Judges, Courts and Economic Development: the Impact of Judicial Human Capital on the Efficiency and Accuracy of the Court System

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Abstract

There is a strong consensus that the courts have a role to play in the development of economies as the enforcer of property rights. As a consequence, there has been substantial work studying how to create accountable and impartial court systems that will be responsive to public needs. However, it is not enough that courts be open and impartial–they must also be efficient and accurate to ensure secure property rights, reduce uncertainty, and promote investment. But there has been little empirical work exploring such issues, despite the possible tradeoffs between policies which increase openness and those which increase judicial human capital that might make judges more efficient and accurate.

This paper attempts to fill that gap by estimating the impact of judicial experience and the human capital it creates on the efficiency and accuracy of patent litigation in the U.S. Patent litigation is particularly good for testing such hypotheses because all patent cases in the U.S. are adjudicated in the U.S. District Court System; this fact reduces the legal and procedural variations that can occur in cases which may be filed in state or federal courts, etc. Moreover, it is an area of law which is highly complex and in which many judges have little experience. Thus, we are able to distinguish between the type of managerial judicial human capital embodied in general experience–as measured by time on the bench–and specialized experience and knowledge of the law–measured by total or recent patent cases presided over. Using these variables, we estimate the impact of judicial human capital on efficiency–as measured by case duration–and accuracy–as measured by the probability of being overruled on appeal.

However, we must control for two levels of unobserved characteristics. Judges in the U.S. District Court System are randomly assigned to cases. Thus, analysis of judicial experience does not suffer from the type of endogeneity which typically plagues studies of education. However, while judges are randomly assigned *within* districts, patent cases are not randomly distributed *across* districts. The "portfolio" of cases in some districts more heavily weighted towards patent litigation than in others. Judges in some districts therefore have a much higher probability of "drawing" a patent case, and consequently those judges accumulate a much higher level of specialized experience than judges in districts with a lower proportion of patent cases. Thus, analysis of experience must control for both district characteristics and unobserved judge characteristics.

We control for district level characteristics through variables measuring district caseload and patent technology variables as well as district level dummies. We control for unobserved judge characteristics by using clustered estimators of standard errors and a shared frailty model in the duration analysis of efficiency. In the logistic regression of the probability of being overruled on appeal we again use a cluster error model and random effects logit model. We find that both general and specialized experience can reduce the duration of patent cases and that this result is robust across the various estimation techniques. However, the probability that the case will terminate through a settlement rather than a judgment increases with general experience but not with specialized experience; this result is consistent with the view that judges with many years on the bench are skilled at "clearing their dockets." On the other hand, while specialized experience reduces the probability of being overruled on appeal, general experience has no impact. Finally, recent specialized experience has a greater impact

on both efficiency and accuracy than does an increase in the total number of patent cases a judge has seen.

These results have implications for policies seeking to improve the contribution of the court system to economic growth. Measures which seek to increase the accountability of judges by actually or potentially removing them from office should take into account the "switching costs" created by removing experienced judges. Both managerial human capital and knowledge of the law can increase the efficiency with which cases are resolved. However, only experience which contributes directly to knowledge increases the accuracy of judicial decisions. Thus, these switching costs are most important when judges preside over complex cases. Complex intellectual property cases may be such a case. In addition, 0ther policies which seek to increase the experience of judges, such as specialized court systems in complex legal areas, may increase both the accuracy and efficiency of the court system.

1 Accuracy and Efficiency of the Courts and Economic Development.

There is a long-standing consensus that the clear definition and enforcement of property rights is an important element in economic development.[1] This consensus is of more than scholarly concern; the experience in the reforming socialist economies demonstrates that secure property rights play an major role in market economies.[2] But well-designed laws and regulations cannot ensure property rights without an institution that will enforce those rights and settle disputes, and in nearly all countries the final forum for resolving property rights disputes is the court system. Thus, a well-functioning court system is crucial for economic growth.

Following this line of reasoning, economists have considered the operations of court systems an important area of study. However, economic study of courts has usually focused on the design of incentive mechanisms to ensure an accountable and impartial judiciary. Much of this literature discusses the inherent tradeoff between judicial independence and judicial accountability.[3] Nonetheless, some authors have noted that even if judicial incentives are perfectly designed, the organization of the court system and the rules under which it operates can have a dramatic impact on its effectiveness as an economic institution. While it is true that judges need to be protected from outside influences which could bias their decision, even unbiased decisions must accurately interpret the law. Inaccurate or well meaning but seemingly idiosyncratic decisions will decrease confidence in the legal system and increase uncertainty in economic activity.[4] And accuracy alone is not sufficient for a high quality court system. Disputes must be resolved and decisions must be rendered in a timely manner if they are to provide investors with the security and certainty necessary to promote investment.

Thus, a judicial system must not only be impartial, it must be accurate and efficient as well. International institutions promoting economic development, such as The World Bank, have recognized this link and launched technical assistance efforts to improve the administration of court systems around the developing world.[5] Economic scholarship also recognizes the importance of a well-managed court system. In their study of the relationship between

[1]See, for example, Douglas North, *Institutions, Institutional Change and Economic Performance* [17]

[2]Reform of the legal system and property rights were an important part of the work of The World Bank and other international institutions in assisting the the transition of the former Soviet Union to a market economy. See, for example, Grey, et. al.[5].

[3]For two examples, see Maskin and Jean Tirole[15], "The Politician and the Judge: Accountability in Government." American Economic Review, Sept. 2004 and Hanssen, "The Effects of Judicial Institutions on Uncertainty and the Rate of Litigation: the Election versus Appointment of State Judges," Journal of Legal Studies, 1999[7]

[4]See Gillian Hadfield, "The Quality of Law: Judicial Incentives, Legal Human Capital and the Evolution of Law," 2007[6].

[5]See "Initiatives in Legal and Judicial Reform," Legal Vice Presidency, The World Bank, 2004[21].

entrepreneurial investment and the "quality" of the legal systems across states in Mexico, Laeven and Woodruff, define "quality" not only as "the *impartiality* of judges" but also as "the *quality* of judges; the adequacy of judicial resources; the efficiency of enforcement of rulings; the efficiency of judicial administration more generally; the cost, ease of use and completeness of property registries and the adequacy of local legislation related to contract enforcement."[6] Rosales-Lopez explores the impact of recent reforms in the Spanish court system on its ability to resolve disputes, citing the "problems such as congestion, the high cost and delay of procedures [that weaken] the access and citizens' equality before the law, as well as the enforcement of laws and the guarantees of property rights and contracts."[7] Choi, Gulati and Posner[8] compare compare appointed and judges and find ambiguous results regarding the "independence" of the two judicial systems. However, they also evaluate both the "productivity" (as measured by the number of opinons written) and the "quality" (as measured by the number of citations received by such opinions) of judges in the two systems. Thus, to ensure public confidence and promote investment, courts must not only be impartial in administering justice, but also accurate and efficient in the resolution of disputes.[9]. Finally, in their massive international study of adjudication of simple civil cases, Djankov, et. al.[3] analyze the importance of court procedures on both accountability and also on accuracy and case duration. Thus Recent economic scholarship has acknowledged the importance of case duration in analyzing the operation of court systems.

However, what this literature generally neglects is that, just as there may be a trade-off between accountability and independence, there may be a trade-off between court reforms promoting accountability and those promoting increased judicial "human capital."[10] The various proposed measures to increase the"openness" and "accountability" of courts–election, versus appointment of judges; term limits; etc.–all involve the actual or threatened removal of judges from office. However, the job of managing a case docket is one which a judge must learn on the job. Presumably, a judge with many years on the bench should have developed a set of skills to keep cases flowing smoothly–scheduling the necessary court procedures, managing lawyers, etc. And previous legal experience may not have exposed a new judge to all the areas of the law s/he may see on the bench; as a judge sees more cases of a particular type, his/her knowledge of that area of the law should become deeper and richer, leading to more accurate decisions and rulings. Thus, the importance of general managerial skills and familiarity with special areas of the law can play a part in discussions of judicial term limits as well as whether judges should be elected or appointed. Maskin and Tirole note this problem by acknowledging that there may be a tradeoff between measures designed to create an unbiased court system and the "set up" costs of a new judge, including the "learning by

[6]Laeven and Woodruff[13], p. 606, italics added.

[7]Rosales-Lopez[18], pp. 231-32

[8]See Choi, Gulati and Posner[2]

[9]In fact, Rosales-Lopez notes an important paradox underlying efforts to increase judicial efficiency: the more efficient the resolution of disputes, the more disputes that will be filed, thereby perhaps increasing congestion and making the management of the courts more difficult.

[10]And exception is Choi, et. al., op. cit.

doing" which occurs on the bench.[11] And there is empirical verification that some policies designed to increase accountability may decrease experience and the resultant stock of human capital. In his study of state court judges, for example, Hanssen finds that appointed judges serve 50% longer on average than do elected judges.[12] Thus, there is cause to worry that some legal reforms my reduce judicial experience due to a legal "switching cost" which kicks in when judges are removed from the bench.

The possibility of such costs could be an important consideration in implementing reforms designed to increase the contribution of the courts to economic development. If the costs are great, reforms which lead to too much "churning" on the bench might be avoided. In fact, it might be worth pursuing policies which increase judicial experience and human capital, even if such changes might lead to a decrease in "impartiality." For example, many countries employ specialized court systems which cover only one type of particularly complex case case. An argument for such specialized courts is that they lead to greater judicial human capital as judges specialize on one area of the law. But one argument against them is that judges and lawyers practicing in that area might become overly familiar, thereby decreasing impartiality.[13] However, behind all the arguments about these potential tradeoffs between openness and experience lies one fact: this underlying hypothesis–that there is a positive relationship between judicial human capital and the accuracy and efficiency of the court system–must be empirically verified.

This paper performs such an analysis, utilizing a class of litigation particulary suited to the question: litigation of patent infringement disputes in the United States. All U.S. patent cases must be filed in the U.S. Federal District Court system. Thus all patent cases are litigated using a uniform set of rules and procedures; data drawn form other types of litigation, which can be filed in both federal and state courts, has to account for a wide variety of legal statutes, precedents and procedural rules.[14] In addition, all cases in U.S District Courts are randomly assigned to judges through a "round robin" system, freeing our analysis of experience from the type of endogeneity that plagues studies of education. Moreover, patent law is a highly specialized area of the law, allowing for a distinction between the "general" judicial human capital acquired through time on the bench and "specialized" human capital acquired through experience with a particular area of the law. Finally, examination of these issues with respect to patent cases has particular policy relevancy; as of this writing, the U.S. is contemplating the creation of a specialized patent trial court in order to increase the specialized knowledge of judges presiding over such cases. Thus, study of the relationship between judicial experience and the litigation of patent cases is both highly suitable and timely.

