How the Senate and the President Affect the Timing of Power-sharing Rule Changes in the US House

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A new model and related empirical work explain how the Senate and President affect the timing of power-sharing rule changes in the US House. We argue that shifts in the Senate's or President's preferences (e.g., a new majority party in the Senate; a new president) reshape House members' expectations about which legislative outcomes are achievable. Reshaped expectations, in turn, can alter House members' perceptions of the consequences of reallocating power among themselves. We prove that such reshaped expectations can induce House members to change power-sharing rules. To evaluate this claim, we examine major rule changes from 1879 to 2009. We find that the House was far more likely to change rules after elections that shifted partisan control of the Senate or Presidency than after elections in which no such shift occurred. Since the existing literature does not anticipate this finding, this work clarifies an important attribute of how power is distributed within the House. (*JEL* C7, D02, D72).

In every legislative session, the US House of Representatives has the ability to make decisions that affect the balance of power among its members. These decisions, about matters such as how legislation is referred to committees and the power of rank-and-file legislators relative to committee chairs, shape legislative outcomes. Such decisions are also largely unconstrained by the US Constitution. Article I, Section 5 gives House members

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broad latitude to determine the chamber's power-sharing rules. Beyond implying that each new House must decide to continue or change the previous session's rules, Section 5 offers no instructions.

When do Houses change their power-sharing rules? Since the Republican takeover in the 104th Congress (1995–97), data collected by scholars, such as Binder, Schickler, Cox, and McCubbins show that the House adopted major power-sharing rule changes in 1995, 2001, 2003, 2007, 2009, and 2011, but did not make such changes in 1997, 1999, and 2005. A common assumption is that changes in House members' policy preferences explain such patterns. But the relationship between House member preferences and the timing of power-sharing rule changes is not so clear. The House's Republican majority not only changed the rules when it took over the House in 1995, but also again in 2001 and 2003. Similarly, the Democratic majority that gained control in 2007 changed the rules that year and then again in 2009. What explains this pattern?

We argue that the timing of power-sharing rule changes in the House is better explained by incorporating the Senate and the President into the analysis. In what follows, we use a model and empirical work to show how changes in the preferences of the Senate or President induce House members to change their power-sharing rules.

Article I, Section 7 of the Constitution motivates our approach. Section 7 states that bills become laws only if the House majority, Senate majority, and the President agree on wording, or if two-thirds of the Senate and the House so agree. To see how Section 7 is relevant to House power sharing, suppose that House members are goal-oriented and forward-looking. Members will know that legislative outcomes depend on the Senate's and President's actions. If members want to achieve certain legislative outcomes, and if the House's power-sharing rules affect how the chamber negotiates with the Senate and the President, then members' preferences over these House rules may depend on the Senate's and President's policy preferences. A member might prefer one power-sharing rule when her party holds the Oval Office, but a different rule when the opposition is in control. As it happens, the Democratic majority in 2009 made radical changes to rules that the same majority adopted in 2007 when it initially regained majority status. We argue this pattern can be traced to the presidential change: a power-sharing arrangement that was useful for House Democrats when dealing with Republican president George W. Bush was not optimal when Democrat Barack Obama won the office.

To date, prominent scholarship has based explanations of how the House allocates power on members' preferences. Krehbiel (1991) and Schickler (2000), for example, argue that power in the House emanates from the preferences of the chamber's median member. Cox and McCubbins (1993, 2005) argue that such power is found within the leadership of the House's majority party. Others (Rohde 1991; Aldrich 1994; Aldrich and Rohde 2000) contend that preference diversity within and between the House parties influence the allocation of power. Collectively, these theories have transformed our understanding of Congress.

We now show that including the preferences of the Senate and the President into the analysis leads to a different, and empirically superior, explanation of House power-sharing. We begin by developing a model that clarifies when House members will seek changes in power-sharing rules. We use the model to identify when changing the preferences of the Senate or the President, while holding constant the preferences of all House members, is sufficient to induce the House to change its rules. The underlying logic of our main finding is as follows: when Senatorial or Presidential preference shifts reshape the set of achievable legislative outcomes, they can change House members' expectations about the consequences of choosing different power-sharing rules. Such changed expectations, in turn, can cause members to seek new rules.

