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Abstract

In 1982, the US Congress established the Court of Appeals for the Federal Circuit (CAFC) as the sole appellate court for patent cases. Ostensibly, this court was created to eliminate inconsistencies in the application and interpretation of patent law across federal courts, and thereby mitigate the incentives of patentees and alleged infringers to "forum shop" for a preferred venue. We perform the first econometric study of the extent of non-uniformity and forum shopping in the pre-CAFC era and of the CAFC's impact on these phenomena. We find that in patentee-plaintiff cases the pre-CAFC era was indeed characterized by significant non-uniformity in patent validity rates across circuits and by forum shopping on the basis of validity rates. We find weak evidence that the CAFC has increased uniformity of validity rates and strong evidence that forum shopping on the basis of validity rates ceased several years prior to the CAFC's establishment. In patentee-defendant cases, we find that validity rates are lower on average, but do not find either significant non-uniformity of validity rates across circuits or significant forum shopping.

JEL Codes: K2, K4

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1. Introduction

In perhaps the most significant institutional change to the federal judiciary since the Circuit Courts of Appeal were established in 1891, the US Congress in 1982 created the Court of Appeals for the Federal Circuit (CAFC) and endowed it with exclusive jurisdiction over appeals in patent cases initiated in US district courts. Ostensibly, the CAFC was created to unify the interpretation and application of US patent law across circuits, thereby eliminating the incentives for patentees and alleged infringers to "forum shop" for a favorable court (Jaffe and Lerner 2004). The CAFC is the only appellate court defined by subject matter alone. Hence, it presents a unique opportunity to study the economic impact of a centralized judiciary.

In this paper, we exploit variation in district court patent validity decisions, sorted by circuit, and find that non-uniformity and forum shopping were prevalent in the pre-CAFC era. We also find that the CAFC mitigates but does not eliminate non-uniformity across circuits. Forum shopping on the basis of validity rates ceases in the late 1970s, several years prior to the CAFC. However, these results hold only for cases in which the patentee chooses where to litigate and files the case, i.e., where the patentee is the plaintiff (henceforth *patentee-plaintiff* cases).[1] We find no evidence of forum shopping by alleged infringers or patent challengers. Our study is an important step toward assessing the welfare impact of the CAFC.

We study these questions using data on validity decisions during 1953-2002. Our data include variables recorded from opinions in patent litigation decisions published in the *United States Patents Quarterly* (USPQ) and variables captured from associated patent documents. Throughout the paper, we specify the geographical circuit as the forum and analyze district court decisions aggregated by circuit. In essence, we treat each set of district courts within a circuit as a single district court. In the pre-CAFC era, the decisions made in a given set of districts are subject to appellate review from the relevant geographical circuit court of appeal. In the CAFC, the decisions made in all sets of districts are subject to appellate review by the CAFC.

[1] It is important to distinguish cases by whether the patentee chooses the venue of litigation. For the sake of brevity, we use the patentee's identity with respect to initiation of litigation (plaintiff or defendant) to make this distinction.

We apply two discrete-choice models to test for uniformity and forum shopping. First, we use a binary-choice model of patent validity to estimate differences in circuit fixed effects and test for non-uniformity in district court validity decisions across circuits. All else equal, we estimate the difference between districts in the weakest circuit (Third) and the strongest (Tenth) in the probability of patent validity to be about .52 in the pre-CAFC era, but only .25 in the CAFC era. This result, along with our finding of significant circuit fixed effects generally, suggests that patentees could gain a tactical advantage by choosing a particular circuit in each era, but that this potential advantage was far greater in the decentralized pre-CAFC era.

Second, we use a binary-choice model of trial circuit location to test for forum shopping. If litigants shop, then we expect patentee-plaintiffs to tend to choose districts favorable on validity.[2] Up to 1977, we find that the most recent five years' validity rate in districts in a patentee's "home" circuit,[3] net of the national average validity rate, has significant predictive value in whether the patentee chooses to litigate in that circuit. Specifically, an increase in this *home validity advantage* of .10 results in an increase of between .05 and .09 in the probability the case is litigated in the home circuit. This effect vanishes after 1977 and does not re-emerge. Hence, our evidence suggests systematic forum shopping on the basis of validity in the pre-CAFC era and that the CAFC, by increasing uniformity, mitigated such forum shopping. We also conclude that patentees anticipated the impact of the CAFC several years prior to its establishment in 1982.

By contrast, in the roughly ten percent of cases where the patent challenger initiates litigation by choosing the venue and filing the case, i.e. where the patentee is the defendant (henceforth *patentee-defendant* cases), validity is about .10 less likely on average, but we do not find strong evidence of non-uniformity of validity outcomes across circuits in either era. Indeed, even in the pre-CAFC era, circuit validity rates in patentee-plaintiff cases are uncorrelated with rates in patentee-defendant cases. This suggests that even if a defendant could gain a tactical advantage by being the forum-naming plaintiff,[4] it would not predictably

[2] As we discuss in our theoretical model in Section 3, patent challengers would seek districts unfavorable on validity.

[3] This is defined according to the patent assignee's physical location. See section 4

[4] Our analysis cannot identify whether the lower validity rate is a treatment or selection effect. Marco (2004) also finds validity rates to be higher in patentee-plaintiff cases, and suggests that the effect represents the selection of weaker patents into "defensive" positions.

gain further by choosing a *particular* forum. It is then not surprising that we also find no evidence of forum shopping on the basis of validity rates in patentee-defendant cases in either era. Given the lower number of patentee-defendant cases, however, our conclusions about them are more tenuous.

Finally, changes in the venue statute due to the 1988 Judicial Improvements and Access to Justice Act did not significantly affect case location. Moore (2001) and others have argued that these changes made the standards for jurisdiction more flexible.[5] In particular, prior to the changes in the statute (and the subsequent CAFC ruling in *VE Holding Corp. v. Johnson Gas Appliance Co.* (1990)), venue for declaratory judgment actions was handled under the general provision of the statute ("personal jurisdiction," section 1391(c)), whereas patent infringement actions were held to a more restrictive standard (section 1400(b)). After *VE Holding*, both declaratory judgment actions and patent infringement actions were held to the "personal jurisdiction" standard.[6] In any event, we find no evidence that these changes had a significant impact on trial circuit choice or on the nature of forum shopping.

Since our data are insufficient to estimate precise district-level validity rates, aggregating across districts by circuit offers the best available identification strategy. This strategy is particularly appropriate for studying the impact of the CAFC. Since the CAFC was created to eliminate disagreements *among circuits*, it is clearly appropriate to study uniformity and forum shopping in the pre-CAFC era by comparing circuit fixed effects on validity rates and by analyzing the determinants of circuit choice, respectively. Because the establishment of the CAFC eliminated appellate review by the geographical circuits, the only variability in patent decisions across venues for 1983-2002 occurs at the district level. Across the pre-CAFC and CAFC eras, the set of district courts is almost constant, but the source of precedents and judicial review is different. Thus, in comparing the variation in district court validity decisions across geographical circuits and across the two eras, we identify the CAFC's impact on uniformity at the district level. We similarly analyze forum shopping using variation in

[5] 16 USPQ2d 1614 [CAFC 1990].

[6] The application of personal jurisdiction to patent infringement cases means that, for the purposes of venue, alleged infringers are subject to the "minimum contacts" standard (Harmon, 2003, p. 536). Personal jurisdiction is universally accepted by scholars to be less restrictive than the "regular and established place of business" standard of section 1400(b) (Moore, 2001; Wille, 1991; Keller and Nunnenkamp, 1991; Harmon, 2003). Thus, subsequent to *VE Holding*, patent holders have greater latitude in district choice; the playing field is even between alleged infringers and patent holders (Wille, 1991).

circuit location choices.

To place our inquiry in the appropriate institutional context, we discuss the background of the CAFC's establishment and review of related literature in section 2. To motivate our empirical tests, we introduce and analyze a simple, stylized model of forum choice in section 3. We describe the data and present descriptive evidence in section 4, then present the main results in section 5. Section 6 discusses our results and concludes.

2. Background

The original basis for appeals court reform was an overload of cases, relative to judges. In 1972, Congress established the Commission on Revision of the Federal Court Appellate System, Structure and Internal Procedures, better known as the Hruska Commission,[7] to investigate possibilities for reform. Patent advocates, unhappy over a perceived disparity across circuits in the interpretation and application of patent law, capitalized on this opportunity to seek a unified appellate court (Scherer 2006). Their arguments are reflected in the statements of Professor James Gambrell and patent attorney Donald Dunner, recorded in the final report of the Hruska Commission (1975).[8] Based largely on 240 responses by patent attorneys to a survey, Gambrell and Dunner conclude that there is significant non-uniformity in the interpretation and application of patent law. Some 48% of the responders indicate that "differences in the application of the law" among circuits were a "major problem," while 28% indicate that "differences in interpretation of law" were a problem.[9] In a letter to the Hruska Commission, Gambrell and Dunner argue that the study confirms their own experience that "...the lack of uniformity in decisions on patent-related issues has been a widespread and continuing fact of life."[10]

Gambrell and Dunner also argue that "forum disputes and the extensive forum shopping that goes on" are "directly attributable" to differences in the interpretation and application of the law, particularly that on patent validity. In their letter, they write "...patent owners and alleged infringers spend inordinate amounts of time, effort and money jockeying for a

[7] Popularly named for Senator Roman Hruska (who chaired the committee), it was created by Public Law 489 (92nd Cong., 2d sess., 13 October 1972).

[8] 67 F.R.D. 195 [1975]

[9] 67 F.R.D. at 369-70. To our knowledge, the full results of this survey are not published.

[10] 67 F.R.D. at 370.

post position in the right court for the right issues. Nowhere is this quest more vigorously pursued than for the right forum to rule on validity." Based, presumably, on their collective experience, they also name the Fifth, Sixth and Seventh Circuits as being particularly favorable to patentees.[11]

Several scholars have commented on the uniformity and forum shopping issues as they were perceived in the 1970s and earlier. Like Gambrell and Dunner, Harmon (1992, p. 574) says the Seventh Circuit was favorable for patentees, but does not discuss the Fifth or Sixth Circuits: "When this author broke into the business, and for many years after, it was quite clear that there was no such thing as a valid patent in the Eighth Circuit, and the climate in the Ninth Circuit was not much more hospitable. In the Seventh Circuit, on the other hand, patent infringement could get a client into big trouble. Each of the other circuits occupied its own band in the enforcement spectrum,..." In contrast to Gambrell and Dunner, Dreyfuss (1989, p. 7) implies that the Fifth and Seventh Circuits were quite different: "forum shopping was rampant, and... a request to transfer a patent infringement action from Texas, in the Fifth Circuit, to Illinois, in the Seventh Circuit, would be bitterly fought in both circuits and, ultimately, in the Supreme Court."

To address these perceived problems, the Hruska Commission recommended that a national appeals court be established to handle particularly difficult questions of patent law, which would be transferred from the geographical Circuit Courts of Appeal.[12] Notably, the report soundly rejected the proposal for a separate appeals court like the CAFC.[13] However, after several more years of lobbying, hearings and debate, Congress passed the Federal Courts Improvement Act of 1982,[14] which created the CAFC and established it as the sole US appeals court in patent cases.