[11] See Maskin and Tirole[15], pp. 1043-44.

[12] See Hanssen[7] (p. 211).

[13] See Kesan and Ball (2010)[10].

[14] See Kesslar and Rubinfeld[12] for a discussion of the difficulty of analyzing court data which cuts across different court systems.

The rest of the paper pursues this issue as follows. First, we provide some background on patent litigation in the United States and why it provides a good vehicle for the study of the impact of judicial human capital. Then, we outline the data collection procedure, including details about the data generating process which make unobserved heterogeneity a cause for concern, as well as the various methods for defining judicial experience. In the next section, we estimate the relationship between experience and efficiency using a duration model and using appropriate techniques for controlling for the impact of both observed and unobserved heterogeneity. Finally, we explore the relationship between experience and accuracy by analyzing the probability that a case will be reversed on appeal. Through these mechanisms we will examine the relationship between judicial human capital and the accuracy and efficiency of the court system.

2 Accurate and Efficient Patent Litigation and Judicial Human Capital.

While most economic scholarship analyzing the importance of the courts has focused on disputes over real property, the relationship between the court system and investment is no less strong for intellectual property. And to a large extent, the relationship between the courts and the patent system depends on the quality of "judicial human capital."

In the United States, as in many countries, the courts are a crucial part of the patent system to the extent that the patent system is can be termed a two-stage process. In the first stage, the U.S. Patent and Trademark Office grants property rights to inventors. In the second stage, inventors can protect those rights through patent infringement suits in the courts and alleged infringers have the right to challenge improvidently granted patents and have them declared invalid. As a consequence, some authors have referred to patent rights as being "probabilistic," depending not only on whether the innovation embodied in the patent has commercial value, but also on the refinement of that patent property right after litigation.[15]

Just as with real property, the management of the court system has an impact on both patenting behavior and on investment in research and development. While the majority of all patents are not litigated, those that are disputed in the courts are among the most valuable.[16] The rules governing the court system may even "feed back" into patenting behavior; some authors have found evidence that the increasingly "patent friendly" rules[17] adopted by the courts are a major factor in the surge in patenting since the 1980s.[18] Moreover, the

[15] See Lemley and Shapiro[14].

[16] Lemley and Shapiro[14]; Allison, et. al.[1].

[17] I.e., rules that start from the presumption that a patent is valid and force the alleged infringer to prove otherwise.

[18] Henry and Turner[8].

ability to define the "probabilistic" property rights is an important element in determining whether patents fulfill their purpose of promoting innovation.[19] Finally, the costs associated with the patent systems can be reduced by an efficient court system; firms may hesitate to invest in new products and technologies which may infringe on existing patents, so any additional delay or cost in clarifying existent rights may slow the process of innovation. The more quickly and cheaply these rights are defined, the more beneficial the patent system will be in promoting and not inhibiting innovation and investment.

However, in the United States this second phase in the patent system is managed by a District Court system in which judges with a general legal background preside over cases ranging from drug trials to anti-trust actions. Under such circumstances, patent infringement suites can pose particular challenges. Patent litigation is officially classified by the U.S. Administrative Office of the District Courts as one of several types of "complex litigation" which place special burdens on judges and other court personnel. Not only are technical issues involved, but there are also procedures and rules that are unique to patent law. For example, since the "Markman" ruling of 1995 on "claim construction," judges in patent cases have been required to examine the claims stated in the patent document, thereby defining the boundaries of the technology.[20] This procedure is a potentially lengthy process involving briefs from the plaintiff and defendant, expert opinions and a special claims construction hearing. Such procedures can create difficulties for judges who are not familiar with the intricacies of patent law. And there is evidence suggesting dissatisfaction with the performance of district courts in patent cases at the District level. Approximately 10% of judgments in other areas of the law are appealed, whereas 50% of the judgments in patent cases are appealed.[21] As a consequence, intellectual property disputes are included as one of the topical areas warranting a special section in the Federal Judicial Center (FJC)[22] Manual for Complex Litigation (2004), along with anti-trust cases, securities cases, employment discrimination, CERCLA (Superfund) and civil RICO. Moreover, in the FJC's 2003-04 study of the amount of work required for District Court cases, while an "average" case is assigned a weight of 1, patent cases received a weight of 4.72. Only environmental cases (4.79) and death penalty cases (12.89) received higher weights.[23]

Thus, lack of familiarity with patent law can be a barrier to efficient resolution of patent disputes, and has led to observations like the following[24]:

> Patent litigation stands among the most complex, with disputes about cutting-edge technology muddied with esoteric and arcane language, laws, and customs.

[19] Lemley and Shapiro[14].

[20] While there are of course major differences, the reader can consider the "claims construction" procedure as being somewhat analogous to the definition of the relevant market in anti-trust litigation.

[21] Michel[16].

[22] The federal agency responsible for administering the federal district court system.

[23] See "2003-2004 District Court Case-Weighting Study," Federal Judicial Center, 2005[4].

[24] Lawrence M. Sung, "Strangers in a Strange Land: Specialized Courts Resolving Patent Disputes," Bus. L. Today, Apr. 17, 2008, p. 27.

> Even with the assistance of legal and technical experts as well as special masters, generalist judges and juries are often at sea almost from the beginning of a patent case. When compared to other adversarial actions, patent cases benefit significantly from having a judge hear the case who is familiar with technical issues.

Most recently, the issue of judicial human capital has been part of a discussion about whether the United States should have a specialized lower-level patent court; several legislative reforms have been proposed in Congress to create opportunities for specialization at the district court level in patent cases.[25]

While a detailed discussion the arguments for and against specialized courts is beyond the scope of this paper,[26] they can large be categorized under four headings: 1) improvements in judicial human capital, 2) uniformity and predictability in the development of legal doctrine, 3) the impact on and influence of the political economy of the judicial system, and 4) the efficiency of the court system. The creation of a specialized appellate court for patent cases[27] in 1982 arguably had some success in dealing with the second and fourth criteria; patent law is now applied in a more uniform manner across the circuits and inefficient forum shopping, though still occurring, is not as great as it once was.[28] Nonetheless, there is still a belief that a specialized patent trial court is needed, and the primary rationale for this is improvements in judicial human capital. Many scholars and policy makers believe that the average district court judge hears too few patent cases and/or does not have the specialized training to adequately and expeditiously rule on complex issues. Appellate review of claim construction, for example, results in a relatively high reversal rate.[29] However, there is little empirical work exploring the relationship between judicial experience-either general or patent specific-and the efficiency and accuracy of the resolution of cases.[30]

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[25]E.g, H.R. Res. 5418, 109th Cong. (2006), and S. 3923, 109th Cong. (2006). Specialized patent courts are currently in use in Korea, Thailand, Turkey and the United Kingdom, although other countries might be included under a somewhat less stringent definition of "specialization.". See Kong-Woong Choe, "The Role of the Korean Patent Court", 9 Federal Circuit Bar Journal 473 (2000) and Ryan S. Goldstein et al., "Specialized IP Trial Courts Around the World," 18 No. 10 Intellectual Property and Technology Law Journal 1 (2006).

[26]For such a discussion of these issues, see Jay P. Kesan and Gwendolyn Ball,2010[**?**] available from the authors.

[27]the Court of Appeals for the Federal Circuit (CAFC)

[28]See Henry and Turner[8] for an empirical demonstrating of the success of the creation of the CAFC in enforcing uniformity in the interpretation of patent law.

[29]See Michel.[16]

[30]One exception is Schwartz[19] does look at appellate reversal rates, but only for rulings on claim construction.

3 The Data.

To analyze the relationship between experience, efficiency and accuracy, we began by compiling a list of all U.S. District Court cases identified as patent cases by the Administrative Office of the District Courts (AO) between 1995 and 2003.[31] The time range studied was deliberately selected; the rules of civil procedure governing patent cases changed significantly in 1995 with the Supreme Court's Markman decision on claim construction.[32] Thus, the procedural rules for patent cases changed so substantially in 1995 that it can be assumed that all judges started from a zero knowledge base as of that date. On the other hand, the range analyzed ends in 2003 to ensure that the vast majority of cases will have terminated and their will be a reasonably small number of right censored observations.[33] Therefore, the years selected are sufficiently recent to reflect the current legal environment for patent infringement cases but sufficiently old to supply information about the entire "life cycle" of a patent case. This gave us an initial initial database of 15,264 cases.[34]

After the list of cases was compile, the case docket for each case was examined through the U.S. Court System's Public Access to Court Electronic Record (PACER) system.[35] These dockets gave us the following information:

–The filing date of the case.
–The date of termination, if any.
–The manner in which the case was resolved, e.g., through a ruling[36] a settlement, or some form of non-adjudicated termination.
–The patent/s at issue in the case.[37]
–The judge presiding over the case.[38]

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[31] District court cases are available through the Inter-University Consortium for Political and Social Research (ICPSR)

[32] Markman v. Westview. which established a new procedural step: the "Markman Hearing" on claim construction. Claim construction in patent cases is a pre-trial procedure conducted by the judge which defines the technological boundaries of the the allegedly infringed patent–roughly analogous to defining the market in anti-trust proceedings. The issue of claim construction is discussed in more detail in section 5.1.

[33] Only 134 cases had not terminated as of mid 2009.

[34] Not all observations could be included in the estimation due to missing information on some judges and/or the patents in the case.

[35] www.psc.uscourts.gov.

[36] Summary judgment, judgment on a jury verdict, judgment on a court trial. See Kesan and Ball[11] for a discussion of the inadequacies of the official AO coding system for research purposes and details on our techniques for coding case outcomes.

[37] The patents at issue were available in the dockets for about half of all cases. Additional patent data was obtained through the LitAlert database available through Westlaw. Ultimately, the patents at issue were available for about 70% of all cases.

[38] Some cases were presided over by a "magistrate" judge not appointed by congress. Biographical information was not available for magistrate judges. For a very small number of cases, no judge was listed. Details on how judicial "experience" was measured are given in the next section.

Efficiency was defined as the duration of the case. Accuracy was defined as probability of being overruled on appeal. Additional details on the construction of the appellate data is given in section 5.1.

A full list of the variables employed in the analysis of case duration is given in Table 5.

