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Experts Judging Experts: The Role of Expertise in Reviewing Agency Decision Making

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What role does judicial subject matter expertise play in the review of agency decisions? Using a data set of decisions in which the Board of Patent Appeals and Interferences (BPAI) is reviewed by the Court of Appeals for the Federal Circuit, we investigate this question and find that greater subject matter expertise does make it more likely that a judge will vote to reverse an agency decision.

> [R]ulings are not reversed unless the appellate court is pretty confident they [the lower court] are wrong, and that confidence . . . will vary with the court's assessment of its own competence relative to that of the lower court or agency that made the ruling.
>
> Posner (2008, 114)

INTRODUCTION

As the administrative state in the United States continues to expand (Light 1995, 1999; Goodsell 2003), the review of agency action is one of the chief concerns of both political scientists and policy scholars (Crowley 1987; Aberbach 1990; Sheehan 1990; Horowitz 1994; Shipan 2004; Smith 2005). Indeed, one set of scholars refers to the administrative state as the "nexus of public policy making in the modern era" (Howell and Lewis 2002, 1095). Yet, those who study bureaucracies have long noted the difficulty inherent in controlling them (Horowitz 1994; Schuk 1994; Spriggs 1996). For many, an essential check on bureaucratic power is judicial review of agency decision making (see Humphries and Songer 1999; Peters 2001), and the review of agency decision making in the federal courts has increased dramatically over the last decade.[1] In general, both theoretically (Tolley 2003) and empirically (Unah 1998), students of court-agency interactions have noted that courts are highly deferential to the decision

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1. Over the time period of our study, from 1997–2007, the number of appeals from administrative agencies heard by the federal appellate courts increased from 4,412 to 10,382 (Judicial Business of the US Courts).

making of federal agencies. This deference is typically thought to stem from two sources: legal mandates (in the form of the Administrative Procedure Act [APA]) and from the fact that federal appellate courts are generalist, as opposed to specialist, bodies and, therefore, lack the expertise to substantively review technical agency decisions. Indeed, professional expertise is the overriding rationale for allowing unelected bureaucrats to exercise significant control over governmental policy (Freedman 1978; Rourke 1992).

No federal court is purely a generalist court (see Cheng 2008), but some courts have higher concentrations of specialists than others—something usually dictated by the composition of the court's docket. Unique among the federal courts of appeal, the Court of Appeals for the Federal Circuit (Federal Circuit) has a specialized jurisdiction encompassing, among other topics, patent law, and has a comparatively large number of judges who are experts in that field. Therefore, though nearly all the federal circuit courts have judges with expertise in a particular area of law, none of them offer the concentration of expertise found on the Federal Circuit in this area. Nearly 500,000 patent applications are filed annually in the United States, and the frequency of patent litigation has increased dramatically over the past twenty years (Hedlund 2007, 1).[2] Because patents represent such a significant component of the national economy, and because patent law provides a useful window on the discretion afforded to bureaucratic decisions by reviewing courts, the issue of patentability is worthy of investigation in its own right. Our interest here lies in determining whether expert and nonexpert judges review these decisions in different ways.

The answer to this question is important, not only because it may provide a more refined understanding of judicial decision making, but because it speaks to the potential autonomy of the federal bureaucracy and, ultimately, the administrative avenues that regularly promulgate public policy. With respect to judicial decision making, scholars have long wondered whether background characteristics affect judicial decision making. The results of these studies have been mixed and have tended to show that, aside from ideology, the background characteristics of a judge do not tend to influence judicial decision making significantly. However, scholars have largely ignored the conditional role of expertise, with some limited exceptions (Hansen, Johnson, and Unah 1995; Unah 1998; Miller and Curry 2009). Therefore, we contribute to the understanding of the role played by expertise in judicial decision making, particularly where the subject matter of those decisions is factually complex.

With respect to the review of bureaucratic decision making, we show that expert judges are less likely than nonexperts to defer to an expert decision maker. In other words, despite admonitions from the Supreme Court and the presence of the APA, agency decisions receive considerably less deference when those reviewing the decision can at least approximate the level of expertise present within an agency. This is important because the number of specialized courts in the United States is likely to increase in the coming years (Legomsky 1990; Baum 2005) and, therefore, the impact of judges with expertise in specific areas of agency decision making is also likely to grow. Hence, we believe that the presence of an expert reviewer is likely to undermine, to some degree, the amount of judicial deference federal agencies can expect to receive in the future.

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2. http://www.uspto.gov/web/offices/ac/ido/oeip/taf/us_stat.htm (last accessed March 21, 2011).

This article proceeds as follows. First, we discuss the reasons to expect judicial deference to agency decision making. Second, we frame our current project by closely examining the Federal Circuit, paying particular attention to patent law and the law of obviousness.[3] Third, we explore and carefully define our notion of expertise and, in doing so, account for multiple conceptualizations of that construct. Fourth, we discuss measurement and modeling issues, and then present the results of our model. Finally, we conclude with a discussion of the implications of our findings for judicial decision making, the review of agency decisions, and the role of bureaucrats in the construction of public policy.

