

Estimating Vote-Specific Preferences from Roll-Call Data Using Conditional Autoregressive Priors

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Ideal point estimation in political science usually aims to reduce a matrix of votes to a small number of preference dimensions. We argue that taking a nonparametric perspective can yield measures that are more useful for some subsequent analyses. We propose a conditional autoregressive preference measurement model, which we use to generate case-specific preference estimates for US Supreme Court justices from 1946 to 2005. We show that the varying relative legal positions taken by justices across areas of law condition the opinion assignment strategy of the chief justice and the decisions of all justices as to whether to join the majority opinion. Unlike previous analyses that have made similar claims, using case-specific preference estimates enables us to hold constant the justices involved, providing stronger evidence that justices are strategically responsive to each others' relative positions on a case-by-case basis rather than simply their identities or average relative preferences.

Ideal point estimation in political science usually seeks to reduce a matrix of voting data to a small number of preference dimensions. This process can be motivated through a theoretical model of spatial voting, but it can also be motivated as a simple exercise in data reduction. The resulting estimates of individual preferences have facilitated a wide range of subsequent analysis because they translate the original voting data into a form that is comparable and amenable to including in a regression model. There is no question that having one or two numbers to summarize the behavior of a political actor, relative to others, has many attractive features for subsequent analysis. However, it also makes certain kinds of analysis difficult.

When used to test theories of bargaining in legislatures or courts, such measures require one to rely on weakly identified temporal variation (Ho and Quinn 2010) or prevent one from holding the composition of the legislature or court constant. Without holding the set of voters constant, it is impossible to adjudicate whether it is actually political preferences

or some other stable features of individuals that are the origin of the patterns that are observed. Going from individual votes to summary measures has the consequence of eliminating from the data all within-individual variation. In this article, we develop the idea that vote-specific measures enables us to look at within-individual variation in behavior across different kinds of votes, where legislators or judges' allies may be different, even as the set of individuals remains the same. If we want to make an argument that the patterns we observe are due to strategic interactions, where actors look at what other actors want in the given instance and respond accordingly, identification is greatly improved if we can exploit variation in relative preferences of the same individuals across different decisions.

However, this is not merely an argument about statistical identification. The application of the approach we develop in this article is to the US Supreme Court. Theories of judicial coalition building and opinion writing in a single case implicate the case-specific preferences of justices, not

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their average preferences across all cases. If the justices do systematically vary in their relative alignment across areas of the law, the outcomes of these bargaining games should vary as a function of these alignments as well. This concern with preference variation by substantive issue is not about measuring modest fluctuations around more important general patterns but rather more precisely identifying the implications of theories with minimum confounding.

To estimate these case-specific preferences, we develop a model where judges' preferences on each new case are expected to be equal to their preferences in preceding cases that are cited in the new case, weighted by the relevance of those cases as measured by the relative number of citations found in the opinions. This model of judges' preferences as following their views about precedent cases is both legally plausible and mathematically tractable, yielding a conditional autoregressive (CAR) model specification like those commonly used in spatial statistics (Besag 1974). The underlying idea is broadly relevant to decision making in common law courts systems, where new cases are explicitly decided in the context of precedent cases. However, because of the connection to CAR models, it is also applicable more broadly to preference estimation problems where it is possible to produce a suitable metric of the similarity among votes based on metadata about the subject of the votes. This model has the effect of smoothing voting patterns across substantively similar cases to estimate relative preferences in individual cases, and there are various ways to define and measure substantive similarity in different domains. The resulting estimates of relative positions have significant uncertainty at the case level; however, they nonetheless achieve the goal of enabling more credible identification strategies because they measure within-justice variation in preferences that can be used to make within-justice comparisons that have been previously unidentifiable.

How does this approach differ from previous approaches to ideal point estimation, in particular the Supreme Court ideal points estimated by Martin and Quinn (2002)? Most fundamentally, it differs in that it is a case-level measure rather than a year-level measure. Our approach does not aim to reduce or simplify the roll-call data but rather to transform it using auxiliary data into a form where it can be used in case-level analyses. These case-level measures can be used to generate yearly summaries of judges' average preferences similar to Martin-Quinn scores; however, they also enable analyses at the case level that are impossible in the absence of within-year, within-judge variation in measured preferences.

To demonstrate how such estimates can be used as the starting point for subsequent analysis, we revisit a central question in the literature on the Supreme Court: how much

influence do individual members of the court exert over the majority opinion? In particular, we consider the assignment of opinion authorship to a member of the majority coalition and the decisions of all the justices in that coalition on whether to join the decision. We find evidence that chief justices strategically assign authorship to associate justices in cases where the associate justice's preferences are more proximate to the chief and to the median, within the set of cases where the chief and a given associate justice are both in the majority. The relative weight on proximity to the chief and to the median varies by chief justice, suggesting that different chief justices have followed different assignment strategies. We also find some evidence that justices who are in the majority are less likely to join the majority opinion in areas of law where their preferences are further from the author, holding constant the identity of the author, the joining justice, and the full set of justices serving on the court. Because these results are true holding justices fixed, as preferences vary by area of law, we interpret this as evidence that the author's preferences influence the content of the opinion, and that chief justices are strategically responsive to this fact in making assignment decisions.

AUTOREGRESSIVE SPATIAL PREFERENCE ESTIMATION

Our estimation approach diverges from previous Bayesian ideal point estimators in several respects. We do not explicitly motivate our model using a random utility model that describes a choice between binary policy alternatives under spatial preferences (Poole 2005), although we explain the mathematical relationship between our model and standard ideal point models in the appendix, available online. For our purposes it is enough to assume that our voters (justices) have latent preferences for each side of each case relative to one another, and that these are correlated across cases. To this end, we do not aim to estimate a small (Jackman 2001) or even a large (Lauderdale and Clark 2014) number of dimensions to summarize behavior: we aim to estimate latent preferences on every vote. That is, we want to know which justices were close to the cutpoint in a case, and in what order of preferences they were likely to have been arranged. To learn this, instead of modeling the latent preferences on each vote in terms of a small number of latent dimensions, we estimate them conditionally on each other, subject to an assumption that latent preferences are more similar on substantively similar cases than on substantively distant cases. From a more mechanical perspective, we aim to smooth the binary observations of justice votes into continuous measures of justice preferences, with the smoothing occurring across substantively similar cases.

To achieve this smoothing, we start with an intuition based on the logic of common law: the views of a judge about how to decide a case will reflect their views in similar past cases. There will be novel features of the immediate case, and so there will not be a deterministic relationship, but past decisions will nonetheless be indicative to the extent that they are legally relevant. There are several possible sources of data on this relevance; here we focus on the use of citation data to identify legally relevant precedents for each new case (Clark and Lauderdale 2012; Lauderdale and Clark 2012). The relative number of citations to each past Supreme Court case indicates the likely strength of the correlation between the latent preferences of a judge in the new case to each of those precedents. A judge's preferences in a particular past case that is cited very heavily are going to be much more predictive of their preferences in the new case than are their preferences in a substantively irrelevant case that is not cited at all.

The model, as we show next, could be estimated using any plausible metric of legal similarity. In some applications, different metrics may be more or less theoretically sound, depending on the types of inferences one wants to draw. We opt for the citation metric for a number of reasons. First, the universe of citations that are relevant is a function of forces largely outside of the court's decision-making processes. The "die is cast," so to speak, when the lower appellate court resolves questions of law, and the Supreme Court subsequently selects those questions for resolution. Second, as opposed to proprietary sources, such as Westlaw KeyNotes, we are able to collect data from every opinion—including those concurring or dissenting—within each case the court resolves.¹ This mitigates against the possibility that the majority opinion strategically avoids a relevant precedent or issue, as concurring or dissenting opinions have an incentive to undermine any such decision—if consequential—by citing the strategically avoided precedent.

The final reason we prefer the citation-based measure of similarity is because the Supreme Court's practice is to decide only a single (or, maybe, two) legal question from potentially complex cases. If we were to use, for example, lower court citation patterns, we might systematically underestimate the similarity of two cases from different jurisdictions,

1. Professionals services, such as Westlaw and LexisNexis, code the legal issues considered in majority opinions and create coding schemes that can be used to measure the legal similarity of any pair of cases. We have estimated our model using the number of Westlaw KeyNotes common to each pair of majority opinions instead of the citation overlap. The estimates from that model are substantively identical to what we find in this analysis. Using the citation data, though, has the benefit of not relying on proprietary data and being therefore fully transparent and replicable.

because they will rely on precedents from their own courts (e.g., California courts will cite California courts, Third Circuit courts will cite courts from the Third Circuit) that are never cited in the other courts because they have their own precedents on those very legal questions. By the same logic, we risk overestimating the legal similarity of substantively diverse cases that happen to come from the same jurisdiction. Thus, while there are plausible alternative metrics of substantive adjacency, we believe that the citation patterns data are sufficiently exogenous to the court's decision-making process, our data collection method mitigates against strategic influences on citations, and the data are properly tailored to measuring similarity.