3.1 Measuring General and Specialized Experience.

Once judges had been identified from the case dockets, we consulted the Federal Judges Biographical Database compiled by the Federal Judicial Center (FJC)[39] to determine when a particular judge was appointed to or left the bench and to verify the district of appointment.

Our first concern was to use this source to determine the amount of general experience by the judge in every case. General experience has a high "managerial" component. An experienced judge should be able to manage his/her workload efficiently, know how to set deadlines and work with the opposing parties. In general s/he should be able to "clear the docket" and get cases resolved in an expeditious fashion.[40] To determine general experience, we calculated the number of years a judge had served on the bench[41] as of a case's filing date using the FJC biographical database.

Specialized experience is a somewhat different matter. A judge may need additional time or assistance on the first patent case s/he sees, and presumably less on the second, etc. There is therefore an implicit learning process as the judge sees more and more patent cases. However, there are many ways in which experience might contribute to learning process. First, experience may be cumulative, with each additional case adding to the judge's human capital in a linear fashion.[42] Second, experience may need to be recent; the experience gained from a case from many years ago may have been forgotten and only the most recent cases contribute to current knowledge. Finally, experience may be cumulative but non-linear. Judges may need to reach a certain experience "threshold" before they gain a sufficient knowledge of patent law. Or they may gain knowledge from the first few cases, but beyond that point the gains taper off. Then we defined our variables with the understanding that 1) experience is cumulative , 2) recent experience matters most, and 3) experience is cumulative, but non-linear.

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[39] *History of the Federal Judiciary.* http://www.fjc.gov. Web site of the Federal Judicial Center, Washington, DC.

[40] Part of this skill may be an ability to push the parties to settle the case rather than continue litigating until a final ruling is reached. In a later section we will examine the relationship between the propensity to settle a case versus judicial experience.

[41] In measuring the time on the bench, we included any time as a magistrate judge. Case management is frequently conducted by magistrate judges on a day to day basis, so such experience should be relevant.

[42] Again, we assume that the accumulation of knowledge on the law relevant to patent litigation began anew in 1995 with the "Markman" decision.

These concepts of the relationship between experience and knowledge were summarized in three different "variables." Cumulative specialized experience is measured as the total number of patent cases[43] the judge had presided over as the filing of the case in question. Recent experience is measured as the number of patent cases presided over in the years previous to case filing. Non-linear experience is measured using a piecewise linear model of the form:

$$Piecewise\ Linear(x, k_1) = (x - k_1)_+$$

where k_1 is the value of the "knot" and "+" denotes only the positive values. Thus, each piecewise linear variable is a horizontal line at zero up until value k_1 and a linear slope c_1 corresponding to that piecewise variable's coefficient. For values of $x \geq k_2$, the slope applied to increasing x is $c_1 * (x - k_1)_+ + c_2 * (x - k_2)_2$. For $c_2 > 0$, the slope will increase at k_1, for $c_2 < 0$, the slope will decrease at k_2.

All three of these methods of measuring experience will be used as proxies for judicial human capital in the estimation.

3.2 Case Assignment, Unobserved Heterogeneity, and Estimating the Effect of Judicial Human Capital.

As stated in the previous section, one advantage of studying judicial human capital in the U.S. District Court System is that judges are assigned to cases randomly.[44] Thus, each judge in a district has the same probability of being assigned a patent case. For this reason, judicial patent experience does not present the same kind of endogeneity problems associated with education; judges with greater aptitude, or greater knowledge of patent law are not, *ceteris paribus,* more likely to draw a patent case.

However, while patent cases are randomly distributed across judges *within* a district, they are not randomly distributed *across* districts. Table 1 Demonstrates the extremely uneven distribution of patent cases across the 92 federal districts–and the resultant average number of patent cases per judge in each district. Over 10% of all patent cases in the study years were filed in the Central District of California, 7% in Northern California, and 6% in the Northern District of Illinois. Thus, three districts accounted for nearly a quarter of all patent cases filed between 1995 and 2003. However, the the importance of these districts was not due solely to their size; some districts have an inordinate share of the "patent docket." As shown in the same table, patent cases constitute 0.65% of all civil cases. But in the three districts cited, patent cases constitute between 1 and 2% of all civil cases. And in the District of Delaware, a relatively small district, patent cases are 6.75% of all civil cases. Thus,

[43] Since 1995.

[44] The only grounds a judge can present for declining a case is conflict of interest.

a district may have a high share of patent litigation because it has a large number of cases and/or because its "portfolio" of cases is heavily weighted towards patent cases. When the reason is the latter, the average number of patent cases per judge will be high. Thus, the average number of patent cases per judge per year ranges from 0.04 in New Mexico to nearly 20 in Delaware. As a consequence, the probability of a judge drawing a patent case is low in some districts (New Mexico) higher in some districts (Central and Northern California and Northern Illinois) and very high in other districts (Delaware).

This fact has several consequences for the analysis of judicial experience and both efficiency and accuracy. First, judges from districts with high rates of patent litigation will have a higher probability of drawing a patent cases and therefore will tend to have more patent experience. Any analysis relying on experience may therefore suffer from omitted variable bias due to *district* characteristics. Table 2 summarizes two factors which observably vary across districts and may have an impact on efficiency and accuracy. First, it seems reasonable that judges will behave differently when they work in a district where the workload is high, and the average per judge caseload varies substantially across districts. Table 2 demonstrates the Annual Weighted Filings per Judge[45], which varies from 737 in Arizona to 199 in Wyoming. Secondly, it seems likely that cases drawn from some technological categories (e.g., medical) might be more complicated than others (e.g., mechanical) and place greater demands on the patent expertise of the judge. Table 2 also demonstrates that there is a wide variation in the distribution of patent cases across NBER technological categories from district to district, usually reflecting the patent-producing industries that are are important within that geographical region.[46] Thus, the patent technology category[47] and weighted case filings are also included in the analysis. Finally, there may be unobservable characteristics of districts which need to be taken into account. For example, the Districts of Northern Texas and Eastern Virginia had a managerial policy of resolving cases rapidly during the period under study, leading them to be known as the "rocket dockets." The importance of this fact for analysis of case duration is obvious. To control for these and other unobservable characteristics, district dummies are also included.

The second consequence of the distribution of patent cases is unobserved heterogeneity of the judges. The non-random distribution of cases across districts leads to non-random distribution of cases across individual judges. Some judges are more likely to draw a patent case, leading to a small group of judges presiding over a large number of cases and a large

[45]The weights are the case-type weights calculated by the Federal Judicial Center. See Section 2 above.

[46]For example, the Southern District of Indiana has a high concentration of patent cases in NBER category 3: medical and drugs. This undoubtable reflects the fact that the pharmaceutical company Eli Lilly has its headquarters in Indianapolis.

[47]Despite the use of two data sources, patent numbers could not be obtained for about 30% of the cases. The estimations described later is this paper were also performed dropping the patent technology variables to utilize the entire dataset. The results were qualitatively similar but the likelihood was substantially worse, suggesting that the added precision from the technology dependent variables outweighs the benefit of the additional data.

number of judges presiding over very few. Four judges-one third of one percent of all judges–presided over more than 100 cases each over the eight years studied, nearly six percent of all patent cases. The top 20% of all judges (that is, the top 250 or so) presided over about 60% of all cases. Half of all judges presided over only about one patent case a year between 1995 and 2003. Thus, there is a highly skewed distribution of cases across judges. It is obvious that a small number of judges have substantial experience dealing with patent cases. A small number of judges will be accumulating experience at a rapid rate.

The highly skewed distribution of patent cases across judges translates into a highly skewed distribution of experience level across the actual level of observation, the individual patent infringement case. The judge presiding over the "average case" in our sample had presided over 15 other patent cases as of the case in question; The judge presiding over the "median case" had presided over 9. The 95th percentile across observations of previous experience is 50 cases. However, the approximately 770 cases falling into this category are presided over by only about 30 judges; the 97.5th percentile of experience across observations were presided over by only 12 judges. Thus, there is the potential for a high degree of correlation between the unobserved characteristics of this small group of judges–such as a high ability level; a propensity to resolve cases quickly; etc.–and a high "experience" covariate.[48] This leaves us with a classic "good news vs. bad news" dilemma: the good news is that we have wide variation in the value of the experience variable across cases. The bad news is that the concentration of cases on a small group of judges means that the results could be affected by unobserved characteristics of the judges such as general ability, managerial style, etc.

As a consequence the unobserved characteristics of judges with a great deal of patent experience could have an impact on analyzing the relationship between experience and efficiency and accuracy. Appropriate methods need to be employed to account for this potential problem.

4 Estimating the Impact of Judicial Experience on Efficiency.

The previous sections outlined the reasons why we might hypothesize that general and specialized experience may have an impact on the efficiency with which court cases are resolved. It also demonstrated that patent litigation provides an opportunity to test this core hypothesis, but that the manner in which patent cases are generated creates unobserved heterogeneity at both the district and individual judge level. Appropriate variables are used in the estimation to control for these factors. In addition, a "time" variable was included to measure the

[48]To reinforce the importance of district characteristics, all of these judges were drawn from the districts of Central and Northern California, Delaware, Western Wisconsin and Minnesota, all of which can be seen in Table 1 to have a high rate of patent cases per judge.

number of years between 1995 and case filing. This additional variable was added to control for unobservable time-related variation such as changes in patent law, macro economic conditions and financial motivations, etc. Details on all the variables employed are provided in Table 5.

We employed two techniques to deal with the potential problems created by unobserved heterogeneity among judges. First, we estimated case duration with with robust sandwich clustered standard errors for each judge. Since the technique estimates the coefficients using all observations and then constructs a robust estimate of the standard errors, the coefficients do not vary from the standard analysis, although significance levels might.[49]

Second, we estimated a shared frailty model. Frailty models are employed in the biometrics literature to account for the fact that in, for example, a clinical trial, some individuals have a natural but unobservable propensity to succumb to the disease. That is, some individuals are more "frail" than others. With time, the more frail individuals die more quickly, and the more robust survive. As a consequence, the relative risk of dying with respect to observable characteristics may seem to decline as the study continues solely due to the fact that the more "robust" individuals remain. Shared frailty models allow for standardizing the effect across observations; for example, if genetic predisposition is a factor, all members of a family may share the same frailty. In the context of this study, it is possible that some judges are inherently more likely to resolve cases quickly due to management style or overall ability. Most importantly from our perspective, cases which are presided over by the same judge should share the same "frailty" reflecting that judge's unobserved characteristics.