Our theoretical conclusions imply that if attempts to explain the timing of major rule changes in the House ignore changes in the preferences of the Senate and the President, they will be subject to knowable errors from omitted variable bias. Empirical tests validate this claim. We analyze the frequency of changes in major House power-sharing rules from 1879 to 2009. Our key explanatory variable is whether there was such a shift in partisan control of the Senate or a new President. We find that major rule changes were far more likely to occur after elections that shifted partisan control of the Senate or a new President than after elections that caused no such shifts. This is true even after accounting for various ways in which House members' preferences can affect power-sharing rules. In other words, we show how lawmaking procedures described in Article I, Section 7 of the Constitution affect whether new power-sharing rules are chosen under Article I, Section 5. This finding is not anticipated by the existing Congress literature but it follows from our model.

We continue as follows: we introduce the model, we define the equilibrium, and we present our result. Then, we use examples and the empirical results to highlight key substantive implications. A technical appendix follows the text.

1. The Model

The purpose of this model is to examine how shifts in the preferences of the Senate or President affect the timing of major changes in the House's power-sharing rules. To facilitate the model's description, Table 1 lists the meaning of key pieces of notation.

The model has two notable attributes. First, its participants play *two distinct games* in succession. In the power-sharing game, House members negotiate a power-sharing rule. In the *legislative game*, House representatives whose identities are influenced by the power-sharing game's outcome work with the Senate and the President to jointly accept legislative outcomes. In other words, the model utilizes House members' expectations of

Table 1. Variable Definitions

$F1$, $F2$, $F3 \in \Re^2$	The ideal points of three House factions. We also use these terms as shorthand to refer to individual factions in the text. In examples, we sometimes refer to $F1$ and $F2$ collectively as the majority party and to $F3$ as the minority party.
$\%Fi$	The percentage of the House that faction i controls, where $i \in \{1, 2, 3\}$
s	The Senate's ideal point, where $s \in \{F1, F2, F3\}$
p	The President's ideal point, where $p \in \{F1, F2, F3\}$
r_i	The bicameral agreement between House faction i and the Senate, where $r_i \in \Re^2$
q	The status quo policy, where $q \in \Re^2$
L	The outcome of the game's legislative process, where $L \in \{r_i, q\}$
$U_i(L)$	The policy utility to players with ideal point Fi from legislative outcome L. Denoted as$-\ \lvert Fi - L \rvert$ for simplicity. In reality, $U_i(L) = -\sqrt{(x_{Fi} - x_L)^2 + (y_{Fi} + y_L)^2}$, where x_d denotes the position of $d \in \{Fi, L\}$ on the horizontal axis of the two-dimensional policy space and y_d denotes the position of $d \in \{Fi, L\}$ on the policy space's vertical axis.
$c_i^k \in [0, 1]$	A power-sharing offer from faction i to faction k, where $k \in \{1, 2, 3\}$.
CS	The constitutional set, where $\mathrm{CS} \in \Re^2$
$v \geq 0$	The amount, in policy utility, by which r_i must beat q for the Senate to support an override of the President's rejection of r_i.
mid_i	The midpoint of a line connecting faction i's ideal point to the Senate's.
sec_i	The point in the CS closest to mid_i when $\mathrm{mid}_i \notin CS$.
π_x	A variable that breaks ties but does not affect outcomes. It represents player x's public stance, where $x \in$ {Senate, President, $F1$, $F2$, $F3$}. $\pi_x > 0$ denotes player x's desire to be seen supporting a particular outcome, even though their decision has no bearing on the outcome. $\pi_x > 0$ denotes player x's desire to be seen opposing the outcome, in the same circumstance. $\pi_x = 0$ denotes player x's indifference in that situation.

"future legislative dynamics" (i.e., anticipated play of the legislative game) to characterize how House members think about possible power-sharing changes.

Second, the model includes the Senate and the President as unitary actors who appear in the legislative game. While modeling the Senate as a unitary actor simplifies reality, it offers a basis for comparison vis-à-vis explanations of House power sharing that do not include the Senate. The model clarifies how shifts in the Senate or the Presidential preferences affect the timing of House member power-sharing decisions.