The unification of the interpretation and application of patent law brought clear consequences. For example, early CAFC interpretations strengthened the statutory presumption of patent validity (35 U.S.C. 282), making an invalidity defense less viable.[15] Numerous

[11] 67 F.R.D. at 370.
[12] 67 F.R.D. at 371.
[13] See Scherer (2006) for a detailed discussion.
[14] (Public Law 164. 97th Cong., 2d sess., 2 April 1982).
[15] According to Quillen (1993, pp. 192-95), the CAFC's three most important changes were the elevation of nonstatutory factors in the determination of nonobviousness, the narrowing of the scope of prior art as it pertains to the obviousness issue, and the enforcement of the "clear and convincing evidence" standard for proving invalidity.

patent attorneys and legal scholars (Kastriner 1991; Harmon 1992; Quillen 1993; Goldstein 1993) note the CAFC's strengthening of the presumption.[16] Empirically, Henry and Turner (2006) and Marco (2004) find that the CAFC accounts for a significant increase in the probability of validity.[17] Not surprisingly, the CAFC has earned a reputation as a "pro-patent" court, and this subject has received considerable attention in the economics and legal literatures. Bessen and Meurer (2005, 2008), for example, study the surge in patent litigation in the 1990s and conclude that "legal changes," including the establishment of the CAFC, are largely responsible. Another group of papers (Kortum and Lerner 1998; Hall and Ziedonis 2001; Hall 2005) studies the "Friendly Court Hypothesis," which contends that the establishment of the CAFC is responsible for the simultaneous surge in patenting in the early 1980s. This research has yet to settle whether this hypothesis is correct.[18]

While there are many anecdotes showing circuit forum shopping in patent cases prior to 1982,[19] ours is the first research to characterize its nature and extent in both the pre-CAFC and CAFC eras.[20] This is surprising, since uniformity and forum shopping were the major problems that the CAFC was ostensibly created to address. Indeed, we know of only one paper that studies forum shopping in patent litigation.

Moore (2001) studies litigation over 1983-99 and argues that forum shopping over validity rates still exists under the CAFC. She does not directly model choice of forum along with litigation outcome, nor can her data assess the impact of the CAFC. Like Moore, Clermont and Eisenberg (1995) compare outcomes in cases where the plaintiff named the forum to

[16]Kastriner (1991, p. 10) refers to the enforcement of the presumption of validity as "the first step taken by the CAFC which materially strengthened patents." Harmon (1992, p. 575) writes that "the Federal Circuit's rigorous observation of the presumption of validity" has made obviousness a more difficult defense in patent litigation. Goldstein (1993, p. 365) states, "The CAFC has not only eliminated intramural conflict and forum shopping. The court has also buttressed the patent grant itself, giving new force to the statutory presumption of validity." Merges (1997) also discusses the "pro-patent" reputation of the CAFC.

[17]Henry and Turner use structural break analysis to estimate that increases in rates of validity occurred at the onset of the CAFC's tenure. They estimate an increase in the probability of validity in district court decisions of .26 occurred in 1982, and an increase in the probability an "invalid" decision is not affirmed of .29 in 1983. Marco (2004) estimates that the CAFC increased the validity rate by .20.

[18]Kortum and Lerner (1998) argue that a simultaneous surge in the productivity of R&D explains the surge in patenting, while Hall and Ziedonis (2001) and Hall (2005) conclude that the CAFC is responsible for some of the surge.

[19]For example, the case of *Bros Incorporated v. W.E. Grace Manufacturing Company et al.* (140 USPQ 324 [N.D.TX 1964]) lasted more than ten years and included simultaneous actions in districts in the Fifth, Sixth and Eighth Circuits.

[20]There are some published works that include statistics on rates of patent invalidity by circuit (Koenig 1980; Federico 1956).

those where the defendant transferred the case, and find that the transfer option counters the negative aspects of forum shopping. They do not analyze patent litigation, however. In analyzing antitrust litigation, Perloff, Rubinfeld and Ruud (1996) find systematic differences across fora, and argue that this may encourage shopping. In a theoretical treatment, Lerner and Tirole (2006) study forum shopping for certification of quality, not in the context of litigation.

3. Theory

In litigation, the patentee is endowed with the choice of forum. An alleged infringer may bring suit via a declaratory judgment action only if an actual controversy exists between the patentee and the alleged infringer. If the patentee makes an explicit threat to sue (e.g. sends a cease-and-desist letter), then the alleged infringer can easily get jurisdiction for a declaratory judgment action. Without such a threat, however, the alleged infringer must show that the patentee's past actions (in previous litigation, license negotiations, etc.) give a reasonable apprehension of suit. Thus, the forum-choice stage of patent litigation is a sequential-move game, in which the patentee moves first.

To provide a framework for understanding the main empirical inquiries in this paper, we develop and analyze a stylized decision-theoretic model with three circuit courts, $1, 2$ and 3. Let the set of circuits be defined as $C = \{1, 2, 3\}$. In each case, there is a set of *available* fora, $C_A \subseteq C$, and a *natural* forum, $c_N \in C_A$. We assume that there is positive probability associated with each combination of c_N and C_A.

The patentee has the sole opportunity to name the forum for the trial, c_T. This is without loss of generality—if the alleged infringer had the choice of forum, the results below would change in cosmetic ways only. For simplicity, we assume that infringement is certain. The circuits are heterogeneous with respect to the likelihood that the patentee's patent is valid. Specifically, the probability of validity in the three circuits is, respectively, α_1, α_2 and α_3, with $\alpha_1 > \alpha_2 > \alpha_3$. Further, define $\beta_1 \equiv \alpha_1 - \alpha_3$ and $\beta_2 \equiv \alpha_2 - \alpha_3$ as the differences in validity rates relative to circuit 3, and assume that $\beta_2 = \frac{1}{2}\beta_1 \equiv \overline{\beta}$. We refer to $\overline{\beta}$ as the *step* in validity between circuits. We assume a constant step between circuits to model uniformity with a single parameter, thereby avoiding a taxonomy.

If the patent is held valid, damages of V are awarded from the infringer to the patentee. Litigation in any forum costs L. Forum *shopping*, the naming of any forum other than the natural forum, carries an additional cost ΔL. For simplicity, we assume that no settlement takes place,[21] and that litigation is always a credible strategy for both parties.

Clearly, the forum-shopping decision is trivial whenever C_A is a singleton. The interesting cases are thus where $C_A \in \{\{1,2\},\{1,3\},\{2,3\},\{1,2,3\}\}$. We restrict remaining attention to these cases. Let the circuit $c_i \in C_A$ where α_i is the largest be $\overline{c}$, and that with the smallest α_i be $\underline{c}$.

Clearly, if the natural forum is most favorable to the party naming the trial forum, the choice is trivial.

Remark 1 *If $\overline{c}$ is natural, then the patentee names $\overline{c}$.*

Thus, the patentee names 1 whenever 1 is the natural forum, and names 2 if $C_A = \{2,3\}$ and 2 is the natural forum. The reason is that naming $\overline{c}$ when it is natural results in the highest likelihood of validity and carries no additional litigation costs.

If $\overline{c}$ is not the natural forum, then the patentee must weigh the higher likelihood of validity in $\overline{c}$ versus the additional litigation costs ΔL. Next, consider the cases where the natural forum is not most favorable.

Remark 2 *Suppose $\overline{c}$ is not natural.*

[21] The model's predictions do not change if the following hold: (i) settlement bargaining is over foregone litigation costs, (ii) the parties split these costs according to a constant fraction, and (iii) rates of settlement are constant across circuits. We do not observe settlement rates in our main data source, which relies on published litigation decisions, and we know of no existing data source for settlement rates, by circuit, for the period when we identify significant forum shopping (1963-77). For cases terminated during 1979-2000, we can estimate settlement across circuits using the Inter-University Consortium for Political and Social Research Data [FEDERAL COURT CASES: INTEGRATED DATA BASE, 1970-2000, Computer file. Conducted by the Federal Judicial Center. ICPSR08429-v7. Ann Arbor, MI: Inter-university Consortium for Political and Social Research (producer and distributor), 2005-04-29]. Rates of settlement vary between .83 and .88 among the circuits for this period . By contrast, conditional on non-settlement, validity rates across circuits for 1953-82 vary between .25 and .81, and validity rates for 1983-2002 vary between .64 and .83 (see Table 1, discussed in detail in Section 4.1). The fact that the range of variation in validity rates is greater, and the fact that we find these rates to be uncorrelated with the estimated rates of settlement for 1979-2000 terminations, gives us confidence that differences in settlement rates do not upset the predictions of the model. Further, it is unnecessary to include settlement rates in our empirical analysis of forum shopping.

(i) If $\overline{\beta} \geq \frac{\Delta L}{V}$*, then the patentee names* $\overline{c}$ *for any* C_A*.*

(ii) If $\frac{\Delta L}{2V} \leq \overline{\beta} < \frac{\Delta L}{V}$*, then the patentee names* $\overline{c}$ *if* $C_A = \{1, 3\}$ *or if* $C_A = \{1, 2, 3\}$ *and* 3 *is the natural forum. Otherwise the patentee names* c_N*.*

(iii) If $\overline{\beta} < \frac{\Delta L}{2V}$*, then the patentee names* c_N*.*

Hence, whenever the patentee shops, she chooses $\overline{c}$. She is more inclined to shop when the validity step is larger, when the value of the damages is larger, and when the cost of shopping is smaller.

While our data permit us to estimate the differences in validity rates, $\{\beta_i\}$, they do not offer us this luxury with respect to V or ΔL, because the ratio $\frac{\Delta L}{V}$ is what matters in determining whether shopping is optimal. We define, without loss of generality, $Z = \frac{\Delta L}{V}$, and assume that Z is distributed on the positive real line according to the cumulative distribution function F, where F is increasing and continuously differentiable.

Given Remark 2, it is clear that, ex ante, the probability that a given patentee shops, conditional on only a one-validity-step increase being available, is $F(\overline{\beta})$, while the probability that a given patentee shops, conditional on a two-validity-step increase being available, is $F(2\overline{\beta})$. This finding gives rise to our first proposition.

Proposition 1. *The unconditional probability a given patent case forum shops is increasing in* $\overline{\beta}$*.*

Proof. This follows directly from the fact that the conditional probability of forum shopping of any patent case, in any circuit, is non-decreasing in $\overline{\beta}$, while it is strictly increasing in $\overline{\beta}$ if there is a possible increase in the validity step through shopping. ***QED***

Thus, when the circuits are less uniform ($\overline{\beta}$ is higher), forum shopping is more likely. We can also draw conclusions about the relative likelihood of forum shopping, conditional on the natural forum.

Proposition 2. *If, conditional on* c_i*, each* C_A *is equally likely, then the probability of forum shopping for a patent case whose natural circuit is* i *is decreasing in* α_i*.*

Proof. Conditioning on the natural forum, each C_A that includes c_N occurs with probability 1/4. Consider first $c_N = 3$. With probability 1/2, there is a possible one-validity-step increase from shopping, while with probability 1/4, there is a possible two-validity-step increase. Thus, we have

$$Prob(Shop|i = 3) = (1/2)F(\overline{\beta}) + (1/4)F(2\overline{\beta}).$$

When $c_N = 2$, the probability of a one-validity-step increase remains 1/2, but there is no possibility of a two-step increase:

$$Prob(Shop|i = 2) = (1/2)F(\overline{\beta}).$$

Clearly, the probability of shopping when $c_N = 1$ is zero. Thus, $Prob(Shop|i = 3) > Prob(Shop|i = 2) > Prob(Shop|i = 1)$. ***QED***

Intuitively, weaker circuits are the source of shopped patents with greater frequency, while stronger circuits are targets.