Frailty models correct for the unobserved heterogeneity problem by introducing a random effect capturing the distribution of inherent frailty. For a cox proportional hazard model,[50] this the hazard rate λ including frailty takes the form:

$$\lambda_i(t) = \lambda_0(t)e^{X_i\beta + Z_i\omega}$$

where Z_i is a design matrix designating which observations share the same frailty and the ω_i's are distributed as the logs of iid gamma random variables with variance θ estimated by the model.[51]

Finally, the nonlinear model was estimated using a piecewise linear model as described above, with the potential "knots" at every 5 centiles (i.e., 5% centile, 10%, 15%, etc.). A stepwise regression procedure was used to select the knots.

[49] This technique is analogous to that used in pooled binary response models. See Wooldridge[20], pp. 482-492.

[50] It should be noted that a frailty model does not rely on a marginal proportional hazard model. The marginal model of duration time for each observation is a cox model conditional on the estimated frailty variance.

[51] It is also possible to assume that the ω_i's have a gaussian distribution. More detail on frailty models can be found in Hosmer, Lemeshow and May[9]

4.1 Experience and Efficiency: Estimation Results.

Table 6 gives the results for estimating total and recent experience using standard cox proportional hazard estimation,[52], a cox model employing clustered standard errors and a shared frailty model for both total cumulative experience and recent experience. It also reports a model allowing for non-linearity in the cumulative experience variable via a stepwise regression procedure.

These results suggest that there is indeed reason to believe that there is a relationship between both general and specialized experience and the duration of a patent case. General experience has a positive coefficient, significant at the 1% level, a result which is robust across all model specifications. Thus, the hazard rate increases with the level of general experience, and the duration of the case falls.

Likewise, there is a positive and robustly significant relationship between the judge's cumulative patent experience and case duration. The coefficient for recent experience is also significant and positive, and is nearly twice as high as that of cumulative experience. This result would be consistent with the hypothesis that a case the judge presided over more than three years ago has a lower impact on his/her current knowledge base than if it had occurred more recently. To put the size of the coefficient in context, the difference between the expected duration of a case whose judge's recent patent experience fell at the twenty-fifth percentile and one whose judge's experience fell at the ninetieth percentile was about one month. While this reduction in duration is not overwhelming, our previous research has shown that the median patent infringement case lasts nine to ten months[53]. Thus, recent experience has a measurable, though modest impact on case duration.

The results of the frailty model suggest that there may indeed be heterogeneity across judges and association across cases with the same judge. The "theta" variance of the gamma distributed heterogeneity is significant at the 1% level. The resultant coefficient for general experience was nearly twice that produced by the cox model and the coefficient of specialized experience was nearly three times as great. However, this result must be interpreted with caution, since the value of the coefficients are conditional on the estimated gamma variance.

Finally, the stepwise regression finds that there is a payoff to relatively low level of specialized experience; case duration begins to fall off after a judge has presided over approximately

[52]the assumption of proportional hazards was examined through a Schoenfeld residual plot and by comparing the hazard rates. On the whole, the assumption holds up fairly well. Both the hazard rates and the residuals support the assumption of proportional hazards over most of the range of duration times. Only cases of very short duration (a week or less) or very long duration deviate from the assumption of proportional hazards according to the Schoenfeld residuals. Since the impact of judicial experience is likely to be less at these two extremes, and because cases falling into these categories are only a small percentage of the data, we did not consider this a major cause for concern.

[53]See Kesan and Ball (2006)

eight previous patent cases.[54] However, nearly half percent of all patent cases were presided over by judges who had less than this level of experience. Moreover, the negative coefficients applied at higher "knots" indicates that the value of additional experience tapers off at higher levels. Thus it would appear that there is a threshold level of experience a judge must achieve to demonstrate accumulation of "judicial human capital," and that as more experience is gained, the rate at which such capital accumulates declines..

These results provide robust support for the hypothesis that judicial experience can improve the efficiency of the legal system. As judges spend more time on the bench, the duration of their cases decrease. The impact may be even greater for specialized experience in complex areas of the law like patent litigation.

4.2 Experience, Efficiency, and Case Outcomes.

The previous section demonstrated that there may indeed be a link between both general and special experience and the duration of a case. However, it is not necessarily true that this result implies that experienced judges have a greater managerial ability or facility with patent law; they may simply be better at pushing the parties to settle the dispute. Our previous work has shown that the duration of cases ending in settlements is significantly shorter than that of ending in judgments. Since settled cases tend to have shorter durations than those which terminate through a judgment, the shorter duration achieved by experienced judges might just reflect this fact.[55] Thus, a negative relationship between the probability of a case ending in a judgement and judicial experience would imply that the previous results were not due to greater knowledge of patent law, but to better ability to avoid applying patent law in a final ruling.[56]

To test this hypothesis, we used the same variables to test whether the probability of a case terminating through some form of judgment as opposed to a settlement increased with the level of general or specialized experience. Again, allowances were made for both district level omitted variables and unobservable judge characteristics by employing both standard logistic regression and including clustered standard errors. A random effects logit model was estimated to measure the impact of individual heterogeneity in a manner analogous to the frailty model of case duration.

[54] The particular results reported were found with STATA's "forward" stepwise regression procedure. The "backwards" procedure was also estimated. While the location of the knots was slightly different, the qualitative story did not change.

[55] See Kesan and Ball[11] for an empirical analysis of the relationship between rulings, settlements, and case duration.

[56] Since rulings in patent cases play a crucial role for post-grant review of patents in the U.S., any factor which decreases the rate of rulings weakens the structure of the U.S. patent system. See Kesan and Ball. op cit.

The results, given in Tables 7, suggest that there is a relationship between judicial experience and the probability that a case will end with a judgment. In most formulations of the model, the coefficient of general experience is significant and negative. This result is consistent with the hypothesis that judges with a many years on the bench are good at "clearing" their dockets, often by "encouraging" the parties to resolve their dispute through a settlement. However, in all models, the coefficient for cumulative patent experience is significant and positive; cases presided over by judges with more specialized human capital are *more* likely to end in a ruling. The result is less clear for recent experience, since the coefficient of number of patent cases in the last three years is not significant in either the clustered error or randome effects model. But these results do suggest that there is a difference in the two types of experience. Judges with general experience may be more inclined to promote settlement. But there is no evidence that the shorter duration of cases with judges holding a high degree of specialized experience is due to their propensity to promote settlements. On the contrary, if anything, such judges seem more inclined to issue final rulings then their colleagues with less patent experience.[57]

5 Judicial Experience and Accuracy in Patent Litigation.

The previous section explored the impact of experience-both generalized and specialized-on the efficiency with which patent infringement suits were managed. However, it can be argued that it is more important that decisions be accurate than that they be rendered quickly. Unfortunately, it is nearly impossible to directly measure whether more experienced judges are more likely to make the "right" or "just" decision in their rulings in patent cases; there is no easy way to quantitatively evaluate the outcome of a trial based on correctness of legal application, reflection of truth, or positive impact on society. However, it is possible to measure whether higher courts agree with a judge's decision based on appellate decisions.

5.1 Judicial Experience and Accuracy: Variables.

To this end, we collected the appellate opinions for all appeals and cross appeals[58] generated by our database of patent cases filed between 1995 and 2003 using the Court of Appeals Federal Circuit website available through the PACER system. We then used these opinions to identify the District Court rulings which were the subject of the appeals and the CAFC

[57]Non-merit resolutions–default judgements, etc., were dropped before estimating the results reported in Table 7. If these cases are included, the both the negative impact of general experience and the positive impact of specialized experience on the probability of ending in a ruling is retained. Thus, even when the definition of cases to be included is relaxed, the result would suggest that, at best, judges with a long period on the bench might be promoting settlements but there is no evidence that judges with specialized patent experience do so.

[58]Where both parties disagree over the same ruling and file arguments and counter arguments with the appellate court.

decision on each ruling. Thus, our level of analysis was the District Court ruling which generated one or more appeals and the decision of the CAFC affirming or reversing that ruling.[59]

The variables employed in the duration analysis–caseload, technology, and district dummies–were also included in this analysis. In addition, the opinions provided data reflecting the type and complexity of issues involved in the trial court ruling and the decision rendered by the Federal Circuit:

1. *The legal issue in question:* From the opinions, we determined whether the parties in a case were questioning a ruling on whether or not to grant a preliminary injunction; patent validity; patent enforceability; infringement (and whether infringement was willful); jurisdictional issues; remedies; inventorship; standing; or whether that opinion referred only to non-patent issues. Since the issue of claim construction is of high level of interest in the analysis of patent litigation, opinions by the appellate court on that issue are treated as the base case in the estimation. As a consequence, if a ruling was classified as covering the legal issue of "infringement," it was made on a legal basis *other* than claim construction.

2. *The Date of Filing of the Appeal:* This variable allowed us to determine the amount of general and specialized experience in a manner similar to that described in the analysis of efficiency. Since appeals must be filed within a short time after the questioned ruling, these variables will give a good picture of judicial experience at the time of the ruling.

3. *Whether there was a Dissenting Opinion:* Appellate rulings in which a member of the panel issued a dissenting opinion are likely to involve questions where the "correct" ruling is not so clear cut. Thus, the issuance of a dissent is a proxy for the complexity of the issue and allows us to control for the difficulty of the decision.

Finally, we recorded the outcome of the appeal–whether the original district court ruling was reversed. However, the actual "affirm/reverse" appellate ruling is not a simple black and white issue. A district court ruling will typically be based on several points of the law. When the appellate court reviews that decision, it will analyze how correctly each of those points were applied. Thus, it is possible for the district court judge to get some of the issues right, but err on others. As a consequence, the appeals court may affirm the ruling; affirm some aspects of the ruling and vacate others; affirm, vacate and reverse; affirm and

[59] A single district court ruling may generate multiple appeals and cross appeals, but there is only one final ruling by the appellate court which either affirms or reverses the original decision. As a consequence, the appeals themselves are not the appropriate unit of analysis; treating the ruling on each appeal as a separate observation would lead to double counting. Basing the observation on the original ruling avoids this problem. Additional information on the collection of appellate data is found in Kesan and Ball (2010)

reverse; vacate; vacate and reverse; or reverse on all issues. In general, these rulings form a continuum describing the appellate view of the "accuracy" of the original ruling.[60] Our analysis will condense this continuum into a binary variable "somewrong," which equals 0 if the district court ruling was completely affirmed and 1 if any part of the ruling is reversed.[61] In a general sense, this variable can be interpreted as distinguishing between judges who have a very deep understanding of patent law and get the ruling completely right and those who may have some understanding but err on at least some aspects.

