

# Modeling Collegial Courts (3): Adjudication Equilibria

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## **Abstract**

We present a formal game theoretic model of adjudication by a collegial court. The model incorporates dispute resolution as well as judicial policy making and indicates the relationship between the two. It explicitly addresses joins, concurrences and dissents, and assumes “judicial” rather than legislative or electoral objectives by the actors. The model makes clear and often novel predictions about the plurality opinion’s location in “policy” space; the case’s disposition; and the size and composition of the disposition-, join-, and concurrence-coalitions. These elements of adjudication equilibrium vary with the identity of the opinion writer and with the location of the case. In general, the opinion is not located at the ideal policy of the median judge. The model suggests new departures for empirical work on judicial politics.

# 1 Introduction

Twenty years ago, positive political theorists began to adapt models developed for the study of legislatures and elections to the study of courts and adjudication. These models, though they have provided great insight into adjudication, largely transfer to courts the assumptions about agenda setting, voting protocols, and objectives used in the study of legislatures. Courts, however, are not legislatures; nor are judges legislators. Further progress requires closer attention to the institutional features that actually distinguish courts – especially collegial courts – from legislatures.

In this essay, we focus on three distinctive features of adjudication on collegial courts. First, a court, whether collegial or not, jointly announces a disposition of the case – whether plaintiff prevails or not – and a policy or legal rule.<sup>1</sup> The announced legal rule, when applied to the facts of the case, must dictate the disposition of the case actually chosen by the court. The *joint production* of resolved dispute and rule rationalizing that resolution is perhaps the most distinctive feature of a court, in contrast with a legislature. Modeling joint production requires significant modifications to the standard spatial theory of voting (Kornhauser 1992).

Second, the voting coalition supporting the majority disposition often differs from the voting coalition supporting the policy in the majority opinion, with substantively important implications for the reception of the opinion. For example, a majority of judges may agree that plaintiff should prevail (e.g., in a 7-2 vote on the U.S. Supreme Court), but this majority may disagree about the rule that should govern this class of cases (e.g., only five justices in the dispositional majority may "join" the majority opinion with the two other justices in the dispositional majority refusing to do so). In other words, even when a collegial court offers a majority opinion, the opinion may provoke "concurrences" as well as "dissents" (the latter being dispositional votes contrary to that of the majority). Most dramatically, courts – at least U.S. courts like the Supreme Court – need not even have a majority opinion, though they

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<sup>1</sup>This claim holds except in special cases. In particular, courts do not always publish their opinions. These unpublished opinions often provide few, if any, reasons for the decision. Thus, though they rely on a rule or policy they do not transform policy.

always must provide a majority disposition. For example, in a case with a 6-3 dispositional vote, the six justices in the majority may split their joins evenly between two competing opinions both of which support the majority disposition, so no single opinion receives a majority of votes or indeed a plurality.<sup>2</sup> The distinction between a dispositional coalition and a policy coalition arises in no voting system employed in any legislature of which we are aware. Moreover, the distinction is consequential since the distribution of votes across joins, concurs, and dissents affects the authoritativeness of the majority-side opinion or opinions in the eyes of legal observers (Ledebur 2009, Thurman 1992). In addition, the constraints imposed by the facts in the case may well alter or restrict the content of the opinion – a belief common among close readers of legal opinions.

Third, the objectives of judges who write opinions differ from the objectives usually attributed to contending candidates in electoral politics. Judges do not aim at winning *per se*; rather, they care about both the disposition of the case and the content of the rule announced by the court. Inevitably the most appropriate specification of the judicial objective function will be controversial (Baum 1998). We take a first cut at particularly “judicial” objectives by assuming that the justice who writes an opinion cares about the policy expressed in the opinion, the opinion’s authoritativeness as determined by the extent of support her opinion attracts from her colleagues, and the resolution of the dispute before the Court. We assume “joins” by non-authoring justices are similar to endorsements, and justices prefer to endorse proximal opinions that yield the “correct” disposition of the instant case.

Failing to account for these three features of adjudication – joint production of dispute resolution and policy, distinct dispositional and policy coalitions, and “judicial” preferences – creates considerable difficulties for the standard analyses of collegial courts. The difficulties are most apparent in the empirical methodology that estimates the ideal *policy* preferences of justices from data on the justices’ votes on *case dispositions* and then uses the estimated

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<sup>2</sup>Remarkably, the voting procedures employed on collegial courts contain no runoff rule when there are multiple “winning” majority-side opinions.

"ideal points" to discuss preferences about policy (Martin and Quinn 2002). But in the absence of a model linking preferences about policy to votes about case dispositions, this procedure seems groundless at best and potentially misleading at worst (Farnsworth 2007). Conversely, most theoretical models of collegial courts simply ignore case dispositions since the judges are presumed to have preferences only over policies and choose among them using the same procedures employed on the floor of Congress. This approach is incapable of addressing the impact of dispute resolution on opinion content. More fundamentally, voting procedures on collegial courts bear little resemblance to those employed in legislatures. Simple intuitions based on legislative procedure – like the results obtained with binary agendas under open or closed rules – may be a poor guide to actual equilibrium outcomes under judicial procedures, in the same way that intuitions from first-past-the-post electoral systems transfer poorly to systems using proportional representation.

New possibilities arise when one explicitly considers joint production, distinct dispositional and policy coalitions, and "judicial" preferences. We highlight four:

- *Opinion assignment is consequential and may affect opinion content non-monotonically.* In the model, opinion content depends on who the author is; more dramatically, assignment to more extreme justices may result in more moderate opinions than assignment to more moderate justices.
- *Dispute resolution may affect policy making.* In the model, the spatial location of the case may affect the spatial location of the Court's opinion. A case located on the wings of the Court (which consequently results in an unanimous dispositional vote) may lead to a policy very different than if the case had been located in the interior of the Court (which results in a split dispositional vote).
- *Policy making may affect dispute resolution.* In the model, the spatial location of the opinion often affects votes on the case's disposition. In extreme cases, changing the opinion location may alter not merely how many votes each plaintiff receives, but which

side prevails.

- "*Replacement effects*" can be *profound and non-monotonic*. In the model, replacing one justice with a new one often alters the content of opinions written by the *continuing* justices on the Court even if the location of the Court's median justice remains unchanged. In some cases, appointment of an extreme justice may lead authors to move their opinion away from the new justice.

We show below that many of these possibilities cannot arise in existing models. They also have strong implications for empirical work (we return to this point in the Conclusion).

We do not pretend the model in this paper fully resolves all the issues attendant on taking judicial procedures seriously. Indeed, the model finesses some very difficult problems involving free entry of multiple competing opinions. But this model, along with similar models – notably Carrubba et al 2008 – begins to address some of the most distinctive features of adjudication in collegial courts.

The paper proceeds as follows. Section 2 reviews the current state-of-the-art in modeling collegial courts. Section 3 presents the model. Section 4 details equilibria. Section 5 explores the comparative statics of opinion content and dispositions, focusing on the impact of the Court's composition and the assignment of opinions. Here we compare the predictions of our model to those of other models of collegial courts. Section 6 concludes. An Appendix contains several proofs. Many of the issues raised in this paper are novel, so we strive for clarity throughout.

## **2 Modeling Collegial Courts: The State of the Art**

Without claiming to be encyclopedic, we note ten recent efforts to analyze adjudication on collegial courts, employing to varying degrees formal game-theoretic methods. These are: 1) the current paper, 2) Carrubba et al 2008, 3) Fischman 2008, 4) Hammond et al 2005, 5) Jacobi 2009, 6) Landa and Lax 2009, 7) Lax 2007, 8) Lax and Cameron 2007, 9) Schwartz 1992,

and 10) Spiller and Spitzer 1995. For ease of reference, we denote the present study as [1] and refer to the nine others, numbered [2]-[10] following alphabetical order of first author. Hammond et al 2005 presents two models, which they call the "median holdout/open bidding" model and the "agenda control" models. We denote these as models [4a] and [4b]. Jacobi 2009 discusses three models, an "ideological" model, a "collegial" model, and a "strategic" model. We denote these models as [5a] through [5c], respectively. Thus, the ten papers present 13 models.

Table 1 highlights the structure of judicial preferences assumed in these recent models of collegial courts. Broadly speaking, three classes of arguments may enter judicial utility functions: 1) the policy content of opinions, 2) the disposition of the instant case (that is, whether the correct party prevails), and 3) other considerations. These other considerations include the effort cost of writing opinions, comity costs from failing to vote with the majority, and the reception or precedential impact or authoritativeness of the opinion. Each combination of these arguments is possible, including no judicial preferences whatever. In the latter approach, judges are viewed purely as a mechanical or stochastic process; however, we do not review this large class of models.

// Insert Table 1 about here //

As shown in Table 1, the largest cluster of models contains policy-only models (models [4a], [4b], [5a], [5c], and [10]). Models of this variety necessarily conflate dispositional coalitions and policy coalitions and ignore how dispute resolution might affect the policy content of opinions. In other words, these models treat judges as if they were legislators. Hand-in-hand with this approach, models in this cluster rarely specify actual game forms detailing endogenous entry of opinions and a formal voting procedure for choosing among them. Rather, they invoke well-known results from legislative voting games and assume they apply to the court, as if it were using legislative procedures. More specifically, several models ([4a], [10]) implicitly assume an "open rule" procedure, that is, a binary amendment procedure with free entry of amendments, leading to the selection of a condorcet winning

policy. In contrast, several models ([4b], [5a], [5c]) assume a "closed rule" procedure, that is, a single opinion paired against a "status quo" policy in an up-or-down binary vote, a procedure affording considerable influence to the opinion author.<sup>3</sup> No collegial court that we know employs either procedure.

A second cluster of models ([5b], [8], [9]) assumes that judges care about policy but also care about some other attribute of judicial opinions or the judicial decision making process. The innovator of such models, Schwartz 1992 (model [9]) assumes judges care not only about the policy content of opinions (assumed exogenous) but also their reception, treated as a choice variable "precedential value." Lax and Cameron 2007 (model [8]) is similar in spirit, in that judges value not only the policy content of the court's majority opinion but also its "quality" (both content and quality now endogenized). In addition, this model assumes judges face effort-costs in crafting higher quality opinions. The "collegial model," (model [5b]) discussed conceptually in Jacobi 2009, assumes judges care about policy but also unmodeled "norms of collegiality and consensus-building."

Within this cluster of models, [8] and [9] specify a game form. Model [9] allows no entry of opinions but assumes two exogenous policy alternatives (this assumption seems to reflect the conflation of decision-making over case dispositions – necessarily binary – with decision-making over policies (opinions), which need not be binary.) Model [8] requires the entry of at least one opinion (authored by the opinion assignee) and allows the entry of at most one other competing opinion. However, in equilibrium only one opinion enters. Presumably all the justices "join" this opinion, so all opinions are unanimous, but the model is silent on this point.<sup>4</sup>

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<sup>3</sup>Sometimes the "closed rule" procedure is rationalized by noting that appellate courts "affirm" or "reverse" a lower court; an "affirm" decision is then associated with maintaining the "status quo" policy. But to "affirm" means to affirm the lower court's *judgment* not its *policy*. It indicates the upper court supports the case disposition reached by the lower court. The upper court's policy supporting that disposition may be radically different from the lower court's policy even when the upper court affirms the lower court's judgment. No voting procedure employed by appellate courts explicitly pits contending opinions against the legal status quo in an up-or-down vote.