The model's focal actors are three House factions. We label them $F1$, $F2$, and $F3$. We focus on the case where no faction constitutes a majority of the House—max ($\%F1$, $\%F2$, $\%F3$) <0.5 and $\%F1 + \%F2 + \%F3 = 1$. We model factions' preferences using ideal points ($F1 \in \Re^2$, $F2 \in \Re^2$, $F3 \in \Re^2$) and the policy space $\Re^2$. So, for faction $i \in \{1, 2, 3\}$ and legislative outcome $L \in \Re^2$, we denote faction i's policy utility as $U_i(F_i, L) = -|F_i - L|^2$. To create examples, we refer to $F1$ and $F2$ as factions of the majority party and to $F3$ as the minority party. While none of our proofs or main claims depends on this labeling, the labels help us offer concrete examples that clarify the model's substantive implications.

Of course, only two parties are usually represented in the House. Why have three factions? Our motivation is that many scholars have emphasized the importance of intra-party factions (Hasbrouck 1927; Nye 1951; Burns 1963; Galloway 1976; Brady and Bullock 1980; Sinclair 1982; Rohde 1991; Schousen 1994; Aldrich 1995; Reiter 2001, 2004), and three factions are the simplest way to allow disagreement within the majority party to affect inter- and intra-party bargaining in our model. So, if $F1$ and $F2$ collectively constitute the majority party, our assumption allows some majority party members to threaten to join the minority party in withholding support when proposals by members of their own party make them sufficiently unhappy.

1.1 The Power-sharing Game

Article I, Section 5 empowers the House to choose its own power-sharing rules but provides minimal instructions on how to do so. Its complete instruction is "Each House may determine the rules of its proceedings, punish its members for disorderly behavior, and, with the concurrence of two thirds, expel a member." While the Constitution does not mandate majority approval for such decisions, the House adopts this convention. We will do the same.

Figure 1 depicts the model's power-sharing game. In it, $F1$ goes first and has an opportunity to offer a power-sharing rule to $F2$ or $F3$. If $F1$ fails to offer an acceptable rule, then $F2$ can make an offer to $F3$. Successful rules require the support of two factions (i.e., a majority of House members). If no faction offers an acceptable rule, the game ends with legislative outcome $L = q$, where $q \in \Re^2$ represents a pre-existing aggregate policy status quo.[1]

1. $F3$ not offering a rule does not affect our rule change–timing conclusions. To see why, note that the extensive form gives each possible factional coalition ($F1$–$F2$, $F1$–$F3$, $F2$–$F3$) one opportunity to form and that there are no informational asymmetries in the game. Hence, if there is at least one rule that at least one coalition prefers to the status quo (given common expectations of equilibrium play throughout the game), then change will occur in the model. Clarifying the conditions under which any such rule exists is the sole focus of the article's theoretical claims and empirical hypotheses. It is our point of contrast with the literature's existing claims.

Our theoretical and empirical claims are not designed to speak to matters of "who gets what." $F3$'s ability to offer a rule would affect the answer to this question. For example, if we extend the power-sharing game to give the factions more opportunities to form coalitions, then "who gets what" can change. However, unless the alteration to the extensive form introduces information asymmetries, time discounting, or similar phenomena that are not analyzed here, any case in which two factions would come to an agreement in a hypothetical later stage of the game can be replicated in one of the game's existing stages.

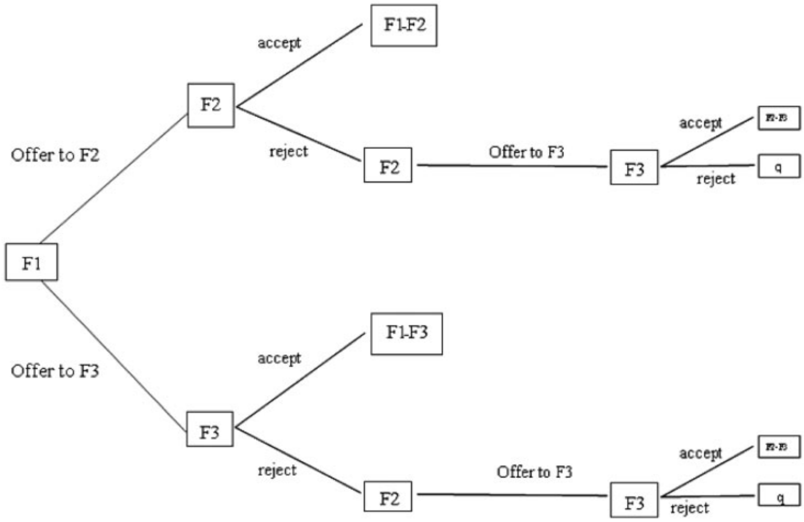

Figure 1. Power-sharing Game Extensive Form.

