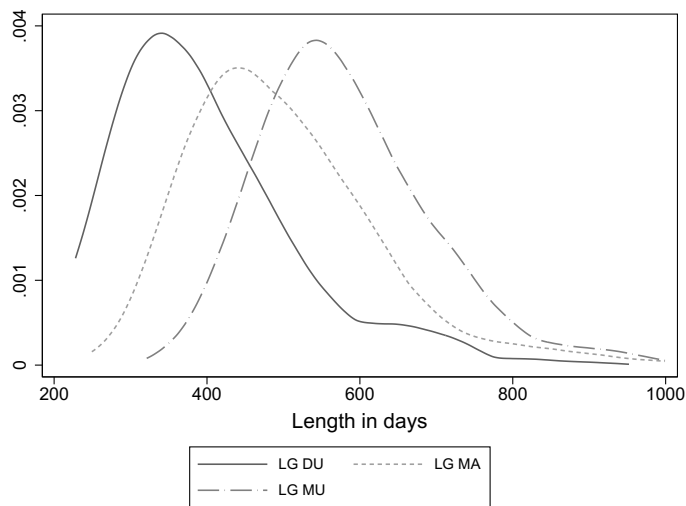
	Expert opinion		Validity challenge		Stay	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Electrical engineering						
LG DU	0.19	0.12	0.50	0.33	0.33	0.16
LG MA	0.25	0.12	0.56	0.32	0.57	0.18
LG MU	0.42	0.10	0.51	0.33	0.59	0.18
Instruments						
LG DU	0.07	0.05	0.65	0.31	0.22	0.12
LG MA	0.30	0.13	0.70	0.29	0.43	0.17
LG MU	0.33	0.09	0.65	0.31	0.45	0.16
Chemistry						
LG DU	0.09	0.04	0.69	0.32	0.25	0.13
LG MA	0.29	0.12	0.74	0.29	0.47	0.16
LG MU	0.27	0.10	0.69	0.32	0.49	0.16
Mechanical engineering						
LG DU	0.11	0.05	0.57	0.30	0.20	0.10
LG MA	0.19	0.05	0.64	0.28	0.41	0.15
LG MU	0.33	0.07	0.58	0.30	0.42	0.15
Other						
LG DU	0.08	0.04	0.52	0.30	0.19	0.09
LG MA	0.23	0.06	0.59	0.28	0.40	0.14
LG MU	0.27	0.07	0.53	0.30	0.41	0.14
All	0.23	0.08	0.59	0.31	0.40	0.16

Notes: The sample consists of all patent infringement proceedings based on patents in force. The unit of observation is at the case level. The results reflect out-of-sample predictions; that is, predictions are on all proceedings for each court. Predicted likelihoods of suspension conditional on a parallel validity challenge.

2.6.2 Results

Table 2.10 shows the results of the alternative-specific conditional logit model on court selection. In regressions (C1) to (C3) I use alternative measures for opportunity cost due to delay in judgment with increasing similarity to the preferred operationalization presented in regression (C4). I assume the longer the time until judgment at one court, the more likely an alternative court will be chosen. Interacting expected length with litigation value leads to a low significant effect (cf. regression (C1)). Taking the maximum length of patent protection into account makes regression (C2) significant again. Regression (C3) introduces technology-specific discount factors but still ignores the product market proximity of the litigants. The effect remains negative while again losing some significance. In regression (C4) I finally present the results of the preferred specification with opportunity costs weighted by product market proximity. Here

Figure 2.3: Ex ante predicted lengths of infringement proceedings until judgment by court (densities)



Source: own data and calculation

Notes: The unit of observation is the infringement proceeding. Truncated at 1,000 days.

again, the effect of opportunity costs is significant and negative. Knowing that the approximation of product market proximity is rather crude, I use the former measure from (C3) on a sample of litigants with low product market proximity ($\alpha \leq 0.5$) in regression (C5) and on a sample of litigants with high product market proximity ($\alpha > 0.5$) in regression (C6). Since the effect of opportunity costs is insignificant in the former regression (C5), but highly significant in the latter regression (C6), I consider the theoretical predictions confirmed: delay in judgment matters most for plaintiffs that operate in the same product market as the defendant.

For all regressions I observe a robust highly significant negative effect of the plaintiff's transaction costs on court selection. The samples used in regressions (C7) and (C8) differ in size of the plaintiffs. I find that the effect of transaction costs is almost twice as large for small plaintiffs in regression (C7) as for large plaintiffs in regression (C8). These results are in line with the theoretical predictions that costs weigh heavier on small, financially constrained, litigants and therefore play a larger role in their court choice.

I also observe a negative effect of the defendant's transaction costs. However, I refrain from interpreting this result as evidence for their role in the plaintiff's consideration for court choice. This effect could be a corollary of the fact that the defendant's residence fulfills the most

basic requirements for territorial jurisdiction (cf. Section 2.3.1).⁴³ Since I find only negligible correlation between the plaintiff's and the defendant's transaction costs ($r = 0.029$), I rule out an interrelationship between the two effects.