<sup>4</sup>Model [8] is formally in case space but case location plays no role in the analysis and the argument neither permits nor implicitly relies on a dispositional vote or a join decision.



The cluster of models containing [3], [6] and [7] stand at the polar extreme from the pure policy models. These models focus on preferences about case dispositions – whether the "correct" party prevails in the dispute. Landa and Lax 2009 and Lax 2007 (models [6] and [7]) consider a collegial court composed of judges with preferences that are essentially over case dispositions. Judicial preferences may be understood as either directly over case dispositions or as over rules that are separable in case dispositions. The separability assumption insures that each judge's decision on a case is independent of her decision on other cases. Model [7] then considers what legal rule, if any, outsiders might infer to predict the likely behavior of the court as a whole.<sup>5</sup> Model [6] examines the structure of rules that are constructed through majority voting. Fischman 2008 (model [3]) considers types of cases in which collegial courts engage in pure dispute resolution without announcing rules. An example is immigration cases, which very rarely result in published opinions. The model considers dispositional voting when the judges are also concerned with collegiality. In this sense it is similar to [5b] but the "collegiality norm" is explicitly modeled. Specifically, [3] treats dissensus as an externality imposed upon colleagues.<sup>6</sup>

A closer look at model [3] is instructive as it is explicit about the relation between cases, rules, and sincere and strategic dispositional voting. In the model, there is a one-dimensional "case space," so that a case is a vector in this space. There also is a corresponding one-dimensional policy space defined by a cut-point. The location of the case relative to the judge's preferred cut point determines her sincere view of the correct disposition of the case. Thus, the rule applied to the case indicates the "correct" disposition of the case, as required by the basic canons of jurisprudence. We employ this technology below. In [3], voting for a disposition different from her sincere view of the correct disposition imposes a cost on the

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<sup>5</sup>This model begins to supply formal micro-foundations for the large empirical literature on fact-pattern analysis, see Segal 1984 and Kastellec 2010a *inter alia*.

These two models might alternatively be placed in table 1's currently empty box of "Policy Preferences, Dispositional Preferences, Nothing Else".

<sup>6</sup>This model begins to supply theoretical micro-foundations for the large empirical literature on peer effects on collegial courts commencing with Revesz 1997; see Boyd et al 2010 and Kastellec 2010b and the references therein.

judge. In our model this loss is a constant, in [3] it is linear in the distance between the case location and the judge's ideal cut-point. In addition, dissent imposes a cost both on the dissenting judge (as it does in our model) and on the two majority judges. This latter cost does not appear in our model. In [3] as in our model, a judge may vote strategically on the disposition of the case. Because [3] treats only cases without opinions, there can be no entry of opinions and hence no policy voting.

Carrubba et al 2008 is the first model explicitly to allow judges to hold preferences over both case disposition and policy, and thus leads to the first model of collegial courts with explicit and distinct dispositional and policy coalitions. The model employs the case-space technology used in [3] but now allows the justices to choose a rule (a cut-point) to be employed in future cases.<sup>7</sup> The model begins by restricting attention to situations in which each justice values correct dispositions so intensely that no justice will ever vote against the disposition she most favors. So, strategic dispositional votes are ruled out *ex ante*. Second, it assumes that justices who find themselves in the minority on the dispositional vote have no influence in determining the majority's choice of a new policy. This assumption is consistent with the view that no policy rationalizing the majority's preferred disposition could ever attract a vote from a member of the dispositional minority. Third, it assumes a decisional procedure within the dispositional majority that selects a condorcet-winning policy for the members of the dispositional majority. This policy corresponds to the most-preferred rule of the median member of the dispositional majority.

Model [2] is in some respects more ambitious and in other respects less ambitious than the model below. Model [2], more fully than ours, acknowledges the importance of opinions that are joined by at least a majority of judges. From this perspective, a majority opinion becomes a public good (or bad) for members of the court. Unfortunately, the public good element of a majority opinion presents difficult analytic problems involving pivot calculations

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<sup>7</sup>It is assumed that the court's choice of a new rule constitutes a credible commitment. Model [2] does not analyze this issue in detail, nor do we do so in the model below. This issue is addressed in models [6] and [7].

in voting so as to free ride and avoid authoring costs. Public good problems become quite severe when several opinions compete for the majority, so that multiple non-Duvergerian equilibria become possibilities. The model below side-steps these issues. On the other hand, [2] is less ambitious than the model below in its preclusion of strategic dispositional voting and its insistence on condorcet-winning policies among the dispositional majority.

Finally, we note that no model (including the present one) allows simultaneous entry of more than two opinions with simultaneous voting across the multiple alternatives, with voting both for policies and dispositions.

### 3 The Model

#### *3.1 Cases, Rules, Dispositions, and Opinions*

Important building blocks of the model are *cases*, *rules*, *dispositions*, and *opinions*, concepts which we now formalize.

The fact or *case space* is the unit interval  $\widehat{X} = [0, 1]$ . A case  $\widehat{x}$  is a distinguished element of the case space  $\widehat{X}$ . The content of an opinion is a “rule,” a function that maps cases into dispositions: given the facts in the case, a rule produces a “correct” disposition. Dispositions are dichotomous, i.e. “for Plaintiff” or “for Defendant.” In our simplified model, we assume rules take the following form

$$r(\widehat{x}, x) = \begin{cases} 0 & \text{if } \widehat{x} < x \\ 1 & \text{if } \widehat{x} \geq x \end{cases} \quad (1)$$

where 0 indicates one disposition and 1 indicates the other. In words, a rule employs a cut-point  $x$  establishing two equivalence classes in the case space with respect to dispositions. For instance, a rule may establish a minimal standard of care, a maximum level of acceptable intrusiveness in a government search, a speed limit, a maximum level of entanglement of state operations with religion, and so on. Using the rule, all cases in which (for instance) the actual level of care  $\widehat{x}$  is less than the standard  $x$  are to receive one disposition, while all

cases in which the actual level of care meets or exceeds the standard are to receive the other. Although we simplify considerably, legal rules often take this form (see, e.g., Twining and Miers 1999).

Given this simple structure for rules, each rule can be indexed by its cut-point; in this special case, policy space is isomorphic to case space.<sup>8</sup> And, the content of each opinion corresponds to the cut-point of the rule it proposes. Accordingly, we denote rule content by  $x \in X = [0, 1]$ . (Formally, the case space  $\hat{X}$  should be distinguished from the opinion space  $X$  though here both are the unit interval.)

### 3.2 *Players and Strategies*

The players are the nine justices, one of whom, the "author", acts as the designated opinion writer. The remaining non-writing justices decide whether to join the author's opinion and cast votes on the case disposition. When referring to a justice as writer we employ subscript  $j$ ; when referring to any other justice we employ subscript  $i$ .

The opinion writer determines the content of the opinion,  $x_j \in X$ , the spatial location of his candidate rule's cut-point. As explained previously, the opinion location in tandem with the case location  $\hat{x}$  implies a case disposition associated with the opinion,  $r(\hat{x}, x_j)$ . Each justice must vote on the case disposition and may or may not join the opinion, effectively endorsing its content. A non-writing justice's action is thus defined by two components, 1) a *dispositional vote*  $d_i \in D = \{0, 1\}$  (e.g. "for Defendant", "for Plaintiff"), and 2) a *join decision*  $s_i \in S = \{0, 1\}$  (i.e., not join, join). Importantly, each justice's pair of decisions must satisfy an *endorsement-consistency constraint*: if a justice joins the opinion, her dispositional vote must conform to that entailed by the opinion's policy when applied to

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<sup>8</sup>More generally, policy space is a set of allowable partitions of case space. Not all understandings of allowable partitions yields an isomorphism between case space and policy space. Consider a set of policies governing allowable speeds on limited access highways. Case space consists of the speed at which the individual drives; we may normalize this to the interval  $[0,1]$ . We might consider policies characterized by two numbers: a minimum speed and a maximum speed. Policy space then consists of all partitions of  $[0,1]$  with this structure that identifies an interval within  $[0,1]$  of allowable speeds. Policy space is now two-dimensional though case space remains one-dimensional. Typically, however, judicially announced policies are simple partitions in the sense they usually create two equivalence classes (see Kornhauser 1992).

the case. Formally, if  $s_i = 1$  then  $d_i = r(\hat{x}, x_j)$ .

The sequence of play is as follows:

1. A case  $\hat{x}$  arrives.
2. A writer  $j$  is designated, who writes an opinion  $x_j$ .
3. Acting simultaneously, the non-writing justices first i) choose whether to join the opinion, and then ii) vote on the disposition of the case; the pair of actions must obey the endorsement-consistency constraint. Majority rule then determines the case disposition.
4. Non-authors receive payoffs based on their dispositional vote, join decision, the opinion's content, and the case location. The author's payoff is similar but also reflects the number of joins received by the opinion and whether a majority of the justices were in dissent (we discuss this possibility shortly).

//Insert Figure 1 about here //

Figure 1 displays the game form associated with the sequence of play, for a three member Court. Justice 1 is the opinion writer; opinions to one side of the case  $\hat{x}$  entail disposition 1, opinions on the other side entail disposition 2. As shown, Justice 2 makes a join decision and then casts a dispositional vote (e.g., “Disp1” or “D1” in the figure); simultaneously Justice 3 does the same (information sets are shown with dashed lines). The endorsement-consistency constraint makes some portions of the game tree unreachable. For clarity, we include these “ghost” portions in the figure but indicate them in gray. We assume the opinion author, Justice 1, joins his own opinion. Summary outcomes are shown at the terminal node using standard legal terminology.

A seemingly odd feature of the sequence of play is that the game may terminate with a majority of the justices dissenting from the author's opinion. This is shown, for example, in the bottom node of the top tree in Figure 1. However, as will be seen, this outcome is never an equilibrium in the game.<sup>9</sup>

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<sup>9</sup>In practice, if a majority dissented the author would have to re-draft and re-submit his opinion. Thus, one can view the game form in Figure 1 as the stage game in an infinite horizon game, in which the game

The actions and sequence of play imply strategies in the game. An opinion-writing strategy for the author is  $\chi_j$ , a function from cases into rules (cut-points). That is,  $\chi : \widehat{X} \rightarrow X$ . A join strategy is a function from cases and opinions into join decisions,  $\sigma : \widehat{X} \times X \rightarrow S$ . A dispositional vote strategy is a function from cases, opinions, and own join actions into dispositions,  $\delta_i : \widehat{X} \times X \times S_i \rightarrow D$ . An adjudication strategy for a non-writing justice is thus the ordered pair  $(\delta_i, \sigma_i)$  while an adjudication strategy for the opinion author is the triple  $(\chi_j, \delta_j, \sigma_j)$ . However, in what follows, we require the opinion writer to join her own opinion.<sup>10</sup> The endorsement consistency constraint then effectively reduces the opinion author’s strategy to the singleton,  $\chi_j$ , the opinion-writing strategy.