AGENCY DECISION MAKING AND JUDICIAL DEFERENCE

Given the rise of the modern administrative state, scholars have become increasingly interested in the ways in which the president controls the bureaucracy (Moe 1989; Wiseman 2009) and that Congress (McNollgast 1987; Bawn 1995) and the federal courts (Sheehan 1990; Humphries and Songer 1999; Yates 1999) monitor bureaucratic power. With respect to the judiciary, the general expectation is that courts will defer to all but the most unreasonable decisions of an agency, given the technical knowledge possessed by agency decision makers and the lack of such knowledge on the part of judges (Tolley 2003). This expectation is formally present in the APA, which holds that courts must defer to agency decisions where there is "substantial evidence" for the decision (Robinson 1991; Humphries and Songer 1999; Scheb and Scheb 2005, 352–53). This is particularly true when the issue involves the determination of complex facts (Benjamin and Rai 2007). In fact, administrative deference is a cornerstone of public administration theory (Horowitz 1994; Tolley 2003), and this is consistent with the view that legislative delegation to agencies represents a "concession to expertise" (Gailmard 2002, 536).

Given the ensconced nature of administrative deference and Supreme Court rulings, most notably *Chevron v. Natural Resources Defense Council* (1984), that encourage the use of this standard in the lower federal courts, it is not surprising that students of the judiciary have found that both the Supreme Court (Sheehan 1990) and the federal appellate courts (Unah 1998; Humphries and Songer 1999) defer to agency action well over 50 percent of the time. Interestingly, even the federal court charged with reviewing the majority of federal agency decisions, the Court of Appeals for the District of Columbia Circuit, tends to uphold agency action over 70 percent of the time (Unah 1998). Naturally, the question is whether this level of deference is appropriate; that is, whether the courts give agencies too much leeway in their decision making. As Humphries and Songer (1999, 209) note, this presents a paradox: "courts are expected

3. Though we discuss the law of obviousness at length later in the article, a short introduction to obviousness provides context for what follows. Obviousness is a doctrine in patent law, codified at 35 U.S.C. § 103(a), which holds that a patent may not be granted "if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." The prevention of obvious patents is the heart of the patentability inquiry, as we describe below. Though the law of obviousness is straightforward, there is considerable complexity arising from the facts to which the courts are asked to apply the law. For an example of this complexity, see note 8.

to be a primary line of defense against the abuse of agency discretion, yet they also are expected to give substantial deference to the exercise of such discretion."

One difficulty in answering the question of how much deference is too much deference stems from the fact that scholars of both the courts and the administrative state have lavished attention on the Supreme Court and the federal appellate courts while largely ignoring the fact that there is little variation in these courts on one critical dimension—the expertise of the judges reviewing agency action. Put differently, with one exception—the Court of Appeals for the Federal Circuit—all the federal appellate courts have general jurisdictions that limit the concentration of judicial expertise in any particular doctrinal area (see Legomsky 1990).[4] In this article, we seek to understand whether judges on a specialized court who possess subject matter expertise are less likely to defer to an agency decision than are their peers who do not possess such subject matter expertise.

The cases we examine are administrative appeals from the Board of Patent Appeals and Interferences (BPAI). These cases originate when a patent examiner denies the grant of a patent and the party seeking the patent appeals within the US Patent and Trademark Office (USPTO) to the BPAI. The BPAI is thought to possess expertise in patent cases, given that it is composed of administrative patent judges with extensive knowledge of patent law as determined by the Secretary of Commerce and the Director of the (USPTO).[5] No fewer than three members of the BPAI hear each appeal.[6] The BPAI also hears questions of interference—a question of the priority of granted or pending patents—but these cases are excluded from the data in this analysis. Finally, it is worth noting that an appeal to the BPAI is fairly costly. Aside from fees charged by a lawyer to prepare the appeal, the fees charged by the USPTO exceed $2,400 under 37 C.F.R. § 41.20. The BPAI is a significant contributor to patent rights in the United States; both its power to reach final administrative decisions on patents and the substantial investigative authority within that domain that it enjoys make it a body worthy of scholarly investigation (see Duffy 2007).

THE FEDERAL CIRCUIT, PATENTS, AND THE LAW OF OBVIOUSNESS

As we have noted, the Court of Appeals for the Federal Circuit can be considered a specialized court, given its narrow jurisdiction. Specifically, the court has exclusive jurisdiction over a number of kinds of cases, of which three types dominate: veterans

4. But there is evidence that federal appellate court judges may specialize despite generalized jurisdictions (see Cheng 2008).

5. 35 U.S.C. § 6(a): "There shall be in the United States Patent and Trademark Office a Board of Patent Appeals and Interferences. The Director, the Commissioner for Patents, the Commissioner for Trademarks, and the administrative patent judges shall constitute the Board. The administrative patent judges shall be persons of competent legal knowledge and scientific ability who are appointed by the Secretary of Commerce, in consultation with the Director." Although the Director of the PTO, a political appointee, supervises administrative patent judges, they have fixed statutory terms, must pass a civil service examination, and thus maintain substantial independence from the director (Duffy 2007, 23).