Looking at the choice-specific variables, I find that representation by a top law firm has a negative effect on the selection of the Mannheim and Munich regional courts.⁴⁴ Multijurisdictional disputes between the litigants have no significant effect on court selection. I find no significant effect of the value at stake on court selection at the Mannheim regional court, but a somewhat significant negative effect in regression (C4) at the Munich regional court. Due to the lack of robustness across the regressions, I am reluctant to confirm a perceived anti-patentee bias associated with the regional court Munich. Further, the effect may also originate from interactions with other court-specific factors at the regional court in Munich which I am not able to observe. These may include a higher likelihood of appeal or a more austere calculation of damages. In a similar vein, prior experience with the Mannheim regional court shows no substantial effect on selecting the court again. In contrast, prior experience with the Munich regional court appears to have a strong negative effect on the decision to revisit the court.⁴⁵

⁴³Apparently, the requirements for territorial jurisdiction at all courts are not met in all cases within the sample, even though I rigorously excluded proceedings with a prior preliminary injunction or trade fair context.

⁴⁴This effect is robust for an alternative classification of legal representatives (not shown).

⁴⁵In further specifications (not shown), I additionally control for the outcome of the prior proceedings, but do not find any effect.

Table 2.10: Alternative-specific conditional logit model results: court selection

Alternative-specific variables		(C1) Court	(C2) Court	(C3) Court	(C4) Court	(C5) Court	(C6) Court	(C7) Court	(C8) Court
Expected length \times litigation value		-0.002* (0.001)							
Opportunity costs ($\alpha = 1, \delta = 0$)			-0.015** (0.005)						
Opportunity costs ($\alpha = 1$)				-0.015* (0.007)	-0.012* (0.005)	-0.013 (0.010)	-0.023** (0.008)	-0.026 (0.012)	-0.010* (0.004)
Opportunity costs									
Plaintiff distance to court (in thousand km, log)			-0.496** (0.058)	-0.489** (0.058)	-0.490** (0.057)	-0.571** (0.101)	-0.443** (0.076)	-0.713** (0.122)	-0.429** (0.071)
Defendant distance to court (in thousand km, log)			-0.306** (0.048)	-0.308** (0.047)	-0.303** (0.046)	-0.313** (0.076)	-0.286** (0.063)	-0.326** (0.094)	-0.295** (0.062)
Case-specific variables: LG Mannheim (MA)									
Prior case at court (in last 3 years) (d)		0.043 (0.179)	0.075 (0.181)	0.100 (0.182)	0.021 (0.171)	-0.089 (0.296)	0.179 (0.209)	-0.561 (0.508)	0.160 (0.184)
Value at stake (in million €)		0.017 (0.164)	0.080 (0.158)	0.099 (0.176)	-0.153 (0.087)	-0.006 (0.248)	0.792** (0.273)	-0.665* (0.298)	-0.048 (0.091)
Multijurisdictional litigation (d)		0.461 (0.461)	0.525 (0.483)	0.400 (0.465)	0.478 (0.487)	0.343 (2.509)	0.246 (0.165)	3.741* (1.827)	-0.565 (3.030)
Top legal representative (JUVE) (d)		-2.150*** (0.161)	-2.019*** (0.152)	-2.063*** (0.158)	-2.181*** (0.142)	-2.255*** (0.345)	-1.844*** (0.197)	-1.708*** (0.298)	-2.304*** (0.178)
Case-specific variables: LG Munich (MU)									
Prior case at court (in last 3 years) (d)		-1.122* (0.448)	-1.196** (0.448)	-1.136* (0.449)	-1.176** (0.450)	-0.697 (2.056)	-1.467*** (2.710)	-0.690 (2.726)	-1.263 (4.823)
Value at stake (in million €)		-0.282 (0.409)	-0.459 (0.420)	-0.444* (0.476)	-0.679* (0.594)	0.031 (0.786)	-0.093 (1.414)	-0.902 (0.812)	-0.521 (2.530)
Multijurisdictional litigation (d)		0.399 (2.711)	0.569 (3.029)	0.379 (2.674)	0.420 (2.696)	-14.512** (12.402)	1.415* (0.703)	2.573** (0.882)	0.644 (1.580)
Top legal representative (JUVE) (d)		-1.660*** (0.240)	-1.562*** (0.243)	-1.594*** (0.243)	-1.669*** (0.244)	-1.440 (1.504)	-1.478** (0.551)	-1.377* (0.491)	-1.611** (0.416)
Plaintiff characteristics		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Technology effects		Yes**	Yes**	Yes**	Yes*	Yes*	Yes*	Yes*	Yes**
Year effects		Yes**	Yes**	Yes**	Yes**	Yes**	Yes**	Yes*	Yes**
Pseudo R^2		0.325	0.353	0.343	0.330	0.427	0.279	0.303	0.361
Observations		6,333	6,333	6,333	6,333	2,895	3,438	1,308	5,025

Marginal effects; Bootstrapped standard errors in parentheses; (d) for discrete change of dummy variable from 0 to 1, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: The sample consists of all patent infringement proceedings based on patents in force without a (prior) request for a preliminary injunction. The unit of observation is at the case level. Base line technology area: Other. Base line regional court: LG Düsseldorf (DU). Plaintiff characteristics: Size categories (by country) (d). Residence categories (by country) (d). Bootstrapped standard errors reported. C5: baseline sample with $\alpha \leq 0.5$. C6: baseline sample with $\alpha > 0.5$. C7: baseline sample with micro and small plaintiffs. C8: baseline sample with medium and large plaintiffs.

2.7 Conclusion

This study analyzed the determinants of court selection in patent litigation using data from German regional courts. Several results from this study may contribute to both theoretical and practical discussions on the optimal designs of patent litigation systems – most notably the ongoing debate regarding the rules and structure of the Unified Patent Court (UPC).