Outcomes follow from the players’ strategies. The disposition of the case results from simple majority rule applied to the nine dispositional votes. Call the majority winning disposition  $\tilde{d}$ . If  $r(\widehat{x}, x_j) = \tilde{d}$ , the author’s opinion is compatible with the winning disposition – we call such an opinion a “majority-disposition compatible” opinion. The number of joins received by a majority-disposition compatible opinion plays an important role in the subsequent analysis. Define the *aggregate join function* for opinion  $x_j$  as  $n(x_j) = \sum_{i \neq j} s_i + 1$  (recall the author joins her own opinion). Finally, it is convenient to define the 9-tuple of disposition votes as  $d \equiv (d_1, d_2, \dots, d_9)$ , the 9-tuple of join decisions as  $s \equiv (s_1, s_2, \dots, s_9)$ , and the 9-tuple of join strategies as  $\sigma \equiv (\sigma_1, \sigma_2, \dots, \sigma_9)$ .

### 3.2.1 Joins, Concurrences, and Dissents

We argue that join decisions and dispositional votes involve different considerations so it is important to consider adjudication strategies as the ordered pair  $(\delta_i, \sigma_i)$ . It is more common, however, to discuss the compound join-dispositional vote decisions; these compound actions have special names in legal terminology. For example, suppose the proposed

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terminates in any stage in which a majority of the justices do not dissent. A seemingly natural solution concept would be stationary Markov perfect equilibrium; but here that implies the same equilibrium as in the stage game considered as a one-shot game. Hence, we focus on that game.

<sup>10</sup>As the author must write in any event, concurring with her own opinion simply requires her to write twice. In some, but not all instances, the opinion writer would rationally join her own opinion.

opinion  $x_j$  requires a ruling for the Plaintiff, given the facts in the case  $\hat{x}$ :  $r(\hat{x}, x_j) = 1$  (recall equation 1). Then the ordered pair of actions  $(d_i, s_i) = (1, 1)$  indicates a so-called “join”: a dispositional vote in accord with the content of the opinion and a join decision joining (endorsing) the opinion. The ordered pair of actions  $(1, 0)$  indicates a so-called “concurrence”: a dispositional vote in accord with the content of the opinion but a refusal to join (endorse) the opinion. The ordered pair of actions  $(0, 0)$  indicates a so-called “dissent”: a dispositional vote opposite to that indicated by the opinion and a refusal to join (endorse) the opinion.

Critically, the ordered pair of actions  $(0, 1)$  is not possible when  $r(\hat{x}, x_j) = 1$  (and the  $(1, 1)$  pair is not possible when  $r(\hat{x}, x_j) = 0$ ): in American jurisprudence a justice is not allowed to join the opinion yet cast a dispositional vote contrary to that required by the opinion’s rule when applied to the facts in the case. So, for example, a justice cannot endorse a rule that requires a disposition for the Defendant but then vote for a disposition in favor of the Plaintiff (simultaneously “join” and “dissent”). This is the endorsement-consistency constraint discussed previously: If  $s_i = 1$  then  $\delta_i(\hat{x}, x_j | s_i = 1) = r(\hat{x}, x_j)$ .

### 3.3 Utility

#### 3.3.1 Utility of Non-Authoring Justices

We define the utility of a non-writing justice as a function over her actions, given the case and the opinion:  $u_i : D \times S \times X \times \hat{X} \rightarrow \mathbb{R}$ . Before we define this function, we require the following. First, let  $\bar{x}_i$  be justice  $i$ ’s ideal rule, a particular point in the space of possible cut points  $X$ . Note that justice  $i$ ’s ideal disposition of the case is  $r(\hat{x}, \bar{x}_i)$  (using equation 1). Second, define the indicator function

$$I(d_i, \hat{x}, \bar{x}_i) = \begin{cases} 1 & \text{if } d_i \neq r(\hat{x}, \bar{x}_i) \\ 0 & \text{otherwise} \end{cases}$$

This function takes the value “1” if the justice’s actual disposition vote does not corre-

spond to her ideal disposition of the case, and takes the value “0” if it does. Third, let  $k$  denote the effort cost of writing a concurrence or dissent, an explanation of why the author’s opinion is a poor rule (it is a norm in American jurisprudence that justices explain their actions).

We can now define non-writing justice  $i$ ’s utility:

$$u_i(d_i, s_i, x; \hat{x}) = s_i v(x_j, \bar{x}_i) - (1 - s_i)k - \gamma I(d_i, \hat{x}, \bar{x}_i) \quad (2)$$

Equation 2 has the following interpretation. If the justice endorses the author’s opinion by joining it (so  $s_i = 1$ ), she receives a policy loss  $v(x_j, \bar{x}_i)$  through her association with the opinion. If she declines to join the opinion, she does not suffer this loss but she must pay the effort cost  $k$  required to write a concurrence or dissent. Finally, if her dispositional vote is not in accord with her ideal disposition of the case, she suffers a dispositional loss  $\gamma$ . We require  $\gamma \geq 0$ .

We assume the policy loss function  $v(x_j, \bar{x}_i)$  attains a minimum loss at the ideal rule  $\bar{x}_i$ , is continuous and involves increasing loss for opinions increasingly distant from the justice’s ideal rule, is symmetric around the justice’s ideal rule, and displays the single crossing property, as is standard in the spatial theory of voting. An example of such a loss function is the quadratic loss function:  $-(x_j - \bar{x}_i)^2$ . Thus, we assume a justice prefers to be associated with a rule that more closely resembles her ideal rule.

The utility of non-writing justices is defined over all possible combinations of join choices and dispositional votes but the endorsement-consistency constraint precludes a simultaneous “join” and “dissent.” The endorsement-consistency constraint can lead to tension between casting the “correct” dispositional vote in the instant case and endorsing a relatively attractive opinion, a point discussed in detail in Section 4.



### 3.3.2 Utility of the Opinion Writer

We assume the opinion writer has preferences identical to those of the non-writing justices in all respects save two. First, the opinion writer cares not only about her dispositional value ( $\gamma$ ) and association with a policy ( $v(x_j, \bar{x}_j)$ ) but also about the “authoritativeness” of the opinion. Specifically, we assume the opinion writer prefers a majority-disposition compatible opinion with more joins to the same majority-disposition compatible opinion with fewer joins. (Recall that a majority-disposition compatible opinion entails a disposition in the case that is the same as the majority winner in the dispositional vote). We introduce this aspect of her preferences in the simplest possible way: her preference for joins is separable from the other aspects of her preferences. Second, the opinion writer suffers a large loss,  $\kappa$ , from failing to author a majority-disposition compatible opinion. We thus have:

$$u_j(d_j, s_j = 1, x; \hat{x}) = \begin{cases} \beta n(x_j) + v(x_j, \bar{x}_j) - \gamma I(d_j, \hat{x}, \bar{x}_j) & \text{if } \tilde{d} = r(\hat{x}, x) \\ v(x_j, \bar{x}_j) - \gamma I(d_j, \hat{x}, \bar{x}_j) - \kappa & \text{otherwise} \end{cases} \quad (3)$$

The top component in equation 3 accrues to the opinion writer if her opinion is compatible with the majority-winning disposition; she receives the bottom component if it is not. The parameter  $\beta$  indicates the marginal value to the author of an additional join when her opinion is majority-disposition compatible; we assume  $0 \leq \beta \leq 1$ . (Recall the aggregate join function for opinion  $x_j$ ,  $n(x_j)$ ). We require  $\kappa$  to be large enough so that penning the most attractive majority-disposition incompatible opinion is always worse for the author than penning the least attractive majority-disposition compatible opinion.<sup>11</sup> We suppress the cost of writing  $k$  for the opinion author as she is obliged to produce an opinion – her effort cost is infra-marginal.

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<sup>11</sup>The most attractive majority-disposition incompatible opinion will be written at the author’s ideal point and allow her to cast a “correct” dispositional vote. The least attractive majority-disposition compatible opinion will be written at the most distant location, gain no joins but her own, and require the author to vote for the “incorrect” disposition. Let  $\underline{v} = v(0, 1)$  and  $\bar{v} = v(\bar{x}_j, \bar{x}_j)$ . Then we require  $\kappa \geq \bar{v} - \underline{v} + \gamma - \beta$ .

### ***3.4 Discussion***

Each of a justice’s two actions – the disposition vote and the join decision – affects a distinct public good. The first public good is the majority-winning case disposition. The second is the degree of authoritativeness for a majority-disposition compatible opinion, which results from aggregating the join decisions. In practice, authoritativeness may jump as the number of joins passes through five, as discussed earlier. To the extent the justices value these public goods, they must engage in extremely sophisticated calculations about the pivotality of their dispositional vote and the impact of their join decision on the authoritativeness of a disposition-majority compatible opinion. Strategic calculations about the two public goods may interact in complicated ways. For example, is it better to achieve an authoritative precedent even if doing so brings the wrong disposition in the instant case?

Our specification of utilities allows us to analyze a baseline case that abstracts from these public goods problems as far as possible: we assume a non-authoring judge evaluates her dispositional vote and join choice purely as acts in themselves; we assume the opinion author also evaluates her own actions but, as the “owner” of the opinion, also cares about its authoritativeness.<sup>12</sup> The assumption of act-oriented justices follows some noted models of electoral competition which treat voters in a similar way (e.g., Callander and Wilson 2007, Hinich et al 1972, Osbourne and Slivinski 1996, Palfrey 1984). But arguably act-orientation is particularly appropriate for the judicial setting. It corresponds to the situation in which a judge asks herself, “What do I think is the right action here, in and of itself?” As will be seen, considerable strategic complexity emerges even in this baseline case.

## **4 Equilibrium**

We now indicate sub-game perfect equilibria to the adjudication game. We proceed by backward induction. Hence, we begin with the dispositional vote strategies and then the join

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<sup>12</sup>It would be easy to allow non-writers to value authoritativeness as well, provided that quality is linearly increasing in joins. Doing so in effect would reduce “ $k$ ” for a non-writer.

strategies of the non-writing justices. We then turn to the opinion author’s writing strategy. As the opinion author’s utility depends on the number of joins, we use the individual join strategies to define  $n(x_j, \sigma)$ , the aggregate join function given an opinion location and a vector of join strategies by the non-authors. We use this aggregate join function in tandem with the policy loss function and dispositional value to characterize the author’s writing strategy. The join and voting strategies of the non-authors and the author’s writing strategy together define an adjudication equilibrium.