We describe a generative model for judges' latent case-specific preferences using the following logic. We assume that the latent preferences of justice $i \in \{1, 2, \dots, n\}$ for case $j \in \{1, 2, \dots, m\}$ have an expected value equal to the citation count weighted mean of her preferences in all previous cases, with a normally distributed variance around that expected value of $1/\lambda_{\psi}$. We define $c_{jj'}$ as the fraction of the citations appearing in case j to all precedent cases that are to the specific precedent case j' (i.e., $\sum_{j'} c_{jj'} = 1$).

$$\psi_{ij} \sim \mathcal{N}(\mu_{ij}, \lambda_{\psi}^{-1}),$$

$$\mu_{ij} = \sum_{j'=1}^{j-1} c_{jj'} \psi_{ij'}.$$

These latent preferences ψ_{ij} are mapped into observable votes for judges according to the following specification. Let Y be an $n \times m$ matrix of votes, where $y_{ij} = 1$ if justice i is in the majority in case j , $y_{ij} = 0$ if justice i is in the minority in case j , and is missing otherwise. Let ψ_{ij} be the latent preferences for justice i on case j , let α_j be the cutpoint for case j , and let $\beta_j \in \{-1, 1\}$ be the polarity of case j . The observed decision is

$$y_{ij} = 1 \text{ if } \begin{cases} \psi_{ij} \geq \alpha_j \text{ and } \beta_j = 1 \\ \psi_{ij} \leq \alpha_j \text{ and } \beta_j = -1 \end{cases}$$

$$y_{ij} = 0 \text{ if } \begin{cases} \psi_{ij} < \alpha_j \text{ and } \beta_j = 1 \\ \psi_{ij} > \alpha_j \text{ and } \beta_j = -1 \end{cases}$$

That is, we assume there exists a threshold value for each case that divides the justices into voting coalitions depending on whether their each justice's latent utility is greater or lesser than that threshold. The β parameter captures the polarity of the case majority—if a case majority is voting in a "liberal" direction, then having latent preferences greater than the case location (α_j) implies that a justice did not vote with the majority; when the majority is voting in a "conservative" direction, the opposite relationship will exist. Hence,

a conservative outcome will be associated with $\beta = 1$, and a liberal outcome will be associated with $\beta = -1$.

It is important to note here that our model does not require that justices vote sincerely when deciding cases. There may be incentives for justices to strategically endorse a majority outcome in order to try to exert influence over the content of the opinion (Cameron and Kornhauser 2013; Epstein and Knight 1998). Our model only relies on the logic of a cutpoint model of voting. Thus, as long as any strategic incentive operates monotonically in the latent space our model will recover the correct ordering of the justices. If, for example, there is a sincere majority of the left five justices in a case, strategic voting with that sincere majority by one of the four remaining judges is only problematic if that judge is not the left-most of those judges. Strategic voting only poses a challenge to this model if the incentive to vote strategically is nonmonotonically associated with the justices' preferences over the case outcome.

The preceding specification of the generative model for the latent votes ψ_{ij} is mathematically equivalent to a particular specification of a conditional autoregressive (CAR; Besag 1974) prior for the covariance of a justice's preferences across cases. Most often CAR models are used in geographic contexts, where a physical adjacency matrix A determines the covariance structure. The following formulation is based on the notation and Gibbs sampler described by Besag et al. (1995). To describe our model as a CAR prior, we define $a_{jj'} \equiv c_{jj'} + c_{j'j}$. That is, the strength of adjacency between two cases is the fraction of citations in case j that are to case j' , plus the fraction of citations in case j' that are to case j . The reason for this is that while we model the generative process for new case preferences purely in terms of past rather than future cases, when making inferences on the basis of such a model the future cases are informative about the past cases as well as vice versa. Thus, the A matrix is symmetric, with $a_{jj} \equiv 0$. Then the CAR model specification for the relationship of a justice's latent preferences across cases is the following:

$$p(\psi_{ij}|\cdot) \propto \lambda_\psi^{m/2} \exp\left\{-\frac{1}{2}\lambda_\psi \sum_j \sum_{j'} a_{jj'} (\psi_{ij} - \psi_{ij'})^2\right\}. \quad (1)$$

This conditionally normal distribution implies that the justices' latent preferences in each case (ψ_{ij}) are, in expectation, a weighted average of their latent preferences across all other cases ($\psi_{ij'}$), weighted by the strength of the relationship to each other case ($a_{jj'}$).

This "intrinsic conditional autoregressive" prior is not a proper multivariate normal distribution: the prior only identifies the latent preferences relative to one another and the mean of the ψ_{ij} is therefore not identified (Besag et al. 1995). Intuitively, if each element of ψ_{ij} has an expected value that is

a precision-weighted mean of the other elements $\psi_{ij'}$ (where $j' \neq j$), then the overall mean $\sum_j \psi_{ij}$ must be unidentified as the same relative positions can be achieved around any overall mean. Thus, to identify the scale, we put independent standard normal priors over the case locations/cutpoints α_j —that is, $\alpha_j \sim \mathcal{N}(0, 1)$. By assuming the case cutpoints fall in a range dictated by a standard normal prior, we guarantee that the justices' case-specific latent preferences ψ_{ij} will lie in a similar range. We also standardize the α_j at each iteration of the MCMC sampling procedure (see the appendix), with proportionate rescaling of all other parameters.

Cases decided unanimously tell us nothing about relative preferences: the cutpoint α_j is either greater than or less than all of the voting justices' latent preferences. We still include these cases as they are part of the adjacency network and can indirectly strengthen the estimation of the correlation structure of preferences across areas of the law, even though we cannot determine whether a case is unanimous because the cutpoint was to the left or to the right of all the justices. This indeterminacy has implications for the design of the MCMC sampling procedure described in the appendix.

To summarize, the inferential problem we are trying to solve is to estimate continuous latent preferences on cases when we only observe binary votes. Our solution is to infer those continuous preferences by looking to justices' behavior (binary votes) on related cases. We assume that the justices' preferences in any given case are generated as a normal draw with mean equal to a weighted average of their latent preferences in legally related precedent cases, with weights determined by relative frequency of citations to those cases. The observed votes result from whether the latent preferences of a justice are above or below a cutpoint that is specific to that case, and whether the case has a left majority or a right majority is estimated from the data at the same time. We specify a MCMC simulation of the posterior distribution for model in the appendix, where we also provide details on chain length, convergence and other implementation details for the results reported below.

Quantities of interest and interpretation

The model generates several quantities of interest. First, the posterior distributions of the ψ_{ij} provide our beliefs about the relative positions of justices on a given case. These allow us to construct probabilistic estimates of which justices were likely to have been pivotal in a given case, and they can also be compared to the estimate of the cutpoint α_j for that case, in order to yield a visual representation of preferences in that case. Second, we can define the conditionally expected decision of each justice as $\mu_{ij} = \sum_{j'} a_{jj'} \psi_{ij'}$. This weighted av-

erage of preferences in related cases is our expectation for the justice's position on a given case, conditional on all his or her other decisions. Compared across justices, this is a useful summary of how the justices are aligned at a given "location" in the law, as opposed to a given case. Third, we can define a justice's mean preferences $\theta_i = (\sum_j \psi_{ij})/m$, which capture the justice's average position and are functionally very similar to unidimensional ideal point estimates of judicial preferences.

Traditional scaling models in political science project a complex high-dimensional space onto a low dimensional space (Jackman 2001; Martin and Quinn 2002; Poole and Rosenthal 1985). As noted earlier, the utility of such scaling is to summarize a great deal of information in a way that captures the systematic patterns underlying the information. Implicitly these models are also models for case/vote-specific preferences, and those preferences can be derived from the estimates of the model as they depend linearly on the estimated preference dimensions and case/vote parameters. Our approach directly estimates these case-specific preferences, dispensing with the intermediate step of constructing a small number of general preference dimensions. This enables more flexible estimation of the case-specific preferences that are implicated by the bargaining theories that we wish to test.