I found that the regional courts in Düsseldorf, Mannheim and Munich differ in their ordinary length of proceeding and likelihood of delaying events. The primary results reveal that plaintiffs consider their economic loss from delayed judgment when choosing their court. Speedy enforcement is highly valued, especially if the litigants operate in the same product market. The self-allocation of patent disputes among multiple courts leads to efficiency gains, because courts have an incentive to invest in specialization, accrue experience and induce procedural innovations to attract suitable patent disputes. The decision to divide the responsibilities of the UPC's regional divisions in Paris, London, and Munich by technology field may facilitate the accumulation of relevant technical expertise at the respective courts to the benefit of faster and more coherent judgments.

The distance to a particular court has a negative effect on the plaintiff's court selection. Here, the magnitude of the effect is considerably larger for small plaintiffs. Since small plaintiffs highly value local access to court, they may be reluctant to file their action in the first place due to overwhelming transaction costs in judicial systems that force them to seek judicial relief at a distant court. The Unified Patent Court will consist of several spatially dispersed local and regional divisions all over Europe. While this ensures that plaintiffs gain local access to legal patent enforcement, the proceeding can be transferred to the central division (in Paris), for instance, in the case of a validity challenge. This again may increase the plaintiff's transaction costs.

I further find evidence that courts do not show perfect uniformity in their decision making. The Düsseldorf regional court tends to grant a stay of proceeding less often than the other two courts and plaintiffs perceive the Munich regional court as having a stronger anti-patentee bias. Prior research has shown that lack of uniformity increases legal uncertainty and impedes settlements (cf. Galasso and Schankerman, 2010). While a centralized appeals court at the Unified Patent Court may promote uniformity in judicial decision making, judges maintain considerable discretion in case management and procedural options prior to a judgment on the merits.

2.8 Appendix to Chapter 2

2.8.1 Figures

Figure 2.4: Court structure in Germany's patent system (Cremers *et al.*, 2013, amended)

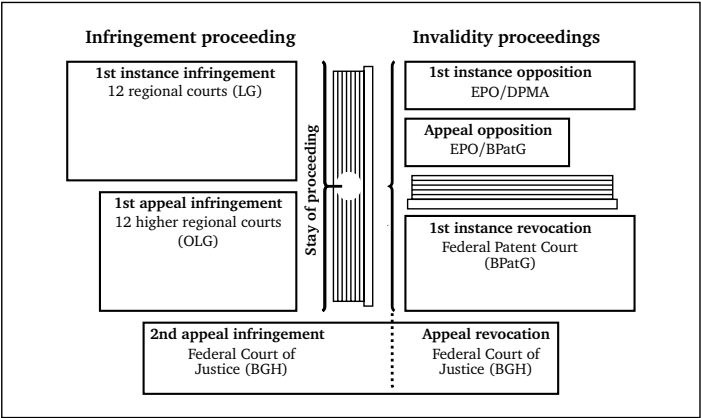


Figure 2.5: Proceedings linked to patent infringement disputes (own illustration)

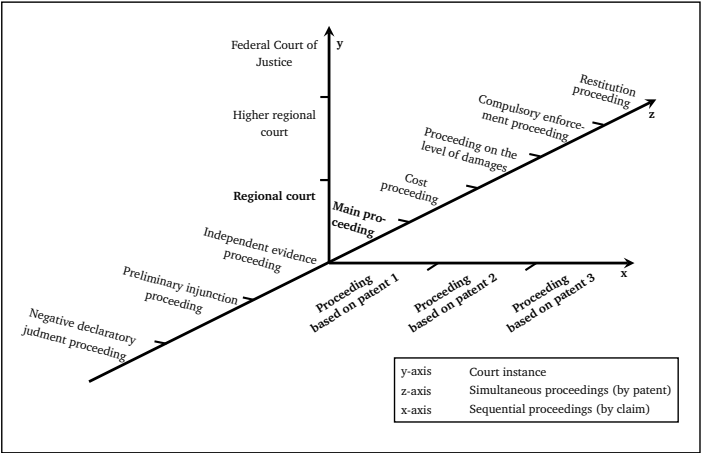


Figure 2.6: Structure of the infringement main proceeding (own illustration)