#### ***4.1 Voting and Joining Strategies by Non-authors***

Given equation 2, the sequence of play, and the endorsement-consistency constraint, non-authoring justices have a simple dispositional voting strategy: they must vote for the disposition required by the opinion if they join the opinion, but if not they should vote so as to avoid a dispositional loss (that is, they should vote for their ideal disposition in the case). Recalling that  $r(\hat{x}, x_j)$  is the disposition required by the rule in the opinion given the facts in the case and  $r(\hat{x}, \bar{x}_i)$  is justice  $i$ ’s ideal disposition of the case in light of its facts, we have

$$\delta(s_i, \hat{x}, x_j, \bar{x}_i) = \begin{cases} r(\hat{x}, x_j) & \text{if } s_i = 1 \\ r(\hat{x}, \bar{x}_i) & \text{if } s_i = 0 \end{cases} \quad (4)$$

Now consider the situation when the endorsement consistency constraint implies a dispositional loss, that is, when joining the opinion requires a dispositional vote other than the justice’s ideal disposition vote. This situation occurs when the cut-point in the opinion and the ideal cut-point of the justice lie on opposite sides of the case, that is, when  $sgn(x_j - \hat{x}) \neq sgn(\bar{x}_i - \hat{x})$ . Call this an “opposite-side opinion” – joining an opposite-side opinion brings a dispositional loss. Conversely, the endorsement consistency constraint forces no dispositional loss in joining a “same-side opinion.”

From equations 2 and 4, it will be seen that joining versus non-joining involves a comparison between 1) a policy loss plus a dispositional loss (if the opinion is an opposite-

side opinion) and 2) a writing cost. The policy loss will be less onerous when the opinion is not too distant from the justice's ideal rule. Define justice  $i$ 's set of endorsable opinions  $\Delta_i$

$$\Delta_i \equiv \begin{cases} \{x | v(x, \bar{x}_i) \leq k\} & \text{if } x \text{ is a "same side" opinion} \\ \{x | v(x, \bar{x}_i) \leq k - \gamma\} & \text{if } x \text{ is an "opposite side" opinion} \end{cases} \quad (5)$$

For example, if the policy loss function is a quadratic loss function, the set of endorsable opinions is  $[\bar{x}_i - \sqrt{k}, \bar{x}_i + \sqrt{k}]$  for same-side opinions and  $[\bar{x}_i - \sqrt{k - \gamma}, \bar{x}_i + \sqrt{k - \gamma}]$  for opposite-side ones.

It is apparent, then, that a non-authoring justice should join an endorsable opinion but no others:

$$\sigma_i(x_j, \hat{x}, k, \gamma) = \begin{cases} 1 & \text{if } x_j \in \Delta_i \\ 0 & \text{otherwise} \end{cases} \quad (6)$$

Note that if a justice is indifferent between joining and not joining an opinion, equations 5 and 6 imply that she endorses the opinion.<sup>13</sup>

We summarize the above analysis in the following proposition.

PROPOSITION 1. (Non-authors' adjudication strategy). *The adjudication strategy for non-authoring justices  $(\delta_i, \sigma_i)$  is given by equations 4 and 6, where  $\Delta_i$  is defined in equation 5 and  $r(\hat{x}, x_j)$  is defined in equation 1.*

PROOF. From the above discussion, 4 clearly specifies an optimal dispositional voting strategy. Similarly, given equation 4, a non-authoring justice can do no better in her join choice than by following equation 6. ■

// Insert Figure 2 about here //

An implication of Proposition 1 is that each justice has a "join region" around her ideal rule: if the opinion lies within the join region, she joins it; otherwise, she does

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<sup>13</sup>This specification avoids an open set problem in the author's optimization problem.

not. This is shown in Figure 2. To make matters concrete, suppose in Figure 2 that the justice’s policy loss function is a quadratic loss function. Then her join region is the interval  $[\bar{x}_i - \sqrt{k - \gamma}, \bar{x}_i + \sqrt{k}]$  (assuming  $\hat{x} > \bar{x}_i - \sqrt{k - \gamma}$ ). If the author’s opinion lies in the region  $[\bar{x}_i - \sqrt{k - \gamma}, \hat{x}]$  the justice will join it even though the endorsement constraint forces her to vote for the “wrong” disposition. This occurs because the opinion is so attractive. We call this join behavior a strategic join or a *cross-over join*, since it involves endorsing an opposite-side opinion. If the dispositional loss  $\gamma$  is small or zero, the region in which the justice is willing to engage in a cross-over join expands. Conversely, if  $\gamma \geq k$  a judge will never engage in a cross-over join, so she is unwilling to join a highly proximate opinion if it yields the “incorrect” case disposition.

## 4.2 Authoring Strategy by Opinion Author

We now turn to the strategy of the opinion author. Recall that the opinion author suffers a policy loss if she authors an opinion different from her ideal policy and a dispositional loss if she authors an opinion that requires a disposition different from that required by her ideal rule. These concerns parallel the concerns of the non-writing justices. In addition, the opinion writer values more authoritative opinions, i.e., *ceteris paribus* she prefers an opinion that attracts more joins to one that attracts fewer joins. To proceed, then, we must first determine how the number of joins varies with the opinion location. We then consider the opinion writer’s choice of opinion.

### 4.2.1 The Aggregate Join Function

The aggregate join function  $n(x_j, \sigma)$  consists of the join from the opinion author  $j$ , plus the sum of the join decisions of the non-writing justices as required by equation 6 for each non-writing justice:

$$n(x_j, \sigma) = 1 + \sum_{i \neq j} \sigma_i(x_j; \bar{x}_i, \hat{x}, k, \gamma)$$

An illustrative aggregate join function is shown in the left-hand panel of Figure 3.

//Insert Figure 3 about here //

The aggregate join function’s exact shape depends sensitively on the distribution of ideal points, the cost of writing concurrences and dissents and – when the justices value correct case dispositions – the case location and the magnitude of dispositional losses. Broadly speaking, however, the aggregate join function takes the form of “steps” each indicating a specific number of joins in a segment of the case space. The aggregate join function is not continuous (though it is drawn so in Figure 3 for ease of visualization) but given the definition of the individual join functions it is upper semi-continuous, a fact of some importance subsequently.

#### 4.2.2 The Choice of Opinion

We now prove the existence of an optimal authoring strategy by the opinion author. Recall the opinion writer’s objective function, equation 3:

$$u_j(d_j, s_j = 1, x; \hat{x}) = \begin{cases} \beta n(x_j) + v(x_j, \bar{x}_j) - \gamma I(d_j, \hat{x}, \bar{x}_j) & \text{if } \tilde{d} = r(\hat{x}, x) \\ v(x_j, \bar{x}_j) - \gamma I(d_j, \hat{x}, \bar{x}_j) - \kappa & \text{otherwise} \end{cases}$$

To maximize this function, the opinion writer wishes to set the content of her opinion so as to maximize the net gain from joins less the loss of departing from her most-preferred rule and any dispositional loss.

The following lemma asserts that the space of opinions over which the writer chooses is a compact set; a proof is in the Appendix.

LEMMA *The set of opinions that command a dispositional majority,  $X_d(\hat{x})$ , is a compact set.*

PROPOSITION 2. (Existence of an optimal opinion). *There exists an opinion  $x_j^* \in X_d(\hat{x})$  that maximizes equation 3.*

PROOF. The aggregate join function is upper semi-continuous and the policy loss function is continuous on the entire case space, so their sum is upper semi-continuous on that space. From the lemma, the set of opinions that command a dispositional majority,  $X_d(\hat{x})$ , is a compact subset of the case space. Accordingly, from an extension to the extreme value theorem, equation 3 must achieve a maximum on  $X_d(\hat{x})$  (see Theorem 2.43 in Alliprantis and Border 2005 (p. 44)). ■

In fact, it is easy to characterize  $x_j^*$ , at least in broad terms. Consider the step (or steps) of the aggregate join function whose range contains an argmax of equation 3. If the opinion writer's ideal rule is also an element of that step's domain and can command a dispositional majority, the writer offers her ideal policy as  $x_j^*$ . If her ideal rule is not in the domain of that step or cannot command a dispositional majority, she offers the element of the step's domain closest to her ideal rule that can do so, the element on the edge step's support in the direction of her ideal rule. Note that  $x_j^*$  is always well defined, as every point that is a member of an open set for one step is a member of a closed set for a higher step.

It is possible for more than one point to maximize equation 3, although this situation is clearly somewhat special. In such a case, a writer would be free to offer either the maximizing opinion that is closer to her ideal rule, or the maximizing opinion that attracts more joins.

### ***4.3 Equilibrium Characterization***

We can now state and prove the paper's main result. Although the result is straightforward, its implications are much less so. Consequently, we supply an example that illustrates the authoring behavior of the opinion writer and the joining and dispositional voting of the non-authors. Then, in the next sections, we will return to the example to illustrate important points about the model's comparative statics.

### 4.3.1 Main Proposition

PROPOSITION 3. (Equilibrium). *Given the nine ideal policies  $\bar{x}_1 \dots \bar{x}_9$ , the case location  $\hat{x}$ , the cost of authoring  $k$ , the value of joins  $\beta$ , and the disutility  $\gamma$  from casting an incorrect dispositional vote, the opinion writer  $j$  offers  $x_j^*(\bar{x}_1 \dots \bar{x}_9, \hat{x}, \beta, \gamma, k) \in X_d(\hat{x})$ , joins this opinion, and casts the dispositional vote required by  $r(\hat{x}, x_j)$ . Each justice  $i \neq j$  joins the opinion if and only if  $x_j \in \Delta_i$ . Finally, each justice who joins the opinion casts a dispositional vote according to  $r(\hat{x}, x_j)$ ; those who do not join the opinion cast a dispositional vote according to  $r(\hat{x}, \bar{x}_i)$ .*

PROOF. From combining Propositions One and Two. ■

### 4.3.2 Example

To illustrate the "basics" of the model, we provide a baseline example in which policy losses are quadratic, the case does not present justices with a dispositional value ( $\gamma = 0$ ), and the writing cost  $k = .05$ , so that a justice will join an opinion if and only if it lies within  $\sqrt{k} = .22$  of her ideal policy.

*Aggregate Join Functions in a Non-polarized Court.* Suppose the nine justices are quite non-polarized, so that justice 1 has an ideal point at .1, justice 2 at .2, and so on. The left-hand panel of Figure 3 shows the aggregate join function facing Justice 2; the functions for the other justices are broadly similar but not identical, since the identity of the non-writing eight justices varies. To aid visualization, we draw the aggregate join functions as continuous; in fact, they are only upper semi-continuous. The opinion author always joins her own opinion since she is obliged to pay  $k$  in any event, a sunk cost. Parts of the aggregate join function far from an opinion author reflect this single assured join.

*Opinion Location and Joins.* The policy loss function and aggregate join function facing an opinion author are key components in her decision where to locate her opinion. But also important is the case location even when the dispositional value is negligible. This is because the opinion author is constrained to write a majority-disposition compatible opinion,



one for which the number of joins plus the number of concurrences is greater than five (or equivalently, the number of dissents is no greater than four). For the moment, we assume an extreme case location (greater than .9 or less than .1) to avoid this complication. For such an extreme case, there are no dissents (all non-joins are concurrences) so the “majority disposition constraint” is immediately satisfied. We examine the implications of a non-extreme case shortly.