Using data on validity decisions, we test for uniformity across courts, and test for the impact of the establishment of the CAFC. Estimating the differences in validity rates $\{\beta_i\}$ is key. Using data on circuit location, we test for whether trial circuit choice is driven by validity rates, and also for how the CAFC affected this choice. Propositions 1 and 2 form the basis of our main tests of forum shopping.

4. The Data

Our data set of patent litigation uses and augments the Henry and Turner (2006) data. Our decisions span 1953-2002, and include all United States utility patents found "invalid," "not infringed" or "valid and infringed" in a case whose opinion is recorded in the *United States Patents Quarterly* (USPQ).[22] The observational unit in the data set is a particular patent in a particular case (a "patent case").[23] There are 2890 patent cases in total.

[22]The USPQ contains all published opinions from cases involving patents, copyrights, and trademarks. Federico (1956) estimates that the USPQ contains about half of US district court decisions for 1948-54.

[23]Thus, for a case with, say, four patents at issue, there are four patent cases. Note that in the analysis presented here, the basic unit is a decision in a patent case.

Many parts of this data set were originally gathered to study how courts have handled the issues of patent validity and infringement. As such, our data include only cases that discuss one or both issues. These criteria are discussed at length by Henry and Turner (2006, pp. 95-97). In the study described here, we restrict attention to utility patents and to validity.

When a court judges some of a patent's claims differently than it does others, we follow Federico (1956) and distinguish such patents as follows. If any claim is held "valid and infringed," the patent is recorded as "valid," no matter how many other claims are found to be "invalid." The reason for this determination is that the patentee is winning something from his patent. If there are no "valid and infringed" claims, then if any claim is held "invalid" while others are held "not infringed," the patent is recorded as "invalid." If the only adjudicated claims are held "not infringed," the patent is recorded as "valid."[24] We record variables pertaining to the litigation from published opinions on the cases,[25] and record variables pertaining to patent characteristics from the patent documents themselves, archived by the USPTO.[26]

We assign each patent case to both a trial circuit and a home circuit. While this is the most natural way to study non-uniformity and forum shopping among circuits in the pre-CAFC era, for continuity, we maintain this level of aggregation for the CAFC era as well. In any event, we do not have enough data to estimate accurate district-level validity rates for most districts.

The trial circuit is the geographical circuit where the district court in the case is located. As we are interested in the determinants of circuit choice, we omit observations with trial circuits where the litigants do not have any choice about where to litigate. Thus, cases in the US Courts of Claims or in the International Trade Commission are ignored.[27] For continuity, we combine Circuits Five and Eleven.[28]

[24]Patents are frequently held "valid but not infringed."

[25]We do not rely on the "particular patents" section in the USPQ annotation at the beginning of each opinion. There are numerous inconsistencies between this and the body of the opinion, so we rely on the latter.

[26]Patent number searches can be initiated here: http://patft.uspto.gov/netahtml/PTO/srchnum.htm.

[27]There are eighteen such observations. Eleven of these are patent cases decided in the US Court of Claims (four "invalid," six "not infringed" and one "valid and infringed"), and seven of the cases were decided by the International Trade Commission (one "invalid," three "not infringed" and three "valid and infringed"). Five of the ITC cases were decided in the pre-CAFC era (one"invalid", two "not infringed" and two "valid and infringed"), when the Court of Customs and Patent Appeals (CCPA) was the relevant appellate court.

[28]The Eleventh Circuit was created in 1982, using the eastern part of the Fifth Circuit.

In our data, we observe the geographic location of the patent assignee, and regard its home circuit as the natural circuit. We say that the patent is "born" in the home circuit and "litigated" in the trial circuit.[29] Although jurisdiction is not guaranteed in the home circuit as we define it, *a priori* it is more likely to be natural than any other circuit. Since knowledge spillovers are localized (see Jaffe, Trajtenberg and Henderson 1993), we expect that infringement will tend to be localized. Also, from the standpoint of the patentee, litigating in the home circuit will typically cost less than litigating in other circuits. Travel costs are low and the patentee's lawyers will typically be more familiar with nearby courts.

4.1. Circuit-level Descriptive Analysis

Many of our main results are evident in circuit-level analysis. Estimates of the probability a patent is valid, broken down by case type and by trial circuit, are presented in Table 1.[30] Consider first the estimated validity rates for patentee-plaintiff cases in the pre-CAFC and CAFC eras (columns 3 and 5 of the top part of Table 1). Due to the relatively small number of cases, we omit the DC Circuit.

These statistics are shown in a scatterplot in Figure 1 and labeled by circuit.[31] First, each point indicates a greater likelihood of validity in the CAFC era for the district courts in each trial circuit. This is not surprising in light of past work showing increased validity rates under the CAFC.

Second, the variation in validity rates is much larger for the pre-CAFC era. The average validity step, calculated by dividing the difference in the highest and lowest validity rates by 10, is .056 in the pre-CAFC era. This is more than three times larger than the .017 average step for the CAFC era. The variance of the circuits' validity rates, .024, is about six times as large as .004, the variance for the CAFC era.[32]

Third, circuits whose districts were "strong" on validity in the pre-CAFC maintained those characteristics, somewhat, in the CAFC era. This is illustrated by the fitted line in

[29] If there is no assignee at issue, then we regard the first inventor as the assignee, and his location determines the home circuit. Ideally, we would use the patentee's actual location at the time the case is filed, but this information is not available from the published opinions.

[30] All tables can be found at the end of the paper.

[31] All figures are generated using STATA.

[32] A one-sided F test is significant at the 1% level.

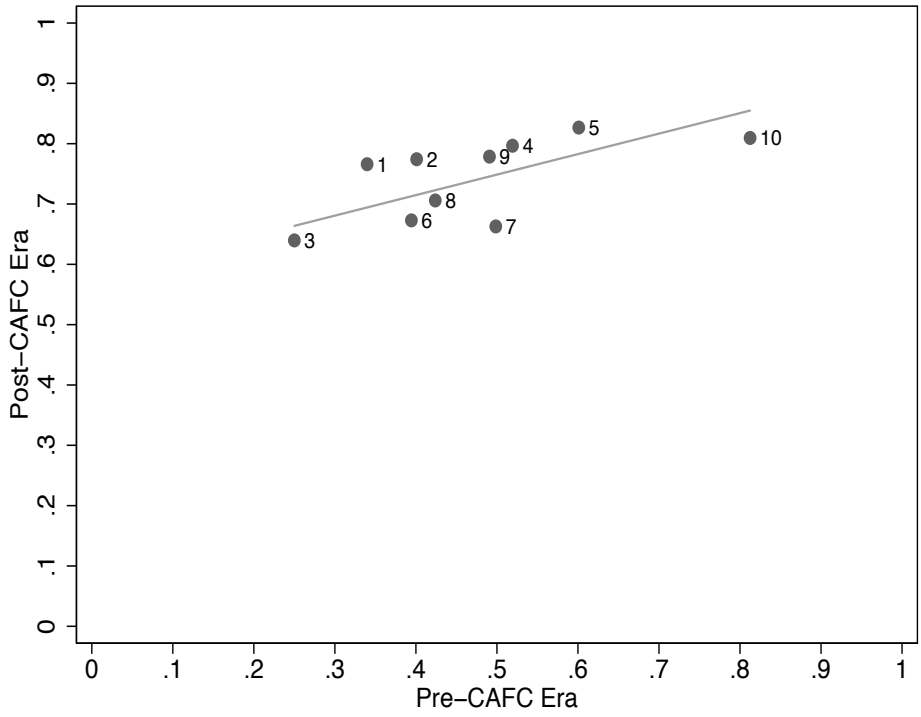

Figure 1: *Validity Rates, Patentee-Plaintiff Cases, by Trial Circuit*

Figure 1, obtained from a weighted OLS estimation of the CAFC-era validity rates on the pre-CAFC-era validity rates.[33] The estimated slope, .32, is statistically significant at the 10% level.[34]

Consider next Figures 2 and 3, which show confidence intervals around the average validity rate, by trial circuit, for the pre-CAFC and CAFC eras.[35] There are far fewer overlaps among the intervals in the pre-CAFC era.[36] The confidence interval for the 3rd Circuit, which has the lowest validity rate, overlaps with only one other interval (Circuit 1). The confidence interval for the 10th Circuit, which has the highest validity rate, does not overlap with any other intervals. By contrast, nearly all of the intervals overlap in the CAFC era

[33]Shares of observations per circuit were used as weights.

[34]The standard error is .17.

[35]Confidence intervals for circuit i, where $i \in \{1, \ldots, 10\}$, were computed at the 95% level around the average validity rate for circuity i, using plus and minus 1.96 times the estimated standard deviation of the validity variable for this circuit divided by $\sqrt{n_i}$, where n_i is the number of cases in circuit i.

[36]Note that our results are consistent with the arguments of Gambrell and Dunner about lack of uniformity during the pre-CAFC era, but do not confirm the perception that the Fifth, Sixth and Seventh circuits were the strongest on validity. The Sixth Circuit, in fact, is the third weakest on validity during the pre-CAFC era.

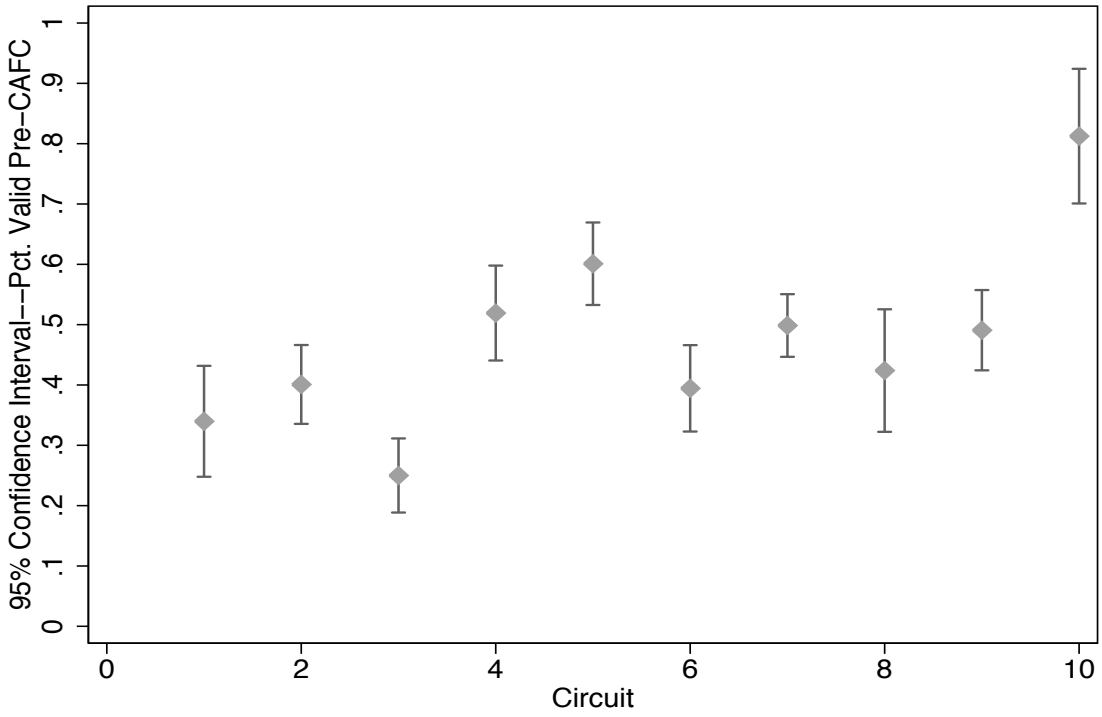

Figure 2: *Validity Rates and Confidence Intervals, by Trial Circuit, Pre-CAFC Era*

(Figure 3). This reflects the greater uniformity of the average validity rates across circuits.