Offers are of the following form: "If you, faction F2, join with us, faction *F*1, then together we shall commit to a power-sharing rule that is weighted as follows: with probability $c_1^2 \in [0, 1]$ the House shall act as if my faction's ideal point is its own and with probability $1 - c_1^2$ it shall act as if your faction's ideal point is its own." Here, subscripts denote the faction offering the rule and superscripts denote the faction to whom the offer is made.

We represent the rule as probabilistic for two reasons. First, we want to adopt the perspective of House members at moments when they make decisions about whether or not to change the allocation of power in their chamber. At these moments, they are uncertain about which issues will arise and rely on probabilistic beliefs about how today's power allocations will affect tomorrow's batches of legislative outcomes. Second, we seek to reflect the fact that many House power-sharing rules are intended to persist for some period of time, typically the duration of the coming legislative term. So, to clarify the relationship between shifts in the Senate and the President's preferences and House rule changes, we represent agreements that give one faction the speakership, another faction the chair of a prestigious committee, and that allocate power across such positions as analogous to a rule in which "your faction controls the legislative process (from the drafting and processing of bills to *ex post* controls on conference committees) c_1^2 % of the time, while my faction controls it in 100 - $c_1{}^2$% of circumstances." In other words, rules are agreements that codify factions' relative power within a governing coalition.

To complete the power-sharing game's description, we define how ties are broken. The default assumption is that a power-sharing rule change requires more than indifference. For reactions to an offer: if an offer to reallocate power yields the same utility as the status quo, it is rejected. If an offer from $F1$ yields the same utility as an offer from another faction, it is accepted (i.e., if $F2$ is indifferent between coalitions with $F1$ or $F3$, it chooses $F1$ to keep all power within the majority party). For making an offer: if no offer provides the offering faction with greater utility than the consequence of making no offer, then no offer is made.

1.2 The Legislative Game

The legislative game has two stages. Each stage represents future events that House members may think about as they decide whether or not to change the power-sharing rules that the previous legislature had in place. The first stage characterizes Congress' abilities to reconcile inter-chamber differences. The second stage is a noncooperative game between the House, the Senate, and the President that follows Section 7s requirements for passing new laws.

1.3 Bicameral Agreement Procedure

During a congressional session, the House and the Senate produce bills. If the Senate's offerings are not identical to those of the House, a need for a bicameral agreement arises. Article 1, Section 7 of the Constitution requires that the chambers reconcile their differences before seeking presidential approval—but Section 7 provides no instructions on how to do this.

Many reconciliation methods have been used over the years. They range from informal consultations to assembling a formal conference committee in which the House and the Senate delegates engage in sustained negotiations. That said, all bicameral agreement procedures share a common characteristic: they require approval by both the House's and the Senate's representatives.

Following this design, we represent the bicameral agreement procedure as a bargain between the Senate (a unitary actor) and the House's chosen representatives.[2] We assume that the Senate seeks a bicameral agreement

2. Shepsle and Weingast (1987) portray House–Senate negotiations as providing *ex post* vetoes on House decisions. We extend their treatment by modeling House–Senate bargaining outcomes themselves as a function of the House's power-sharing rule. To see how a House power-sharing rule can affect a bicameral agreement, consider the Speaker's conferee selection powers. When inter-chamber negotiations are conducted through conference committees, House Rule 1, Clause 11 gives the Speaker power to select conferees. Even after naming an initial set of conferees, the Speaker retains the right to subtract or add as s/he wishes and "[t]here is no effective way to challenge the Speaker's choice of conferees in the House" (Longley and Oleszek 1989: 38). While we do not believe that the Speaker is entirely unconstrained (i.e., if enough members are sufficiently displeased, they can replace the Speaker or reduce her powers), House rules give the Speaker considerable latitude. For example, Speaker Dennis Hastert (R) chose 13 Republican conferees to represent the House in negotiations over a managed care package that he had worked hard to defeat in the House. All but one of the conferees had opposed the House bill and, in the end, Hastert was able to use his conferee selection power to kill in conference a bill that passed the House by a very wide margin—but that he opposed (Lazarus and Monroe 2007).