With our approach, one might object that the preference space onto which we project the data is just as complex as the original data: what does this model achieve? One response to this objection is to observe that the data we summarize are not just N justice votes for each of m cases but also an m by m matrix of legal similarity among all pairs of cases, so some data reduction is occurring. However, the better response is to simply acknowledge that our estimates are better thought of as a transformation of the dispositional voting data than as a reduction of that data. Data reduction occurs later through the applications that the transformation enables. Binary judicial votes plus citation counts jointly contain information about justices' expressed preferences regarding case disposition and how those preferences vary across areas of the law, but they do not contain this information in an immediately accessible way. To be useful for theory testing, these raw data sources must be transformed, and this is the role of the model we describe above. These model-based transformations of the raw data are useful for secondary analyses of judicial behavior, in particular for empirically testing theories about the processes of bargaining over opinion assignment and content.

ESTIMATES

In figure 1 we show local linear regressions of the case-specific preferences ψ_{ij} for each individual justice over their career. In contrast to the dynamic preference estimates of Martin and Quinn (2002), our method estimates much

more limited changes in judicial preferences in this period. The reason for this difference is that our model is not explicitly dynamic: the default expectation of our model (before observing the votes of justices in a new case) is that justices' preferences stay the same over time. The model for each justice's preferences in a new case is a weighted average of that justice's preferences in past, relevant cases, plus normally distributed variation around that expectation. Nonetheless, we do recover shifts in preferences for several justices widely believed to have shifted over their time on the court (Black, White, Blackmun, Souter), because their votes unambiguously indicate that they have moved relative to their colleagues. In contrast, the Martin-Quinn scores assume a constant distribution of case parameters over time, which sometimes implies large parallel, convergent, or divergent shifts in the preferences of all the justices in the latent space.

Median justices

Past research on the US Supreme Court has shown that there is variation in who serves as the critical median justice (e.g., Lauderdale and Clark 2012, 2014). Our approach here allows us to estimate, similarly, who is the median justice in any given case, with the additional benefit of being able to characterize the significant uncertainty intrinsic to such estimates. We compute the probability of any justice being the median or pivotal justice in every case that the justice heard by identifying the median justice at each iteration of the MCMC simulation for every case, and then computing a mean across iterations to compute the posterior probabilities of being in this pivotal position, for each justice in each case. In figure 2, we average these estimates by term, generating estimates of the fraction of cases in each term for which each justice was the pivotal justice.

As Lauderdale and Clark (2012) show, the relative degree to which the role of median is concentrated on particular justices varies over time. During the 1970s, the pivotal role was held disproportionately by Justices Stewart, White, Blackmun, and Powell. By contrast, throughout the late-1990s and early-2000s, the pivotal role was shared disproportionately by two justices—O'Connor and Kennedy. However, the central lesson we can draw from figure 2 is that no single justice is ever pivotal in all, or even most, of the cases heard by the court. Compared to common public perceptions of a court dominated by a small number of pivotal justices, these estimates reveal that the variation in the rate at which justices are pivotal is not nearly as unequal as some presume. In terms of the average rate over their careers, the least frequently pivotal justice in the data set is Douglas, the most frequently pivotal is White, but they only differ by about a

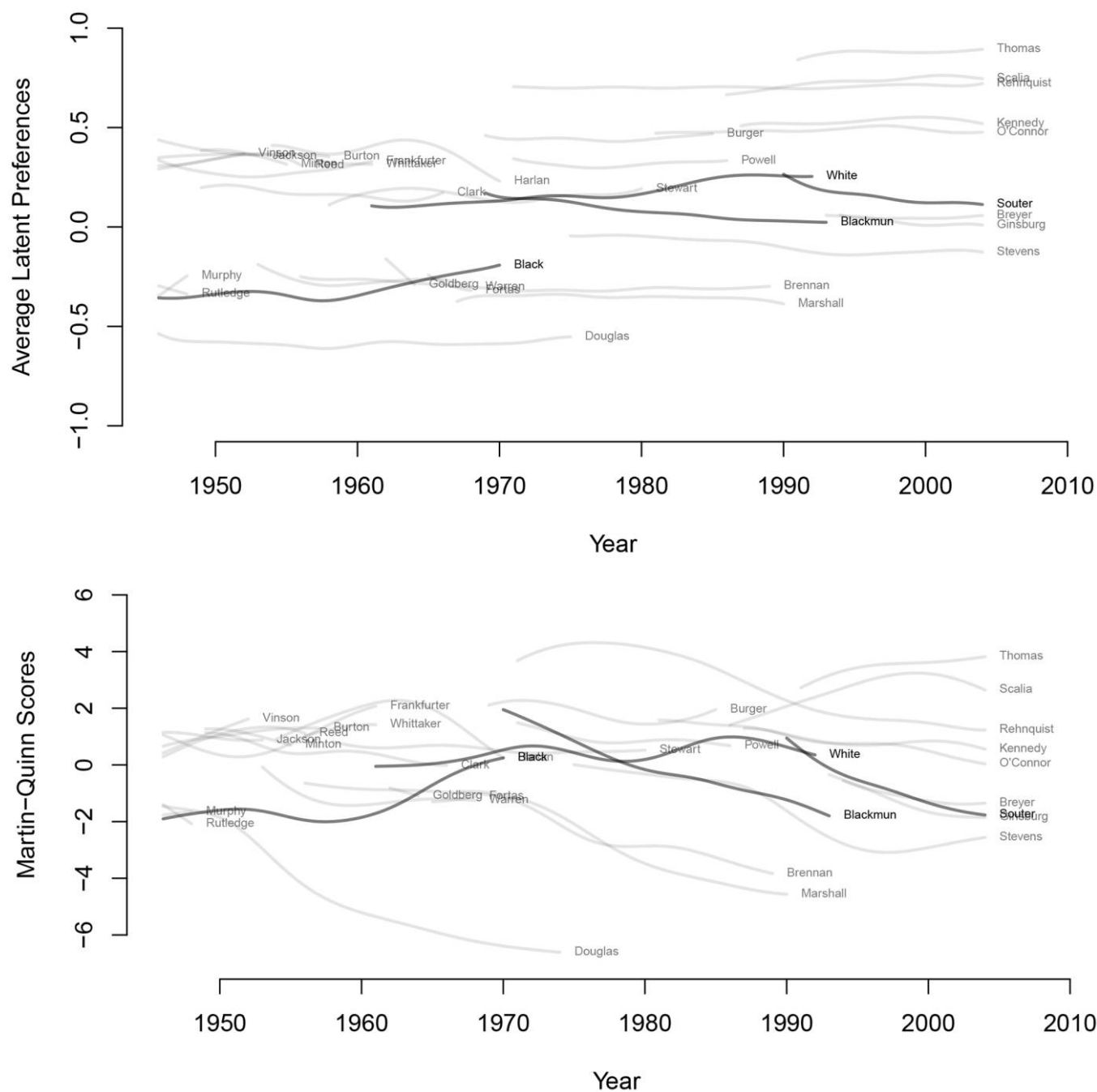


Figure 1. Local linear regression (normal kernel, Bandwidth 2 years) estimates of the mean position of each Supreme Court justice over time (top). Local linear regression (normal kernel, bandwidth 2 years) of Martin-Quinn scores for each Supreme Court justice over time (bottom).

factor of four in the fraction of cases where we estimate them to have been pivotal.

In some sense this should not be a surprise. We observe dispositional voting coalitions that cannot be rationalized by a constant unidimensional ordering of justices, and these occur in a substantial number of cases. This indicates that there must be substantial case-to-case variation in the relative preferences of justices, and that the pivotal justices in such cases may be individuals who one thinks of as inhabit-

ing the extremes of the court more generally. Put differently, knowing who is pivotal depends on knowing something about the substantive nature of what the court is deciding.