Taken together, these results suggest significant non-uniformity in the pre-CAFC era and a significant impact of the CAFC on validity outcomes. Namely, there is greater uniformity in validity outcomes in patentee-plaintiff cases in the CAFC era, but systematic differences across circuits may remain. We investigate this further using a binary-choice model of validity, below.

Consider next the relationship between validity rate and case location. We begin by defining a new measure, "net inflow," for each circuit. Let h_i be the number of patent cases born in Circuit i and let l_i be the number of patent cases litigated in Circuit i. Let $H = \sum_{i=1}^{10} h_i$ be the total number of patent cases born in Circuits 1-10 and let $L = \sum_{i=1}^{10} l_i$ be the total number of patent cases litigated in Circuits 1-10, respectively. We then define

$$NI_i = \frac{l_i}{L} - \frac{h_i}{H}$$

for each $i \in \{1, ..., 10\}$. Hence, the net inflow into the ith Circuit is the share of total patent

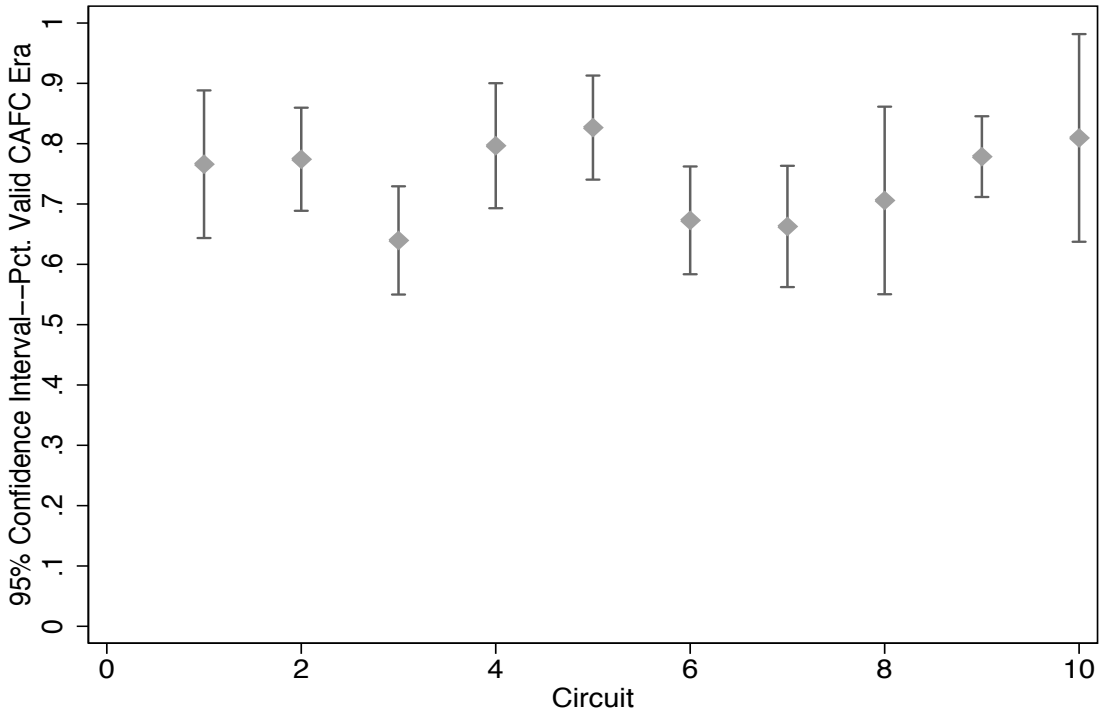

Figure 3: *Average Validity and Confidence Intervals, by Trial Circuit, CAFC Era*

cases litigated in the ith Circuit less the share of total patent cases born in the ith Circuit.

If systematic forum shopping (for preferred venues on validity) prevails, then circuits that are weak on validity should export cases to other circuits (so NI would tend to be negative). Circuits that are strong on validity should import cases (so NI would tend to be positive). Scatterplots of NI vs. validity rates are shown for the pre-CAFC and CAFC eras in Figure 4, along with fitted lines from weighted regressions.[37]

Two features of the figure highlight forum shopping and the impact of the CAFC. First, this figure indicates that case migration (from home to trial circuit) is more *concentrated* in the pre-CAFC era. The spread in net inflow across circuits (plotted vertically) is much greater in the pre-CAFC era. Circuits 2, 4, 5, 6 and 7 each have, for the pre-CAFC era, net inflow that is larger, in absolute value, than net inflow for *every* circuit in the CAFC era.

Second, the relationship between net inflow and validity is consistent with the theory in both eras but far stronger in the pre-CAFC era. The estimated slope coefficient is .16 for

[37]We use share of litigated cases per circuit as weights.

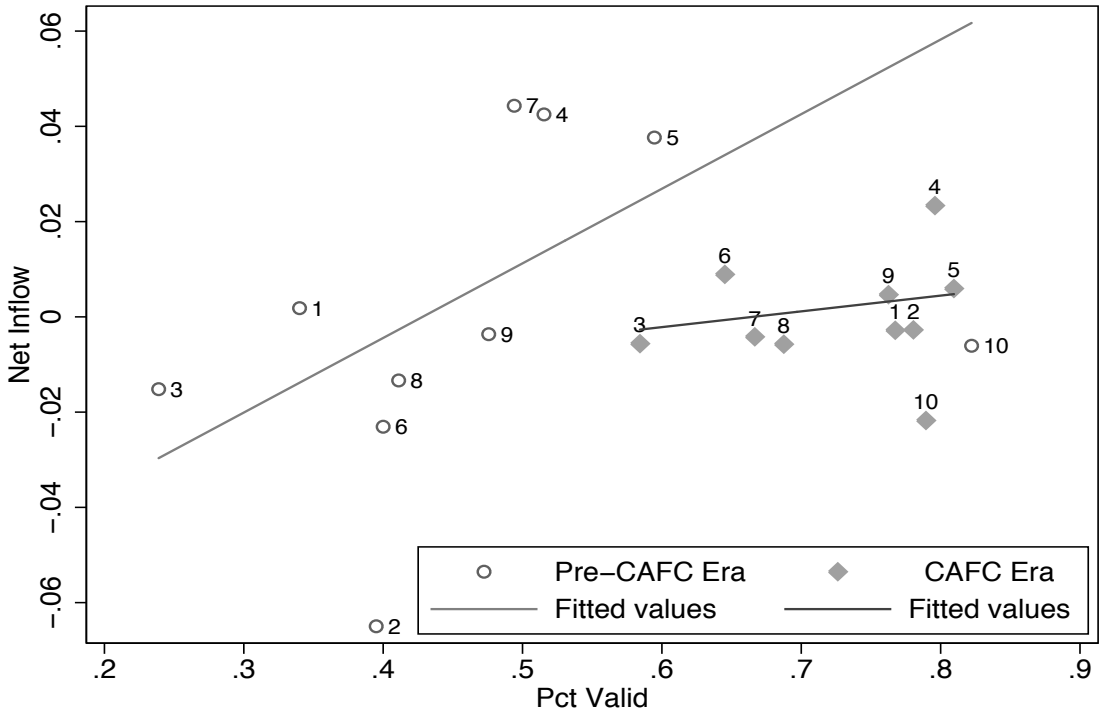

Figure 4: *Net Inflow vs. Validity Rate, by Geographical Circuit*

the pre-CAFC-era fitted line, but only .03 for the CAFC-era fitted line. The former estimate is of marginal statistical significance, while the latter is clearly insignificant.[38] In both cases the 10th Circuit appears to be an extreme outlier, as it has a very high validity rate but a low net inflow. Most likely, this reflects its geographic and economic remoteness (it spans several sparsely-populated states in the interior midwest of the US), which tends to decrease the incidence of patent infringement occurring there. In testing for forum shopping using patent-case-level data, we can control for this circuit effect.

4.1.1. Patentee-Defendant Cases

The preceding descriptive results all pertain to patentee-plaintiff cases only. The patterns of validity rates are quite different for patentee-defendant cases, where validity is about ten percentage points less likely, on average, in both eras. In fact, validity rates in patentee-defendant cases in the pre-CAFC era are *not statistically correlated* with validity rates in

[38]Estimated standard errors are .10 and .04, respectively.

patentee-plaintiff cases in the pre-CAFC era.[39] This implies that whether a circuit is strong on validity in patentee-plaintiff cases is not correlated with whether it is strong in patentee-defendant cases. The variance in validity rates, in the pre-CAFC era, is also low relative to the variance in patentee-plaintiff cases in the pre-CAFC era. This suggests that validity rates were more uniform in patentee-defendant cases than in patentee-plaintiff cases.[40]

These results suggest that the differences across circuits themselves differ between patentee-plaintiff cases and patentee-defendant cases. A court's handling of the validity inquiry in infringement (patentee-plaintiff) actions is statistically distinct from its handling of validity in declaratory judgment (patentee-defendant) actions. Pairing this with the relatively low variance in validity rates for patentee-defendant cases in the pre-CAFC era, it appears that forum shopping by alleged infringers was less valuable, and thus, less likely. This raises the possibility that litigation disputes over venue may be driven in part by the advantage conferred to the plaintiff.

4.2. Litigation Characteristics

To test rigorously for uniformity across circuits in validity decisions, and to test for forum shopping, we analyze our data at the patent-case level. This permits us to control for a large number of patent- and litigation-specific characteristics. A list of our variables, grouped into five categories, is shown in Table 2. The variable $trial\_circuit_j$ takes a value of 1 if the case is litigated in circuit j, while $home\_circuit_j$ takes a value of 1 if the patent is born in circuit j. The variable $away\_circuit$ takes a value of 1 if the case is litigated outside the home circuit.

Filing dates are particularly important for the forum shopping estimations, because we wish to test whether *recent* circuit-specific validity rates help to explain the circuit chosen at the time the case is filed. Unfortunately, these variables are not typically recorded in the USPQ. We use two sources to identify filing dates. If possible, we cross reference case docket numbers in our USPQ data with docket numbers from the Inter-University Consortium for Political and Social Research (ICPSR) Federal Judicial Center data on new litigation

[39] For example, in a regression of % valid (patentee-defendant cases) on % valid (patentee-plaintiff cases), the estimated slope is -.13 and the standard error is .25.

[40] The variance in pre-CAFC validity rates in patentee defendant cases is also low relative to the variance in such cases in the CAFC era. Most likely, this is because there are relatively few observations from the CAFC era.

filings.[41] The ICPSR data include the filing day, month, and year. For cases in our data that do not match any cases in the ICPSR data, where the docket number includes a two-digit year modifier, we record the two-digit year from the docket number as the filing year. These modifiers are seldom observed in patent cases filed before the mid-1960s. In total, we record filing years for 1,580 observations.[42]

The variable *home_valid_adv* records the recent validity *advantage* of the home circuit relative to the national average. It is constructed by subtracting the five-year rate of validity for all circuits, *valid_rate*5*_all*, from the five-year home rate, *valid_rate*5*_home*.[43] These five-year rates are lagged one year from the date of filing. So, for a patent born in the Fourth Circuit, upon which the patentee initiates litigation in 1974, *home_valid_adv* is the validity rate for the Fourth Circuit for 1969-73 minus the aggregate validity rate for all circuits for 1969-73. The reason we construct *home_valid_adv* this way is that, given the structural break in overall validity rates at the onset of the CAFC (see Henry and Turner 2006), *valid_rate*5*_home* is itself non-stationary. By subtracting *valid_rate*5*_all*, we remove the non-stationarity while retaining the key informational feature of the home validity rate, namely its relationship to the overall rate.