6. 35 U.S.C. § 6(b).

benefit cases, personnel decisions within the federal government, and patent cases.[7] Together, these three case categories comprise about 80 percent of the court's docket. Among these, patent law has pride of place: the Federal Circuit was largely formed at the behest of the patent bar and debates in Congress about creating the court centered on the state of patent law (Baum 1990). Therefore, in investigating the role of expertise in judging, we focus on patent law.

A patent grants "the right to exclude anyone else from the production or use of a specific new device, apparatus, or process for a stated number of years" (Griliches 1990, 1661). In general, then, the law of patents is designed to grant an exclusive right for use of the technology to an inventor to reward efforts toward creating the invention. By doing so, the US patent system encourages innovation (Mansfield 1986, 173). However, in order to receive such a government-sanctioned monopoly, an invention must meet several criteria. Chief among these numerous criteria is that an invention be considered nonobvious. Simply put, under the law of obviousness, no invention may be granted a patent if it would have been obvious to someone skilled in that particular field. Nonobviousness is often at the heart of most questions of patentability, and one patent law expert has called the doctrine of obviousness the "core" requirement of patent law (Mandel 2006). Making such obviousness determinations typically requires judges to weigh exceedingly complex case facts,[8] and the weighing of those facts typically has far-reaching economic and social consequences.[9] Thus, our analysis focuses on cases that raise the issue of patentability and questions of obviousness.

Two Dimensions of Expertise

Although it may seem intuitive that the possession of legal expertise, broadly conceived, would have the potential to influence judicial decision making in patent

7. There is some debate about the proper terminology when defining the Federal Circuit as a specialized court. In reality, the court is a multispecialty court hearing not only patent cases, but also international trade cases, the appeals of veterans, personnel decisions within the US government, and nontort claims against the US government. We refer to the Federal Circuit as a specialized court throughout, where we intend that term to mean that the Federal Circuit has a jurisdiction limited by subject matter and not by geographic area. According to the Federal Circuit, patent cases consumed more of the court's time than any other issue area in 2008. Patents took about 35 percent of the judges' time; the next closest category included cases involving personnel issues in the federal government with 28 percent (see http://www.cafc.uscourts.gov/pdf/Chart/Adjudications08.pdf) (last accessed March 21, 2011).

8. For instance, in *Eli Lilly v. Zenith Goldline Pharms.* (2007), the Federal Circuit was called on to decide whether Zenith could defend itself against an infringement claim by showing that a Lilly patent for a schizophrenia drug was invalid in some way. Therefore, the court was required to consider whether previous patents anticipated or made obvious Lilly's patent. This, in turn, required the court to review a number of other chemical patents and to compare the chemical structures of the drugs in those patents with the structure of Lilly's drug. As the court concluded, "olanzapine [Lilly's drug] differs structurally from flumezapine, by substitution of a hydrogen atom (H) for the fluorine atom (F) in flumezapine at the 7-position of the benzene ring" (471 F.3d at 1375). Having reviewed the prior art extensively, the court determined that Lilly's patent was neither anticipated nor obvious. Consequently, Zenith was found to have infringed Lilly's patent. Moore (2001) has an extensive discussion of the difficulties involved in determining the facts in many patent cases.

9. As but one example, patents are viewed as being particularly important to the pharmaceutical and chemical industries (Schacht and Thomas 2005, 5). According to one estimate, up to 90 percent of pharmaceutical innovations might not have been conceived in the absence of patent protections (Mansfield, Schwartz, and Wagner 1981).

obviousness cases, the optimal way to operationalize that construct is less straightforward. Indeed, scholars from a variety of disciplines have expressed frustration with the confusion that has resulted from the failure of researchers to specify what, precisely, is encompassed by "expertise" (Jacoby et al. 1986; McGraw and Pinney 1990; Braunsberger and Munch 1998). Jacoby et al. (1986) suggest that expertise is often incorrectly conflated with experience, and Miller and Curry (2009) have demonstrated the validity of this conclusion with respect to the adjudication of patent cases in particular. Specifically, their study indicated that prior expertise represented a significant determinant of judicial decision making in that legal area, but accumulated experience did not.

In light of this extant research, our analysis of obviousness cases assesses the importance of an individual's competency in that legal field by examining two constructs—expertise and experience. As we note below, we operationalize "expertise" to represent formal training in patent law that an individual either possesses or does not possess upon being appointed to the bench—thus, it cannot be acquired over time. By contrast, the hallmark of what we refer to as "experience" is repeated exposure to technical legal questions over the course of one's judicial career.