Figure 2 also demonstrates a second pattern. The probability of being pivotal is not something that often shifts sharply and dramatically. Rather, we often see a justice’s pivotality waxing or waning over the course of his or her career. Justice White, for example, became increasingly pivotal during the late-1960s and early-1970s. Justice Blackmun, ini-

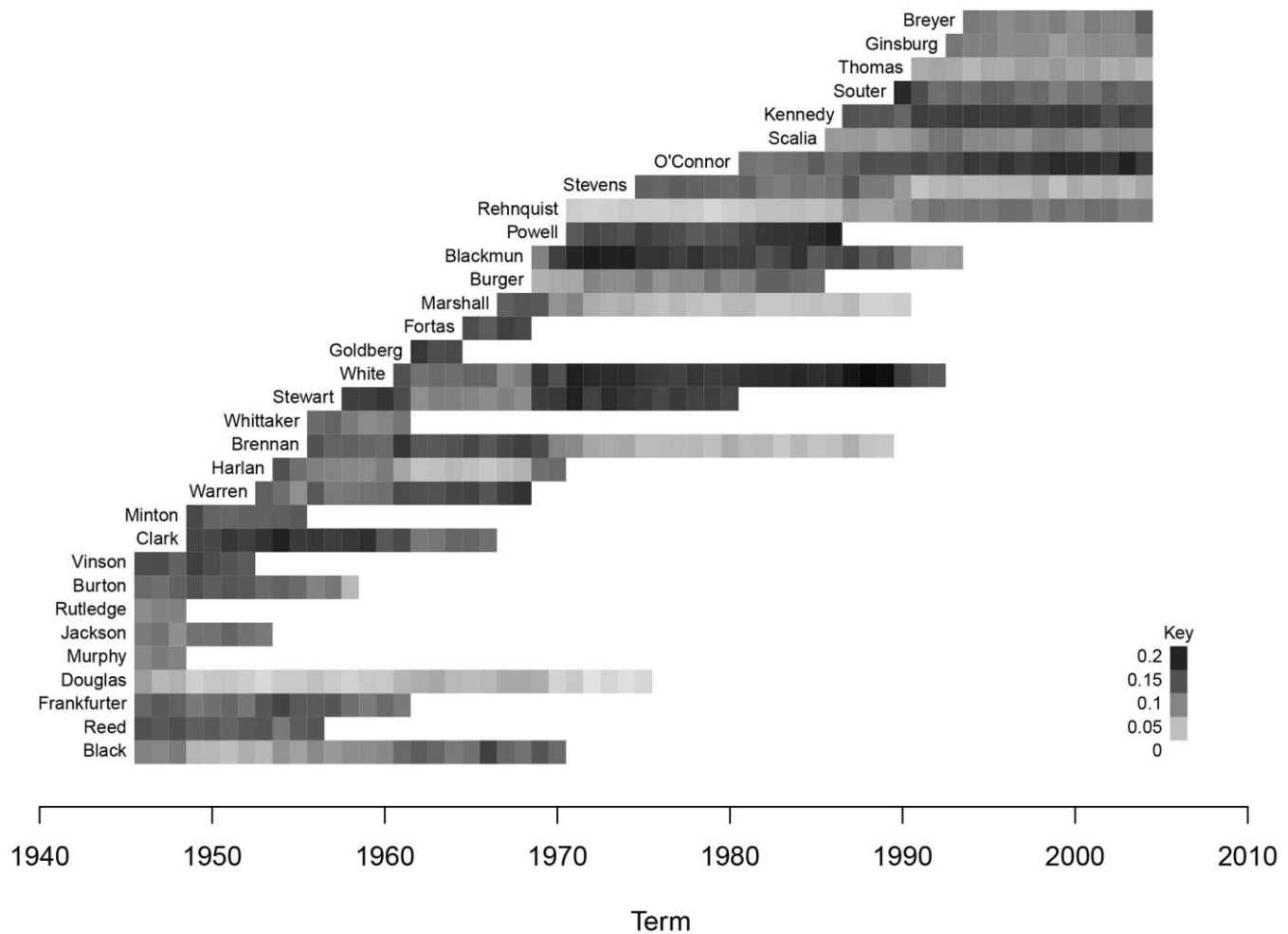


Figure 2. Estimated fraction of cases in which each justice was the pivotal justice, for each term

tially a frequent pivotal voter, became less so over the course of his career. Occasionally, though, we see sharp shifts involving many justices. In a short period of time during the late-1960s and early-1970s, Justices Black, Warren, Harlan, and Fortas left the court, while Burger, Blackmun, Powell, and Rehnquist joined the court. This had the consequence of making Justices Marshall and Brennan much less frequently pivotal, as justices who were often to their left were replaced by justices who were rarely to their left. However, the relatively smooth pattern of transitions, accompanied by an even smoother evolution in the issues and questions the court addresses, leads to a picture of the influence of individual justices that is gradually evolving and that does not change sharply in response to single justice replacements.

Case-specific preferences

Figure 3 shows the relative positions of the justices voting on four high-profile cases. These plots show preferences rel-

ative to the cutpoint, so they slightly overstate the uncertainty of justices' positions relative to one another. The top two cases show *Roe v. Wade* and *Planned Parenthood v. Casey*. The alignments of justices within the voting coalitions in these cases are roughly as we would expect them to be. In the 7–2 decision in *Roe*, the justice most tenuously in the majority is Burger, who rarely voted for the pro-choice side of subsequent abortion cases. While the majority opinion author Blackmun was fourth from the left, near the middle of the court in *Roe*, our estimates in *Casey* place him farthest to the pro-choice end of any justice. Blackmun's concurrence/dissent in the complicated disposition of *Casey* was notably apocalyptic in reference to the four justices who voted to strike down *Roe*, reinforcing the idea that Blackmun was likely furthest of any justice on the left of *Casey* from voting the other way.

In *Miranda*, we see the expected result that the more ardent civil libertarians Brennan and Douglas were to the left of the remaining justices in the majority: Black, Fortas, and Warren. Black, while typically on the left of the court

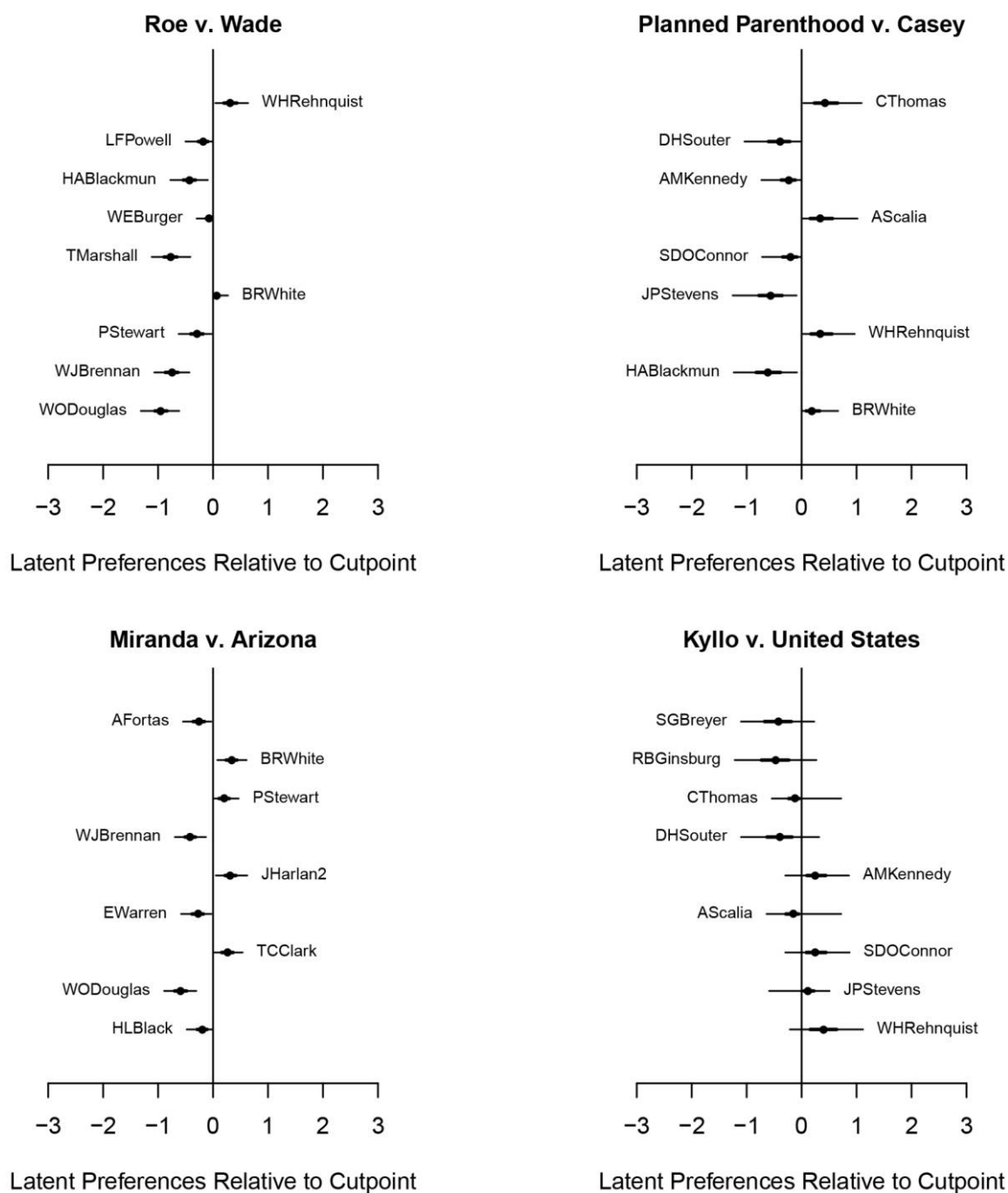


Figure 3. Estimated latent ideal points for justices in selected cases

during his career, shifted right late in his career and particularly so in criminal justice cases. *Kyllo*, the final panel, is an interesting case because it involves the unusual alliances of justices discussed at the beginning of this article. It also is a good case for demonstrating the fact that our model is not always confident of the polarity of the decision. Unlike the other cases plotted in figure 3, in *Kyllo* the 95% intervals of some justices cover the estimated cutpoint. This happens because our model estimates the probability that the ma-

ajority is on the left (i.e., $\beta_j = -1$) to be 68%, in contrast to estimates of very nearly 0% or 100% for the other cases shown in the figure. Substantively, the expansive definition of what constitutes a 4th Amendment search is usually considered to be a left position, and so placing Thomas and Scalia to the left of Stevens, O'Connor, Kennedy, and Rehnquist is probably the correct alignment, as opposed to placing Ginsburg, Souter, and Breyer to their right. However, given only the voting and citation data, there is some remaining

ambiguity in this case, precisely because the alignment of the justices is unusual.