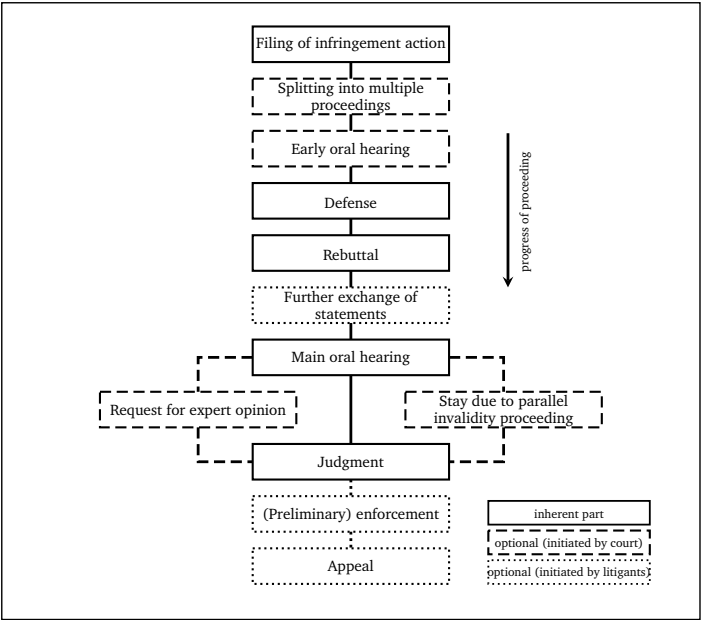
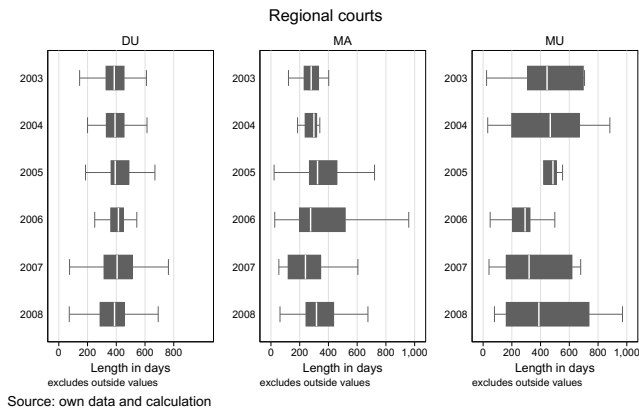
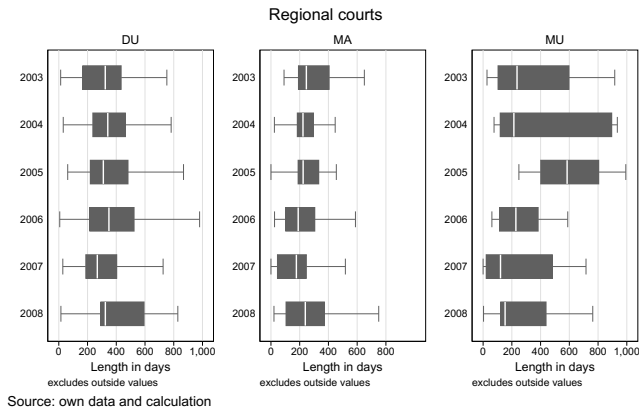


Figure 2.7: Length of main infringement proceedings with judgment by court and year



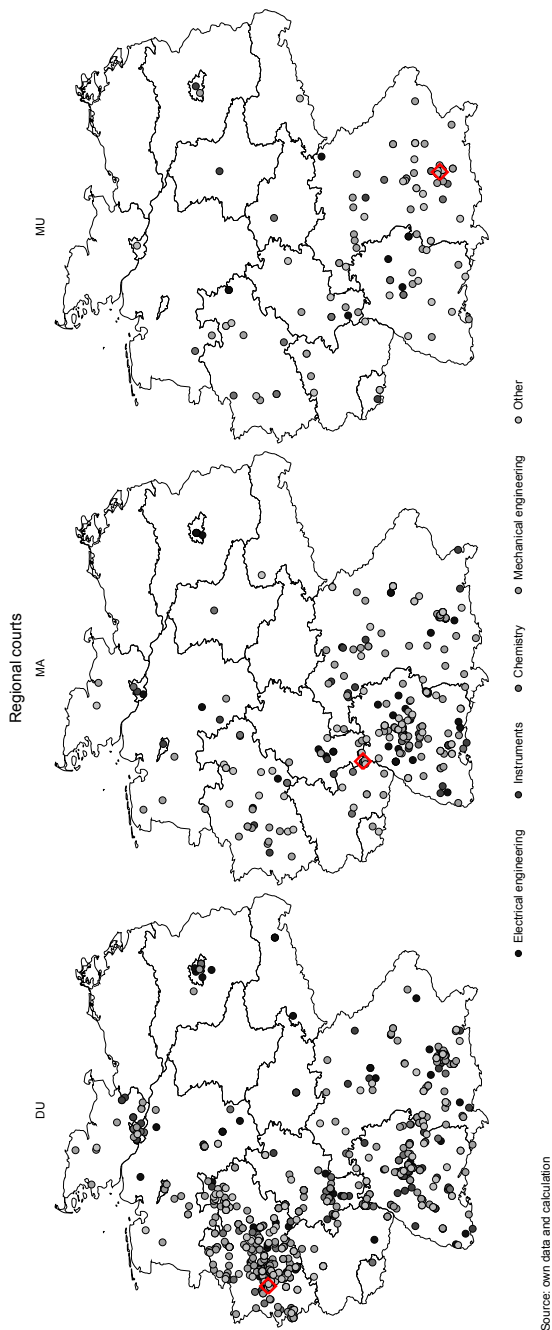
Notes: The sample consists of all patent infringement proceedings based on patents in force without a (prior) request for a preliminary injunction. The unit of observation is at the case level. Truncated at 1,000 days.