In this project, we conceptualize expertise in two reinforcing ways. An expert is a judge who (1) possesses the background technical skills (i.e., undergraduate or graduate degree) that will be necessary to evaluate the obviousness of a patent upon ascension to the bench[10] and (2) has previously been a member of the patent bar. First, attorneys are required to possess a technical background degree in order to sit for the patent bar and to practice before the USPTO. Second, upon satisfying this requirement of technical ability, we count as experts only those who have served as patent lawyers prior to their ascension to the bench. In short, the individuals we characterize as "experts" had received formal, specialized training in the field upon their appointment to the Federal Circuit. We expect that those judges who possess patent expertise will be more likely to vote that an invention is nonobvious—in other words, we anticipate those judges will be less deferential to the BPAI's decision when that agency finds an application unpatentable. We base this expectation on studies by Baum (1977, 1990), which indicate that judges with patent backgrounds were favored by the patent bar in the belief that they would generally be more favorably disposed to patent protections. More generally, as experts who possess technical proficiency in the intricacies of patent law, these judges should be better positioned to question the decisions of the BPAI and be less reliant on them than their nonexpert colleagues.

In contrast, we operationalize the acquisition of proficiency in the area of patent law as a function of experience, reflecting exposure to obviousness cases that deepens one's ability to appreciate the intricacies of those case facts over time. As such, judges may have extensive experience in adjudicating patent cases, but have no subject matter expertise in the area. Conversely, two judges with expert training in patent law will

10. For instance, see 37 C.F.R. 11.7(a)(2)(ii). In relevant part, no individual may register to take the patent bar exam unless that individual: "Possesses the legal, scientific, and technical qualifications necessary for him or her to render applicants valuable service. . . ." Therefore, a prerequisite for practice before the US Patent and Trademark Office is some evidence of prior education that would allow one to understand technical material.

almost surely possess different levels of experience in adjudicating those cases, depending on their length of service on the Federal Circuit.

The Potential Relevance of Ideology

The extent to which ideological considerations are relevant to predicting judicial decision making in technical areas of law has been the subject of considerable scholarly debate. Some studies (Allison and Lemley 2000; Moore 2001; Staudt, Epstein, and Wiedenbeck 2006) cast doubt on ideology's role in structuring judicial choice in factually complex legal areas, while others (Howard 2005; Miller and Curry 2009) have provided evidence of ideological influence under certain theoretically meaningful conditions. In any event, in order to accurately assess the possible pertinence of ideological considerations to the Federal Circuit's decisions in obviousness cases, in addition to any interactive effect ideological factors may have with expertise, we must necessarily define liberal and conservative outcomes in patent obviousness cases. As has been noted elsewhere (Sag, Jacobi, and Stych 2007; Miller and Curry 2009), simply relying on the underdog/upperdog distinction that often governs the coding of economic case data is inappropriate for examining obviousness decisions.[11] Consequently, we utilize traditional economic stances of Republicans and Democrats to conceptualize the ideological outcomes in patent obviousness cases.

This, we believe, is the most appropriate course of action for two reasons. First, judges are likely to have policy preferences about patent disputes because they concern "fundamental questions regarding property rights" (Sag, Jacobi, and Stych 2007). This view is buttressed by Landes and Posner's (2003) observation that free market capitalists traditionally favor more extensive protections for patent rights.[12] Second, liberals traditionally favor more extensive trust-breaking activities, while conservatives generally support giving greater protection to monopolies (Landes and Posner 2003). Because the possession of a valid, nonobvious patent amounts to a government-approved monopoly on a particular invention, those who favor greater legal protections for patents are also likely to favor greater monopoly rights.[13]

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11. This is so because the parties in cases where the validity of a patent is at issue are frequently both upperdogs. Such disputes typically occur between two large corporations with substantial patent portfolios (e.g., *KSR v. Teleflex* [2007]).

12. One might also conceive of this ideological cleavage in terms of potential societal costs. Governmental patent rights are, in some sense, a promise from society to an inventor that if the invention is nonobvious, the inventor will have exclusive rights to that invention. On the other hand, granting a patent to an invention that is obvious will create additional costs and, potentially, foster patent races. Patent races, which occur when multiple firms invest in the creation of the same technology, produce unnecessary costs in that they make any patented invention considerably more expensive than it otherwise would have been. Indeed, this is the primary purpose of the obviousness requirement—it is designed to prevent patent races (Landes and Posner 2003, 302–05). For these reasons, liberal judges should be more likely to view an invention as obvious than conservative judges, presumably due to the fact that more liberal judges will believe society deserves greater protection from nonuseful patents.

13. This view is also buttressed by the partisan cleavages that were evident in the House of Representatives in its vote on the Patent Reform Act of 2007. That vote was largely an ideological one, with nearly three-fourths of Democrats voting to make it easier for applications to be upheld as unpatentable and two-thirds of Republicans opposing rules that would make applications for patents easier to hold unpatentable.