In the baseline example, assume Justice 2 is the opinion author. As shown in the left-hand panel of Figure 3, an opinion written at Justice 2’s ideal policy would garner four joins (including her own). An opinion placed at several more central locations would gain six joins; of these locations, the one closest to Justice 2 is the location that receives endorsements from Justices 3-7, plus Justice 2. This location occurs at  $.7 - \sqrt{.05} = .48$ .

Suppose Justice 2 values joins at  $\beta = .06$ . Justice 2’s utility function is shown in the right-hand panel of Figure 3. (To ease visualization, the utility function is drawn as a continuous function but in fact it is only upper semi-continuous). The function attains a clear maximum, as indicated by Proposition 2. In fact, it will be seen that the utility-maximizing opinion for Justice 2 is the closest opinion that gains five joins, that is, joins from a coalition of Justices 1-5. As Justice 5 is the most distant member of this coalition, the optimum opinion is located at the nearer edge of Justice 5’s acceptance region:  $.5 - \sqrt{.05} = .28$ . If Justice 2 valued joins somewhat more highly, she would location her opinion at the nearest join maximizing location, .48, thereby receiving six joins. If she valued joins somewhat less, she would offer a policy at her ideal point, .2, gaining four joins (those from Justices 1-4). In the latter case, the case location must also be such that at least one additional justice concurs with the disposition implied by the opinion, if the case location lay at or above Justice 5’s ideal policy.

*Dispositional votes and the majority-disposition compatibility constraint.* When the case location is extreme – to the right (or to the left) of the ideal points of all of the judges – the dispositional vote will be unanimous. When the case location is not extreme, the

dispositional vote may be divided. Of course, if dispositional value is low and the cost of writing high, then the dispositional vote may nonetheless be unanimous.

Our baseline example illustrates more interesting behavioral possibilities. Suppose the case location were not extreme but in fact rather central, say,  $\hat{x} = .55$ , so the ideal policies of justices 1-5 lie to the left of the case location and those of justices 6-9 lie to the right. Non-joins may be either concurrences or dissents, depending on whether the voting justice's ideal policy is on the same side or the opposite side of the case as the opinion. As a result, the opinion writer may be constrained in locating her opinion by the need to hold dissents below five.

//Insert Figure 4 about here //

Figure 4 shows the aggregate join functions and aggregate dissent functions facing Justice 9 in the example. The functions indicate the number of joins and the number of dissents at each case location for cases authored by this justice. As shown, an opinion located far to the right (above .72, the vertical line in the figure) would provoke five dissents so the opinion would not be disposition-majority compatible. Because of the resulting loss to the author (recall equation 3) Justice 9 would not locate opinions on the far right of the policy space, above .72. In fact, though, under the assumed parameter values ( $\beta = .06$ ) Justice 9 prefers to locate her opinion somewhat more centrally in order to gain more joins, so disposition-majority compatibility does not enter her calculations.

## 5 Comparative Statics

### *5.1 Overview of the Model's Comparative Statics*

Comparative statics studies how a change in the value of an exogenous variable changes the value of an endogenous variable. In this section, we focus on two endogenous variables, opinion location and case disposition. And, we consider changes in two important exogenous

variables: the ideal points of the justices and the designation of the opinion writer. The comparative statics of these two variables have straightforward substantive interpretations and dramatic empirical implications.<sup>14</sup>

We consider three comparative static scenarios. In the first, we change only the identify of the opinion author. This scenario corresponds to altering opinion assignment within a natural court (a court with fixed membership). We show that opinion content not only may change with opinion assignment but may do so *non-monotonically*: assignment to a more extreme justice may result in a more moderate opinion. In addition, case disposition can be sensitive to opinion assignment, so that the same case assigned to two different justices may result in two different majority dispositions. These unusual predictions are distinct signatures of the model. In the second scenario, we change only the ideal point of the opinion author while keeping the ideal points of all other justices the same. This scenario corresponds to a justice retiring from the Court and being replaced by a new justice, who receives an opinion assignment that would have gone to the previous justice. We compare the opinion locations chosen by the new appointee with those chosen by the departing justice. Thus, we examine the "direct effect" of a new appointment to the Court (Cameron et al 2009). We establish a general monotonicity result. In the third scenario, we fix the ideal point of the authoring judge but alter the ideal point of a non-authoring justice. This scenario also examines the impact of new appointee to the Court, but the impact of the new justice on the opinion locations chosen by the continuing justices. Thus, we examine the "indirect effect" of a new justice (ibid). We show that the presence of a new justice may alter opinions non-monotonically: the opinions of some justices may move *away* from the new justice. Again, this unusual prediction is a signature of the model.

To further highlight what is and what is not distinctive about the present model, we contrast the comparative statics of our model with the comparative statics of median voter models (models [4a] and [10]), the median-of-the-majority model (model [2] in Table 1),

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<sup>14</sup>In an earlier working paper, we examine the comparative statics of other exogenous variables, especially the case location  $\hat{x}$ , the dispositional value  $\gamma$ , and the value of joins  $\beta$  (Cameron and Kornhauser 2008).

and so-called "author influence" models (models [4b], [5a-c], and [8] in Table 1). In the first two cases, opinion location is independent of authorship and the comparative static analyses consequently have a simple structure though, in the median-of-the-majority model, one needs to be attentive to how the dispositional majority may change with a change in the ideal point of a justice. Author-influence models display greater complexity.

These three comparative static analyses reflect the distinct mathematical structure of the model. The utility of the opinion author reflects two components: a policy loss function and the aggregate join function. The first comparative static involves changes in both components. As a consequence, general results are difficult to derive and we illustrate what is possible through explicit computation of examples. The second comparative static alters only the policy loss function; the aggregate join function remains constant. General analytic results are obtainable through monotone comparative statics. The third comparative static analysis fixes the policy loss function but changes the aggregate join function. Because changes in that function are complex, we again illustrate possibilities in the model through explicit calculation of examples.

## ***5.2 Varying the Opinion Author Within a Natural Court***

### 5.2.1 Non-monotonic Opinion Locations

We return to the baseline example considered earlier. Figure 5 is an "author-opinion" diagram showing the optimum opinion for each justice in the non-polarized Court, arrayed by the justices' ideal point (Cameron et al 2009).<sup>15</sup> The example assumes an extreme case location, hence a unanimous disposition.

// Insert Figure 5 about here //

Note first that opinion assignment is extremely consequential for opinion location: each justice writes a somewhat different opinion. Second, note that opinion location need not be

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<sup>15</sup>These were calculated for each justice in a fashion similar to calculation for Justice 2 in the baseline example, above.

monotonic in the ideal point of the opinion author. More specifically, in the example Justices 3-7 author at their ideal policy. Because they are centrally located in the non-polarized court, they need not deviate from their most preferred rule to garner joins. Justices 1, 2, 8 and 9, however, locate opinions more centrally than their ideal policy, seeking joins. But notably, the most extreme justices, 1 and 9, locate their opinions even more centrally than their slightly less extreme neighbors, Justices 2 and 8. This non-monotonicity results from the “gravitational pull” of Justices 1 and 9 on Justices 2 and 8; in contrast, Justices 1 and 9 need not fear losing their own join as they move toward the center seeking joins.

Figure 5 underscores the irrelevance of the median voter theorem for opinion content in the present model, though of course the preferences of the median voter are extremely consequential for case dispositions.

### 5.2.2 Author Effects on Case Disposition

We continue with the same example, but now assume a case located in the interior of the Court ( $\hat{x} = .55$ ). We assume no dispositional value ( $\gamma = 0$ ) for the justices. These assumptions imply that if a justice does not join the opinion, she concurs if her ideal point lies on one side the case but dissents if it lies on the other side. However, strategic or cross-over joins are a possibility – a justice whose ideal point lies on the "dissent" side of the case may nonetheless join a relatively proximal (and hence attractive) majority opinion even though it requires the "wrong" disposition. Recall from the discussion of Figure 4 that the majority-disposition constraint does not bind on the justices in the example, so they continue to place their opinions as shown in Figure 5.

// Insert Figure 6 about here //

Figure 6 shows the dispositional vote associated with each justice’s optimal policy. The dispositional votes range from 7-2 to 5-4. A striking feature of the model is that not only do opinion locations vary with the opinion author; *so can case dispositions*. Given a central

case location, opinion authors on the left side of the Court craft opinions that draw support from a center-left coalition in favor of one disposition; but authors on the right side of the Court craft opinions that draw support from a center-right coalition in favor of the other disposition. This feature of the model underscores the importance of opinion assignment, and suggests the importance for case dispositions of the Chief Justice's assignments.

From Figure 6 we may also infer the presence of strategic joins. For instance, Justice 6 makes a strategic join when Justices 1, 4 or 5 writes the opinion; Justice 7 makes a strategic join when Justice 5 writes. Justice 5 makes a strategic join when any "minority" justice – justices 6 - 9 – writes the opinion. Justice 4 makes a strategic join when Justices 6 or 9 writes the opinion. No other model in Table 1 predicts strategic joins.

### 5.2.3 The Effect of Opinion Assignment in the Other Models

In the median voter models, the opinion location is invariant to the identity of the opinion's author, given a fixed set of ideal points. Thus, in an author-opinion diagram similar to Figure 5, the graph of the predicted opinion location is a flat line located at the ideal point of the median justice. Similarly, in the majority-of-the-median model, the opinion location is invariant to assignment within the disposition majority. (The model does not permit a non-majority disposition author). Again, the graph of the predicted opinion location is a flat line, now located at the ideal point of the median justice in the majority disposition coalition. Clearly, this prediction is quite different from that above.

Among the author influence models, we focus on Lax and Cameron (Model [8] in Table 1). In this model, opinion location moves in the direction of the author's ideal point (*ceteris paribus*). The non-monotonicity shown in Figure 5 is impossible.

Finally, consider the disposition-only models (models [3], [6], and [7] in Table 1). Model [3] does not include an opinion so technically there is no opinion assignment. But the model does randomize the order of voting and the order matters for some configurations of the

judicial ideal points. So the disposition may depend on the order of voting.<sup>16</sup> This result somewhat resembles that shown in Figure 6. However, this effect disappears if the majority does not incur a cost from a dissent.<sup>17</sup>

In models [6] and [7] the disposition game is played case-by-case and is a median voter game in which every player has a dominant strategy to vote sincerely. There is no order of voting and no opinion to assign. So there can be no effects from opinion assignment. Similarly, in the second part of [7], which discusses a rule-making game, the set of equilibria seems to depend only on the ideal policies of each judge and thus cannot be affected by opinion assignment. Again, in these models there is no formal opinion writer nor an order of voting.