that is as close as possible to its ideal point, and that its ideal point, s, is in the set $\{F1, F2, F3\}$. The House power-sharing arrangement determines the House's objective in this negotiation, i.e., we assume that power-sharing arrangements affect the likelihood that the interests of various House factions will be represented in bicameral agreements. So, with probability $c_i^k \in [0, 1]$ faction i represents the House in negotiations with the Senate and with probability $1 - c_i^k$ faction k represents the House.[3]

We now characterize the content of a bicameral agreement. One alternative would be to assume that either the House or the Senate has a greater ability to influence the content of an agreement. While some scholars have argued that the House prevails in negotiations (e.g., Steiner 1951), others contend that the Senate is more successful (e.g., Fenno 1966; Manley 1973). Still others (e.g., Ferejohn 1975; Strom and Rundquist 1977) claim that chambers get their way when they have intense preferences. As Sin (2012) details, there is nothing approaching consensus on this topic in the literature.

Following this lack of consensus and the absence of procedural instructions in Section 7, we use the Nash Bargaining Solution (Nash 1950) to represent the inter-chamber negotiation. Scholars often use this solution to characterize bargaining outcomes in situations where there are no obvious exogenous bases of bargaining power asymmetries (Binmore et al. 1986). In our model, the Nash Bargaining Solution is the point in the policy space that maximizes the product of the utility gain to the Senate and the relevant House faction (i.e., the faction selected as a result of the power-sharing game) that results from a new legislative outcome. If this solution can prevail as the legislative outcome in the second stage of the legislative game (explained below), then it is the bicameral agreement, $r_i \in \Re^2$ where i refers to the House faction that forged the agreement with the Senate (e.g., r_1 refers to an $F1$ Senate bicameral agreement, r_2 refers to an $F2$ Senate bicameral agreement, and so on). Otherwise, the algorithm searches the policy space for the point that maximizes the product of the utility gain to the participating factions while also being able to prevail in the game's final stage. This point then becomes the bicameral agreement. If no such point exists, then there is no bicameral agreement and the game ends with $L = q$ as the legislative outcome.

In our model, a bicameral agreement is the representation of a set of bills that House members foresee when they allocate power. We do not

3. To see why a House faction may choose to give power to its coalition partner, suppose that $F1$ and $F2$ have agreed to a new power-sharing arrangement in the House, that the Senate is represented by $F3$ and that all three factions have bargaining leverage such that it is the common knowledge they will split the difference when attempting to manage their disagreements in the game's legislative stage. If $F2$ is to the left of $F1$ and $F3$ is to the right of $F1$ such that $F1$ is roughly halfway between $F2$ and $F3$, then the point at which $F2$ and $F3$ would "split the difference" can be much closer to $F1$'s ideal point than would the halfway point between $F1$ and $F3$. Hence, $F1$ may obtain higher utility by, in effect, giving its more extreme coalition partner, $F2$, greater power in inter-chamber negotiations.

intend for it to represent a single bill. To motivate this assumption, note that our goal is to permit "future legislative dynamics" (as represented by the legislative game) to influence decisions made in the power-sharing game. So, when modeling the bicameral agreement stage, we work from the perspective that House members have when they are playing the power-sharing game. Hence, we assume that House members use common knowledge about the Senate and the President's preferences to form an expectation about the aggregate policy consequences of any possible power-sharing rule. The bicameral agreement in our model represents that expectation.

The following is also worth noting: while a bicameral agreement must make both conferees better off than the status quo, it may benefit one chamber more than the other. Such asymmetric outcomes will occur when the status quo is farther from one of the chamber's ideal points than it is from the other.

1.4 The Final Stage

Figure 2 depicts the extensive form of the legislative game's final stage. The House, the Senate, and the President consider the bicameral agreement r_i under a closed rule (i.e., $L \in \{r_i, q\}$). In what follows, we use the subscript on r only when referring to a bicameral agreement between the Senate and a specific House faction. Otherwise, we simply use r.