In sum, to the extent that ideology influences judicial decision making in the cases we examine here, conservative judges should be expected to uphold the validity of patent rights because (1) those rights are analogous to other private property that stimulates economic activity, and (2) to the extent that patents can be equated with monopolies, conservative judges tend to favor monopoly holders. On the other hand, keeping these same considerations in mind, liberal judges should be more likely than their conservative colleagues to find an application unpatentable. Because the data in our analysis consist of appeals in which the BPAI has found an application unpatentable (see Data and Measurement section), a decision to reverse the lower authority is tantamount to casting an ideologically conservative vote—in essence, it is a vote overturning a decision to deny an application as unpatentable for obviousness. Thus, all else equal, we would expect conservative judges to exhibit less deference to the BPAI in this analysis due to the parameters of our data.

DATA AND MEASUREMENT

Our data come from published and unpublished decisions on the obviousness of a patent or patent application decided by the Court of Appeals for the Federal Circuit between 1997 and 2007.[14] The relevant decisions were located via exhaustive searches in LexisNexis and Westlaw. We choose this time period because it allows for a sufficient number of votes by Democratic judges, none of whom were appointed before 1994. We analyze cases in which the BPAI has refused to grant a patent to an inventor on obviousness grounds. There are sixty-seven cases in our data, although only two-hundred votes because one panel consisted of only two judges due to the death, before a decision, of Judge Rich.

The dependent variable in our analysis is designed to capture deference to the administrative decision that is being appealed. Given that we have limited our data to cases in which the BPAI finds an application unpatentable, the decision to uphold a patent is also a decision to overturn the agency's decision. We code the dependent variable, decision to reverse, as 1 when a judge votes to reverse the BPAI and 0 otherwise. To examine this notion of deference, we include a number of independent variables in the model, which are summarized in Table 1. It is worth noting that the occurrence of votes to reverse the BPAI is well-spread over the judges in our data. Every judge included in the analysis votes at least once to reverse the BPAI and no one judge's votes comprise more than 10 percent of the votes to reverse.

Our chief independent variable of interest is patent expertise, which registers whether or not a given judge had previous expertise with respect to patent law upon his or her ascension to the Federal Circuit.[15] For the reasons noted previously, we expect

14. The results reported below are robust to the use of either published decisions only or unpublished decisions only.

15. We coded as patent experts those who possessed technical degrees (e.g., a PhD in chemistry or a BSEE) before their ascension to the bench *and* who were also members of the patent bar. Those judges in our data set who were counted as experts include Pauline Newman (Reagan), Alan Lourie (H. W. Bush), Arthur Gajarsa (Clinton), Richard Linn (Clinton), and Giles Rich (Eisenhower). See also Moore (2001, n93).

TABLE 1.
Descriptive Statistics for Selected Variables

Variable	Mean	*SD*	Minimum	Maximum
Vote to reverse	0.28	0.45	0	1
Ideology	0.34	0.56	–0.68	0.85
Patent expertise	0.23	0.42	0	1
Experience	10.76	5.19	0	23
Panel expertise	0.59	0.49	0	1
Panel ideology	0.34	0.30	–0.53	0.74
Combined references	0.84	0.37	0	1
APA change	0.66	0.47	0	1

Descriptive information for the interaction terms and the restricted cubic spline are omitted.

that judges who possess patent expertise will be less likely to defer to the BPAI's decision than their nonexpert counterparts.

Experience is a continuous variable that captures the amount of time, in years, that a given judge had served on the Federal Circuit at the time the case was decided (and assumes that such cases are evenly distributed over time).[16] As evidenced in Table 1, the value of this variable ranges from zero to twenty-three years and increases with a judge's length of service on the court. In operationalizing this measure, we do not count experience accrued before the Federal Circuit was formed in 1982.[17]

Capturing the ideology of judges on the Federal Circuit is not an easy task. We have opted to use the first dimension DW-NOMINATE scores first created by Poole and Rosenthal (1997), which capture the ideology of a judge's appointing president on issues that include those of traditional economic concern to Democrats and Republicans. We use the DW-NOMINATE score of the appointing president instead of the more nuanced approach advocated by Giles, Hettinger, and Peppers (2001) because there is no senatorial courtesy for appointments to the Federal Circuit. The ideology scores range from –0.678 to 0.851, with higher scores indicating greater conservatism on economic issues. Therefore, we expect the ideology variable to be positive in our analysis, given that a vote to overturn the BPAI's determination represents a vote to uphold a patent.

We include two interaction terms to account for the possibility that the effects of expertise and/or experience may operate in conjunction with an individual's ideological views. In the model there is an interaction between ideology and expertise, ideology * expertise, and another between ideology and experience, ideology * experience. We

16. Because the Federal Circuit hears approximately the same number of patent appeals every year (Miller and Curry 2009, 852), we believe measuring experience in years is a sensible way to capture an individual judge's exposure to issues of patent law.

17. We tested an alternative specification of this variable in which we counted prior experience as including service on the Court of Customs and Patent Appeals, the predecessor to the Federal Circuit, but because there are only two judges with previous experience on this court in our data (and only one with significant experience), this alternative operationalization does not change our results.

expect that these interactions will be negative for conservatives and positive for liberals—in essence, that expertise or experience will accentuate the effect of ideology on decision making.