As we can see from these plots, our estimates of justices' relative locations are not precise for any particular case but do reflect meaningful variation in justices' relative preferences across different areas of the law. Our ability to pin down the relative locations of justices varies by case, as a function of the number of total citations from that case to other cases. For example, *Roe* is a case connected to many other cases, with a large number of subsequent cases elaborating the court's doctrine on abortion rights and related issues, often with varying cutpoints as the case facts varied. As a result, we can infer a great deal about the relative positions of the various justices on this case. In contrast, for a case like *Kyllo*, there are fewer related cases with more heterogeneous rulings, and so our uncertainty about the relative positions of justices is greater.

APPLICATION: STRATEGIC DYNAMICS IN OPINION ASSIGNMENT AND WRITING

The US Supreme Court makes decisions on many important policy questions, deciding by a simple majority who wins or loses a dispute arising under the law. Critically, though, the court does much more than decide which litigant wins or loses (the disposition)—the court is primarily responsible for developing principles of law that control all future cases posing similar legal questions. Those principles of law are not the outcome of a simple vote but instead a complex process of opinion writing and bargaining among those justices in the dispositional majority. It is for this reason that scholars of the Supreme Court have devoted considerable attention to understanding the politics and process of opinion writing and negotiation among the justices. In particular, the process of selecting an author for the court's majority opinion and the decision by individual justices to "join" a majority opinion have been the subject of considerable interest (e.g., Brenner 1982; Epstein and Knight 1998; Lax and Cameron 2007; Maltzman, Spriggs, and Wahlbeck 2000; Murphy 1964).

When the Supreme Court decides a case, the chief justice, if he is in the majority, has the power to select the majority opinion writer. If the chief is not in the majority, the most senior member of the majority has the power. Next, the majority opinion writer drafts an opinion and has an incentive to attain the assent of at least four other justices, because only an opinion signed by a majority of justices has the weight of binding precedent. These two stages of Supreme Court decision making have given rise to several theoretical questions. Can a chief justice strategically

shape the nondispositional outcome of cases with his power to assign majority opinions? Who controls the content of the opinion, given the complexities of unstructured bargaining among a group of justices?

Modeling opinion assignment

Opinion assignment on the Supreme Court is one of the longest-studied phenomena in the literature on judicial behavior (e.g., Brenner and Spaeth 1988; Lax and Cameron 2007; Maltzman et al. 2000; Murphy 1964; Rohde and Spaeth 1976; Segal and Spaeth 2002; Ulmer 1970). Among other findings and claims, scholars have argued that the opinion assigner, usually the chief justice, has an incentive to assign opinions to his ideological allies and experts in the particular area of the law at hand, and that the importance of a given case can condition those incentives. These studies almost always rely on simple, parsimonious measures of judicial preferences to measure ideological alignment among the justices—such as issue-specific agreement rates (Maltzman et al. 2000) or Martin and Quinn (2002) estimates of latent ideology (Carrubba et al. 2012). These approaches, while grounded in validated measures of judicial preferences, limit the ability to statistically identify variation in ideological alignment among justices. The former method only allows for variation in agreement between pairs of justices across the 12 substantive areas of the law studied. As a consequence, justices cannot vary in their agreement over time or in substantively more nuanced ways. The latter approach only allows for variation in alignment between justices over time, precluding differential alignment across substantive questions presented in cases.

The traditional approach of treating justices' relative preferences as stable across areas of the law provides a great deal of analytic leverage and has the great benefit of parsimony (see, e.g., the myriad applications of Martin and Quinn 2002). However, in recent years, scholars have increasingly asked how judges' preferences might vary across legal dimensions and questions (e.g., Bailey and Maltzman 2011; Kornhauser 1992; Lauderdale and Clark 2012, 2014; Lax 2007). These observations have particular import in the context of opinion assignment and writing, because there exists a strong norm on the US Supreme Court that opinions be assigned in equal numbers across the justices, though deviations have been observed (e.g., Benesh, Sheehan, and Spaeth 1999; Maltzman and Wahlbeck 1996a). As a consequence, if chief justices work to ensure equity in opinion assignments, varying ideological alignments from case to case may present a strategy opportunity for the chief justice to influence opinion writing and content. The chief justice can distribute cases to justices

with generally divergent preferences when they are relatively proximate in a specific case, reducing his average distance to the author across all cases while maintaining the norm of equal assignment.

A class of formal and informal models of opinion-writing predicts that who writes the opinion could matter greatly for the content of the opinion (Bonneau et al. 2007; Lax and Cameron 2007; Maltzman et al. 2000). We refer to these models of bargaining and opinion assignment as “author influence models” and contrast them with “monopoly models,” which predict that opinion authorship does not matter. The key distinction between these two classes of models is that the former predicts a set of strategic incentives for opinion assignment, whereas the latter predicts no strategic incentives concerning opinion assignment.

The empirical literature has examined opinion assignment, in part to help adjudicate among these competing models of bargaining. Some of this evidence suggests that the power to assign the majority opinion is used strategically to influence case outcomes (Lax and Rader 2015; Maltzman et al. 2000). One of the most powerful research designs in the literature leverages “vote fluidity” to evaluate strategic opinion assignment. Vote fluidity refers to the idea that justices who are “marginal,” in the sense that they are ideologically proximate to the minority coalition, have the potential to “defect” and switch their votes from the majority coalition to the minority coalition. Past empirical studies have argued that justices who are closest to being on the fence between the two coalitions are assigned the majority opinion at a disproportionately high rate (Brenner 1982; Brenner and Spaeth 1988). Lax and Rader (2015) push this research design further by connecting it to four specific models of opinion writing: two monopoly models and two author influence models. They find evidence consistent with the claim that the chief justice uses opinion assignment to strategically maintain coalitions and induce opinions that are aligned with his preferences.

However, it has also been widely documented that there exists a norm by which opinion assignments are distributed evenly among the justices (e.g., Brenner and Palmer 1988; Maltzman and Wahlbeck 1996b; Maltzman et al. 2000). Assuming this norm is binding, if the justices’ relative preferences do not vary from case to case, then it is not possible for the chief justice to assign cases disproportionately to his ideological allies, though he might assign disproportionately important cases to them. But if relative preferences vary case to case, then the chief justice could use that variation to strategically assign cases to justices when they are most aligned with him, relaxing the constraint imposed by the norm of balanced workloads. Relying on measures of preferences that

do not allow for case-to-case variation in preferences has prevented previous analyses from comparing two competing accounts of strategic opinion assignment. According to the vote fluidity logic, the chief justice assigns opinions to marginal justices in order to hold coalitions together. According to author influence models, the chief justice has an incentive to assign opinions to justices that share his views on a given case, particularly when they do not do so more generally.

Because we estimate case-by-case preferences, we can exploit potentially consequential variation in which justices are closest to the Chief, or to other key positions in the distribution of justices, across different areas of law. To this end, we specify an empirical model in which opinion assignment is estimated as a function of either a justice’s ideological distance to the chief justice or ideological distance to the case-specific voting threshold (the point of indifference between the two coalitions). An alternative possible operationalization of the vote fluidity model is that distance to the median, rather than the coalition division, is what really matters. Thus, we also consider each justice’s distance to the court median. Finally, we consider each justice’s distance to the coalition median, which, though not predicted by the median of the majority coalition model, potentially captures the influence of the center of the majority coalition. In order to test these varying predictions about authorship assignment, we construct case-specific measures of the median justice, the ideal point of the majority coalition median, the voting cutpoint, and the chief justice. We then calculate the absolute distance for each justice to each of these points, for each case.