The second key litigation variable, $patentee\_defendant$, takes a value of "1" if the patentee is the defendant. This characterizes who names the forum. In the majority of cases where $patentee\_defendant = 1$, the alleged infringer files a declaratory judgment action against the patentee.[44] Given the differing origin of such cases, we continue to treat patentee-plaintiff and patentee-defendant cases separately in our patent-level analysis.

For the uniformity estimations, we assign each case to an era, based on the establishment of the Federal Circuit. Where we observe a subsequent appellate decision, then the case is

[41] See footnote 20 for the reference for this data set.

[42] For several patent cases involving multiple patents, the filing date occurs prior to the patent issue date, indicating that the patent was added to the litigation after the filing date. We remove these patent cases from the analysis of forum shopping.

[43] Each validity rate is calculated as $\frac{\sum_{t=-5}^{-1} valid_t}{\sum_{t=-1}^{-5} N_t}$, where $valid_t$ is the number of patents found valid in year t, and N_t is the number of patents adjudicated in year t. This formulation allows for a well-defined average even for circuits that occasionally adjudicate no patents over the course of a year. In some cases, a circuit had no decisions in the previous five years. These observations are recorded as missing.

[44] Exceptions occur in a handful of cases where both the plaintiff and defendant own patents at issue in the suit. The most common example of this is when a patentee sues for patent infringement, and the alleged infringer counter claims for infringement.

in the "CAFC era" if the CAFC hears the appeal, and in the "pre-CAFC era" otherwise. If there is no appellate decision, we assign the case to the CAFC era if the decision occurs after October 1982.

For the forum shopping estimations, we specify *away_circuit* as the dependent variable. Cases take an average of three years from filing to reach a first decision, and the legislative history of the CAFC played out over nearly a decade. Given this, there is no obvious way to define the CAFC era based on filing date. Thus, we define eras more flexibly in the forum shopping estimations, using a set of time dummy variables.

The remaining litigation variables are straightforward. For our analysis of validity rates, *valid* is our dependent variable. It takes on a value of "1" if the patent is not found invalid, and "0" if the patent is found invalid. The variables *decision_age*, which is the time elapsed between patent issue and the decision in the case, and *numpatents*, the number of patents in the case, are directly observable from the USPQ decisions. We record $individual = 1$ if the patentee at litigation is a person or persons, while we record $patentee\_assignee = 1$ if the patentee at litigation is very similar to the assignee. This includes cases where the assignee is a person, and the patentee is a company, estate or trust whose name clearly references the patentee.

4.3. Patent Characteristics

We sort patent characteristics, captured from the patent documents themselves, into six sub-categories: Application, Assignee, Makeup, References and Vintage. Each variable is directly observable in patent documents. The Application variables *continuation* and *division* refer, respectively, to whether the patent is a continuation (in whole or in part) or a division of a previous application. If a patent is either a continuation or a division, or both, we use the earliest related application date to compute the patent pendency duration variable *delay*.

Variables with basic characteristics of assignees and inventors are included in the Assignee sub-category. The variable *inventor_assignee_same_state*, which equals 1 if the inventor and assignee reside in the same state, is not well-defined when the patent assignee is foreign, so there are fewer observations of this variable.[45] The Makeup sub-category in-

[45]This variable is typically not well-defined whenever *away_circuit* is not well-defined, but there are three

cludes dummies for *chemical*, *computer*, *drugs*, *electrical*, *mechanical* and *other*, along with the variable recording the number of claims. Product dummies are recorded consistent with the NBER classification of Hall, Jaffe and Trajtenberg (2001).

In the Reference sub-category, all six variables reflect backward references. These are recorded on virtually all patents in our sample that are issued after January 1, 1947, but are not recorded on earlier patents.[46] The variables $design\_refs$, $foreign\_refs$ and $utility\_refs$ record the number of design, foreign, and utility patents referenced, respectively. These variables characterize both the size and composition of the prior art of the patent.[47] The duration variable $oldest\_ref\_age$ records the elapsed time between the issue of the oldest referenced patent and the issue of the subject patent. The similarly-constructed variable $median\_ref\_age$ records the elapsed time since the median-aged reference. Taken together, these variables capture the age and time-concentration of the preceding technology. Forward references are, unfortunately, prohibitively difficult to measure for patents issued before January 1, 1976.[48] Since the disproportionate majority of patents litigated in the pre-CAFC era were issued prior to this date, we do not attempt to study the importance of forward citations.

The Vintage category includes a single variable, the issue year of the patent. As we see in the next section, there are temporal trends in patent characteristics. This vintage variable permits us to control for these trends.

4.4. Descriptive Statistics

The average patent in our sample has one or two American inventors and has an American assignee at issue, both located in the same state. At the time of the district court decision, patents tend to be about nine years old (from the date of issuance). The lag between patent application and patent issuance is about three and one-half years. In our sample, patents issue most commonly from an original application, as opposed to a continuation or division.

exceptions where *away_circuit* is observed but *inventor_assignee_same_state* is not observed. One patent has a foreign inventor and an American assignee at issue. For two other patents, the state in which the assignee resides is not clear but the circuit in which the assignee resides is clear.

[46] The net effect is that Reference variables are missing for 259 patent case observations.

[47] Reissue patent references here are treated as utility references.

[48] The USPTO has full-text HTML documents only for patents issued after this date. For earlier patents, one must view the image. Thus, finding all images that reference the litigated patent is infeasible.

The typical patent references no US design patents, about seven US utility patents and one foreign patent. Its oldest referenced patent was issued about 35 years prior to its own date of issuance.

The patentee at trial is most commonly a company, not an individual, but that company is typically the same as, or similar to, the inventor/assignee at issue,[49] and litigates two patents in the case. Patentees are the plaintiff (and therefore choose the district court), for just under 90% of patent cases. Roughly half of the trials in our sample take place in the home circuit.

There are sizable differences between patents litigated in the pre-CAFC and CAFC eras, although the differences are consistent with overall patenting trends. Table 3 gives statistics for characteristics of patents litigated in the two eras, respectively, and also reports simple z-statistics for difference-in-means tests across eras. Table 4 does the same for characteristics of litigation.

In our sample, the distribution of patent birth in the CAFC era is different from that of the pre-CAFC era. Patents are significantly less likely to be born in the Second, Seventh and DC Circuits, and significantly more likely to be born in the Ninth Circuit and abroad. These changes reflect demographic trends such as the declining relative population of New York, the growing relative population of California, and the greater proportion of patents issued to foreign assignees.[50]

In the CAFC era, applications of litigated patents have been about four times more likely to be continuations and about 43% more likely to be divisions of earlier applications, but there is no significant difference in *delay*. Thus, applications of CAFC-era litigated patents (henceforth "CAFC-era patents") take about the same amount of time to issue, but undergo significantly more recorded changes at the USPTO.

CAFC-era patents have, on average, about 26% more inventors, which is consistent with greater average R&D per patent, a trend from the 1950s to 1980s noted by numerous researchers.[51] These patents also have about 43% more claims. The mix of patent product

[49]Under this definition, the patentee either is exactly the same, is a company or trust in which the original inventor/assignee or his heirs has clear ownership, or is a group of entities which includes the original inventor/assignee.

[50]There are 11 observations where the birth location cannot be identified. Most of these involve assignees that are companies with no given address.

[51]See Griliches (1990) for an excellent survey.

characteristics is significantly different across eras as well. Chemical, computer and drug patents, covering products in growth industries, occur more frequently in the CAFC era, while mechanical patents, more represented in industries in relative decline in this period, occur less frequently.

CAFC-era patents, generally, have more backward references than pre-CAFC-era patents. This fact is consistent with observed "citation inflation" in patenting (Hall et al. 2001). CAFC-era patents have about seven times more US design references (though the magnitudes are quite small), 37% more US utility references, and more than twice as many foreign references. The age of the technology, as measured by the median cited patent and oldest cited patent, is smaller for CAFC-era patents, by about 21% under the former measure and by about 5% under the latter, reflecting faster rates of innovation.

On average, CAFC-era patents are a little more than half a year older when the cases are filed, but a little less than half a year older when the district court decides them. CAFC-era cases are litigated with 17% more additional patents. The patentee at trial is about 27% less likely to be an individual, but is equally likely to be the same as the inventor/assignee at issue. The patentee is about 63% less likely to be the plaintiff in the case in the CAFC era, and is half as likely to have its patent invalidated.

5. Estimation

We estimate two models in this section. The first model specifies the determinants of validity decisions. The second specifies the determinants of trial circuit choices.[52]

5.1. Uniformity of Validity Outcomes

We specify the validity model as follows:

$$valid_j^* = \delta + \eta X_j^{Era} + \beta X_j^{Trial} + \theta X_j^{Era} X_j^{Trial} + \phi X_j^{Home} + \lambda X_j^{Lit} + \pi X_j^{Patent} + \varepsilon_j, \quad (5.1)$$

[52]All estimates in this paper are obtained by maximum likelihood using Time Series Processor (TSP). Standard errors are computed using analytical second derivatives. Partial effects are computed using the average of the partial effect for every observation.

where $valid^*$ is a latent variable measuring the degree to which the patent satisfies the legal requirements for patentability. The subscript j indexes the patent cases and ε_j is independently and identically distributed Normal with mean zero and constant variance. This error term primarily reflects unobservable factors determining patent validity, such as the competence and performance of randomly assigned judges, special masters and jurors. Observe:

$$valid_j = \begin{cases} 1 & \text{if } valid_j^* \geq 0 \\ 0 & \text{if } valid_j^* < 0\,. \end{cases} \tag{5.2}$$

Here, the vector X_j^{Era} includes only the dummy variable $cafc\_era_j$, X_j^{Trial} is the vector of trial circuit dummies, X_j^{Home} is the vector of home circuit dummies, X_j^{Lit} is the vector of litigation variables, and X_j^{Patent} is the vector of patent variables.

We omit the Third Circuit dummy from X_j^{Trial} and X_j^{Home}. Conditional on this, the elements $\{\beta_1, \beta_2, \beta_4, ..., \beta_{10}\}$ that comprise the vector β are differences in circuit effects for the pre-CAFC era,[53] while the elements of the vector θ are changes to these differences wrought by the CAFC. Elements of the summed vector $\beta + \theta$ are differences in circuit effects for the CAFC era. These parameters form the basis of our three key tests of uniformity.

Hypothesis 1. $\beta = 0$.[54] Validity rates are uniform across circuits in the pre-CAFC era, ceteris paribus.[55]

Hypothesis 2. $\theta = 0$. The effect of the CAFC on validity rates is the same across all circuits, ceteris paribus.

Hypothesis 3. $\beta = -\theta$. Validity rates are uniform across circuits in the CAFC era, ceteris paribus.

Conditional on the litigation era, we assume that circuit fixed effects are identical for all patent cases. This is a key assumption for identification. Given the size and scope of our data, we cannot control for all possible patent-circuit-specific effects in estimating circuit fixed effects. Fortunately, estimated differences in circuit effects are similar to those obtained

[53] We omit the fifteen cases in the DC Circuit from this and ensuing estimations because of their relative infrequency. We also do not impose a constant validity step here, in contrast to the theoretical model.

[54] Specifically, $\beta_1 = \beta_2 = \beta_4 = ... = \beta_{10} = 0$. Subsequent hypotheses use notation analogously.