### ***5.3 Change Across Natural Courts: The New Justice as Opinion***

#### ***Author***

Consider a natural court that must decide case  $\hat{x}$ . Let justice  $j$  be the opinion author. We examine how the disposition and the opinion location changes when we substitute Justice  $j'$  for Justice  $j$  as the opinion author. Obviously, the preferences of the author change. But critically, the environment facing the opinion author  $j'$  is the same as that facing his predecessor  $j$ . In other words, the policy loss function of the new justice differs from the policy loss function of the justice she replaced but both justices face the same aggregate joint function.

#### 5.3.1 Direct Effects of New Justices on Opinions and Dispositions

First, consider the effect of changing the ideal point of the opinion author on the opinion location. For clarity, we assume that the change in the ideal point of the writer does not change the case disposition. Phrased differently, we might imagine an extreme case location

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<sup>16</sup>See the discussion of cases 5, 6, and 7 in Fischman 2008.

<sup>17</sup>See Corollary 9 in Fischman 2008.

so that the justices are unanimous in their views on disposition. We have:

PROPOSITION 4. (Direct Effect of Nominations). *Fixing the remainder of the Court, as the ideal rule of the opinion writer increases but the writer's preferences about the case disposition remain unchanged, the opinion's content increases (weakly) if and only if the policy loss function displays increasing differences in the writer's ideal rule.*

PROOF. Recall the opinion writer's utility function, equation 3. In equation 3, the parameter of interest  $\bar{x}_j$  enters the policy loss function  $v(x_j, \bar{x}_j)$  and the "correct disposition" indication function  $I(d_j, \hat{x}, \bar{x}_j)$ . The proposition stipulates, however, that the latter remains fixed. Critically,  $\bar{x}_j$  does not enter the aggregate join function  $n(x_j)$ . If the utility function were twice continuously differentiable, the effect of a change in  $\bar{x}_j$  on the equilibrium opinion location  $x_j^*$  would follow immediately from the positive sign of the cross-partial. As the author's utility function is not continuous, we rely on the theory of monotone comparative statics. If equation 3 displays increasing differences in  $\bar{x}_j$ , then  $x_j^*$  weakly increases. Proposition 5 in the Appendix demonstrates that equation 3 displays increasing differences in  $\bar{x}_j$ .

■

Example. Suppose the policy loss function is the quadratic loss function . Then opinion content weakly increases when the writer becomes more conservative (but does not thereby alter his preference about the case disposition).

Proposition 4 indicates that, if the adjudication model is a reasonable representation of the operation of the Supreme Court, nominations are not a "move-the-median" game as is often assumed in formal models of Supreme Court nomination politics (Krehbiel 2007, Moraski and Shipan 1999, Rohde and Shepsle 2007). Rather, each nominee is potentially consequential for the Court's policy. This is often not true in move-the-median games since a new justice may not move the location of the median.

Now suppose the case location is not extreme. As the ideal point of the new opinion author varies, the disposition of the case may change. This change might occur when



the case location splits the court 5-4 and the change in justice alters the disposition to 4-5. A change in disposition might also occur when the case location initially divides the dispositional vote on the court 6-3 if strategic joins are possible. In addition, suppose the dispositional value is law but authoring costs are high. Then all justices will join the opinion author's opinion, yielding a 9-0 disposition. The new authoring justice may favor the other disposition resulting in a 0-9 dispositional vote. These phenomena again distinguish the model in this paper from the move-the-median model (model [2] in Table 1) where moving the ideal point of the authoring justice can only change the case disposition when the court is split 5-4.

### 5.3.2 Direct Effects in the Other Models

We first consider the median voter models (models [4a] and [10]). In these models case location does not matter for opinion content. And, a newly arriving justice alters the majority opinion only if her presence alters the location of the median justice. Even then, the opinion location shifts only as far as the location of the new median, typically the justice adjacent to the old median on the side of the arriving justice. The location of the equilibrium opinion is weakly monotonic in the ideal point of the arriving justice.

Equilibrium opinions in the majority-of-the-median model behave in a slightly more complex way. Fixing the case location, if the new justice changes neither the majority disposition (that is, on which side of the case lie the majority of justices) nor the median of the majority, her arrival has no effect. If her arrival does not change the majority disposition but does alter the median of the disposition majority, her arrival shifts the opinion location to the new majority median. If her arrival alters the majority disposition, her arrival alters the opinion location from the median of the old majority to that of the new. In all cases, however, the location of the equilibrium opinion is weakly monotonic in the ideal point of the arriving justice.

In the author influence models, the arrival of a new author typically moves the opinion

in the direction of the new author.<sup>18</sup> In many of these models, the opinion may also shift if the new arrival alters the location of the median justice.

In sum, the possible non-monotonicity of direct replacement effects on opinion content is a distinctive signature of the present model.

Now consider the comparative statics of dispositions in the disposition-only models, models [3], [6] and [7]. In models [6] and [7] the new writer appointed to the court can affect the case disposition only if the new writer's ideal point shifts the median disposition. If the median disposition changes, then the implicit collegial rule in these models changes. Consequently, the equilibria of their opinion writing game also change but, as the policy space is multidimensional, monotonicity is not well-defined. Behavior in model [3] can be complex. First, fix the case location in a non-extreme location. Now fix two justices. Shifting the ideal point of the third justice may shift the dispositional outcome (though the shifts might depend on the order of voting). However, notice that when the cost of dissent to the majority is zero, [3] becomes a median voter model and shifting the ideal point of a judge can only affect the outcome if the ideal point moves across the case location. So the case must be located to produce a 2-1 vote and changing the ideal point only of a majority vote justice may matter. When the cost of dissent to the majority is positive, shifting the ideal point of the minority judge can change the disposition. In sum, the disposition-only models display direct effects on case dispositions, though typically for reasons that are different from those in the current model.

#### ***5.4 Change Across Natural Courts: Continuing Justices as Opinion Authors***

We now examine the "indirect replacement effect" of a new justice: the effect of a new justice on the opinions of the *other* justices. In particular, we fix the identity of the opinion

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<sup>18</sup>For example, Corollary 1 in [8] establishes that the opinion location is weakly monotonic in the ideal point of the author.

author and then move the location of one of the other justices. Thus, the opinion author's policy loss function remains the same but she faces an altered aggregate join function. Because the aggregate join function can change in complex ways, so can opinion locations. Strikingly, in some cases an authoring justice may shift her opinions *away* from the new arrival.

#### 5.4.1 Non-monotonic Indirect Effects on Opinion Content

In general, the effect on a continuing justice's opinions of the departure of a justice and the arrival of another depends on which continuing justice is the author, which justice retires, and where the new justice enters. We consider an example keyed to the baseline example introduced in Section 4.3. Again the justices are evenly spaced from .1 to .9, the case location is extreme, and  $\beta$  and  $k$  take moderate values. Suppose Justice 5, the median justice, is the opinion author. Figure 7 shows the effect on Justice 5's opinion if Justice 4 retires and is replaced by another justice. In the figure, the values on the x-axis indicate the ideal point of the newly arriving justice. Justice 5's resulting opinion location is shown on the y-axis. The dotted line indicates Justice 5's original opinion location prior to Justice 4's retirement.

// Insert Figure 7 about here //

First note that when the entering justice has an ideal point greater than .5, the median justice shifts to the right, either to Justice 6 or the entering justice (if he enters between .5 and .6). From the perspective of the median voter theorem, Justice 5 "overreacts" to entry to her right. When the entering justice is close to the center, Justice 5 locates her opinion at .676, a position to the *right* of the ideal point of the new median justice. When the entering justice has an ideal point to the extreme right, Justice 5 moves her opinion even further to the right, writing as far as .776.

Even more remarkable behavior occurs when the replacement justice has an ideal point to the left of Justice 5. In this instance, the median justice of the court remains Justice

5. Nonetheless, for an entering justice with an ideal point in the interval  $[\cdot 2, \cdot 3]$ , Justice 5 does not write the same opinion; rather, she moves the opinion to the left. Perhaps most remarkably, when the replacement justice enters on the far left, Justice 5 shifts her opinion to the *right*, locating it at roughly  $\cdot 676$ , well to the right of her own ideal point.

This non-monotonic behavior reflects the "gravitational" nature of the model. When Justice 4 is replaced by someone to the right, Justice 5 finds it attractive to move right, chasing joins. After all, an opinion located at her ideal point now attracts one rather than two votes from justices to her left. Moving right, by contrast, now attracts joins from the replacement justice as well as the continuing, non-writing members of the court. At the opposite extreme, an entering justice on the extreme left lies too far away from Justice 5 to exercise much gravitational pull while the near left has been weakened by Justice 4's departure. As a result, Justice 5 shifts her opinion to the right, seeking joins in that relatively densely populated part of the space.

#### 5.4.2 Indirect Effects in Other Models

In the median voter models, changing the ideal point of a non-writing justice can only affect opinion content if the new justice alters the location of the median justice, since opinions are always located at the median regardless of who the author is. As a consequence, peer effects in these models are monotonic. A similar logic holds in the median-of-the-majority model and most of the author-influence models – entry of the new justice is only consequential if it alters the location of the median justice (or, the majority-median justice). In the author influence model [8], indirect effects arise if the entering justice changes the location of the median justice, but also if the new justice changes the location of the justice whose opinion must be blocked by the author's opinion. In both cases, however, the effects remain monotonic in the ideal point of the entering justice. In sum, non-monotonic indirect effects are another distinctive feature of the present model.

## 6 Conclusion

The model in this paper tries to take adjudication seriously, or at least more seriously than simple models imported from legislative studies. It does so by investigating three distinctive features of courts: First, courts jointly produce resolved disputes and policies, not simply one or the other; second, judges are apt to have preferences about both of these products (and "winning" may not be terribly consequential for either one); and third, individual decision making about each of the two products probably involves different considerations but the two may interact so that each affects the other. As treated here, these features imply that non-authoring justices join (effectively, endorse) proximal opinions, constrained to a degree by dispositional preferences. Opinion authors "chase joins," balancing marginal joins against their own policy losses, while constrained by the need to hold a dispositional majority. As a consequence of this behavior, the entire distribution of preferences on a Court can be consequential for opinion locations, not merely those of the median justice or the opinion author.

We do not claim that the present model is the only way to address the distinctive features of courts, nor the best way. For example, the model side-steps difficult questions about opinion competition, questions we leave for future work. In addition, the approach taken here comes at some cost in complexity. Behavior in the model can be complicated and surprising. But, this approach offers benefits as well. Here we emphasize some of the novel directions for empirical work suggested by the model.

First, the model emphasizes the distinction between a case's policy coalition (the join coalition) and the case's dispositional coalition, and suggests that the former is much more consequential for policy than the latter. Very little empirical work examines policy coalitions, for example on the U.S. Supreme Court. Instead, most empirical work focuses almost exclusively on dispositional votes (Knight 2009). Can the distinction between the two be ignored in practice? In fact, how different are policy coalitions from dispositional coalitions?

Second, the model suggests that the same natural court is may well produce liberal,

moderate, and conservative opinions, depending on the case location and opinion assignment. (This prediction is dramatically different from that of median voter models). The model indicates that the corresponding join coalitions are apt to be quite distinct, e.g., left-center coalitions, center coalitions versus both ends, and right-center coalitions. Are policy coalitions on natural courts in fact diverse? Do different opinion authors tend to generate different policy coalitions? Do different policy coalitions seem to be associated with different opinion content?