Because a number of recent studies have suggested that an individual judge's vote may, in part, be impacted by the composition of the three-judge panel on which he or she sits (Revesz 1997; Unah 1998; Farhang and Wawro 2004; Sunstein, Schkade, and Ellman 2004), we include the variable panel ideology median to capture the median ideology of the three-judge panel that hears each case. We expect that variable to be positive in our model because positive values of our ideology measure signify conservatism and, all else equal, judges on Republican-dominated panels should be less likely to defer to bureaucratic decisions that find applications unpatentable for obviousness.

In addition, we believe that judges are likely to be influenced by the presence of an expert judge on their panel and so we include the panel expertise variable, which is equal to 1 when there is at least one expert on the panel and 0 if there are no experts on the panel.[18] We expect that the presence of an expert on the panel will lend confidence to all the reviewing judges or that, at the very least, nonexperts on a panel with at least one expert will be more likely to defer to the expert's decision. Therefore, we expect that this variable will be positive.

Finally, our models contain a number of additional variables to capture the factual context in which the Federal Circuit's review of obviousness decisions occurs. We control for these additional variables because it may be that fact patterns in particular cases dictate a certain decision regardless of expertise-based or ideological considerations. In light of evidence that the Federal Circuit may be especially prone to defer to obviousness determinations when there is a combination of references (Mandel 2006), we include a combined references variable that is coded 1 when the BPAI combined references in its fact-finding inquiry on the obviousness of a patent claim. The combination of references suggests than an invention is not plainly obvious on the basis of just one piece of prior art—that is, both prior patents and a host of possible reference works such as journal articles (see 35 U.S.C. § 103). We expect this variable to be negatively related to our dependent variable, meaning that when references have been combined, the Federal Circuit will be especially likely to defer to the BPAI's determination of obviousness.

To capture the potential effect of Supreme Court rulings on the treatment of agency decisions by the Federal Circuit, we include a variable called APA Change that captures a breakpoint in Supreme Court jurisprudence on the treatment of cases from the BPAI by the Federal Circuit. In 1999, the Supreme Court held, in *Dickinson v. Zurko* (1999), that the Federal Circuit was required to apply the standards of the APA to the patent system (see Benjamin and Rai 2007). In other words, this decision required the Federal Circuit to treat decisions from the BPAI as being worthy of substantial deference. The APA Change variable is coded 1 for cases occurring in or after 2000 and we expect that it will be positive. Put differently, we believe that, all else equal, the Federal Circuit will become more deferential to the BPAI after *Zurko* was decided, indicating a negative coefficient.

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18. We thank an anonymous reviewer for suggestions with respect to this variable.

Finally, in order to account for variation in our dependent variable over time we include a cubic spline with three knots, as recommended by Beck, Katz, and Tucker (1998) for use in binary cross-sectional time-series data, such as the data we analyze here. We allow the data to determine where these knots should be. We checked the necessary number of knots by comparing models with varying numbers of knots by their Akaike information criterion (AIC). We use three knots because the model with three knots had the lowest AIC score. The values of the knots and their coefficients are not displayed, since we treat them primarily as nuisance parameters of little substantive interest.

RESULTS

Table 2 presents the results of the logit model. To account for the potential nonindependence of the errors, we cluster the errors by judge. As noted above, we use a cubic spline with three knots to account for the potential time dependence in our data (see Beck, Katz, and Tucker 1998). In general, the model appears to fit the data well, with an area under the receiver operating curve of 0.80. The percent reduction in error is 0.20. Further, the model has a highly statistically significant Wald χ^2 statistic. To summarize the

TABLE 2.
Logit Model of Deference in the Federal Circuit

	BPAI Cases, 1997–2007		
Variable	**Coefficient**	**S.E.**	**Δ in Predicted Probability**
Background Variables			
Ideology	1.100	0.713	
Patent expertise	0.744*	0.185	See Figure 1
Experience	0.008	0.031	
Ideology * Expertise	–1.085*	0.335	See Figure 1
Ideology * Experience	–0.048	0.062	
Panel expertise	2.118*	0.347	0.39
Other Variables			
Panel ideology	1.420	0.737	
Combined references	–1.435*	0.305	–0.30
APA change	–0.484	0.718	
Constant	352.183	545.509	
N	200		
Wald χ^2	204.13*		
PRE	0.20		
Area under ROC	0.80		

*Coefficients are significant at $p < 0.05$ (two-tailed).

Dependent variable is whether the judge votes to overturn the decision of the BPAI. Standard errors are clustered on the judges and robust to heteroscedasticity. Duration dependence is accounted for using a restricted cubic spline in years with three knots, but the coefficients are not displayed. Changes in predicted probabilities are calculated by holding continuous variables constant at their means and dichotomous variables constant at their modal values using the Clarify program (King, Tomz, and Wittenberg 2000; Tomz, Wittenberg, and King 2001).

dependent variable's distribution, judges on the Federal Circuit vote to overturn the BPAI's decision to deny an applicant for obviousness grounds just 28 percent of the time.