Figure 2.8: Length of main infringement proceedings with settlement by court and year



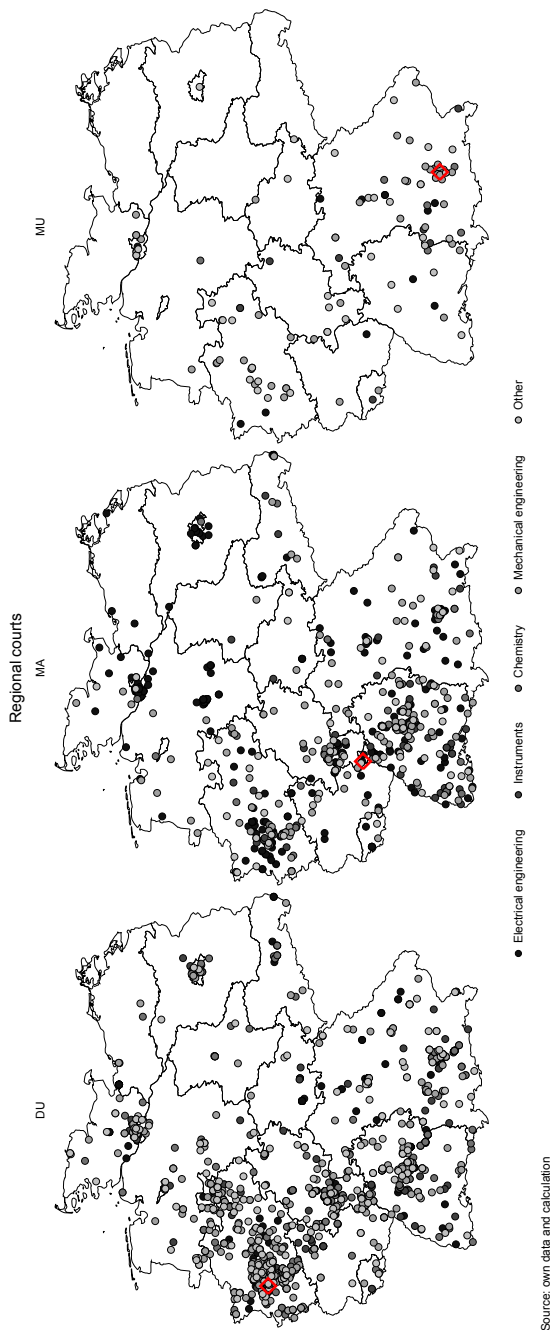
Notes: The sample consists of all patent infringement proceedings based on patents in force without a (prior) request for a preliminary injunction. The unit of observation is at the case level. Truncated at 1,000 days.

Figure 2.9: Spatial distribution of patent holders by court and technology main area



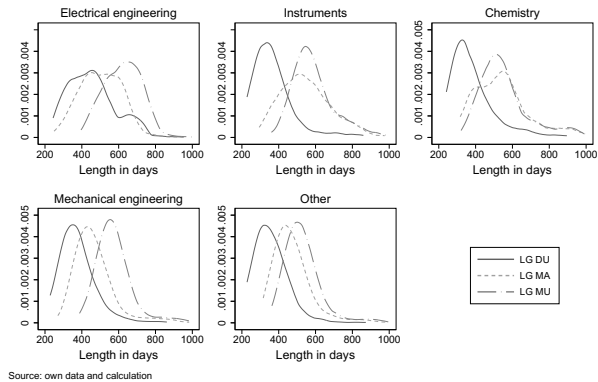
Notes: The sample consists of all patent infringement proceedings based on patents in force. The unit of observation is at the case level. Only patent holders with residence in Germany represented. In case of multiple patent holders, the one closest to court is chosen. Diamond symbolizes place of regional court.

Figure 2.10: Spatial distribution of alleged infringers by court and technology main area



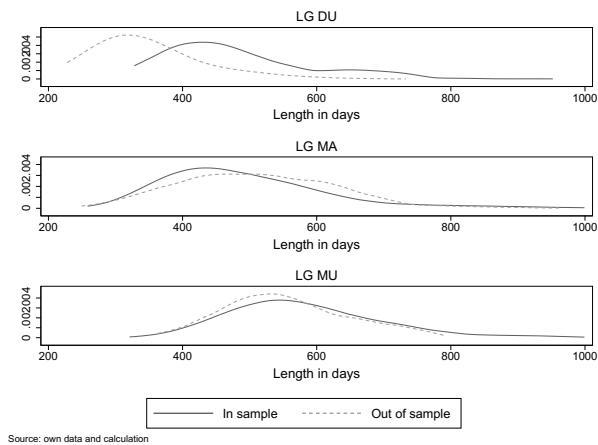
Notes: The sample consists of all patent infringement proceedings based on patents in force. The unit of observation is at the case level. Only alleged infringers with residence in Germany are represented. In case of multiple alleged infringers, the one closest to court is chosen. Diamond symbolizes place of regional court.

Figure 2.11: Ex ante predicted length of infringement proceeding with judgment by court and technology main area (densities)



Notes: The sample consists of all patent infringement proceedings based on patents in force. The unit of observation is at the case level. Truncated at 1,000 days.

Figure 2.12: Ex ante predicted length of infringement proceeding with judgment by court and sample (densities)



Notes: The sample consists of all patent infringement proceedings based on patents in force. The unit of observation is at the case level. In sample contains all proceedings actually heard by regional court. Out of sample contains all proceedings heard by another regional court. Truncated at 1,000 days.