Third, the model underscores the importance of indirect replacement effects, that is, the effect of a new justice on the opinions of the continuing justices irrespective of any impact on the location of the median voter. Does the arrival of a new justice alter the policy coalitions generated by the opinions of the continuing justices? This seemingly obvious question seems yet to have received much empirical investigation (but note Cameron et al 2009).

Fourth, the model suggests that dispositional votes may sometimes be strategic. Current efforts to scale judicial votes employ dispositional votes exclusively and invariably assume dispositional votes are sincere. It is unclear how important this issue might be but it raises questions about current scaling practices.

Fifth, even more significantly, the model indicates that join decisions and dispositional decisions both convey information, and not only about judicial ideal points but about case locations and opinion locations. We cannot explore this point in detail here but scaling methods that use all the information in both types of votes may be able to generate not only better estimates of deal points but – even more importantly – estimates of case locations and opinion locations.

In short, theory that takes adjudication more seriously not only produces novel models but suggests new departures for empirical work on collegial courts.

# Appendix

## *Proof of Lemma*

The lemma asserts that the set of opinions that command a dispositional majority,  $X_d(\hat{x}) = \{x | n(\hat{x}, x_j)\}$  is a compact set. The idea of the proof is that  $X_d(\hat{x})$  may be decomposed into two types of opinions that yield dispositional majorities: 1) the set of opinions,  $X_s(\hat{x})$ , that yield the “sincere” majority disposition (the disposition that would result if each justice voted for the disposition dictated by her ideal point), and 2) the set of opinions  $X_{ns}(\hat{x})$  that yield an “insincere” majority (a majority that can only occur if there are cross-over joins) (this set may be empty). The proof shows that each of these set of opinions is a compact set; consequently the union of the two sets is a compact set (a well-known result in topology).

Define the sincere case disposition correspondence:

$$d_s(\hat{x}, \bar{x}_1, \dots, \bar{x}_9) = \begin{cases} 1 & \text{if } \sum_i (1) \text{sgn}(\hat{x} - \bar{x}_i) > 0 \\ 0 & \text{if } \sum_i (1) \text{sgn}(\hat{x} - \bar{x}_i) < 0 \\ 0 \text{ and } 1 & \text{if } \sum_i (1) \text{sgn}(\hat{x} - \bar{x}_i) = 0 \end{cases}$$

LEMMA  $X_d(\hat{x})$  is compact.

PROOF. First consider the multi-valued portion of the sincere case disposition correspondence, which occurs only when  $\hat{x}$  is located on the ideal point of the median justice. In such an instance, an opinion at any location in the case space must command a (sincere) dispositional majority even absent cross-over joins. So the entire case space corresponds to  $X_d(\hat{x})$ , which is therefore compact since  $X$  is the unit interval. Now consider the single-valued portion. First consider  $X_s(\hat{x})$ , the members of  $X_d(\hat{x})$  such that  $r(\hat{x}, s) = d_s(\hat{x}, \bar{x}_1, \dots, \bar{x}_9)$  (majority opinions whose disposition corresponds to the single sincere disposition). This set is either  $[0, \hat{x}]$  or  $[\hat{x}, 1]$ ; in either case, the set is compact. Now consider  $X_{ns}(\hat{x})$ , the members, if any, of  $X_d(\hat{x})$  such that  $r(\hat{x}, s) \neq d_s(\hat{x}, \bar{x}_1, \dots, \bar{x}_9)$ . If the set is empty, it is compact. If the set is not empty, then there must be enough cross-over joins from the “insincere” side of to

gain a majority. Consider a location on the insincere side such that a justice at this location is indifferent between joining and not joining the opinion. If this point lies outside  $X$  then  $X_{ns}(\hat{x})$  is compact since it runs from  $\hat{x}$  to the boundary of  $X$  on the insincere side. If the indifference point is interior to  $X$ , equations (5) and (6) require an indifferent justice to join, hence the set of insincere majority opinions is the closed interval from  $\hat{x}$  to the indifference point, a compact set. This exhausts the possibilities. Thus, both  $X_s(\hat{x})$  and  $X_{ns}(\hat{x})$  are compact so their union,  $X_d(\hat{x})$ , is compact. ■

### *Monotone Comparative Statics in the Model*

The following proposition provides the basic result governing comparative statics in the adjudication game.

PROPOSITION 5. (Monotone comparative statics).  $x_j^*$  is non-decreasing in a parameter if and only if equation 3 has increasing differences in the parameter. If the parameter enters only one of the components of equation 3 (e.g., the aggregate join function or the policy loss function),  $x_j^*$  is non-decreasing in the parameter if and only if that component of equation 3 has increasing differences in the parameter.

PROOF. Follows from Theorem 2.3 in Vives 2001; see also Athey et al 1998 Theorem 2.3. ■

The comparative statics of the model thus turn on demonstrating increasing differences in the parameter of interest. More precisely, where  $x_j^H > x_j^L$  and parameter  $y^H > y^L$ , we require

$$u(x_j^H; y^H) - u(x_j^L; y^H) > u(x_j^H; y^L) - u(x_j^L; y^L)$$

This condition must often be checked directly rather than through the relevant cross-partial derivative  $\frac{\partial^2}{\partial x_j \partial y} u(x_j; y)$ , which may not exist since the aggregate join function is not differentiable.



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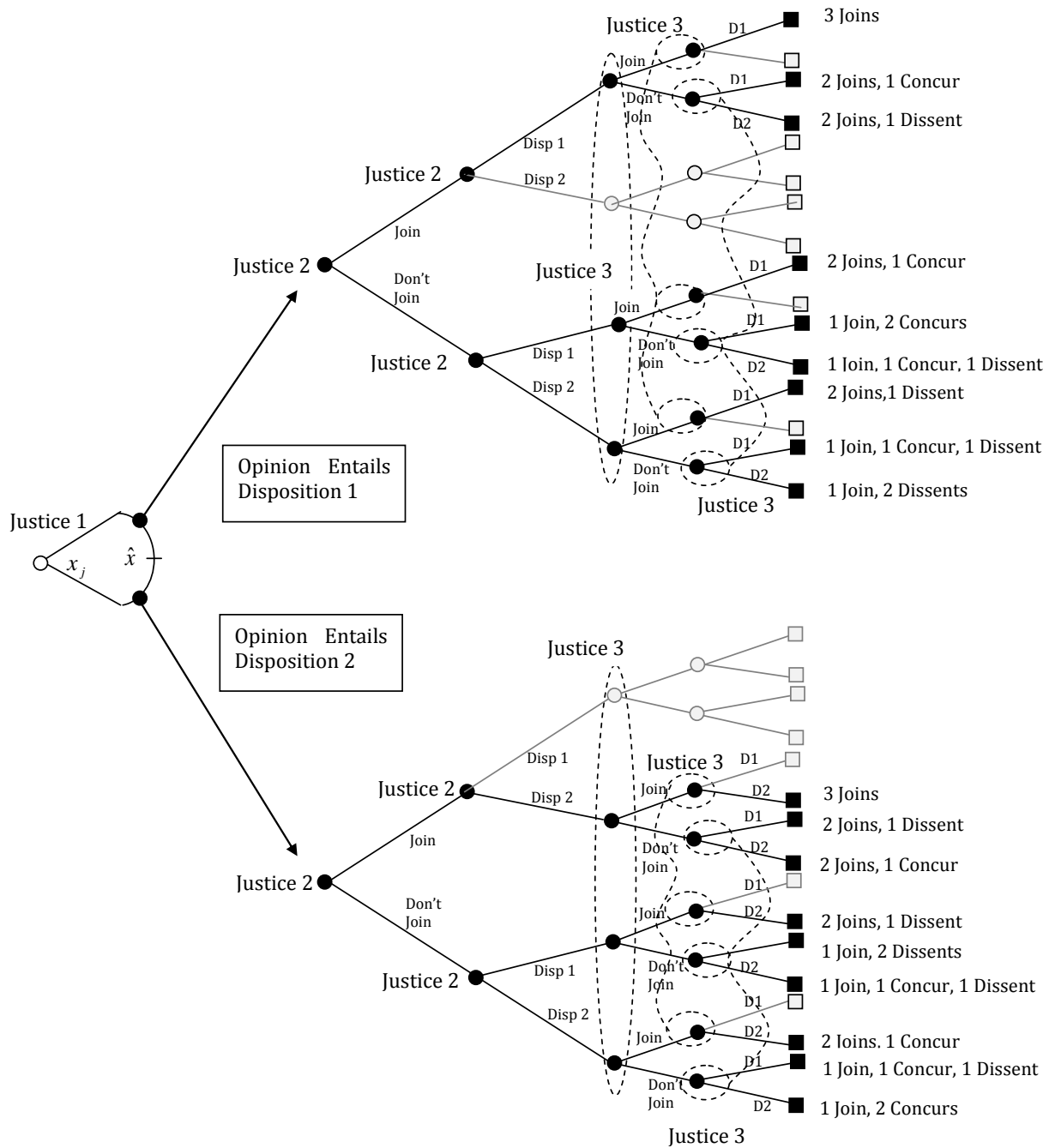
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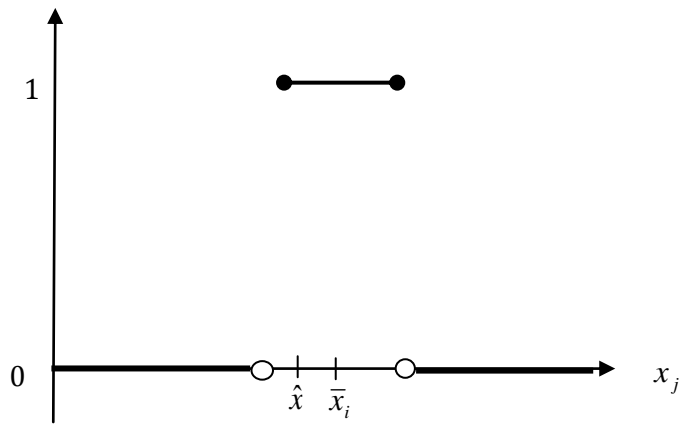
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	Policy Preferences and ...		No Policy Preferences	
	Disp. Pref.	No Disp. Pref.	Disp. Pref.	No Disp. Pref.
Costs, other	[1], [2]	[5b], [8], [9]	[3]	
Nothing else		[4a,b], [5a,c], [10]	[6],[7]	(no preferences)