Aside from the expertise, panel expertise, and ideology variables, which we focus on below, the only variable in the analysis that is statistically significant is the combined references variable. As we expected, that variable is negative. When the BPAI combines references to deny a patent application, a judge on the Federal Circuit is 30 percentage points less likely to vote to reverse the board. Given the baseline rate of voting to overturn the BPAI, when the BPAI combines references to deny a patent, it is extremely unlikely that judges on the Federal Circuit will vote to overturn that decision. Contrary to expectation, we observed no statistically significant panel effects in the model. Interestingly, the APA Change variable's lack of significance appears to indicate that the Federal Circuit's level of deference to the BPAI was not influenced by the Supreme Court's decision in *Zurko* (though it is negative, consistent with our expectations).

Of central importance to our theory of the effects of specialization, the panel expertise variable is substantively important and statistically significant. When a panel contains at least one expert, all the judges on that panel are significantly more likely to vote to overturn the BPAI. In our model, judges serving on a panel with at least one expert are 39 percentage points more likely to vote to overturn the BPAI, regardless of whether they themselves are experts. This suggests that, independent of their own voting proclivities, experts influence other members of the panel.

Interpreting interaction effects in models with dichotomous dependent variables can be difficult (Braumoeller 2004; Brambor, Clark, and Golder 2006), particularly when the issue is creating confidence intervals (Norton, Wang, and Ai 2004). However, simulation is one method for accurately interpreting interaction effects and their confidence intervals (Brambor, Clark, and Golder 2006). Therefore, Figure 1 presents the

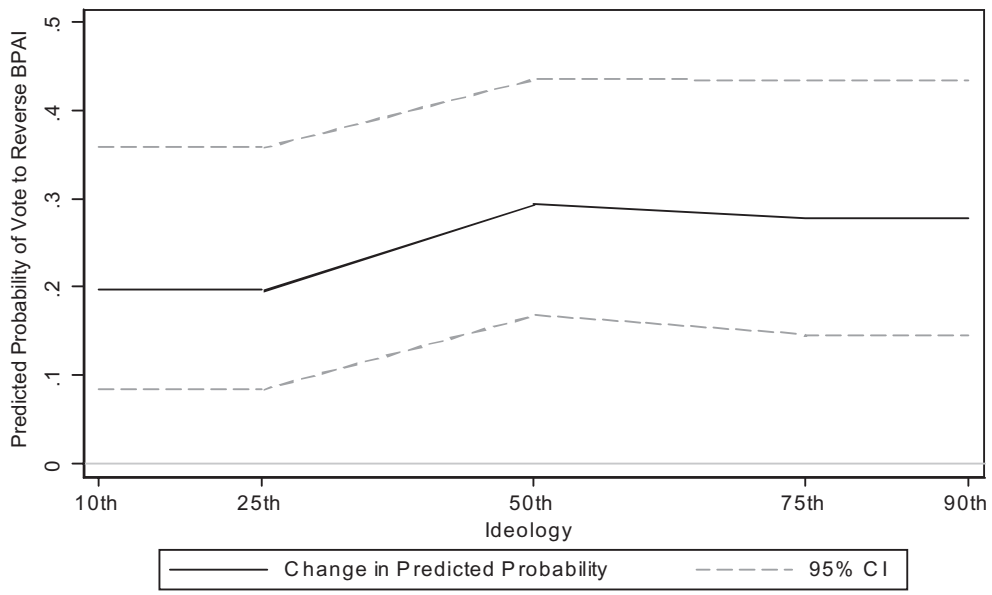

FIGURE 1.
Effect of Expertise on Vote to Reverse the BPAI

interaction effect, in terms of probability of voting to overturn the decision of the BPAI, as the first difference of moving from a nonexpert to an expert judge across the range of ideology in our data based on simulations generated using the Clarify package in Stata (King, Tomz, and Wittenberg 2000; Tomz, Wittenberg, and King 2001). In Figure 1, we see that the difference between experts and nonexperts is statistically significant for all judges and that the line is positively sloped, meaning that conservative experts are somewhat more likely to vote to overturn the BPAI.

To summarize the results for expertise, the likelihood of a judge voting to reverse the agency's decision increases considerably when the judge is also a subject matter expert—29 percentage points for the ideologically moderate judge. Interestingly, as can be seen in Figure 1, the effect of the interaction between ideology and expertise is not constant. Given that overturning a decision to strike a patent is an inherently conservative decision (see Miller and Curry 2009), it is not surprising that conservative experts are more likely to vote to overturn the BPAI's decisions than their more liberal brethren. Nevertheless, the difference between liberal and conservative experts is less than the difference between experts and nonexperts, so we see that expertise may be more important than ideology as an explanation for decision making in these cases of agency review.

As the quote from Judge Posner at the opening of our article suggests, when a judge is comfortable with the subject matter at issue, he or she is considerably more likely to question the decision of an agency, at least when that agency is the BPAI. We now turn our attention to what this lack of deference is likely to mean as the size of the administrative state grows and the federal judiciary becomes, potentially, more specialized and therefore more likely to possess subject matter expertise.