5.2 Estimation: Experience and Accuracy.

Table 8 gives the results of our estimations of how the probability of being at least partially reversed is related to both general and specialized experience. Again, we control for the possibility of unobserved judge characteristics and omitted district variables using logit, logit with clustered errors, and random effects logit. Nearly all of the variables introduced to account for district characteristics are insignificant and a much smaller number of district dummies are significant than in the analysis of efficiency. Thus, district characteristics do not seem to have an impact on the probability of reversal. Moreover, the statistical techniques intended to control for possible unobserved heterogeneity across judges also have no significant effect.

However, the appeal-specific variables provide more information on reversals. Several legal issue category variables are negative and significant. Since the base case was "legal rulings based on claim construction," this result is consistent with the view among legal scholars that claim construction is the most difficult and contentious issue on which judges are asked to rule in patent cases. Thus, our results generally accord with pervious scholarship on appeals and reversals in patent litigation.

In this context, the results for experience are interesting. General experience has no impact on the probability of being at least partially overruled on appeal. Thus, the skills a judge acquires with time in managing his/her courtroom and docket have little or no impact on how well s/he understands and applies the law. However, the coefficient for recent specialized experience is negative and robustly significant across specifications. does reduce the probability of being overruled. And this result is robust across specifications. Cumulative experience is only significant in the clustered error model, where it is again negative. Moreover, recent experience with patent law has a much larger (negative) coefficient than does cumulative specialized experience. In fact the coefficient for recent experience is nearly four times that of cumulative experience. These results suggest that the skills judges acquire

[60] Unfortunately, an attempt to use ordered logit to analyze this continuum was not successful.

[61] We also attempted the analysis with a variable "allwrong," which distinguished between the opposite end of the scale–vacated and reversed or completely reversed–and a ruling in which the district court judge was at least partially right. These results were not terribly significant, and are reported in Kesan and Ball, 2010.

as they serve more time on the bench do not contribute to the accuracy of their rulings.[62] However, specialized experience, especially that gained recently, does increase the accuracy of judicial rulings in patent cases.

6 Conclusion.

There is a strong consensus that the courts have a role to play in the development of economies as the enforcer of property rights. Thus, the structure and performance of the court system is of interest to students of economic development, not only in terms of judicial accountability and impartiality but also in terms of judicial accuracy and efficiency. This study focused on the later two issues by examining the impact of "judicial human capital" measured as general and specialized experience on the duration and reversal rates in patent litigation.

We find that both types of experience tend to reduce the duration of patent cases. Thus experienced judges do seem to be more efficient in managing patent cases. And this result is robust across statistical methodologies designed to account for unobserved characteristics of the presiding judges. We also find that specialized experience with patent cases lowers the appellate reversal rate, though general experience gained through time on the bench does not. These results have potential ramifications for policies that might remove judges with high experience levels in order to increase judicial accountability. There are also implications for policies designed to increase specialized judicial experience in areas of complex litigation such as the creation of specialized courts.

[62] It is possible that this results from non-linearities in the general experience variable, an approach which is left for further study.

7 Tables and Figures

Table 1: All Civil Cases and Patent Cases Studied by District, Filed 1995-2003.

	District Number	Patent Cases	% of Observations	Total Civil Cases	Patent Cases as % of Civil Cases	Patent Cases Filed per Judge per Year
Alabama-middle	27	7	0.05	14,814	0.05	0.26
Alabama-north	26	28	0.18	48,821	0.06	0.43
Alabama-south	28	7	0.05	10,362	0.07	0.26
Arizona	70	248	1.67	30,659	0.81	2.90
Arkansas-east	60	23	0.15	20,710	0.11	0.51
Arkansas-west	61	17	0.11	10,224	0.17	0.63
California-central	73	1,587	10.40	115,174	1.38	6.49
California-east	72	74	0.48	36,183	0.20	1.17
California-north	71	1,063	6.96	55,020	1.93	8.44
California-south	74	388	2.54	25,135	1.54	5.32
Colorado	82	257	1.68	25,480	1.01	4.08
Connecticut	5	237	1.55	24,128	0.98	3.29
Delaware	11	634	4.15	9,388	6.75	17.61
District of Columbia	80	106	0.69	27,360	0.39	0.79
Florida-middle	3A	267	1.75	58,997	0.45	2.35
Florida-north	29	26	0.17	14,684	0.18	0.72
Florida-south	3C	358	2.35	64,448	0.56	2.41
Georgia-middle	3G	20	0.13	12,236	0.16	0.53
Georgia-north	3E	236	1.55	39,963	0.59	2.06
Georgia-south	3J	6	0.04	12,387	0.05	0.22
Guam	93	1	0.01	741	0.13	0.11
Hawaii	75	8	0.05	9,344	0.09	0.22
Idaho	76	33	0.22	5,616	0.59	1.83
Illinois-central	53	47	0.31	11,676	0.40	1.31
Illinois-north	52	962	6.30	83,930	1.15	4.86
Illinois-south	54	21	0.14	13,748	0.15	0.58
Indiana-north	55	85	0.56	18,380	0.46	1.89
Indiana-south	56	156	1.02	26,050	0.60	3.47
Iowa-north	62	20	0.13	6,330	0.32	1.11
Iowa-south	63	64	0.42	9,732	0.66	2.37
Kansas	83	77	0.50	16,950	0.45	1.43
Kentucky-east	42	21	0.14	20,266	0.10	0.48
Kentucky-west	44	36	0.24	14,112	0.26	0.89
Louisiana-east	3L	71	0.47	34,328	0.21	0.64
Louisiana-middle	3N	15	0.10	18,546	0.08	0.65
Louisiana-west	42	42	0.28	24,017	0.17	0.67
Maine	0	28	0.18	6,198	0.45	1.04
Maryland	16	164	1.07	37,970	0.43	1.82
Massachusetts	1	467	3.06	29,445	1.59	3.99
Michigan-east	45	441	2.89	64,500	0.68	3.27
Michigan-west	46	158	1.04	14,837	1.06	4.33
Minnesota	64	493	3.23	29,239	1.69	7.83
Mississippi-north	37	11	0.07	11,883	0.09	0.41
Mississippi-south	38	29	0.19	25,992	0.11	0.54
Missouri-east	65	174	1.14	22,984	0.76	2.42

Source: Administrative Offices of the U.S. Courts, "Federal Court Management Statistics."

Table 1 (contd.)	District Number	Patent Cases	% of Observations	Total Civil Cases	Patent Cases as % of Civil Cases	Patent Cases Filed per Judge per Year
Missouri-west	66	66	0.43	22,038	0.30	1.22
Montana	77	20	0.13	6,339	0.32	0.74
Nebraska	67	64	0.42	9,752	0.66	1.78
Nevada	78	67	0.44	21,889	0.31	1.19
New Hampshire	2	60	0.39	5,886	1.02	2.22
New Jersey	12	557	3.65	58,089	0.96	3.64
New Mexico	84	2	0.01	15,242	0.01	0.04
New York-east	7	322	2.11	67,620	0.48	2.39
New York-north	6	85	0.56	17,975	0.47	1.89
New York-south	8	678	4.44	99,932	0.68	2.69
New York-west	9	104	0.68	14,908	0.70	2.89
North Carolina-east	17	63	0.41	13,540	0.47	1.75
North Carolina-middle	18	119	0.78	10,428	1.14	3.31
North Carolina-west	19	77	0.50	9,669	0.80	2.67
North Dakota	68	8	0.05	2,868	0.28	0.33
Ohio-north	47	289	1.89	74,544	0.39	2.68
Ohio-south	48	176	1.15	27,056	0.65	2.44
Oklahoma-east	86	2	0.01	6,581	0.03	0.15
Oklahoma-north	85	28	0.18	10,133	0.28	0.89
Oklahoma-west	87	43	0.28	19,032	0.23	0.80
Oregon	79	162	1.06	21,762	0.74	3.00
Pennsylvania-east	13	346	2.27	83,390	0.41	1.73
Pennsylvania-middle	14	39	0.26	21,096	0.18	0.72
Pennsylvania-west	15	152	1.00	27,960	0.54	1.68
Puerto Rico	4	15	0.10	15,365	0.10	0.24
Rhode Island	3	62	0.41	6,000	1.03	2.30
South Carolina	20	79	0.52	38,379	0.21	0.93
South Dakota	69	11	0.07	4,329	0.25	0.41
Tennessee-east	49	57	0.37	16,600	0.34	1.27
Tennessee-middle	50	39	0.26	14,600	0.27	1.08
Tennessee-west	51	42	0.28	13,585	0.31	0.93
Texas-east	40	142	0.94	36,663	0.39	2.19
Texas-north	39	341	2.23	50,856	0.67	3.16
Texas-south	41	311	2.04	69,786	0.45	1.89
Texas-west	42	129	0.85	29,899	0.43	1.35
Utah	88	210	1.38	11,135	1.89	4.67
Vermont	19	19	0.12	3,888	0.49	1.06
Virginia-east	22	327	2.14	47,609	0.69	3.55
Virginia-west	23	32	0.21	17,404	0.18	0.89
Washington-east	80	49	0.32	6,768	0.72	1.36
Washington-west	81	283	1.85	28,392	1.00	4.49
West Virginia-north	24	14	0.09	6,816	0.21	0.52
West Virginia-south	25	11	0.07	13,340	0.08	0.24
Wisconsin-east	57	183	1.20	12,945	1.41	4.72
Wisconsin-west	58	156	1.02	7,702	2.03	8.67
Wyoming	89	10	0.07	3,330	0.30	0.37
TOTAL		15,264	100.00	2,336,105	0.65	2.60

Table 2: District-Level Variables, 1995-2003.