2.8.2 Tables

Table 2.11: Statistics of litigation value by court and technology main area

Regional court	Litigation value (in thousand €)				
	Mean	Median	Std. dev.	Min	Max
Electrical engineering					
LG DU	1,809.80	1,500.00	1,768.64	2	15,000
LG MA	297.44	50.00	696.70	0	9,000
LG MU	242.15	85.00	531.76	5	3,500
Instruments					
LG DU	1,012.78	500.00	1,917.48	4	18,000
LG MA	760.85	450.00	1,171.50	12	5,000
LG MU	373.77	250.00	394.21	39	1,500
Chemistry					
LG DU	1,288.44	800.00	2,339.10	38	30,000
LG MA	899.68	500.00	2,392.97	10	16,500
LG MU	505.83	275.00	517.00	50	2,000
Mechanical engineering					
LG DU	684.35	500.00	969.71	1	10,000
LG MA	491.06	500.00	503.94	7	5,000
LG MU	403.07	275.00	443.40	5	2,000
Other					
LG DU	606.16	300.00	978.90	2	10,000
LG MA	317.40	250.00	296.64	2	1,534
LG MU	270.70	180.00	309.89	20	2,000
All	859.12	500.00	1,485.07	1	30,000

Notes: The sample consists of all patent infringement proceedings based on patents in force. The unit of observation is at the case level.

Table 2.12: Residence countries of litigants by court

Country	Regional court						Total	
	LG DU		LG MA		LG MU			
	N	%	N	%	N	%	N	%
Patent holders								
European								
AT	41	2.4%	14	2.0%	3	1.6%	58	2.2%
BE	18	1.0%	2	0.3%	0	0.0%	20	0.8%
CH	84	4.9%	26	3.8%	7	3.7%	117	4.5%
DE	812	47.2%	279	40.3%	117	62.2%	1208	46.5%
DK	32	1.9%	2	0.3%	1	0.5%	35	1.3%
FR	73	4.2%	16	2.3%	11	5.9%	100	3.8%
IE	11	0.6%	4	0.6%	1	0.5%	16	0.6%
IT	53	3.1%	250	36.1%	23	12.2%	326	12.5%
NL	93	5.4%	31	4.5%	0	0.0%	124	4.8%
NO	12	0.7%	0	0.0%	0	0.0%	12	0.5%
SE	29	1.7%	11	1.6%	4	2.1%	44	1.7%
UK	51	3.0%	4	0.6%	5	2.7%	60	2.3%
Other	21	1.2%	10	1.4%	0	0.0%	31	1.2%
Non-European								
IL	23	1.3%	3	0.4%	0	0.0%	26	1.0%
JP	170	9.9%	5	0.7%	8	4.3%	183	7.0%
US	174	10.1%	32	4.6%	4	2.1%	210	8.1%
Other	22	1.0%	3	0.4%	4	2.1%	29	1.1%
Total	1,719	100.0%	692	100.0%	188	100.0%	2,599	100.0%
Alleged infringers								
European								
AT	27	1.6%	9	1.3%	2	1.1%	38	1.5%
BE	19	1.1%	0	0.0%	0	0.0%	19	0.7%
CH	17	1.0%	6	0.9%	2	1.1%	25	1.0%
CZ	14	0.8%	0	0.0%	1	0.5%	15	0.6%
DE	1242	72.3%	563	81.4%	125	66.5%	1930	74.3%
DK	12	0.7%	0	0.0%	0	0.0%	12	0.5%
ES	15	0.9%	7	1.0%	12	6.4%	34	1.3%
FR	54	3.1%	5	0.7%	3	1.6%	62	2.4%
IT	63	3.7%	15	2.2%	9	4.8%	87	3.3%
NL	31	1.8%	9	1.3%	2	1.1%	42	1.6%
PL	21	1.2%	3	0.4%	0	0.0%	24	0.9%
SE	10	0.6%	0	0.0%	1	0.5%	11	0.4%
TR	6	0.3%	4	0.6%	1	0.5%	11	0.4%
UK	48	2.8%	2	0.3%	1	0.5%	51	2.0%
Other	23	1.3%	3	0.4%	1	0.5%	28	1.1%
Non-European								
CN	52	3.0%	18	2.6%	9	4.8%	79	3.0%
HK	10	0.6%	16	2.3%	1	0.5%	27	1.0%
KR	11	0.6%	7	1.0%	1	0.5%	19	0.7%
TW	18	1.0%	17	2.5%	5	2.7%	40	1.5%
US	8	0.5%	2	0.3%	2	1.1%	12	0.5%
Other	18	1.0%	6	0.9%	9	4.8%	33	1.3%
Total	1,719	100.0%	692	100.0%	188	100.0%	2,599	100.0%

Notes: The sample consists of all patent infringement proceedings based on patents in force. The unit of observation is at the case level. In case of multiple patent holders or alleged infringers, the one closest to court is chosen. Category Other refers to countries with $N < 10$ in total.

Table 2.13: Median lengths of proceedings by year

Year	Infringement (DE+EP)			Opposition (DE)			Opposition (EP)			Revocation (DE+EP)		
	Length	Authority	Length	Authority	Length	Authority	Length	Authority	Length	Authority	Length	Authority
2000	-	LG DU	-	LG MA	-	LG MU	47.80	DPMA	39.80	EPO	15.27	BPatG
2001	-	LG DU	-	LG MA	-	LG MU	44.80	DPMA	40.63	EPO	16.45	BPatG
2002	-	LG DU	-	LG MA	-	LG MU	20.77	BPatG	42.22	EPO	16.63	BPatG
2003	11.52	LG DU	9.03	LG MA	10.52	LG MU	29.27	BPatG	41.55	EPO	17.70	BPatG
2004	12.77	LG DU	8.57	LG MA	10.52	LG MU	37.85	BPatG	42.87	EPO	16.50	BPatG
2005	12.50	LG DU	10.12	LG MA	10.52	LG MU	44.43	BPatG	43.42	EPO	21.10	BPatG
2006	13.62	LG DU	8.55	LG MA	10.52	LG MU	49.83	BPatG	39.47	EPO	23.37	BPatG
2007	12.30	LG DU	9.28	LG MA	10.52	LG MU	27.30	DPMA	36.87	EPO	19.03	BPatG
2008	12.60	LG DU	10.03	LG MA	10.52	LG MU	27.30*	DPMA	36.87*	EPO	20.38	BPatG
2009	-	LG DU	-	LG MA	-	LG MU	27.30*	DPMA	36.87*	EPO	20.22	BPatG

* Value from prior year used to avoid truncation.