DISCUSSION

We have shown that in trying to understand the balance between agency oversight and deference to agency skill, the relative subject matter expertise of the judge reviewing a decision matters. Specifically, agencies can expect less deference when the reviewer is an expert than when he or she is not. The question is whether the lack of deference shown by expert judges is proper and whether subject matter expertise in the federal courts is likely to grow with the increases in agency decision making that accompany an administrative state.

First, in discerning whether the courts are providing the proper amount of protection against abuse of agency discretion, it is important to note that most federal courts, including the D.C. Circuit Court of Appeals (tasked with hearing the majority of administrative appeals), are highly deferential to agencies (see Unah 1998). The question, then, is not whether agencies receive too little deference, given the already high levels of deference that exist, but whether they receive too much. Since most federal judges are generalists (but see Cheng 2008),[19] it is not surprising that they are not in a

19. Cheng (2008) notes, interestingly, that the idea of generalist judges in the federal courts is something of a myth because many judges do in fact specialize while on the bench. Most importantly for agency review, Cheng notes that several judges on the D.C. Circuit can be considered subject matter specialists (see Table 2 in Cheng [2008]), raising the possibility that effects similar to those we have uncovered here exist on the D.C. Circuit court as well. We hope to investigate this possibility in future work.

position of strength when assessing the propriety of, say, an EPA rule on air pollution. The fact that expert judges are considerably less deferential to the agency than their nonexpert counterparts suggests that there is some reason to suspect that too much deference is regularly granted agencies. Put differently, if expert judges on the Federal Circuit believe that the BPAI gets it wrong more frequently than their nonexpert colleagues, and those experts are better positioned to evaluate agency decision making and accurately judge whether the agency is correct, then it seems reasonable to suspect that agencies not subject to expert review may be being given too much leeway. Further, the effect of experts serving on panels seems to increase the scrutiny with which nonexpert judges treat the BPAI. Of course, this assumes that all agencies are like the BPAI and that all areas of law are similar to patent law, and these are clearly tenuous assumptions. Discerning the areas of law in which our findings are likely to apply and those in which they are not is a project for the future.

Second, we have suggested that subject matter expertise is likely to grow, not diminish, over time. For instance, Posner notes that because specialization also increases the efficiency with which cases are handled, as caseloads grow, the tendency among judges is to specialize in order to cope with burgeoning workloads (Posner 1999). Furthermore, as others have observed (Legomsky 1990; Cheng 2008), the rest of society is highly specialized, including the practice of law and legal academia; thus, it is not clear why the federal courts should remain insulated from the broader trends that have encouraged specialization in the practice and study of law. Therefore, we are in agreement with Baum (2005) that the coming century is likely to be one in which judicial specialization is a strong trend. The questions for scholars of judicial behavior are whether such specialization is policy neutral and whether the lessening deference that is likely to accompany that increased specialization is appropriate. For those focused on congressional delegation and mechanisms of bureaucratic oversight, our results also suggest that the creation of additional specialized courts may be another way for Congress to check bureaucratic power.

Lastly, though we have not emphasized it in this article, we believe that our results fit nicely into existing theories of judicial decision making. More specifically, we think that expertise may act to accentuate the use of ideology in the decision-making process—hence the fact that the interaction between ideology and expertise is significant and in the expected direction. Though we have detailed this process elsewhere (Miller and Curry 2009), it is worth repeating here that the relationship between expertise and ideological decision making is best understood in terms of motivation. In complex areas of law, such as patent law, we believe that ideological decision making is normally difficult or unattractive for nonexperts because they lack the underlying motivation to view legally or factually complex cases within an ideological framework. However, experts are likely to have greater interest in imposing an ideological framework on these kinds of cases since they are likely to see them as crucial policy-making opportunities and will not have difficulty understanding the subject matter of such an appeal. Therefore, ideological dimensions may be difficult to uncover in so-called technical areas of law because of a failure to distinguish expert and nonexpert decision makers.

We began this article with a quote from Judge Posner suggesting that judges only overrule a lower authority after undertaking an assessment of their own competence to

review a decision. To that end, we have found that subject matter expertise makes federal appellate judges significantly less likely to defer to an agency than their nonexpert peers. What is less clear is why expertise appears to have an effect that is separable from experience, though we suspect that motivation to impose an ideological schema in these subject areas is a key part of the explanation. We hope to investigate that issue by exploring the possibility of subject matter expertise in other federal appellate courts (see Cheng 2008). Finally, we believe that our findings here will be more broadly applicable to the federal courts of appeal generally, since we view the Court of Appeals for the Federal Circuit as a court having higher concentrations of expertise—though not necessarily a tribunal that is unique in and of itself.

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STATUTES CITED

Appendix R Patent Rules; fees. 37 C.F.R. § 41.20.
Board of Patent Appeals and Interferences. 35 U.S.C. § 6.
Conditions for Patentability. 35 U.S.C. § 103.