[55] The definition of β here is consistent with that in the earlier theory section.

from the unconditional circuit validity rates in section 4, suggesting that any such effects are negligible.

Based on the unconditional circuit validity rates discussed in section 4, inter-circuit differences appear to be themselves different in patentee-plaintiff cases compared to patentee-defendant cases. We control for this through sample segmentation. Our first estimation includes only patentee-plaintiff cases. Because we include Reference variables, and these are missing for the oldest patents, our sample size is reduced further, to 2306 usable observations.[56]

The results are presented in Table 5. The McFadden R-squared is .14 and the model yields about 66% correct predictions. The (omitted) Third Circuit is estimated to be the weakest circuit with respect to validity in both eras because $\widehat{\beta_i} > 0$ and $\widehat{\beta_i} > -\widehat{\theta}_i$ for all $i \in \{1, 2, 4, ..., 10\}$. The Tenth Circuit is estimated to be the strongest in both eras, as $\widehat{\beta}_{10}$ is the highest of the elements of $\widehat{\beta}$, and $\widehat{\beta}_{10} + \widehat{\theta}_{10}$ is the highest of the elements of $\widehat{\beta} + \widehat{\theta}$. The partial effect associated with β_{10} indicates that, all else constant, a switch from the Third Circuit to the Tenth Circuit in the pre-CAFC era results in an increased likelihood of patent validity of .52. The partial effect associated with θ_{10}, -.27 means that the same switch in the CAFC era results in an increase in the likelihood of validity, .25, of less than half as much. Hence, the spreads in validity rates for the two eras are estimated to be roughly consistent with what we find in the aggregate statistics (.56 and .17, respectively).

We test Hypotheses 1-3 by computing likelihood ratio test statistics as $-2(\mathcal{L}_{\mathcal{R}} - \mathcal{L}_{\mathcal{U}})$, where $\mathcal{L}_{\mathcal{R}}$ is the restricted log-likelihood and $\mathcal{L}_{\mathcal{U}}$ is the unrestricted log-likelihood. The statistic is asymptotically distributed χ^2_q with q restrictions. For each of the following tests, $q = 9$. For Hypothesis 1 ($\beta = 0$), the test statistic is 76.0 with a p-value of .000. Hence, we fail to accept this hypothesis and conclude that the pre-CAFC era is characterized by significant non-uniformity in validity outcomes.

For Hypothesis 2 ($\theta = 0$), the test statistic is 15.0 with a p-value of .091. Hence, we fail to accept this null hypothesis at the .10 significance level. We interpret this test as providing weak evidence that the impact of the CAFC was heterogeneous across circuits.

For Hypothesis 3 ($\beta = -\theta$), the test statistic is 21.2 with a p-value of .012. Hence, we fail

[56]The means and standard deviations of our variables are highly similar to the full sample.

to accept this null hypothesis at the .05 significance level and conclude that the CAFC era is also characterized by significant non-uniformity. However, the coefficients in θ do offset those in β to a degree, so that non-uniformity is decreased in the CAFC era.

The estimates on the home circuit dummies are all low and statistically insignificant. This indicates that the origin of a domestic case (home circuit) is not an important determinant of validity, ceteris paribus.[57] We do find that patents with foreign assignees are significantly more likely to be found valid. The estimated partial effect is about .12. This is consistent with Marco's (2004) estimate of ten percentage points.[58]

Other significant variables include the number of patents and the decision age of the patent. In each case the coefficient estimate (and hence the partial effect) is positive. Adding one additional patent to the case increases the likelihood of validity by just over two percentage points. Adding one additional year of decision age results in just under a one percent increase in the likelihood of validity. Both the number of patents and the duration of the suit may relate to the size of the stakes for the patent holder.[59]

We also estimate the coefficients in (5.1) for patentee-defendant cases and test Hypotheses 1-3. Because of the small sample size, we are forced to drop all Tenth Circuit dummy variables and observations (home and trial circuit) to achieve convergence. Only hypothesis 3 is rejected.[60] Hence, consistent with the discussion of Figure 2 earlier, there is no evidence of systematic differences across circuits in validity decisions in patentee-defendant cases in the pre-CAFC era. There is some evidence for systematic differences across circuits in the CAFC era. Because of the small sample size (274 observations) and a general lack of statistically

[57]We interpret this as strong evidence that forum shopping, if it exists, does not introduce selection biases to circuit validity rates. Our estimations indicate, for example, that the likelihood of validity does not significantly change if the home circuit changes from the Third, which is an unfavorable trial circuit and therefore a relatively likely source of shopped patent cases, to the Fifth, a relatively unlikely source.

[58]Marco's data span pre-CAFC and CAFC eras (1977-97), but the sample is limited to publicly held patentees. The estimates are statistically insignificant in some specifications. Studying a small sample from 1989-96, Allison and Lemley (1998) find that foreign litigants have lower rates of success. Moore (2003) finds similar results for data from 1983-99.

[59]The theoretical results of Priest and Klein (1984) suggest that as more disputes are litigated, the win rate will be closer to the population win rate, and less subject to the 50% self-selection bias of litigated cases. Higher stakes generally increase the litigation rate, ceteris paribus. We can expect that the "population" win rate of patents will be above 50% for validity, given the presumption of validity held by the courts. We can also expect that litigating a greater number of patents may indicate greater stakes for the patentee, and because of those stakes, the duration of the suit will increase.

[60]For hypothesis 1, the likelihood ratio statistic is 7.6, for a p-value of .476. For hypothesis 2, the likelihood ratio statistic is 7.2, for a p-value of .518. For hypothesis 3, the likelihood ratio statistic is 17.8, for a p-value of .022.

significant independent variables, we do not place great weight on these findings.[61]

5.2. Forum Shopping

We specify the circuit choice model as follows:

$$away\_circuit_j^* = \delta + \eta X_j^{Era} + \psi X_j^{Era} * valid\_home\_adv_j + \phi X_j^{Home} + \lambda X_j^{Lit} + \pi X_j^{Patent} + \varepsilon_j, \tag{5.3}$$

where $away\_circuit^*$ is a latent variable measuring the degree to which the patentee prefers to litigate outside the home circuit. The error ε_j, independently and identically distributed Normal with mean zero and constant variance, primarily reflects unobservable random factors, such as infringer location, that affect case location. Then[62]

$$away\_circuit_j = \begin{cases} 1 & \text{if } away\_circuit_j^* \geq 0 \\ 0 & \text{if } away\_circuit_j^* < 0\,. \end{cases} \tag{5.4}$$

Using a circuit-location dummy as the dependent variable necessitates some important adjustments to the regressors from (5.1). First, we specify X_j^{Era} as a set of time dummies from 1963-96, $\{yr_{63-67,j}, yr_{68-72,j}, yr_{73-77,j}, yr_{78-82,j}, yr_{83-87,j}, yr_{88-92,j}, yr_{93-96,j}\}$, where the subscript represents a window of filing years. We cannot say, *a priori,* when patentees began anticipating that the CAFC would be the likely appeals court. The legislative history of attempts to create the CAFC date to the early 1970s, there were numerous different proposals for precisely how to restructure the courts, and the average time between filing an infringement suit and a first decision is around 3 years. Hence, even if the CAFC did mitigate forum shopping, it is an open empirical question when that mitigation began. We specifically place 1982 and 1983 in different dummy categories to capture possible immediate effects of the CAFC. We also wish to identify any changes in circuit location due to the 1988 legislative changes in venue statutes, confirmed by the CAFC in the 1990 *VE Holding Corp.* case.

[61] We also do not report the full results of this estimation for this reason. They are available from the authors on request.

[62] We rely on a binary-choice model because of a technical constraint—a ten-choice multinomial probit model, with circuit as the dependent variable, fails to converge.

Second, the variable *home_valid_adv* is added as an explanatory variable. Our basic test of forum shopping is whether patentees systematically litigate at home when home districts have recently been favorable on validity and litigate away from home when home districts have been unfavorable. Thus, we estimate the effect of *home_valid_adv* on *away_circuit* and test for its significance.[63] To test for temporal changes in forum shopping, we interact this variable with a set of time dummies. We test the following hypothesis.

Hypothesis 4. $\psi = 0$. Recent home-circuit validity rates are not asociated with the likelihood the home circuit is chosen as the trial circuit, ceteris paribus.

The third change is that *away_circuit* is simultaneously determined with the trial circuit, so we omit the endogenous trial circuit dummies from the right-hand side and adjust our other variables accordingly to obtain a reduced-form equation. In this specification, X^{Lit} excludes *decision_age* but includes $filing\_age$ and X^{Patent} remains the same as in (5.1). The home circuit dummies $\{X_j^{Home}\}$ measure fixed effects on location choice, i.e., characteristics that affect the set of available circuits in which the patentee could choose to litigate but do not affect validity rates. By controlling for these, we can test Proposition 2.

Using *away_circuit* as the dependent variable also necessitates some changes to the sample, because the basis for the data set is decisions recorded in the USPQ. Cases take three years on average to reach a first decision, so we have very few observations for the last few years in the set. To avoid sample selection biases,[64] we trim the data and restrict attention to patent cases with filing years through 1996.[65] We choose a six-year cutoff because it is the minimum interval in which over 90% of cases in our data reach a first decision. We also omit, for symmetry, a handful of observations with filing years prior to 1963.[66]

Finally, the key variable *home_valid_adv* is well-defined only for domestically assigned patents. Foreign-assigned patents do not have a home circuit as we define them here. This further restricts our sample size.

[63] We assume that additional information about validity rates, used by the patentee to decide whether to litigate at home, is uncorrelated with the information reflected in *home_valid_adv*.

[64] An obvious possibility is that home cases might finish more quickly.

[65] This is the reason the final time dummy spans only 4 years (1993-96), in contrast to the five-year windows for other dummies.

[66] Given that the ICPSR data start in 1970 and nearly every case there was filed in 1969 or earlier, we use 1969 as the basis for going back six years.

In our first estimation, we restrict attention to patentee-plaintiff cases. This, and the other constraints discussed above, limit our sample size to 1200 observations.[67] We omit yr_{78-82} from the right-hand side, so the coefficients on the year dummies are interpreted relative to the 1978-82 period.

The results of this estimation are given in Table 6. The McFadden R-squared is .12 and the model yields about 65% correct predictions. The coefficient estimates on the three earliest η dummies are negative and, for η_{63-67} and η_{73-77}, significantly different from zero. Our interpretation of these estimates is that greater travel costs during the earlier years of the sample made patentees less inclined to litigate far away from home.

Next, consider the tests of forum shopping on the basis of validity rates. Estimates for the elements of ψ, the $home\_valid\_adv * X^{Era}$ parameters, are in the lower part of Table 6 (note that the subscript gives the filing window). For the 1963-67, 1968-72 and 1973-77 windows, the estimate is negative and significant. This implies that if a home-circuit validity rate is higher, relative to the average across all circuits, then the patentee is more likely to file its suit in the home circuit. The average partial effects imply that, for the 1963-67, 1968-72 and 1973-77 periods, a 10 percentage point increase in the home advantage is associated with roughly a 9, 5 and 7 point increase, respectively, in the likelihood that the case is litigated in the home circuit. For the dummies representing 1978 and later, the estimates vary considerably and are not statistically significant. Three of the four estimates are far lower in absolute value as well.