We specify a hierarchical conditional logit model, which we customize for these data. We limit our attention to the cases where the chief justice is in the majority and is therefore assigning the author of the opinion. The general form of the model using all four distance measures described above is as follows; however we also fit the model using one distance measure at a time by fixing other coefficients to zero. Let $Y_{ij} = 1$ if justice i is in the majority in case j . Where $S_{ij} \in \{0, 1\}$ indicates whether justice j was the author in case i , we fit a conditional logit model as a function of the position of that justice relative to the four positions. X_{1ij} is the distance from justice i to the cutpoint in case j ; X_{2ij} is the distance to the median of the court; X_{3ij} is the distance to the median of the majority coalition; X_{4ij} is the distance to the chief justice.

Each of these distance measures X_{kij} is estimated with uncertainty, and so we do not plug the mean posterior measure of each distance \tilde{X}_{kij} directly into the model. Instead, we model each measured mean posterior distance as distributed normally around the (unknown) true value of that

distance measure, with standard deviation equal to the standard deviation (error) of the posterior estimate (ω_{kij}):

$$\tilde{X}_{kij} \sim \mathcal{N}(X_{kij}, \omega_{kij}^2), \quad (2)$$

where $t \in \{1, 2, \dots, 27\}$ is the natural court for case j , and $r \in 1, 2, 3, 4$ is the chief justice for case j , our model has the following form:

$$S_{ij}^* = \gamma_{it}^{court} + \sum_{k=1}^4 \delta_{kt}^{court} X_{kij} \text{ if } Y_{ij} = 1, \quad (3)$$

$$S_{ij}^* = -\infty \text{ if } Y_{ij} \neq 1, \quad (4)$$

$$p(S_{ij} = 1) = \frac{\exp(S_{ij}^*)}{\sum_{i=1}^n \exp(S_{ij}^*)}. \quad (5)$$

Notice that we assume in our specification that if a justice is not on the court or not in the majority, her probability of authoring is zero ($S_{ij}^* = -\infty$). Among those who are on the court and in the majority (including the chief justice), the probability of authoring is generated by a conditional logistic model where the latent utility of authorship for each justice is based on a justice by natural court specific intercept γ_{it} , plus the effects of the distance measures k , which depend on natural court specific coefficients δ_{kt} . We generally expect the δ_{kt} to be zero or negative for most of the distance measures we consider, as the theories of authorship assignment we consider yield predictions where authorship probability declines as a justice's position gets further from the cutpoint, the court median, the majority median and/or the chief justice.

The slope and intercepts from this model are indexed by the natural court; however we specify the model as a hierarchical model, in which natural courts are nested within chief justice regimes. Such a specification allows us to make statements about the average relationships among all courts, among natural courts during a particular chief justice's tenure, and so forth. Thus, we include the following parameters and prior distribution assumptions in our model: $\gamma_{it}^{court} \sim \mathcal{N}(\gamma_{ir}^{chief}, \sigma_{\gamma}^{2, chief})$, $\gamma_{ir}^{chief} \sim \mathcal{N}(\gamma_i, \sigma_{\gamma}^2)$, $\delta_{kt}^{court} \sim \mathcal{N}(\delta_{kr}^{chief}, \sigma_{\delta}^{2, chief})$, $\delta_{kr}^{chief} \sim \mathcal{N}(\delta_k, \sigma_{\delta}^2)$, and $\sigma_{\gamma}^2, \sigma_{\delta}^2, \sigma_{\gamma}^{2, chief}, \sigma_{\delta}^{2, chief} \sim \mathcal{E}(1)$.

The hierarchical model for γ and δ reflects the fact that baseline authorship probabilities for a given justice will depend on the other justices on the court, and particularly on the chief justice. For example, if we set $\beta_{kt} = 0$, we would be assuming that the relative positions of justices on a given case versus other cases do not matter, but the γ_{it} would still allow for the possibility that some justices are more likely to author than others, given that they are both in the majority. These natural court-specific intercepts mean that the composition of the court as well as the average distance to a given chief justice is accounted for in the baseline probability of each justice authoring an opinion, conditional on be-

ing in the majority. As a result, any effects associated with the distance measures must come from within natural court variation across areas of law.

We program and simulate these models in JAGS (Plummer 2008) via R (R Development Core Team 2008), with reported results based on two parallel chains of 4,000 iterations, thinned by 2, recorded after a burn-in of 1,000 iterations. We summarize the core findings in figure 4, which shows the posterior estimates of the δ_{kt} coefficients for each natural court (posterior means and central 95% credible intervals). The top row of results shows slope estimates for four distinct (univariate) models in which we include only a single distance measure as a covariate, reflecting the distinct theoretical predictions from each model. The bottom row shows δ_{kt} estimates from a (multivariate) model that nests all the distance measures together in a single empirical specification assuming additive effects on the logit scale.

These results suggest that there are real and significant differences between the assignment strategies followed by different chief justices. When estimated in separate models, distance to the court median and to the chief justice are negatively associated with being assigned to author by the chief justice, both when used alone to predict assignment and in the model including all predictors. These findings are consistent with a class of theoretical models (both formal and informal) in which the chief justice simultaneously tries to assign opinions to individuals who share his policy views while also maintaining the stability of the majority coalition (e.g., Lax and Cameron 2007). The results for the majority median and cutpoint distances are weaker and less consistent between the univariate and multivariate models.

With respect to differences across the chief justices, there is evidence that Chief Justice Warren's assignment strategies were more influenced by distance to the court median than to his own position. This is suggestive of a more consensual model of assignment under Warren than under the later chief justices, one that aimed primarily to use authorship to consolidate the majority by ensuring that the author was close to the median of the court. In contrast, Chief Justice Burger's assignments are predicted most strongly by distance to his own position, strikingly more so than either Warren or Rehnquist. This is consistent with Burger's reputation as being particularly strategic in his authorship assignment decisions, with an aim to maximize his own influence on opinions (e.g., Woodward and Armstrong 1979). One particularly notable example arose in the context of *Roe v. Wade*, where the justices feuded at length over Burger's attempt to assign the opinion despite disagreeing with the disposition, resulting in a circulated, though not published, opinion by Douglas accusing the chief justice of acting