	Patent Cases	Patent NA	NBER Patent Technology Categories (%) 0 Design	1 Chemical	2 Computers	3 Drugs, Medical	4 Electrical	5 Mechanical	6 Other	Weighted Case Filings per Judge*
Alabama-middle	7	2	40.00	.	20.00	.	20.00	.	20.00	592
Alabama-north	28	12	6.25	6.25	18.75	12.50	12.50	25.00	18.75	581
Alabama-south	7	6		.	.	.	.	100.00	.	542
Arizona	248	79	5.33	9.47	20.71	12.43	10.06	20.12	21.89	737
Arkansas-east	23	10	7.69	7.69	.	15.38	.	53.85	15.38	456
Arkansas-west	17	8	11.11	11.11	22.22	.	11.11	11.11	33.33	361
California-central	1,587	380	16.40	6.30	11.52	12.10	14.08	13.01	26.59	484
California-east	74	26	12.50	12.50	8.33	6.25	10.42	12.50	37.50	650
California-north	1,063	275	4.06	7.87	35.15	14.97	15.36	7.87	14.72	491
California-south	388	29	7.52	9.19	23.40	21.45	6.96	11.70	19.78	938
Colorado	257	54	3.94	7.88	18.23	14.78	10.34	12.32	32.51	543
Connecticut	237	177	8.33	5.00	11.67	16.67	25.00	10.00	23.33	407
Delaware	634	69	1.06	16.11	26.02	25.31	10.27	9.56	11.68	291
DC	106	46	5.00	20.00	28.33	20.00	10.00	8.33	8.33	256
Florida-middle	267	31	6.78	8.90	16.10	8.90	9.32	18.64	31.36	651
Florida-north	26	10	6.25	12.50	6.25	18.75	12.50	18.75	25.00	446
Florida-south	358	67	13.75	6.19	21.31	13.76	7.90	10.31	26.12	491
Georgia-middle	20	6	7.14	7.14	.	7.14	.	14.29	64.29	426
Georgia-north	236	76	3.13	11.88	18.75	13.75	7.50	18.75	26.25	524
Georgia-south	6	1		20.00	.	20.00	.	.	60.00	466
Guam	1	1	.	.	.	.	.	.	.	206
Hawaii	8	6	.	.	.	50.00	.	.	50.00	450
Idaho	33	3	16.67	13.33	23.33	.	6.67	10.00	30.00	433
Illinois-central	47	18	6.90	. 3.45	6.90	6.90	3.45	27.59	44.83	393
Illinois-north	962	132	9.52	7.83	17.35	10.48	9.28	15.06	30.48	447
Illinois-south	21	14		.	14.29	.	.	.	85.71	428
Indiana-north	85	31	3.70	14.81	. 3.70	14.81	1.85	40.74	20.37	468
Indiana-south	156	84	5.56	6.94	13.89	29.17	6.94	12.50	25.00	585
Iowa-north	20	3	5.88	5.88	.	5.88	.	47.06	35.29	511
Iowa-south	64	17	12.77	6.38	6.38	25.53	2.1	8.51	38.30	480
Kansas	77	37	7.50	12.50	10.00	.	12.50	7.50	50.00	423
Kentucky-east	21	14	.	14.29	. 28.57	.	.	28.57	28.57	511
Kentucky-west	36	15	.	19.05	.	4.76	19.05	9.52	47.62	386
Louisiana-east	71	6	12.31	6.15	4.62	13.85	10.77	7.69	44.62	347
Louisiana-middle	15	3	.	16.67	8.33	25.00	.	16.67	33.33	597
Louisiana-west	42	5	8.11	5.41	.	8.11	2.70	18.92	56.76	392
Maine	28	18	.	40.00	.	30.00	20.00	.	10.00	294
Maryland	164	28	2.94	8.82	20.59	21.32	7.35	13.24	25.74	462
Massachusetts	467	163	3.62	10.86	21.05	18.09	16.78	8.22	21.38	327
Michigan-east	441	79	8.29	8.01	10.77	4.14	9.12	29.01	30.66	544
Michigan-west	158	33	8.80	5.60	4.80	6.40	6.40	18.40	49.60	468
Minnesota	493	131	6.63	11.60	11.33	15.75	4.97	16.85	32.87	547
Mississippi-north	11	3	.	.	.	37.50	.12.50	.	50.00	438
Mississippi-south	29	25 .	.	.	.	.	.	50.00	50.00	472
Missouri-east	174	27	6.80	8.84	4.76	36.73	6.80	12.50	23.13	438

* Cases weighted according to case difficulty weights calculated by Administrative Office of the District Courts.

Table 2 (contd.)	Patent Cases	Patent NA	NBER Patent Technology Categories (%)							Weighted Case Filings per Judge*
			0 Design	1 Chemical	2 Computers	3 Drugs, Medical	4 Electrical	5 Mechanical	6 Other	
Missouri-west	66	25	7.32	24.39	9.76	7.32	2.44	26.83	21.95	513
Montana	20	14	.	.	.	16.67	.	.	83.33	446
Nebraska	64	22	2.38	11.90	11.90	7.14	4.76	28.57	33.33	490
Nevada	67	9	3.45	8.62	17.24	8.62	6.90	8.62	46.55	523
New Hampshire	60	15	8.89	6.67	15.56	8.89	15.56	20.00	24.44	305
New Jersey	557	164	8.91	8.91	10.18	36.39	5.60	10.69	19.34	430
New Mexico	2	2	.	.	.	.	.	.	.	651
New York-east	322	159	12.88	6.13	15.95	12.27	31.29	4.29	17.18	617
New York-north	85	33	3.85	9.62	17.31	7.69	11.54	23.08	26.92	480
New York-south	678	182	13.31	5.65	20.16	17.54	6.25	6.45	30.65	493
New York-west	104	39	9.23	16.92	7.69	18.46	7.69	16.92	23.08	545
N. Carolina-east	63	25	7.89	10.53	2.63	23.68	15.79	13.16	26.32	521
N. Carolina-mid.	119	24	24.21	3.16	11.58	12.63	9.47	17.89	21.05	410
N. Carolina-west	77	19	5.17	10.34	5.17	10.34	8.62	18.97	41.38	671
North Dakota	8	3		.	.	20.00	.	60.00	20.00	328
Ohio-north	289	87	6.93	6.93	7.92	3.47	10.89	20.30	43.56	470
Ohio-south	176	68	5.56	10.19	13.89	10.19	5.56	23.15	31.48	442
Oklahoma-east	2	1	.	.	.	.	.	100.00	.	503
Oklahoma-north	28	4	4.17	12.50	29.17	4.17	12.50	12.50	25.00	372
Oklahoma-west	43	11	9.38	3.13	6.25	15.63	3.13	37.50	25.00	369
Oregon	162	76	8.14	8.14	17.44	5.81	8.14	36.05	16.28	541
Pennsylvania-east	346	100	6.50	9.76	10.57	17.89	8.94	18.29	28.05	422
Pennsylvania-mid.	39	16	.	8.70	8.70	17.39	21.74	17.39	26.09	421
Pennsylvania-west	152	61	8.79	7.69	4.40	8.79	8.79	30.77	30.77	327
Puerto Rico	15	14	.	.	.	100.00	.	.	.	399
Rhode Island	62	59	33.33	.	66.67	.	.	.	.	288
South Carolina	79	19	3.33	11.67	5.00	6.67	3.33	15.00	55.00	538
South Dakota	11	2	.	.	11.11	.	.	22.22	66.67	408
Tennessee-east	57	23	5.88	8.82	5.88	26.47	8.82	8.82	35.29	521
Tennessee-middle	39	32	.	14.29	.	14.29	28.57	42.86	.	510
Tennessee-west	42	29	7.69	.	.	53.85	7.69	15.38	15.38	453
Texas-east	142	27	1.74	6.96	36.52	2.61	15.65	18.26	18.26	528
Texas-north	341	76	9.81	3.40	22.26	10.19	8.30	15.85	30.19	539
Texas-south	311	127	2.72	13.04	11.96	5.98	10.33	11.41	44.57	633
Texas-west	129	32	5.15	3.09	34.02	7.22	10.31	12.37	27.84	864
Utah	210	19	5.76	9.95	10.47	19.37	6.28	20.94	27.23	441
Vermont	19	6	.	.	.	23.08	.	38.46	38.46	353
Virginia-east	327	122	3.85	11.54	7.69	3.85	.	26.92	46.15	575
Virginia-west	32	12	5.00	15.00	25.00	.	25.00	15.00	15.00	513
Washington-east	49	6	3.85	11.54	7.69	3.85	.	26.92	46.15	302
Washington-west	283	76	6.76	5.80	18.84	10.63	12.08	26.09	19.81	553
W. Virginia-north	14	3	.	.	9.09	45.45	18.18	18.18	9.09	364
W. Virginia-south	11	5	16.67	.	.	33.33	.	16.67	33.33	310
Wisconsin-east	183	44	5.76	10.79	4.32	8.63	6.47	30.22	33.81	409
Wisconsin-west	156	61	.	9.47	5.26	18.95	13.68	25.26	27.37	461
Wyoming	10	7	33.33	.	.	.	.	.	66.67	199
TOTAL	15,264	4,237	8.01	8.76	16.70	14.60	10.30	14.93	26.70	495

Table 3: Judicial Experience with Patent Cases, 1995 to 2003				
	Judges per Category		Total Patent Cases	
	Number	Percentage	Number	Percentage
More than 100	4	0.34	624	4.09
51 to 100	34	2.86	2,182	14.30
21 to 50	215	18.08	6,423	42.08
10 to 20	254	21.36	3,613	23.67
5 to 9	215	18.08	1,469	9.62
Less than 5	467	39.28	953	6.24
Total	1,189	100.00	15,264	100.00
Average				13
Median				7

Table 4: Percentiles of Observations (Cases)								
4.a Total Number of cases Presided over Since 1995 as of Filing of Observation Case								
Percentile	Mean	5th	10th	25th	50th	75th	90th	95th
Number of Cases	15.4	0	1	3	9	20	35	50

4.b Number of Cases Presided over in Three Years Previous to Case Filing								
Percentile	Mean	5th	10th	25th	50th	75th	90th	95th
Number of Cases	9.8	0	1	3	7	13	21	29