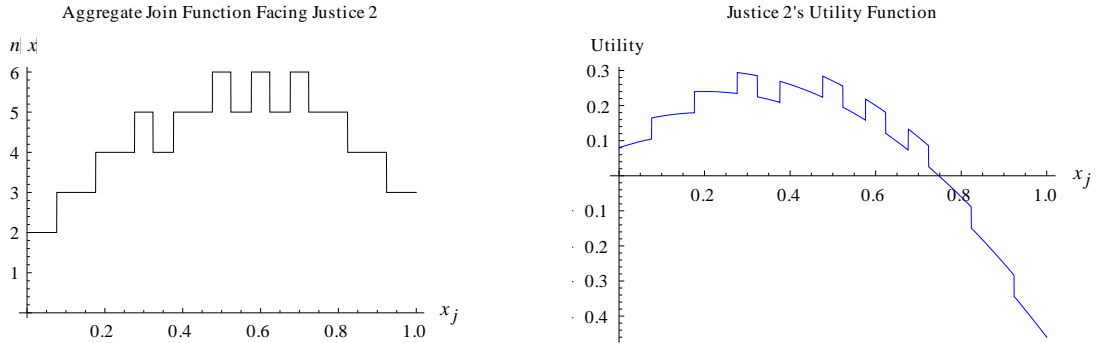
Table 1: Judicial Preferences in Existing Models of Collegial Courts



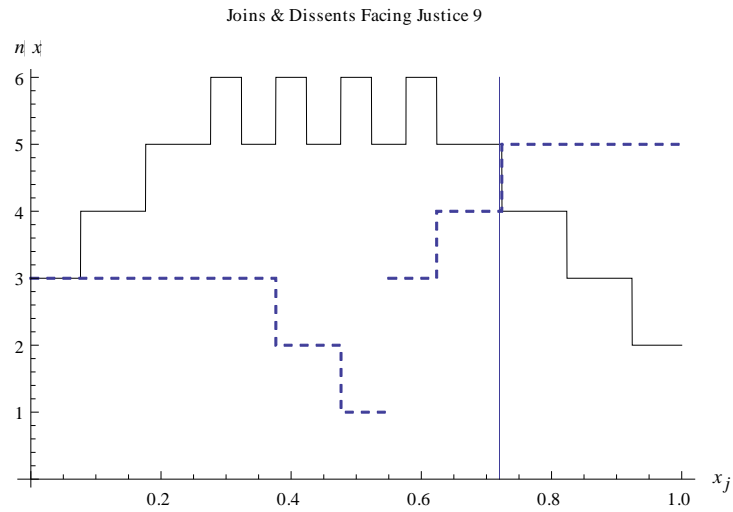
**Figure 1. Game Form for a Three Member Court.** Justice 1 writes an opinion with policy content that, when applied to the case, entails one or the other disposition. Justices 2 and 3 move simultaneously. They join the opinion or not, then cast a vote on the case's disposition. However, if Justice 2 or 3 join the opinion, their dispositional votes must agree with that required by the opinion. Justice 1 automatically joins her own opinion. The final result is an opinion coalition (a join coalition) with 1-3 members and at least one but possibly two dispositional coalitions. Grey nodes cannot be reached because the dispositional vote must be compatible with a joined opinion.



**Figure 2. An individual join function.** Shown is the probability of joining an opinion with content  $x_j$ . For opinions outside the join region, the justice writes a concurrence or dissent expressing her preferred case disposition. Note the possibility of a strategic join: the justice will join some opinions to the left of the case location  $\hat{x}$ , implying an incorrect disposition from her perspective. Nonetheless she joins because the content of the opinion is so attractive.

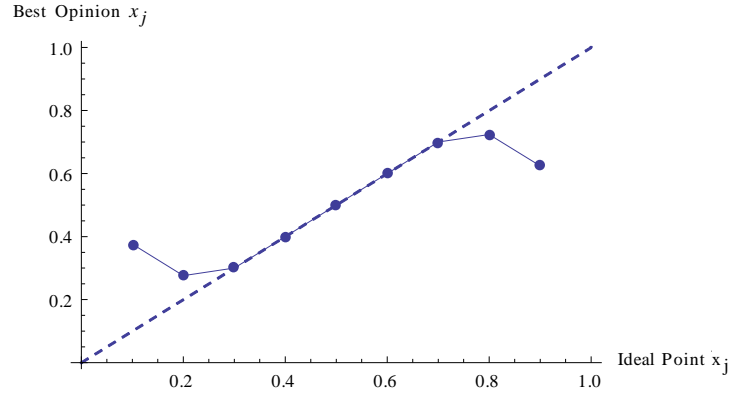


**Figure 3. Aggregate Join Function and Utility Function for Justice 2.** The left-hand panel shows the aggregate join function facing Justice 2 in the baseline example. An opinion placed at the location on the x-axis brings the number of joins shown on the y-axis. The right-hand panel shows Justice 2's utility for opinions, taking into account the gain from joins and the policy loss from more distal opinions. Justice 2's most preferred opinion lies at the location nearest his ideal point that brings five joins. The example assumes a non-polarized Court, an extreme case location, no dispositional value ( $\gamma = 0$ ), and moderate values for writing costs ( $k = .05$ ) and joins ( $\beta = .06$ ).

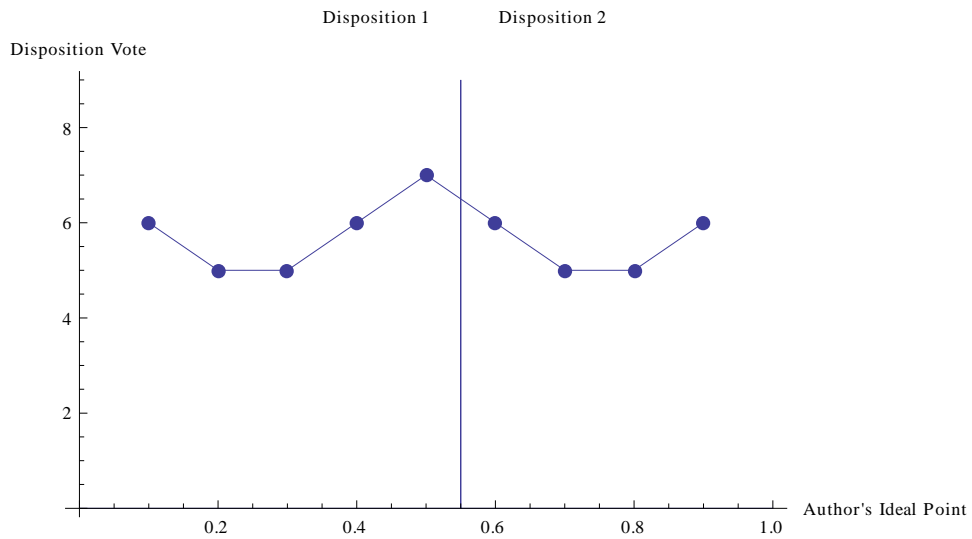


**Figure 4. Constraints on Opinion Location Imposed by Disposition-Majority Compatibility.** Shown are the aggregate join function (solid line) and dissent function (dashed line) facing Justice 9 in the baseline example, with a case located at  $\hat{x} = .55$ . (Not shown are concurrences). Justice 9 cannot locate opinions to the right of .72 (the vertical line) since doing so would fail to gain enough joins and concurrences to support the required case disposition – there would be five dissents.

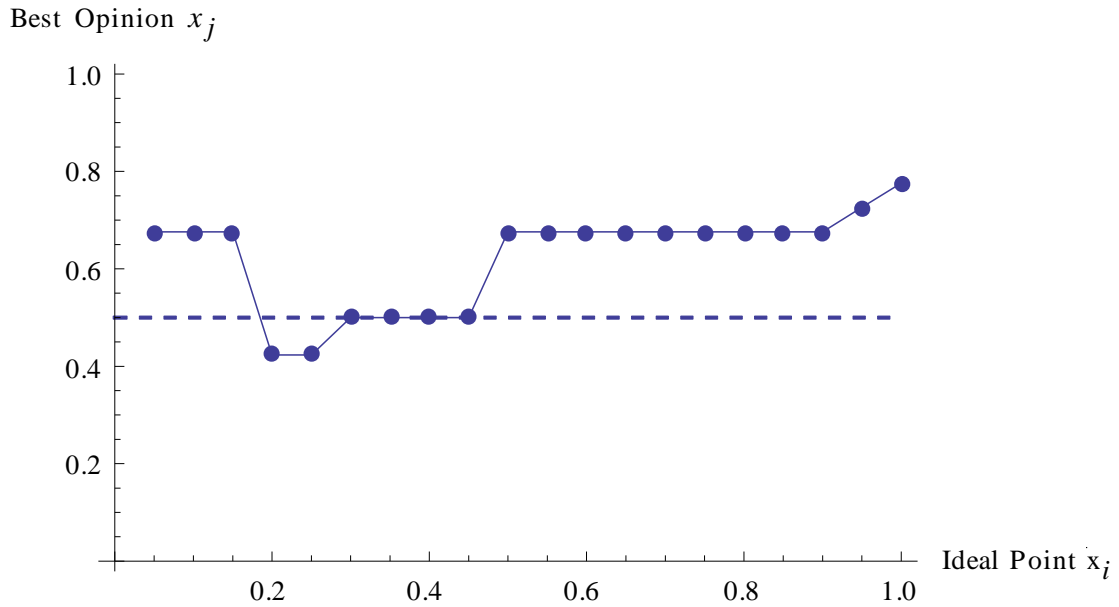




**Figure 5. Non-monotonicity of Opinion Location and Author Ideal Point.** Shown is the “author-opinion diagram” for the baseline example; it indicates the optimal opinion locations for each justice as a function of her ideal point. Different justices author quite different opinions. More than that, optimal opinions are not monotonic in author ideal point: Justices 1 and 9 write more moderate opinions than do Justices 2 and 8. The dashed line is the 45-degree line. ( $k = .05, \gamma = 0, \beta = .06$ , extreme case location).



**Figure 6. Disposition Votes for the Justices' Optimal Opinions.** The case location is shown by the vertical line ( $\hat{x} = .55$ ). Given the parameters, justices to the left of the case write opinions yielding one disposition, those to the right write opinions yielding the other disposition. For example, Justice 1's optimal opinion generates a 6-3 vote for Disposition One; Justice 8's opinion generates a 5-4 vote for the other disposition. Several justices engage in strategic joins, e.g., Justice 6 when Justices 1, 4, or 5 write. ( $k = .05, \gamma = 0, \beta = .06$ )



**Figure 7. Non-monotonic Indirect Replacement Effects.** Justice 5 (with ideal point at .5) is the opinion author. Justice 4 with ideal point at .4 retires and is replaced by a new justice at the position indicated on the x-axis. Justice 5's best opinion location is shown on the y-axis. The dashed line indicates the optimal opinion location for the Court with the original Justice 4. Justice 5's opinions are non-monotonic in the ideal point of the arriving justice: if the new justice is located too far to the left, Justice 5 does better to "chase joins" to the right. The median voter theorem is irrelevant: entry to the left of .5 retains Justice 5 as the median voter, but he places his opinion left of .5 or right of .5 depending on the entry location. Entry to the right of .5 makes Justice 6 the median voter yet the best opinion is never at .6. (Extreme case location, quadratic policy loss functions, moderate values for  $k$  and  $\beta$ )