Notes: Length represents the median length in months of all respective proceedings. Year refers to year of filing. I exclude infringement and revocation proceedings that did not end by judgment from the calculations. Information on infringement: own data and calculations. Information on DPMA oppositions: PATSTAT (cf. Section 2.4.1). Information on EPO oppositions: PATSTAT (cf. Section 2.4.1). Information on BPatG oppositions: data received directly from BPatG. Information on revocations: data introduced and used in Gremers *et al.* (2014).

Table 2.14: Probit model results: incidence of expert opinion (interaction effects)

	(E1) Expert opinion	(E2) Expert opinion	(E3) Expert opinion	(E4) Expert opinion
Court effects				
LG Mannheim (d)	0.136*** (0.031)	0.113*** (0.026)	0.342*** (0.094)	
LG Munich (d)	0.243*** (0.050)	0.238*** (0.049)	0.652*** (0.117)	
Judge effects				
Judge 1 (LG MA) (d)				0.514 (0.348)
Judge 2 (LG DU) (d)				−0.079 (0.061)
Judge 2 (LG MU) (d)				0.240 (0.190)
Judge 2 (LG MA) (d)				−0.037 (0.078)
Judge 3 (LG MA) (d)				0.166 (0.154)
Judge 3 (LG DU) (d)				−0.170*** (0.014)
Technology effects				
Electrical engineering (d)			0.067 (0.044)	0.030 (0.054)
Instruments (d)			0.057 (0.060)	−0.056 (0.052)
Chemistry (d)			0.020 (0.048)	−0.037 (0.048)
Mechanical engineering (d)			0.025 (0.036)	−0.014 (0.045)
Court x Technology effects				
LG MA x Electrical engineering			−0.098** (0.031)	
LG MA x Instruments (d)			−0.006 (0.078)	
LG MA x Chemistry (d)			0.111 (0.119)	
LG MA x Mechanical engineering (d)			−0.035 (0.051)	
LG MU x Electrical engineering (d)			0.006 (0.081)	
LG MU x Instruments (d)			0.020 (0.131)	
LG MU x Chemistry (d)			0.027 (0.108)	
LG MU x Mechanical engineering (d)			0.005 (0.079)	
Judge x Technology effects				
Judge 1 (LG MU) x Electrical engineering (d)				0.059 (0.124)
Judge 1 (LG MU) x Instruments (d)				0.092 (0.236)
Judge 1 (LG MU) x Chemistry (d)				0.085 (0.165)
Judge 1 (LG MU) x Mechanical engineering (d)				0.056 (0.130)
Judge 1 (LG MA) x Electrical engineering (d)				−0.029 (0.103)
Judge 1 (LG MA) x Instruments (d)				0.211 (0.293)
Judge 1 (LG MA) x Mechanical engineering (d)				0.062 (0.192)
Judge 2 (LG DU) x Electrical engineering (d)				−0.035 (0.062)
Judge 2 (LG DU) x Instruments (d)				0.255 (0.164)
Judge 2 (LG DU) x Chemistry (d)				0.134 (0.129)

Continued on next page

Table 2.14 – continued from previous page

	(E1)	(E2)	(E3)	(E4)
	Expert opinion	Expert opinion	Expert opinion	Expert opinion
Judge 2 (LG DU) x Mechanical engineering (d)				0.097 (0.093)
Judge 2 (LG MU) x Electrical engineering (d)				-0.021 (0.110)
Judge 2 (LG MU) x Instruments (d)				0.212 (0.248)
Judge 2 (LG MU) x Chemistry (d)				0.080 (0.184)
Judge 2 (LG MU) x Mechanical engineering (d)				0.040 (0.136)
Judge 2 (LG MA) x Electrical engineering (d)				-0.099*** (0.027)
Judge 2 (LG MA) x Instruments (d)				0.022 (0.115)
Judge 2 (LG MA) x Chemistry (d)				-0.004 (0.108)
Judge 2 (LG MA) x Mechanical engineering (d)				-0.015 (0.068)
Judge 3 (LG MA) x Electrical engineering (d)				-0.058 (0.058)
Judge 3 (LG MA) x Instruments (d)				0.295 (0.240)
Judge 3 (LG MA) x Chemistry (d)				0.513* (0.247)
Judge 3 (LG MA) x Mechanical engineering (d)				-0.019 (0.102)
Judge 3 (LG DU) x Electrical engineering (d)				0.892*** (0.009)
Judge 3 (LG DU) x Chemistry (d)				0.897*** (0.008)
Other	Yes	Yes	Yes	Yes
Pseudo R^2	0.047	0.062	0.080	0.103
Observations	1,690	1,690	1,690	1,645