The bicameral agreement needs the support of two House factions (i.e., a majority) to pass in the final stage. So, if two House factions and the Senate support the bicameral agreement, it goes to the President. Otherwise, the game ends with legislative outcome $L = q$. We assume that the House moves before the Senate. Since the model is one of complete information, this assumption is inconsequential.

If the bicameral agreement makes it to the President, s/he can approve it or reject it. If approved, the game ends with outcome $L = r_i$. A presidential rejection causes the game to continue. We assume that the President, like the other players, seeks a legislative outcome that is as close as possible to an ideal point, p, where $p \in \{F1, F2, F3\}$.

The game's final decision represents the House and the Senate reactions to a presidential rejection. If neither chamber can generate sufficient support for an override, then $L = q$. If the override succeeds, then $L = r_i$. Following the constitutional requirements for a Congressional override of a presidential veto, an override in our model requires the support of 2/3 of the members of each chamber. We represent this requirement in different ways for the House and the Senate.

For the House, an override requires the support of at least two-thirds of the membership. The support of 2/3 of the factions may not be sufficient. Instead, the size of the factions supporting the override must be greater than or equal to two-thirds of the membership. For example, suppose that factions $F1$ and $F3$ support an override. The override has sufficient support only if $\%F1 + \%F3 \geqslant 2/3$.

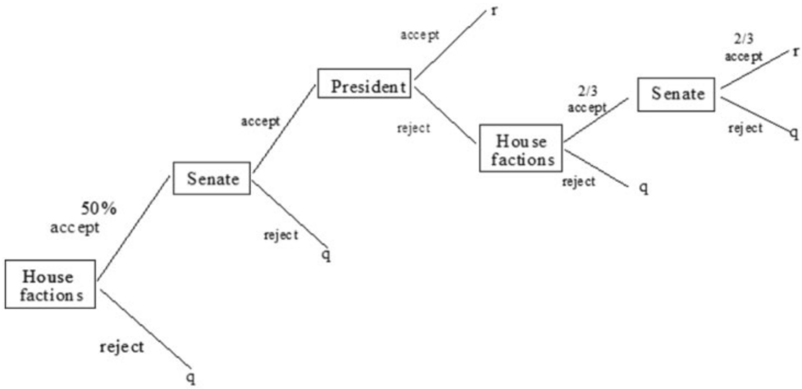

Figure 2. Final Stage Extensive Form.

For the Senate, we assume that all else constant, it can be more difficult for it to support an override than it is to support normal legislation (i.e., it can be more difficult for the Senate to solicit support of 2/3 of the chamber than it can be to obtain 50 votes needed to pass legislation or the 60 votes needed to invoke cloture). We represent the Senate's supermajoritarian requirements by stating that the Senate supports an override only if r provides at least $v \geqslant 0$ more utility to the Senate than q, where v is exogenous. In other words, an override may require that the bicameral agreement be substantially better for the Senate than the status quo.[4]

2. Equilibrium Properties

Our conclusions come from a subgame perfect equilibrium whose uniqueness is proven in Appendix A. In our model, a subgame perfect Nash equilibrium consists of the following components: in the legislative game's final stage, players choose strategies that are best responses to the actions of all other players in this stage, and in the power-sharing game, House members choose strategies that are best responses to the actions of all other players, all of which are conditioned on common knowledge of the bicameral agreement algorithm and the belief that players will choose best responses in the final stage. Since we draw our conclusion via backward induction on the game's extensive form, we describe properties of the equilibrium in the same order. The first proposition describes focal properties of the legislative game's final stage and produces the definition of a key concept, the constitutional set (CS).

4. Note that the Senate's ideal point need not represent a median Senator. It can also represent a pivotal Senator whose support is needed to prevent filibusters. Under the latter interpretation, arbitrarily small values of v can represent the super-majoritarian aspect of the Senate's bargaining position.

Proposition 1 (The CS)
The final stage yields $L = r \neq q$ iff one of the conditions is met

(i) $s \neq p$, $|s-q|^2 - |s-r|^2 > 0$ and $|p-q|^2 - |p-r|^2 > 0$
(ii) $s = p = Fi$, $|s-q|^2 - |s-r|^2 > 0$, and $|Fj-q|^2 - |Fj-r|^2 > 0$ for $j \neq i$
(iii) $s \neq p$, $\%P \leqslant 1/3$, $|p-q|^2 - |p-r|^2 \leqslant 0$, $|s-q|^2 - |s-r|^2 - v > 0$, and $|Fj-q|^2 - |Fj-r|^2 > 0$ for $Fj \notin \{s,p\}$.