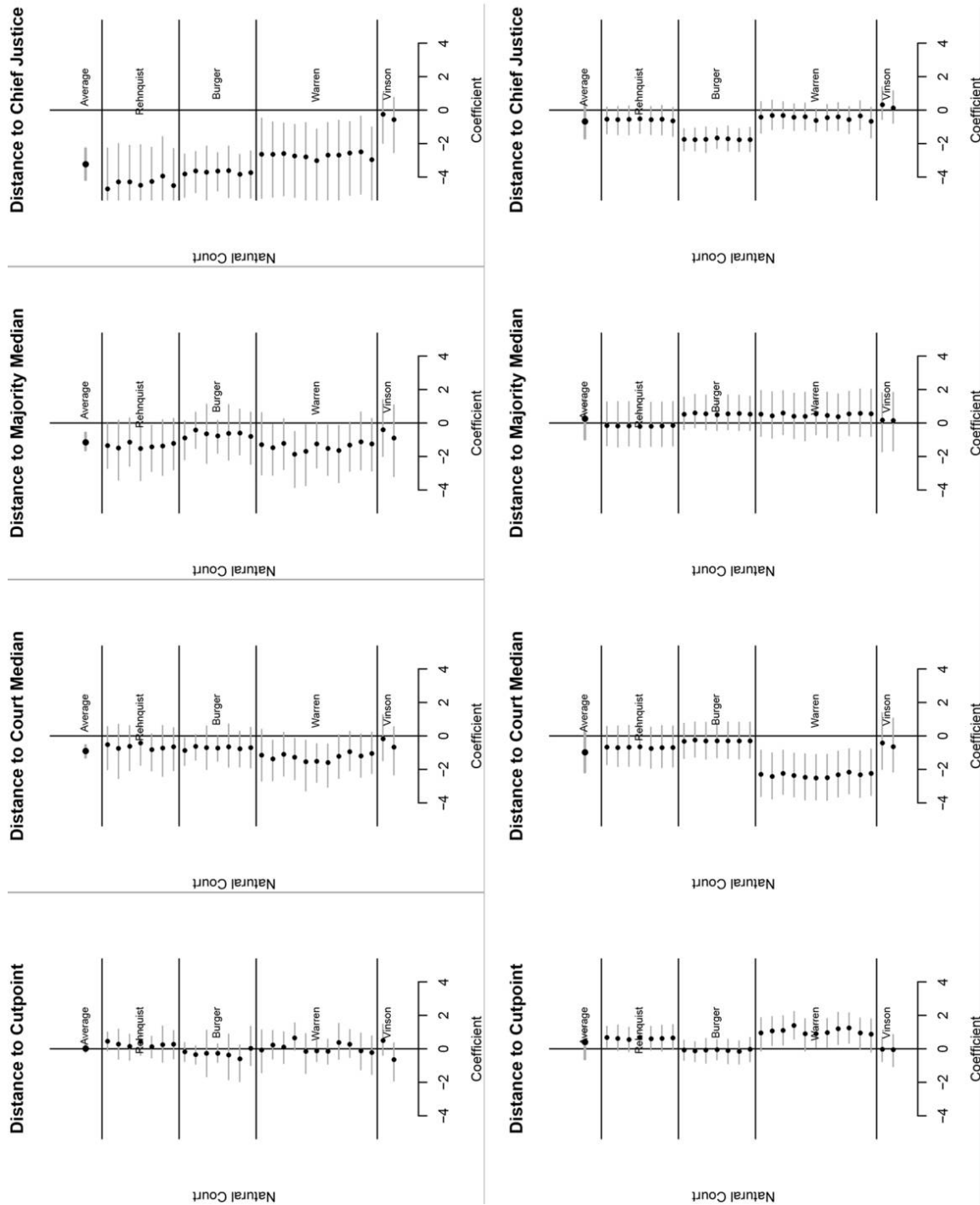


Figure 4. Coefficients of hierarchical conditional logit model for authorship, for each natural court in chronological order, with central 95% posterior intervals. The top row shows estimates from four models including only the single distance as a predictor. The bottom row shows estimates from four models including each of the distances together.

inappropriately (Schwartz 1988, chap. 4). Rehnquist appears to be somewhere in between Warren and Burger in terms of assignment strategy, with both proximity to the court median and to his own position weakly predicting assignment.

This evidence points to an insight that could only be recovered by contemplating case-specific preferences. Due to an empirical focus on static (Segal and Cover 1989) preferences, or preferences that can only vary term by term (Martin and Quinn 2002), scholars have missed a potential implication of the norm of proportionate assignment of opinions among the justices. Rather than simply being required to assign opinions to all justices and therefore strategically selecting “marginal” justices when there is a risk that a coalition will fall apart, it may instead be that the chief justice follows the norm of proportionate assignment by leveraging case-by-case variation to assign opinions to justices when they are more closely aligned either to the chief’s own position (Burger) or to the median of the court (Warren). Chief Justice Burger, and to a lesser extent Rehnquist, was able to utilize variation in which justices most strongly share his views to help sustain a pattern of relatively equal assignment across cases.

Modeling the decision to join an opinion

Part of the motivation behind the studies seeking to understand the choice of opinion author is an interest in the influence individual members of the court have over the content of the Supreme Court’s opinions. Various theories and empirical tests have appeared in the literature (for a review, see Clark and Lauderdale 2010). The key issue at hand concerns how the court’s institutional arrangements shape the way in which the collective views of up to nine justices will be aggregated into a single statement of law in the form of the court’s opinion. Among the many competing theories are claims that the median justice will control the court’s opinion (this argument is a direct application of Black 1948). Bonneau et al. (2007) argue that if the Supreme Court were to operate as a closed-rule institution, then the logic of Romer and Rosenthal (1978) would apply, and the opinion author would have some degree of control over the opinion. Other arguments are more oriented around the court’s actual institutional rules and constraints and make arguments about author influence (e.g., Lax and Cameron 2007) or the difference in bargaining leverage between members of the majority coalition and members of the minority coalition (Cameron and Kornhauser 2013; Carrubba et al. 2012). Related arguments contend that justices likely to “switch” sides and are therefore more marginal members of the majority coalition have special influence (e.g., Lax and Rader 2015).

These (sometimes) competing theories yield a set of predictions for which our estimates provide new empirical le-

verage. Justices who are more proximate to the opinion should be more likely to join the opinion. Therefore, we can evaluate whether the distance from a justice to any theoretically predicted point is predictive of her decision to join the majority opinion. From the existing literature, we identify five such points: (1) the cutpoint dividing justices into voting coalitions (more marginal justices have influence); (2) the court median; (3) the chief justice (assignment power); (4) the majority coalition median; and (5) the opinion author.

We model the decision to join a majority opinion by each member i in the majority voting coalition of case j . Let $O_{ij} = 1$ if justice i joins the majority opinion in case j and $O_{ij} = 0$ if she does not join the majority opinion. We specify the decision as a function of each justice’s distance to each of the theoretically implicated points in the voting space. As in the model for authorship, we explicitly incorporate the measurement error associated with the estimated distance measures, as described in the previous section. For this model, we also add in dummy variables Z_{lj} for the total number of judges l in the majority coalition on the decision in case j , to capture the fact that the incentives to join change with the number of justices in the majority, not just their relative positions. Coefficients for each of these variables are estimated for each natural court, hierarchically modeled within chief justices, hierarchically modeled within the entire period.

$$O_{ij}^* = \gamma_{iat}^{court} + \sum_{k=1}^5 \delta_{kt}^{court} X_{kij} + \sum_{l=1}^9 \nu_{lt} Z_{lj}, \quad (6)$$

$$p(O_{ij} = 1) = \frac{\exp(O_{ij}^*)}{1 + \exp(O_{ij}^*)}. \quad (7)$$

In the model for authorship, the slope and intercepts from this model were indexed by the natural courts, which we estimated as nested within chief justice regimes. Here we use a similar nested structure for the slope coefficients δ_{kt}^{court} and the coefficients on the dummy variables for coalition size ν_{lt} . However, we use a different nested structure for the intercepts, reflecting the goal of holding constant the joining justice, the authoring justice, and the overall composition of the court (natural court). We estimate separate intercept for each combination of these three, with the variation in these across natural courts varying around mean joining justice by authoring justice effects. Simulation details are also as in the previous application. The estimates for the coefficients on each of the five distance variables are reported by natural court in figure 5. As before, we report in the top row models that include only each of the distance measures individually and in the bottom row slope estimates from an empirical model that nests the theories into a single specification.