Table 5: Variables used in Estimation

Name	Definition	Type	Mean*	Median
casetot	Number of other patent cases judge had presided over since 1995 as of case filing.	Numerical	15.42	9
three	Number of cases judge presided over in the three years preceding case.	Numerical	9.76	7
45th Percentile	Piecewise linear measure of experience, beginning at 8 cases.			
35th Percentile	Piecewise linear measure of experience, beginning at 5 cases.			
60th	Piecewise linear measure of experience, beginning at 13 cases.			
70th	Piecewise linear measure of experience, beginning at 17 cases.			
95th Case	Piecewise linear measure of experience, beginning at 50 cases.			
yearsbench	Number of years judge had served on the bench as of case filing.	Numerical	10.30	9.28
Time	Number of years from 1995 to case filing	Numerical	4.41	5.00
wtfilings	Cases filed in district per judge in year of case filing, weighted by complexity of cases.	Numerical	495.00	480.00
NBER 0	NBER technology category 0: design patents.	Binary	8.01	
NBER 1	NBER technology category 1: chemical.	Binary	8.76	
NBER 2	NBER technology category 2: computers.	Binary	16.70	
NBER 3	NBER technology category 3: drugs, medical.	Binary	14.60	
NBER 4	NBER technology category 4: electrical.	Binary	10.30	
NBER 5	NBER technology category 5: mechanical. (Base Category)	Binary	14.93	
NBER 6	NBER technology category 6: others.	Binary	26.70	
District No.	Dummy for each Federal District Court district (See Table 1).	Binary		
Additional Variables used in Accuracy Analysis				
appcasetot	Number of other patent cases judge had presided over since 1995 as of filing of appeal	Numerical	28.94	21
appthree	Number of cases judge presided over in the three years preceding appeal.	Numerical	11.56	8
appbenchyears	Number of years on bench as of filing of appeal.	Numerical	8.13	9.96
claimcons	Legal Issue: Claim Construction (Base Category)	Binary	29.28	
preliminj	Legal Issue: Preliminary Injunction	Binary	4.70	
validity	Legal Issue: Validity of Patent (Non Claim Construction)	Binary	20.15	
enforceability	Legal Issue: Enforceability of Patent	Binary	3.71	
infringement	Legal Issue: Infringement of Patent (Non Claim Construction)	Binary	29.30	
remedies	Legal Issue: Remedies (damages, injunction, etc.)	Binary	7.05	
jmol	Legal Issue: Judgment as a Matter of Law	Binary	1.61	
other ruling	Other Legal Issues	Binary	4.20	
Dissenting	Dissenting Opinion filed by Appellate Court.	Binary	10.75	

* Percentage falling in category for binary variable.

Table 6: Coefficients for Duration Analysis of Judicial Efficiency, Total,Recent and Non-Linear Experience

	1. Cox	2. Clustered	3. Frailty	4. Cox	5. Clustered	6. Frailty	7. StepWise Cox
casetot	0.0019*** (0.0007)	0.0019** (0.0009)	0.0027*** (0.0009)				
Three				0.0036*** (0.0013)	0.0036* (0.0020)	0.0055*** (0.0017)	
45th (casetot=8)							0.0160*** (0.0055)
60th (casetot=13)							−0.0074** (0.0037)
70th (casetot=17)							−0.0052* (0.0027)
90th (casetot=35)							−0.0030** (0.0016)
95th (casetot=50)							−0.0045*** (0.0014)
yearsbench	0.0094*** (0.0014)	0.0094*** (0.0019)	0.0121*** (0.0019)	0.0098*** (0.0014)	0.0098*** (0.0014)	0.0126*** (0.0018)	0.0084*** (0.0020)
time	−0.0198*** (0.0049)	−0.0198*** (0.0059)	−0.0177*** (0.0057)	−0.0177*** (0.0045)	−0.0177*** (0.0045)	−0.0152*** (0.0051)	−0.0319*** (0.0066)
wtfilings	-0.0000 (0.0001)	-0.0000 (0.0001)	-0.0000 (0.0001)	-0.0000 (0.0001)	-0.0000 (0.0001)	-0.0000 (0.0001)	-0.0000 (.0001)
nber0	0.4011*** (0.0439)	0.4011*** (0.0468)	0.4014*** (0.0452)	0.4007*** (0.0439)	0.4007*** (0.0467)	0.4006*** (0.0452)	0.3947*** (0.0467)
nber1	−0.1878*** (0.0430)	−0.1878*** (0.0469)	−0.1757*** (0.0441)	−0.1862*** (0.0430)	−0.1862*** (0.0478)	−0.1752*** (0.0441)	−0.1924*** (0.0482)
nber2	−0.1278*** (0.0361)	−0.1278*** (0.0416)	−0.1276*** (0.0372)	−0.1217*** (0.0361)	−0.1269*** (0.0419)	−0.1268*** (0.0372)	−0.1330*** (0.0419)
nber3	−0.2295*** (0.0379)	−0.2295*** (0.0444)	−0.2217*** (0.0388)	−0.2308*** (0.0379)	−0.2308*** (0.0444)	−0.2238*** (0.0388)	−0.2397*** (0.0445)
nber4	-0.0530 (0.0407)	-0.0530 (0.0414)	-0.0588 (0.0419)	-0.0537 (0.0379)	-0.0532 (0.0414)	-0.0585 (0.0419)	-0.0623 (0.0419)
nber6	0.0528* (0.0325)	0.0528 (0.0351)	0.0404 (0.0334)	0.0563* (0.0325)	0.0563 (0.0351)	0.0407 (0.0334)	0.0623 (0.0352)

Table 6 (contd.)	1.	2.	3.	4.	5.	6.	7.
District 4		−0.4964***			−0.4841***		−0.3520***
District 5	−0.2746*		−0.3117*			−0.3070*	
District 6	0.3724**	0.3724*	0.3647*	0.3745**	0.3745*	0.3651*	0.4085*
District 7	0.2750***	0.2750**		0.2786***	0.2786**		0.2837**
District 8	0.3237***	0.3237**	.3005***	0.3253***	0.3253**	0.3023***	0.3624***
District 13	0.7462***	0.7462***	0.7619***	0.7503***	0.7503***	0.7683***	0.8114***
District 15	0.3078**	0.3078*	0.2918*	0.3112**	0.3112*	0.2955*	0.3544**
District 16	0.4676***	0.4676***	0.4574***	0.4726***	0.4726***	0.4636***	0.4979***
District 19							0.2797*
District 20							0.3144*
District 22	1.0260***	1.0260***	1.0124***	1.0224***	1.0224***	1.0053***	1.0310***
District 27	0.9344*	0.9344***	0.9038*	0.9334*	0.9334***	0.9046*	1.1241***
District 29		0.4945*			0.5005**		0.6282**
District 36	0.3460**	0.3460**		0.3521**	0.3521**		0.4229***
District 38		0.5625**			0.5558**		0.6384***
District 39	0.3835***	0.3835***	0.3522***	0.3856***	0.3856***	0.3537***	0.4047***
District 41	0.3683***	0.3683***	0.3432**	0.3701***	0.3701***	0.3434**	0.3722***
District 42	0.2642*			0.2644*			0.3160*
District 43	0.7504**	0.7504***	0.7140*	0.7524*	0.7524***	0.7176*	0.9102***
District 45	0.1544*			0.1558*			
District 46	0.4030***	0.4030***	0.3668**	0.4070***	0.4070***	0.3688**	0.4055***
District 47	0.3693***	0.3693*	0.3461***	0.3752***	0.3752***	0.3528***	0.3897***
District 52	0.4020***	0.4020***	0.3989***	0.4020***	0.4020***	0.3954***	0.4065***
District 54		0.5611*			0.5716*		0.7112**
District 55	0.5264***	0.5264***	0.4132**	0.5299***	0.5299***	0.4167**	0.5858***
District 57	0.1898*			0.1940*			
District 58	0.9269***	0.9269***	0.8637***	0.9302***	0.9302***	0.8579***	0.9377***
District 60		0.4563*			0.4609*		0.6084**
District 61	0.9177***	0.9177*	0.9000**	0.9227***	0.9227***	0.9083**	1.0565***
District 64	0.2316***	0.2316*		0.2328***	0.2328***		0.2216*
District 65	0.4180***	0.4180***	0.3929**	0.4194***	0.4194***	0.3932**	0.4355***
District 67	0.7093***	0.7093***	0.6665***	0.7096***	0.7096***	0.6671***	0.7525***
District 68		0.5785***			0.5819*		0.7693***
District 72	0.5086***	0.5086***	0.4868**	0.5106***	0.5106***	0.4907**	0.5537***
District 73	0.4312***	0.4312***	0.4554***	0.4250***	0.4250***	0.4445***	0.4417***
District 74	0.5320***	0.5320***	0.5656***	0.5314***	0.5314***	0.5624***	0.5360***

Table 6 (contd.)	1.	2.	3.	4.	5.	6.	7.
District 75		-0.6786^{***}			-0.6746^{***}		-0.5058^{**}
District 77		-0.4720^{***}			-0.4698^{***}		-0.4579^{**}
District 78	0.3520**	0.3520**	0.3256*	0.3487**	0.3487**	0.3225*	0.4505***
District 81	0.5389***	0.5389***	0.4929***	0.5358***	0.5358***	0.4862***	0.5438***
District 82	0.2718***		0.2432*	0.2711***		0.2424*	0.3033*
District 83	0.3401**	0.3401*		0.3430**	0.3430*		0.3734**
District 86	2.7140***	2.7140***	2.6839***	2.7211***	2.7211***	2.6940***	2.8740***
District 87	0.5928***	0.5928***	0.5876***	0.5963***	0.5963***	0.5938***	0.7050***
District 88	0.4202***	0.4202***	0.4342***	0.4214***	0.4214***	0.4333***	0.4212***
District 89		0.6631*			0.6605*		0.7003*
District 3A	0.5884***	0.5884***	0.5320***	0.5906***	0.5906***	0.5344***	0.6142***
District 3C	0.5659***	0.5659***	0.5452***	0.5702***	0.5702***	0.5503***	0.6127***
District 3E	0.2644***	0.2644**	0.2285*	0.2677***	0.2677**	0.2330*	0.2932**
District 3L	0.6010***	0.6010***	0.6175***	0.6051***	0.6051***	0.6245***	0.7071**
Model Evaluation							
LR Chi Sq. (91,97)	867.94			868.19			
Wald Chi Sq. (91,97)		40493.28	598.43		40270.31	598.73	38816.90
Prob ≥ Chi Sq.	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Log or Pseudo Likelihood	-84814.27	-84814.26	-84735.32	-84814.14	-84814.14	-84734.19	-84787.93
Frailty Model Evaluation							
theta (gamma variance)			0.0547 (0.0075)			0.0552 (0.0075)	
LR test theta=0: Chi Sq. (1) Prob ≥ Chi Sq.			 157.89 0.000			 159.90 0.000	
N	10402	10402	10402	10402	10402	10402	10402
Number of Groups		911	911		911	911	911

Table 7: Probability of Case Ending in a Ruling, (Dropping non Merit Resolutions)