In words, a new legislative outcome occurs if:

(i) the Senate and the President have distinct ideal points (here labeled s and p) and the House factions that share these ideal points prefer the bicameral agreement to the status quo,
(ii) the Senate and the President share an ideal point, the House faction that shares this ideal point (here labeled Fi), and at least one other faction (here labeled $Fj \neq Fi$) prefers the bicameral agreement to the status quo, OR
(iii) the President prefers the status quo to the bicameral agreement, the size of the House faction that agrees with him (denoted $\%P$) is not large enough to prevent an override ($\%P < 1/3$), the Senate prefers the bicameral agreement to the status quo so much that it will support an override, and the House faction that is aligned with neither the Senate nor the president also prefers the bicameral agreement.

Henceforth, we refer to the subset of the policy space that satisfies the conditions of Proposition 1 as the CS. An implication is that supplanting the status quo requires a bicameral agreement that it is in the CS. Parts of the policy space that are not in the CS are not viable legislative outcomes.

It is important to note that the CS *need not be connected*. The set of points that the President, the Senate, and the House majority prefer to the status quo need not overlap with the set of points that two-thirds of the Senate and two-thirds of the House prefer. Figure 3 offers an example. In it, $\%F1 + \%F2 > 2/3$. The CS is the union of the shaded areas. The black area represents the set of policies that the President, the Senate, and a majority of House members prefer to the status quo. The gray area represents the set of policies for which the House and the Senate will override a presidential rejection. The fact that these two areas are not connected alters the bargaining dynamics in an important way. Instead of choosing a point on a continuous one-dimensional policy space, actors in our model can use the threat of a very different kind of outcome, say the "override" subset of the CS, when bargaining with other actors. Substantively, disconnected CSs are a consequence of the fact that Section 7 allows laws to be made by *two different kinds of coalitions*—a House majority/Senate majority/Presidential coalition, or a House supermajority/Senate supermajority coalition.

Moving backward, we now characterize the bicameral agreement. Let nbs_i be the Nash Bargaining Solution of a negotiation between House

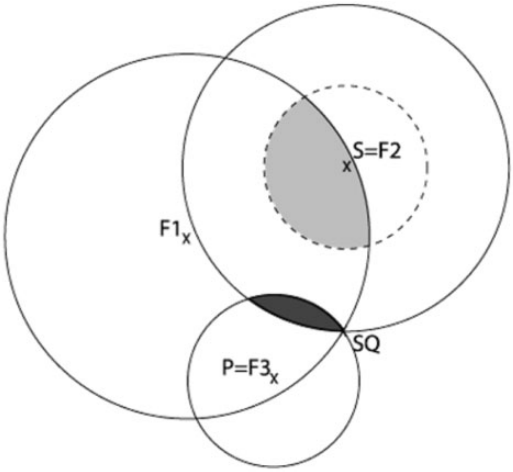

Figure 3. A Non-Connected Constitutional Set.

faction i and the Senate (i.e., the point in the policy space that maximizes the product of the gain to faction i and the Senate from changing the legislative outcome from the status quo). This point is the default bicameral agreement. By assumption, if $\text{nbs}_i \in$ CS, then $r_i = \text{nbs}_i$. When this point is not in the CS, the algorithm searches for the point that maximizes the product of the factional gains subject to the constraint that the point is also in the CS. Call this "*sec*ond best" point, sec_i. Therefore, $r_i \in \{\text{nbs}_i, \text{sec}_i\}$ denotes the bicameral agreement. Appendix A includes a complete specification of the conditions under which each kind of bicameral agreement emerges.

The bicameral agreement's most important implication is as follows: if we hold all House members' ideal points constant and shift the Senate or President's ideal point, the CS can change. By changing the set of feasible legislative outcomes, CS shape changes can alter the values of current and potential House power-sharing arrangements. Such alterations can affect all factions' bargaining leverage and can induce House members to seek new power-sharing rules. Hence, CS shape changes are the vehicle through which Senatorial or Presidential preference shifts affect House power-sharing rules.