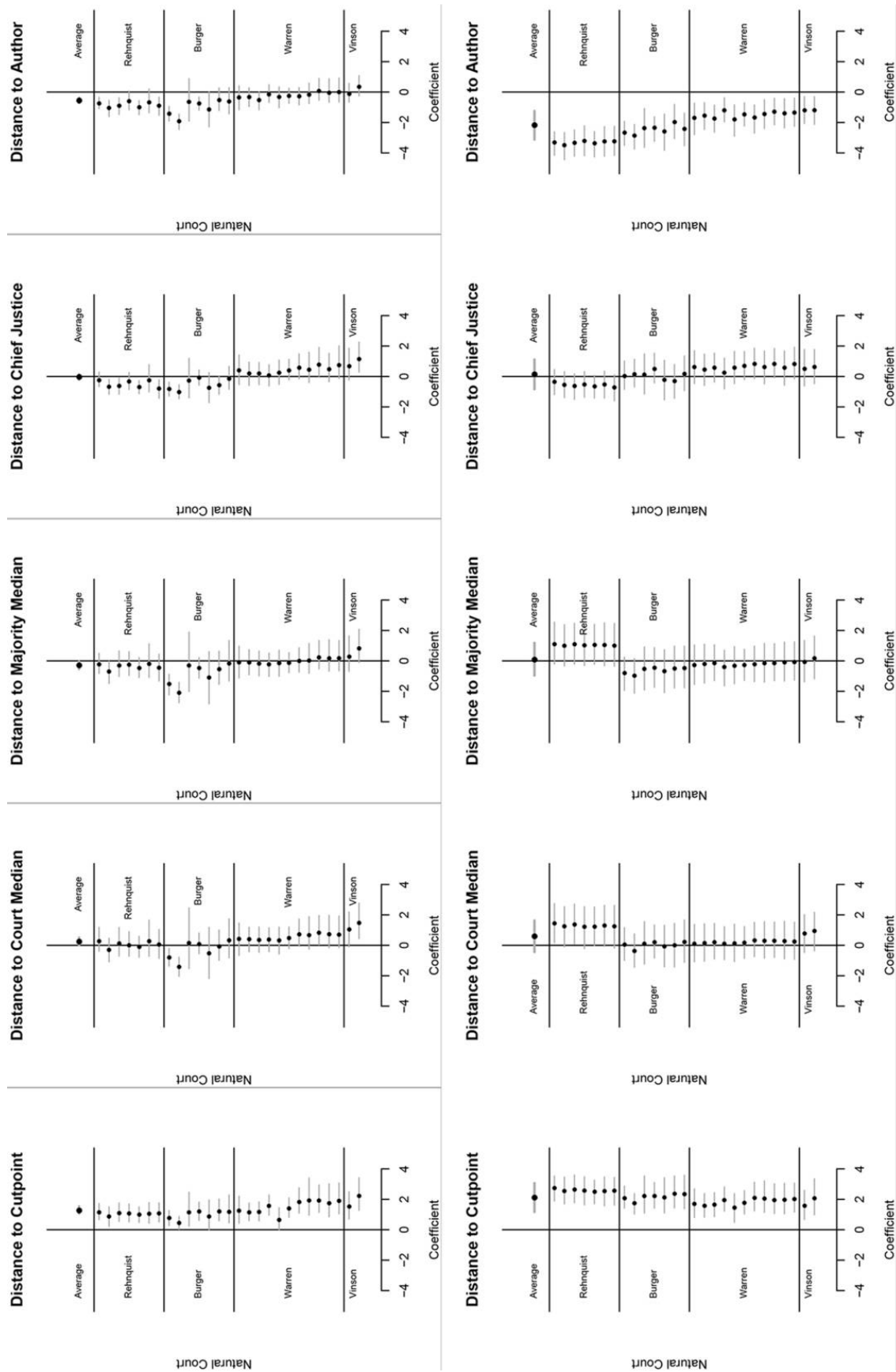


Figure 5. Coefficients of hierarchical logit model for joining the majority opinion, for each natural court in chronological order, with central 95% posterior intervals

Starting with the left column of figure 5 and moving through the columns in order, we find a clear positive association between distance to the cutpoint and joining the majority opinion in both the univariate and multivariate models. In the second column, we see a weak relationship between distance to the median justice and joining the majority opinion. In the third column, we see inconsistent and generally weak relationships with the distance from the median of the majority coalition. In the model that includes all five distance measures, though, the effect is consistently larger during the Warren and Burger courts. In the fourth column, there is similarly weak and inconsistent evidence that distance to the chief justice predicts joining behavior. Finally, in the fifth column is a negative association between joining the majority opinion and distance from the opinion author, which has grown stronger over time. This is a much stronger relationship in the multivariate model than the univariate model, a model in which there are positive associations between joining and distance to the cutpoint.

Why do we find a consistently strong negative association with distance to the author in the joint model at the same time that we also find positive associations with distance to the cutpoint? Recall that our model assumes a cutpoint voting decision in which any strategic incentives to vote against one's sincere preference operate spatially. If any justice, for example, to the right of the cutpoint is strategically induced to vote as if he were to the left of the cutpoint, then all justices to that justice's left are also so induced. The justices nearest the cutpoint in any given case are the most likely justices to be insincerely supporting the majority side of the case. This would tend to reduce their probability of joining the majority opinion, particularly when authorship is awarded to an extreme judge within the majority. When the situation is reversed, the extreme judge in a majority coalition with a moderate author has a much weaker incentive to not join the opinion, as their dispositional vote is always sincere.

All of these relationships reflect variation as a function of case-specific estimated position, holding fixed the joining justice, the authoring justice, and the natural court. The major implication of these results is that distance to the opinion author is the most powerful predictor of the decision to join a majority opinion, and this has become more true over time, at least since the end of the Warren court. Connecting these results back to those in the previous application and recognizing that the chief justice can only select the author, not the majority coalition, there is a strong suggestion that a strategic chief justice can use his assignment power to select opinion authors who share his own views in any given case, and this has consequences for the content of the opinions that are

ultimately written. Taken together, these two analyses suggest a strategic dynamic by which the chief justice knows that, given a particular majority coalition, the opinion author can influence the opinion content and therefore strategically selects different opinion authors as they vary from case to case.

Threats to inference

As with all studies of the history of the Supreme Court, the data we examine are observational, and it is necessary to be cautious in the interpretation we draw from the associations we find. The first stage of our analysis, generating case-specific preference estimates using dispositional voting and citation data, is fundamentally descriptive rather than causal. We understand our measures of preference as estimates of the relative positions of justices on a case, based on their behavior in legally similar cases. Where our analysis does implicate causal questions is when we move to the analysis of models relating these preference measures to opinion assignment and joining behavior.

We have argued that the association between distance to the chief justice and opinion authorship, holding fixed court composition and the identity of the Chief, suggests strategic assignment on the part of the Chief. This could also reflect strategic and successful lobbying for assignment by the associate justices, or some spurious association between the issue areas that particular justices specialize in authoring opinions within, and the preferences of those justices and the Chief. Since our identification strategy utilizes relative preference variation of justices across areas of law, we cannot effectively control for areas of law in the models for assignment and joining behavior.

Another set of alternative explanations for our results arise to the extent that the measure of legal adjacency that we use (i.e., citation) is endogenous to whether particular justices voted together, although we do not believe this is a major concern given the inferences that we draw. For it to matter that the specific cases cited are chosen after these outcomes that we consider, it would need to be the case that opinion authors catered to the chief justice or median justice by preferentially citing the past cases where they agreed with those justices on the disposition but did so in different ways under different chief justices.

To yield a similar spurious finding in our analysis of joins, the author would have to do this selectively for only the other justices in the majority who ultimately join the opinion. We also note again that our data include the total number of citations appearing in an entire set of opinions for a given case—including citations from majority, concurring, and dissenting opinions. If there exists a serious

concern that a precedent that is legally relevant is being downplayed by the majority, for example, then some other justice will have an incentive to note that in a separate opinion. What we cannot overcome, though, is the possibility that all potential legal questions or concerns raised by the litigants or participating justices are completely co-opted by the majority in a way not reflected in the pattern of citations in the case. While we cannot entirely rule out these possibilities, we can note that our results replicated using Westlaw Key Numbers rather than citations to generate measures of legal similarity, which are not produced directly by the judges. However, because those data are proprietary and not available publicly, we opt to rely on the publicly available citation data for the analyses here.

DISCUSSION AND CONCLUSION

In this article, we have described an approach to estimating case-specific (or vote-specific) preferences, using roll-call data in combination with data describing the substantive similarity of cases to one another. Our approach is a departure from most scaling methods in one fundamental respect: traditional scaling methods aim to simplify the patterns in the data as much as possible. This is attractive if the goal is parsimony, but leaves little variation left to be examined in subsequent analysis. Our “rescaling” method aims to simplify the patterns in the data as little as possible, aiming instead at making them interpretable for subsequent analysis. Case votes are binary, and we aim to give a smooth, flexible and continuous summary of the preferences that generate those votes. To generate this, we take account of how individuals voted in similar cases, as well as the varying polarity and cutpoints of individual cases. The model we present in this article is not the only way to generate such measures, but it is a particularly simple way of doing so. Citations are an especially attractive basis for generating case-specific preferences because they closely track the degree to which shared points of law are raised across cases.

As we note, the estimates of justice preferences at the individual case level are not particularly precise. Thus the goal of the exercise is not so much to estimate relative preferences of particular judges in particular cases but instead to generate measures that can be used in subsequent analysis of the set of cases as a whole. Our application is to the context of the Supreme Court, where we have made an argument for the utility of employing case-specific preferences in studying the arguments that have been previously made about the role of strategic bargaining in the process of generating majority opinions.

Armed with our estimates of preferences, an analysis of opinion authoring and joining strengthens past evidence

of the strategic incentives facing the justices. For example, while scholars have frequently observed the constraining effect of the norm of equal assignment of opinion-writing responsibilities across the justices and proposed norm-based justifications for this practice, our analysis suggests a norm of balanced workloads may be supported by the chief justice’s strategic assignment of opinions to justices who are closest to him in a given case (cf. Lax and Cameron 2007). But where one chief justice (Burger) might use this flexibility to ensure the author is relatively close to his own position, another might use this flexibility to ensure the author is relatively close to the median of the court (Warren). Taken together, these findings suggest a complex interaction among assignment power and bargaining among the justices that could not be documented as convincingly in the absence of case-specific estimates of judicial preferences. While our analysis is far from the final word in the study of Supreme Court bargaining, we hope that the estimation strategy and empirical applications reported here will open the door to future empirical investigations of additional theoretical predictions from the literature.

We conclude by reiterating that while our estimation approach fits particularly well with the logic of common law courts, it could also be applied to other contexts including to legislative voting. The measures of similarity between votes could be a text-based distance measure between legislative texts or debates, it could be a network-based function of connections to common underlying statutes, or something else. One can also estimate dynamic preference models by specifying the strength of connections as a function of chronological rather than legal distance. Of course more typical ideal point estimates remain attractive for many applications. The approach we present in this article is valuable primarily for incorporation into subsequent analyses that aim to leverage variation in preferences across different kinds of votes to assess whether observed legislative processes depend on relative preferences, or whether existing ideal point estimates proxy for other constant attributes of individuals.

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