	Cumulative Number of Prior Cases			Number of Prior Cases in Last Three Years		
	1. Logit	2. Cluster	3. Random Effects	4. Logit	5. Cluster	6. Random Effects
Casetot	0.0053**	0.0053**	0.0045*			
	(0.0023)	(0.0025)	(0.0027)			
Three				0.0069*	0.0069	0.0043
				(0.0040)	(0.0043)	(0.0047)
Yearsbench	−0.0109**	−0.0109*	−0.0141**	−0.0093**	-0.0093	−0.0126**
	(0.0049)	(0.0059)	(0.0057)	(0.0048)	(0.0057)	(0.0056)
Time	−0.0760**	−0.0760***	−0.0771***	−0.0668***	−0.0668***	−0.0665***
	(0.0160)	(0.0171)	(0.0176)	(0.0149)	(0.0160)	(0.0160)
Wtfilings	-.0002	-0.0002	-0.0003	-0.0002	-0.0002	-0.0002
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
NBER0	−0.7384***	−0.7384***	−0.7333***	−0.7417***	−0.7417***	−0.7359***
	(0.1806)	(0.1897)	(0.1833)	(0.1805)	(0.1902)	(0.1833)
NBER1	0.2142	0.2142	0.1977	0.2097	0.2097	0.1951
	(0.1338)	(0.1436)	(0.1371)	(0.1337)	(0.1437)	(0.1371)
NBER2	0.0638	0.0638	0.0829	0.0642	0.0642	0.0840
	(0.1174)	(0.1273)	(0.1203)	(0.1174)	(0.1276)	(0.1203)
NBER3	0.3367***	0.3367***	0.3444***	0.3356***	0.3356***	0.3437***
	(0.1171)	(0.1232)	(0.1199)	(0.1170)	(0.1236)	(0.1200)
NBER4	-0.0695	-0.0695	-0.0713	-0.0688	-0.0688	-0.0711
	(0.1359)	(0.1376)	(.1389)	(0.1359)	(0.1379)	(0.1389)
NBER6	-0.0790	-0.0790	-0.0719	-0.0790	-0.0790	-0.0714
	(0.1082)	(0.1112)	(.1106)	(0.1082)	(0.1113)	(0.1106)
Constant	−0.6788***	−1.0128***	−1.0330**	−1.0668***	−1.0668***	−1.0836***
	(0.2469)	(0.2957)	(0.2737)	(0.2342)	(0.2934)	(0.2734)

Table 7 (contd.): Coefficients for Significant District Dummies

		1. Logit	2. Cluster**	3. Random Effects	4. Logit	5. Cluster	6. Random Effects
District Dummies	District 7	−1.3619***	−1.3619**	−1.2894**	−1.3691***	−1.3691**	−1.3077**
	District 13	−0.8123**	−0.8123**	−0.79441*	−0.8162*	−0.8162**	−0.8059*
	District 18		−0.7303***			−0.7283***	
	District 19					−1.2368*	
	District 24					1.2707**	
	District 47	−0.5807**	−0.5807*		−0.5748*	−0.5748*	
	District 50	1.4979*	1.4980**	1.5557*	1.4820*	1.4820**	1.5283*
	District 51		0.9176**			0.8941**	
	District 52	−0.5307***	−0.5307**	−0.5072**	−0.5330**	−0.5330***	−0.5111*
	District 57	−0.9440**	−0.9440*	−0.8750*	−0.9389**	−0.9389*	−0.8743*
	District 61		1.4746*			1.4637*	
	District 64	−0.6153***	−0.6153**	−0.5652*	−0.5979**	−0.5979*	−0.5457*
	District 65	−0.6527*	−0.6527*		−0.6600*	−0.6600*	
	District 71	−0.4127*			−0.4017*		
	District 73	−0.4079**			−0.4111**		
	District 74	−0.7805***	−0.7805*		−0.7935**	−0.7935*	
	District 80		−1.5518*			−1.5659*	
	District 81	−0.5780**			−.5831*		
	District 88	−1.1198***	−1.1299***	−1.1039**	−1.1151***	−1.1151***	−1.1011*
	District 3A	−1.0154***	−1.0154**	−1.0001**	−1.0219***	−1.0219**	−1.0158**
	District 3C	−0.4912*			−0.4947*		
	District 3E	−1.1057**	−1.1057**	−1.0806**	−1.1138***	−1.1138***	−1.0981**
Model Evaluation							
Log Likelihood		-3188.94		-3168.54	-2738.84		-3169.5665
Pseudo Likelihood			-3188.94			-3190.1443	
Pseudo R^2		0.0340	0.0340		0.0336	0.0336	
LR Chi Sq. (8)		224.57			222.17		
Prob $\geq$ LR χ^2		0.000			0.000		
Wald χ^2			286.29	170.60		283.55	168.94
Prob $\geq$ Wald χ^2			0.00	0.00		0.00	0.00
Evaluation of Random Effect							
sigma u				0.4530 (0.0625)			0.4550 (0.0620)
rho				0.0590 (0.0153)			0.0592 (0.0152)
LR χ^2 test of rho=0				36.38			26.58
Prob $\geq$ LR χ^2				0.000			0.000
N		8014	8014	8133	8014	8014	8133
No. of Clusters			824	874		824	874

Table 8: Probability of a Ruling being at least Partially Reversed

		Cumulative			Recent		
		Logit	Cluster	Random Effects	Logit	Cluster	Random Effects
Specialized Experience	Casetot	-0.0080	−.0080*	-0.0072			
		(0.0052)	(0.0043)	(0.0052)			
	Three				−0.0225**	−0.0225**	−0.0202*
					(0.0113)	(0.0096)	(0.0114)
General Experience	Yearsbench	0.0090	0.0090	0.0128	0.0044	0.0044	0.0083
		(0.0134)	(0.0143)	(0.0135)	(0.0125)	(0.0130)	(0.0125)
Time		-0.0646	-0.0646	-0.04807	-0.0795	-0.0795	-0.06339
		(0.0571)	(0.0552)	(0.0587)	(0.0557)	(0.0569)	(0.0574)
Wtfilings		.0003	0.0003	-2.10e-06	0.0002	0.0002	-0.0001
		(0.0012)	(0.0010)	(0.0013)	(0.0012)	(0.0010)	(0.0013)
Technology Category	NBER0	-0.3269	-0.3269	-0.3602	-0.2855	-0.2855	-0.3291
		(0.7527)	(0.6073)	(0.6865)	(0.7533)	(0.6064)	(0.6854)
	NBER1	-0.1896	-0.1896	-0.1178	-0.1952	-0.1952	-0.1230
		(0.3702)	(0.3878)	(0.3606)	(0.3703)	(0.3864)	(0.3608)
	NBER2	-0.2357	-0.2357	-0.1692	-.2363	-0.2363	-0.1761
		(0.3357)	(0.3027)	(.3400)	(0.3363)	(0.3028)	(0.3403)
	NBER3	-0.2256	-0.2256	-0.2326	-0.2596	-0.2596	-0.2680
		(0.3224)	(0.3141)	(0.3150)	(0.3200)	(0.3100)	(0.3123)
	NBER4	−1.0110***	−1.0110***	−0.9968**	−0.9957**	−0.9957***	−0.9852***
		(0.3917)	(0.3724)	(0.3945)	(0.3926)	(0.3750)	(0.3955)
	NBER6	-0.5147	−0.5147*	−0.5738*	−0.5146*	−0.5146*	−0.5766*
		(0.3119)	(0.2979)	(.3082)	(0.3124)	(0.2999)	(0.3087)
Legal Category of Ruling	Preliminj	−1.0461**	−1.0461**	−1.0137**	−0.9868**	−0.9868**	−0.9543*
		(0.4541)	(0.4945)	(0.4891)	(0.4523)	(0.4750)	(0.4873)
	Validity	-0.3017	-0.3017	-0.3388	-0.2976	-0.2976	-0.3386
		(0.2424)	(0.2620)	(0.2484)	(0.2429)	(0.2616)	(0.2487)
	Enforceability	−1.1248**	−1.1248**	−1.1661**	−1.1326**	−1.1326**	−1.1903**
		(0.5208)	(0.5575)	(0.5175)	(0.5229)	(0.5617)	(0.5198)
	Infringement	−0.9934***	−0.9934***	−0.9751***	−1.0082***	−1.0082***	−0.9881***
		(0.2364)	(0.2385)	(0.2420)	(0.2361)	(0.2426)	(0.2415)
	Remedies	0.3792	0.3792	.5870	0.3560	0.3560	0.5766
		(0.3841)	(0.4317)	(0.3971)	(0.3861)	(0.4404)	(0.3990)
	Jmol	-0.2834	-0.2834	-0.1834	-0.1975	-0.1975	-0.0686
		(0.7011)	(0.6994)	(0.7673)	(0.7073)	(0.6771)	(0.7742)
	Other ruling	0.3434	0.3434	0.3430	0.3258	0.3258	0.3277
		(0.4811)	(0.5177)	(0.4811)	(0.4800)	(0.5181)	(0.4803)
Dissenting Opinion		0.8480***	0.8480***	0.9132***	0.9169***	0.9169***	0.9774***
		(0.3084)	(0.3078)	(0.3190)	(0.3131)	(0.3186)	(0.3237)
Constant		0.3725	0.3725	0.3366	0.5451	0.5451	0.5108
		(0.7538)	(0.7230)	(0.7794)	(0.7557)	(0.7121)	(0.7805)

Table 8 (contd.)

		Cumulative			Recent		
		Cox	Cluster	Random Effects	Cox	Clustered	Random Effects
District Dummies	District 5						
	District 8						
	District 39	−1.5819*	−1.5819*	−1.6186*	−1.6196*	−1.6196*	−1.6608*
	District 41						
	District 47						
	District 50		1.0340*			1.0874*	
	District 62		−1.1004**			−1.2358**	
	District 63		1.1789**			1.1913**	
	District 73	1.0361*		1.0986*	1.1559**	1.1559**	1.2039**
	District 79						
	District 82						
	District 83					−1.4347*	
Model Evaluation							
Log Likelihood		-404.45	-404.45	-386.38	-403.59	-403.59	-385.74
Pseudo R^2		0.11	0.11		0.12	0.12	
LR χ^2		104.10			105.83		
Prob $\geq$ LR χ^2		0.0015			0.0002		
Wald χ^2				81.41			81.41
Prob $\geq$ Wald χ^2				0.5598			0.5599
Evaluation of Random Effect							
sigma u				0.0007 (0.0872)			0.0006 (0.0070)
rho				0.0590 (0.0000)			1.28e-07 (2.76e-06)
LR χ^2 test of rho=0				0.00			0.00
Prob $\geq$ LR χ^2				1.00			1.00
N		677	677	681	677	677	681
Number of Groups			271	275		271	275

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