Marginal effects; Standard errors in parentheses

(d) for discrete change of dummy variable from 0 to 1

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

Notes: The sample consists of all patent infringement proceedings based on patents in force that did not end in settlement prior to the call for an expert opinion ($\bar{t}_{jt}^{ord} - 50$ days). Proceedings with judgment by consent/default decree excluded. The unit of observation is at the case level. 45 observations in regression (E4) dropped due to perfectly predicted failure. Wald test in regression (E4) jointly significant for Judge x Technology effects with one constraint dropped. Base line regional court: LG Düsseldorf (DU). Base line technology area: Other. Others: nonpatent literature backward citations (ratio), no. of claims, IPC count, age of patent, grant lag (difference from mean in days), prior infringement decision on patent (d), litigation value (in thousand €, log), multijurisdictional litigation (d), tenure as judge (in years), prior exposure to technology, and year effects. Standard errors clustered by patent.

Table 2.15: Discount factor by technology area

	Technology area				
	Chemistry	Electrical engineering	Instruments	Mechanical engineering	Other fields
Discount factor δ	0.04	0.15	0.10	0.15	0.10

2.8.3 Definition of Product Market Proximity

For corporate litigants I obtained the assigned NACE (Nomenclature of Economic Activities) Rev. 2 industry codes from company databases.⁴⁶ The official European statistical classification of economic activities since 2008, NACE Rev. 2 industry codes are 4-digit codes grouped into increasingly specified industry categories with each decimal place.⁴⁷ To quantify the product market proximity of opposing litigants, I compare their industry codes and define proximity through the match of decimals of the 4-digit code.⁴⁸

Let a plaintiff's industry code be X and a defendant's industry be Y , with

$$X = \sum_{i=0}^3 a_i \cdot 10^i \quad \text{and} \quad Y = \sum_{i=0}^3 b_i \cdot 10^i.$$

The product market proximity α is then expressed as

$$\alpha = \frac{\gamma}{4} \quad \text{with} \quad \gamma = \begin{cases} 1 & \text{if } a_3 = b_3, \forall i \in \{0, 1, 2\} : a_i \neq b_i \\ 2 & \text{if } a_3 = b_3, a_2 = b_2, \forall i \in \{0, 1\} : a_i \neq b_i \\ 3 & \text{if } \forall i \in \{1, 2, 3\} : a_i = b_i, a_0 \neq b_0 \\ 4 & \text{if } X = Y \\ 0 & \text{if } \forall i \in \{0, 1, 2, 3\} : a_i \neq b_i. \end{cases}$$

I determine the product market proximity between a nonproducing entity (NPE), which by definition is not active in the product market, and any litigant as $\alpha = 0$. Litigants are classified as NPEs using the methodology found in Helmers *et al.* (2014). Litigants, especially large diversified firms, may have several assigned industry codes. In these cases, I define the product market proximity as the highest α of all industry code combinations. Likewise, infringement proceedings may have multiple litigants on both the plaintiff and defendant sides. In these cases, I define the product market proximity as the highest α of all combinations of opposing litigants.

⁴⁶http://ec.europa.eu/eurostat/ramon/nomenclatures/index.cfm?TargetUrl=LST_NOM_DTL&StrNom=CL_NACE2&StrLanguageCode=EN [accessed: 22 July 2015].

⁴⁷Where only industry codes of a different classification system were available, I transformed those into NACE Rev. 2 industry codes pursuant to official correspondence tables.

⁴⁸This measure is highly related to yet distinct from the one used by Bloom *et al.* (2013), who capture product market proximity with industry codes weighted by their share of sales. Unfortunately, information on corporate sales at IPC level is not available in Orbis.

2.8.4 Operationalization of Opportunity Costs

Opportunity costs emerge from the time required until the plaintiff is able to legally enforce his patent. Every patent litigation dispute i is defined by a litigation value L . This litigation value is determined by the value of the patent, the remaining time of patent protection, and the scope of the infringement. The observed litigation value L_i thus equals the value of all rents the patent holder could receive during the time from the start of the dispute until the patent's expiration, T , discounted by the technology-specific factor δ ($\delta \in [0, 1]$)⁴⁹:

$$L_i = \int_0^T M_i (1 - \delta_i)^t dt. \quad (2.8.1)$$

For the sake of simplicity I assume $B = 0$ and solve for M :

$$M_i = \frac{L_i \ln(1 - \delta_i)}{(1 - \delta_i)^T - 1} \quad (2.8.2)$$

The opportunity costs of dispute i at court j can then be operationalized by plugging equation (2.8.2) into equation (2.2.3) from Section 2.2.1:

$$\begin{aligned} OPC_{ij} &= \alpha_i \int_0^{l_{ij}} M_i (1 - \delta_i)^t dt \\ &= \alpha_i \int_0^{l_{ij}} \frac{L_i \ln(1 - \delta_i)}{(1 - \delta_i)^T - 1} (1 - \delta_i)^t dt \\ &= \alpha_i \frac{L_i ((1 - \delta_i)^{l_{ij}} - 1)}{(1 - \delta_i)^T - 1}, \end{aligned} \quad (2.8.3)$$

where the factor α ($\alpha \in [0, 1]$) represents the product market proximity between the litigants.

⁴⁹Future returns from a patent are commonly discounted due to the likelihood of technological obsolescence or the possibility to invent around the patent. I broadly follow the technology-specific approximate decay rates estimated in Schankerman (1998) (see also Table 2.15).



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