These results strongly indicate that through 1977 patentees systematically locate cases in home districts when those districts are strong, but do so to a far lesser extent, and perhaps not at all, from 1978 on. That is, there was significant forum shopping on the basis of validity rates in the pre-CAFC era, but not in the CAFC era. We also find that such forum shopping appears to cease several years prior to the CAFC's establishment in 1982, suggesting that patentees anticipated both its establishment its impact. We find no evidence of significant changes in case location or forum shopping after 1988. Hence, our data indicate that the legislative changes to the venue statute in 1988 and the CAFC's 1990 *VE Holding Corp.* ruling had no significant impact.

The 1963-77 results are consistent with some of the major conclusions about patentees

[67] The means and standard deviations of our variables are highly similar to the full sample.

reached by Dunner and Gambrell in the 1975 Hruska Commission report, and are also consistent with Proposition 2. The finding that the CAFC mitigates the incidence of forum shopping is consistent with Proposition 1.

In determining *away_circuit*, we expect the most significant home circuit fixed effects to be geography, population and speed of case resolution. Specifically, patents in home circuits far from other circuits have higher travel costs of shopping, so such patents should be characterized by a greater probability of staying home for litigation. However, if a circuit has low population, and thus a low level of economic activity, the likelihood that products are marketed in that circuit, and that infringement occurs there, is lower as well. Finally, quick circuits should also be more popular.

By and large, these circuit effects are small. Only one circuit, the Tenth, has a statistically significant effect. This negative effect is not surprising, as this circuit is both remote from other circuits and has low population. Patents born in this circuit are litigated elsewhere with .34 greater likelihood. This helps to explain why the Tenth Circuit appears to be a statistical outlier in Figure 4.

Other significant determinants of *away_circuit* are *inventor_assignee_same_state* and *patentee_assignee*. Each of these variables pertains to the research and development capacity of the inventor, assignee and patentee. If the patent is assigned to an entity located in the same state, this indicates a relatively localized inventive activity complex, so the patent case should be more likely to stay at home. When the patentee is the same as the assignee, the patent has not changed hands. Since purchasers of patents typically have more resources than sellers, it is to be expected that $patentee\_assignee = 1$ is associated with a higher probability that the case is litigated in a home circuit district. Both variables are estimated to be negative and significant. The partial effects imply that assignees whose patents were invented locally are about 14 percentage points less likely to litigate away from home, and patentees who maintain ownership of their patents throughout the patent's life are an additional 7 percentage points less likely to litigate away from home.

Next, we estimate (5.4) with patentee-defendant cases included. This brings our sample size up to 1336. Results from this estimation are presented in Table 7. Despite the greater sample size and larger number of independent variables, the R-squared (.12) and fraction of correct predictions (.64) are lower than in the previous estimation. Our forum shopping

results for patentee-plaintiff cases are robust to this specification. The coefficient estimates on the $home\_valid\_adv * X^{Era}$ parameters for the 1963-67, 1968-72 and 1973-77 time windows are nearly identical to those in Table 6, as are the standard errors.

We control for patentee-defendant cases using the dummy $patentee\_defendant$ and interactions between this variable, the era dummies, and $home\_valid\_adv$. Our theoretical model predicts that, in a forum-shopping equilibrium, signs should be positive, as alleged infringers will wish to avoid circuits favorable to patentees. Five of the seven dummy estimates are indeed positive, consistent with the theory. None are statistically significant at the .05 level, however. The standard errors are quite large, due in part to the relatively small number of observations of patentee-defendant cases. Hence, we conclude that there is very little evidence for forum shopping in patentee-defendant cases.

6. Discussion

The establishment of the Federal Circuit represents a sea change in the federal judiciary. For the first time a single court oversees district decisions for the specific subject matter of patents. Because of this, the CAFC provides a unique opportunity to examine the causes and consequences of non-uniformity in the judiciary. Our analysis is the first to directly investigate uniformity and forum shopping in litigation under both decentralized (pre-CAFC) and centralized (CAFC) regimes. Examining both eras is critical for understanding the role of the federal court system and for understanding the clear association between uniformity and forum shopping.

We conclude that, in patentee-plaintiff cases, there was significant non-uniformity in validity outcomes across US geographical circuits in the pre-CAFC era, and significant forum shopping. In the CAFC era, systematic non-uniformity across circuits remains, but it is much smaller in magnitude. Forum shopping on the basis of validity rates appears to have been mitigated. We estimate 1978 as the end of systematic circuit forum shopping on the basis of validity.

We also find no evidence of systematic non-uniformity across circuits in patentee-defendant cases in the pre-CAFC era, and no strong evidence for forum shopping in those cases either. Unconditional validity rates in patentee-plaintiff cases are about ten percentage points higher

than in patentee-defendant cases, in both the pre-CAFC and CAFC eras. While the relatively small amount of data used to reach these conclusions makes us reluctant to place great weight on them, the results do suggest a possible alternative interpretation for jurisdictional battles. One possibility is that in the pre-CAFC era, patentees had the incentive both to forum shop and to be the plaintiff, while alleged infringers had only the incentive to be the plaintiff.[68] Hence, venue disputes could be common even with asymmetric incentives to forum shop.

Much of the rhetoric supporting the establishment of the CAFC criticized the practice of forum shopping. We believe that some of this rhetoric may have been misplaced, in that the root cause of the forum shopping was the non-uniformity of validity outcomes. Forum shopping is not an ill, in and of itself, but is a symptom of non-uniformity.

Viewed broadly, our results suggest that in the CAFC era the outcome of patent litigation has been more predictable and the decision of where to litigate has been simpler. That is, patentees have faced reduced risks associated with the *uncertainty* of litigation and reduced search costs for judicial fora. These apparent benefits have come at the cost of reduced judicial experimentation and greater risk of judicial "tunnel vision" by the specialized judges of the CAFC.[69] Additionally, the amount of patent litigation has surged in the CAFC era (Bessen and Meurer 2005, 2008), suggesting a higher aggregate expense associated with patent disputes. Not surprisingly, the establishment of the CAFC remains controversial (Jaffe and Lerner 2004). Assessing the net welfare effect of this centralization of the judiciary represents an important challenge for future research.

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[68] Recall that the structure of the law ensures that infringers cannot unilaterally bring a suit.

[69] 67 F.R.D. 195, 234-35. See Scherer (2006).

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Table 1: VALIDITY PROBABILITIES

		Pre-CAFC		CAFC
Circuit	N	Not Invalid	N	Not Invalid
Patentee-Plaintiff Cases				
First	103	.340	47	.766
Second	217	.401	93	.774
Third	192	.250	111	.640
Fourth	156	.519	59	.797
Fifth	198	.601	75	.827
Sixth	180	.394	107	.673
Seventh	357	.499	86	.663
Eighth	92	.424	34	.706
Ninth	218	.491	149	.779
Tenth	48	.813	21	.810
DC	5	.200	0	n/a
Sub-Total	1,766	.456	782	.734
Patentee-Defendant Cases				
First	23	.522	4	.750
Second	60	.350	7	.286
Third	33	.273	12	.833
Fourth	14	.571	5	.800
Fifth	13	.385	5	.800
Sixth	33	.303	8	.625
Seventh	23	.435	14	.643
Eighth	14	.357	4	.250
Ninth	36	.250	11	.445
Tenth	13	.231	0	n/a
DC	8	.500	2	1.000
Sub-Total	270	.356	72	.625
Total	2036	.443	854	.725

Note: The numbers in this table reflect all district court validity decisions in US patent cases, during 1953-2002, whose opinions are published in the *United States Patents Quarterly.* If the patentee files the case, then it is regarded as the plaintiff. If the alleged infringer or patent challenger files the case, then the patentee is regarded as the defendant.

Table 2: VARIABLES

Category variable	Units	Sub-category	Description
Circuit Dummies			
trial_circuit$_j$	0/1		"1" if district court is in geographical circuit j.
home_circuit$_j$	0/1		"1" if assignee is in geographical circuit j.
away_circuit	0/1		"1" if patent case not in "home" circuit.
Era Dummies			
cafc_era	0/1		"1" if the CAFC is the relevant appeals court.
Litigation			
decision_age	years		years from patent issue to decision date.
filing_age	years		years from patent issue to filing date.
individual	0/1		"1" if patentee is an individual.
numpats	count		number of patents in the case.
patentee_assignee	0/1		"1" if patentee is the same or similar to assignee.
patentee_defendant	0/1		"1" if patentee is the defendant.
valid	0/1		"1" if patent not found invalid.
Patent			
continuation	0/1	application	"1" if application is a continuation.
division	0/1	application	"1" if application is a division.
issue_delay	years	application	time from first application to patent issue.
assigned	0/1	assignee	"1" if patent is assigned at issue.
inventor_assignee_same_state	0/1	assignee	"1" if assignee in same state as inventor.
numinventors	count	assignee	number of inventors.
chemical	0/1	makeup	"1" if product code in NBER "chemical" category.
computer	0/1	makeup	"1" if product code in NBER "computer" category.
drugs	0/1	makeup	"1" if product code in NBER "drugs" category.
electrical	0/1	makeup	"1" if product code in NBER "electrical" category.
mechanical	0/1	makeup	"1" if product code in NBER "mechanical" category.
other	0/1	makeup	"1" if product code not in any NBER category.
numclaims	count	makeup	number of claims.
design_refs	count	reference	number of backward US design patent references.
foreign_refs	count	reference	number of backward foreign patent references.
median_ref_age	years	reference	time since issue of median backward patent reference.
oldest_ref_age	years	reference	time since issue of oldest backward patent reference.
utility_refs	count	reference	number of backward US utility patent references.
issue_year	year	vintage	year of patent issue.
Validity Rates			
valid_rate5_all	[0,1]		previous 5 years' avg. validity rate in all circuits.
valid_rate5_home	[0,1]		previous 5 years' avg. validity rate in the home circuit.
home_valid_adv	[-1,1]		valid_rate5_home - valid_rate5_all.

Note: The source for these data is all of the patents in all district court validity decisions in US patent cases, during 1953-2002, whose opinions are published in the *United States Patents Quarterly*. The variables in the Circuit Dummies, Era Dummies and Litigation categories are recorded from the opinions. We use these variables to construct variables in the Validity Rates category. The variables in the Patent category come from the US patent documents, which are archived by the USPTO and can be searched by number at http://patft.uspto.gov/netahtml/PTO/srchnum.htm.

Table 3: DESCRIPTIVE STATISTICS - PATENT CHARACTERISTICS

Category	Pre-CAFC			CAFC			DIM
variable	N	Mean	SD	N	Mean	SD	z
Birth							
home_circuit$_1$	2026	0.06	(0.24)	853	0.06	(0.24)	−0.01
home_circuit$_2$	2026	0.18	(0.38)	853	0.11	(0.31)	−4.97
home_circuit$_3$	2026	0.12	(0.32)	853	0.12	(0.32)	0.15
home_circuit$_4$	2026	0.04	(0.18)	853	0.04	(0.20)	0.61
home_circuit$_5$	2026	0.07	(0.25)	853	0.08	(0.27)	1.15
home_circuit$_6$	2026	0.12	(0.33)	853	0.11	(0.32)	−0.79
home_circuit$_7$	2026	0.15	(0.35)	853	0.11	(0.31)	−3.13
home_circuit$_8$	2026	0.06	(0.24)	853	0.05	(0.21)	−1.63
home_circuit$_9$	2026	0.12	(0.32)	853	0.17	(0.37)	3.17
home_circuit$_{10}$	2026	0.04	(0.19)	853	0.04	(0.20)	0.69
home_circuit$_{DC}$	2026	0.01	(0.09)	853	0.00	(0.05)	−2.00
home_circuit$_{Foreign}$	2026	0.05	(0.23)	853	0.12	(0.33)	5.62
Application							
continuation	2036	0.09	(0.29)	854	0.36	(0.48)	14.97
delay	2036	3.55	(2.39)	854	3.51	(2.89)	−0.34
division	2036	0.07	(0.25)	854	0.10	(0.30)	2.72
Assignee/Inventor							
assigned	2036	0.64	(0.48)	854	0.74	(0.44)	5.58
inventor_assignee_same_state	1912	0.84	(0.37)	748	0.81	(0.39)	−1.66
numinventors	2036	1.33	(0.64)	854	1.69	(1.01)	9.60
Makeup							
chemical	2036	0.14	(0.35)	854	0.17	(0.37)	1.87
computer	2036	0.04	(0.18)	854	0.09	(0.29)	5.16
drugs	2036	0.03	(0.18)	854	0.16	(0.36)	9.53
electrical	2036	0.10	(0.30)	854	0.11	(0.31)	0.69
mechanical	2036	0.26	(0.44)	854	0.20	(0.40)	−3.21
other	2036	0.43	(0.50)	854	0.27	(0.44)	−8.75
numclaims	2036	10.38	(10.80)	854	14.91	(13.36)	8.79
References							
design_refs	1777	0.01	(0.08)	854	0.08	(0.87)	2.38
foreign_refs	1777	0.68	(1.22)	854	1.50	(3.77)	6.18
median_ref_age	1777	13.40	(10.84)	854	11.10	(9.64)	−5.49
oldest_ref_age	1777	35.70	(23.30)	854	33.92	(27.99)	−1.61
utility_refs	1777	6.39	(4.38)	854	8.94	(11.50)	6.28

Note: The source for these data is all of the patents in all district court validity decisions in US patent cases, during 1953-2002, whose opinions are published in the *United States Patents Quarterly.* The variables recorded in this table come from the US patent documents, which are archived by the USPTO and can be searched by number at http://patft.uspto.gov/netahtml/PTO/srchnum.htm.

Table 4: DESCRIPTIVE STATISTICS - LITIGATION CHARACTERISTICS

	Pre-CAFC			CAFC			DIM
variable	N	Mean	SD	N	Mean	SD	z
away_circuit	1915	0.55	(0.50)	748	0.49	(0.50)	−2.77
decision_age	2036	8.59	(5.27)	854	8.93	(5.36)	1.57
filing_age	761	5.49	(4.42)	819	6.28	(4.92)	3.38
individual	2036	0.14	(0.35)	854	0.11	(0.31)	−2.35
numpats	2036	1.93	(1.45)	854	2.10	(1.90)	2.38
patentee_assignee	2036	0.68	(0.47)	854	0.70	(0.46)	1.19
patentee_defendant	2036	0.13	(0.34)	854	0.08	(0.28)	−3.98
valid	2036	0.44	(0.50)	854	0.72	(0.45)	14.98

Note: The source for these data is all district court validity decisions in US patent cases, during 1953-2002, whose opinions are published in the *United States Patents Quarterly*. The variables recorded in this table come from the text of the opinions.

Table 5: UNIFORMITY ESTIMATION
(Eq. (5.1): Patentee-Plaintiff Cases Only)
Dependent Variable: Valid

Parameter	Value	(Std. Error)	Partial Effect
constant	7.5786	(8.2874)	2.6572
trial_circuit_1	0.2478	(0.1903)	0.0869
trial_circuit_2	0.3206	(0.1490)*	0.1124
trial_circuit_4	0.5063	(0.1640)*	0.1775
trial_circuit_5	0.9708	(0.1537)*	0.3404
trial_circuit_6	0.4150	(0.1610)*	0.1455
trial_circuit_7	0.6367	(0.1386)*	0.2232
trial_circuit_8	0.2595	(0.1920)	0.0910
trial_circuit_9	0.6817	(0.1534)*	0.2390
$\text{trial\_circuit}_{10}$	1.4876	(0.2470)*	0.5216
numpatents	0.0443	(0.0200)*	0.0155
cafc_era	0.8922	(0.1894)*	0.3128
$\text{cafc\_trial\_circuit}_1$	0.0254	(0.3057)	0.0089
$\text{cafc\_trial\_circuit}_2$	0.1702	(0.2442)	0.0597
$\text{cafc\_trial\_circuit}_4$	0.0405	(0.2785)	0.0142
$\text{cafc\_trial\_circuit}_5$	-0.3126	(0.2619)	-0.1096
$\text{cafc\_trial\_circuit}_6$	-0.2683	(0.2388)	-0.0941
$\text{cafc\_trial\_circuit}_7$	-0.5277	(0.2328)*	-0.1850
$\text{cafc\_trial\_circuit}_8$	0.0742	(0.3282)	0.0260
$\text{cafc\_trial\_circuit}_9$	-0.1168	(0.2275)	-0.0410
$\text{cafc\_trial\_circuit}_{10}$	-0.7744	(0.4308)	-0.2715
home_circuit_1	0.2958	(0.1582)	0.1037
home_circuit_2	0.0602	(0.1126)	0.0211
home_circuit_4	0.1372	(0.1721)	0.0481
home_circuit_5	-0.1066	(0.1403)	-0.0374
home_circuit_6	0.0641	(0.1221)	0.0225
home_circuit_7	0.1123	(0.1165)	0.0394
home_circuit_8	0.0030	(0.1484)	0.0011
home_circuit_9	-0.0165	(0.1215)	-0.0058
home_circuit_{10}	-0.0048	(0.1728)	-0.0017
$\text{home\_circuit}_{Foreign}$	0.3491	(0.1366)*	0.1224
numclaims	0.0051	(0.0029)	0.0018
decision_age	0.0204	(0.0067)*	0.0071

Note: asterisk indicates significance at the .05 level. Additional variables included in the model were chemical, computer, drugs, electrical, issue-year, mechanical, numclaims, continuation, delay, division, assigned, numinventors, individual, design-refs, foreign-refs, utility-refs, median-ref-age, oldest-ref-age, and filing-age.

Table 6: FORUM SHOPPING ESTIMATION
(Eq. (5.3): Patentee-Plaintiff Cases Only)
Dependent Variable: Away-Circuit

Parameter	Value	(Std. Error)	Partial Effect
constant	70.6601	(56.4051)	25.1699
home_circuit_1	-0.1999	(0.2080)	-0.0712
home_circuit_2	-0.1857	(0.1552)	-0.0662
home_circuit_4	0.3845	(0.2386)	0.1370
home_circuit_5	0.2246	(0.1997)	0.0800
home_circuit_6	-0.0694	(0.1633)	-0.0247
home_circuit_7	-0.2144	(0.1679)	-0.0764
home_circuit_8	0.3331	(0.2042)	0.1187
home_circuit_9	-0.2154	(0.1591)	-0.0767
home_circuit_{10}	1.1706	(0.2662)*	0.4170
yr_{63-67}	-1.0003	(0.4436)*	-0.3563
yr_{68-72}	-0.3515	(0.3074)	-0.1252
yr_{73-77}	-0.3898	(0.1952)*	-0.1388
yr_{83-87}	0.0971	(0.2038)	0.0346
yr_{88-92}	-0.1357	(0.3251)	-0.0483
yr_{93-96}	0.2485	(0.4379)	0.0885
inventor_assignee_same_state	-0.4062	(0.1055)*	-0.1447
patentee_assignee	-0.1932	(0.0915)*	-0.0688
$\text{home\_valid\_adv}_{63-67}$	-2.5158	(0.8310)*	-0.8962
$\text{home\_valid\_adv}_{68-72}$	-1.4449	(0.7105)*	-0.5147
$\text{home\_valid\_adv}_{73-77}$	-1.8852	(0.7036)*	-0.6715
$\text{home\_valid\_adv}_{78-82}$	0.0869	(1.0529)	0.0310
$\text{home\_valid\_adv}_{83-87}$	-0.6238	(0.6264)	-0.2222
$\text{home\_valid\_adv}_{88-92}$	-1.5383	(1.1274)	-0.5480
$\text{home\_valid\_adv}_{93-96}$	0.1583	(1.9452)	0.0564

Note: asterisk indicates significance at the .05 level. Additional variables included in the model were chemical, computer, drugs, electrical, issue-year, mechanical, numclaims, continuation, delay, division, assigned, numinventors, individual, design-refs, foreign-refs, median-ref-age, oldest-ref-age, utility-refs, and decision-age.

Table 7: FORUM SHOPPING ESTIMATION
(Eq. (5.3): All Cases)
Dependent Variable: Away-Circuit

Parameter	Value	(Std. Error)	Partial Effect
constant	31.0602	(53.4035)	11.1115
home_circuit_1	-0.1928	(0.1975)	-0.0690
home_circuit_2	-0.2960	(0.1472)*	-0.1059
home_circuit_4	0.2968	(0.2274)	0.1062
home_circuit_5	0.1504	(0.1916)	0.0538
home_circuit_6	-0.0760	(0.1555)	-0.0272
home_circuit_7	-0.2097	(0.1589)	-0.0750
home_circuit_8	0.2462	(0.1944)	0.0881
home_circuit_9	-0.2529	(0.1522)	-0.0905
home_circuit_{10}	0.9369	(0.2480)*	0.3352
yr_{63-67}	-0.6490	(0.4181)	-0.2322
yr_{68-72}	-0.1669	(0.2885)	-0.0597
yr_{73-77}	-0.2877	(0.1825)	-0.1029
yr_{83-87}	0.0437	(0.1944)	0.0156
yr_{88-92}	-0.3086	(0.3096)	-0.1104
yr_{93-96}	-0.0393	(0.4171)	-0.0141
inventor_assignee_same_state	-0.4128	(0.0998)*	-0.1477
patentee_assignee	-0.2212	(0.0864)*	-0.0791
$\text{home\_valid\_adv}_{63-67}$	-2.2593	(0.8138)*	-0.8083
$\text{home\_valid\_adv}_{68-72}$	-1.4946	(0.6935)*	-0.5347
$\text{home\_valid\_adv}_{73-77}$	-1.8623	(0.6867)*	-0.6662
$\text{home\_valid\_adv}_{78-82}$	0.2037	(1.0415)	0.0729
$\text{home\_valid\_adv}_{83-87}$	-0.3969	(0.6191)	-0.1420
$\text{home\_valid\_adv}_{88-92}$	-0.9881	(1.1110)	-0.3535
$\text{home\_valid\_adv}_{93-96}$	0.6064	(1.9288)	0.2169
patentee_defendant	-0.1202	(0.1239)	-0.0430
$\text{patentee\_defendant\_hva}_{63-67}$	3.4445	(2.1353)	1.2322
$\text{patentee\_defendant\_hva}_{68-72}$	2.5057	(1.7654)	0.8964
$\text{patentee\_defendant\_hva}_{73-77}$	-0.5174	(1.5565)	-0.1851
$\text{patentee\_defendant\_hva}_{78-82}$	-0.6174	(3.3376)	-0.2209
$\text{patentee\_defendant\_hva}_{83-87}$	0.7940	(3.4713)	0.2840
$\text{patentee\_defendant\_hva}_{88-92}$	2.7208	(4.3301)	0.9734
$\text{patentee\_defendant\_hva}_{93-96}$	0.1411	(4.6283)	0.0505

Note: asterisk indicates significance at the .05 level. Additional variables included in the model were chemical, computer, drugs, electrical, issue-year, mechanical, numclaims, continuation, delay, division, assigned, numinventors, individual, design-refs, foreign-refs, median-ref-age, oldest-ref-age, utility-refs, and decision-age.