We now characterize choices in the power-sharing game. Since our model joins two distinctively structured bargaining games (the power-sharing game and the legislative game), where each stage allows a nontrivial number of relations between variables, the number of possible contingent relationships among variables in our model is large. Proving that the game yields a unique equilibrium requires a full accounting of all such contingencies and makes the formal statement of power-sharing game equilibrium strategies quite long. An appendix gives the full accounting. Here, we offer a more intuitive presentation.

Consider the moment in the game where faction $F1$ can offer a new power-sharing rule to $F2$ or $F3$. First, $F1$ considers the consequences of $F2$ and $F3$ rejecting its offer and asks "Will rejection lead to the continuation of the status quo rules or to an agreement between $F2$ and $F3$?" Second, $F1$ determines which shares of power each faction will accept, taking into consideration that $F2$ and $F3$ will only accept a power-sharing rule that provides at least as much utility as either would gain from a rule that $F2$ would later offer to $F3$. Third, if there exists a rule that is acceptable to $F2$ or $F3$ and that makes $F1$ better off than the status quo, then $F1$ will offer a rule. If there is more than one such rule, $F1$ offers the rule that maximizes its expected utility.

This sequence has noteworthy implications for what follows. For example, a faction that does not have attractive alternative possibilities (e.g., a faction whose ideal point is far from that of two other factions whose respective ideal points are close to one another) will have less bargaining leverage. If this "distant" faction is included in the power-sharing arrangement, it will be under unfavorable terms. Moreover, a faction need not prefer a rule that gives them the greatest share of power—they may accept less power from a partner who yields better legislative outcomes (see note 3 or, for related insights in parliamentary contexts, Lupia and Strom 1995; Kedar 2005).

3. Implications

We now use examples to highlight the model's implications. In the easiest case, suppose that the Senate, the President, and at least two House factions share the same ideal point, $F1$. The unique subgame perfect equilibrium implies legislative outcome $L = r_1 = r_2 = r_3 = F1$. In this case, all players are indifferent between all power-sharing rules because all produce the same outcome.

Power sharing is more interesting in other cases. Generally speaking, we find that bargaining outcomes are more than a function of the House member's ideal points. The Senate and the President's preferences also affect the outcome. Proposition 2 states a necessary condition for Senatorial or Presidential preference shifts to affect House power-sharing rules.

Proposition 2. If shifting s or p changes the CS's shape in a way that affects the value of at least one possible power-sharing rule to at least one faction, then the shift can cause a rule change. Otherwise, such shifts do not affect House rules.

Hence, it is possible to hold constant every House member's ideal point, shift the ideal point of the Senate or the President, and change the House's power-sharing rule if the shift changes the CS's shape. Shape changes matter when they alter at least one faction's preferences about which factions should represent the House in the bicameral stage. Even a change in one faction's preference can have a ripple effect—as one faction changing what rules it is willing to offer or accept can affect the bargaining leverage of all factions. Hence, when the CS changes shape, new House rules can result. Figure 4 gives an example.

The top of the figure depicts initial conditions. In it, the President, the Senate, and the House faction *F*2 share the ideal point (12, 12). House factions *F*1 and *F*3 have ideal points (12, 24) and (30, 30), respectively. The status quo is (24, 18) and $v=0$. *F*1 controls 40% of the House. *F*2 and *F*3 control 35% and 25%, respectively. Factions engage in power-sharing negotiations knowing that the bicameral agreement resulting from an agreement between *F*1 and the Senate would be $r_1=(12, 18)$, and the one resulting from an *F*3 Senate agreement would be $r_3=(21, 21)$, with both bicameral agreements simultaneously maximizing the product of the respective utility gains of Senate's and that of the relevant House faction while also being in the CS. Since the Senate and *F*2 share an ideal point, that point—$r_2=(12, 12)$—is the bicameral agreement that they would produce.

The outcome of this game is a power-sharing arrangement between *F*1 and *F*2, where $c_1^*2=1$ (*F*1 represents the House in all bicameral negotiations) and $L=r_1=(12, 18)$. This rule is sufficient to induce faction *F*2 to coalesce with *F*1, rather than allowing power-sharing negotiations to continue. To see why, note that if *F*1 thought that *F*2 would reject $c_1^*2=1$, *F*1 could offer $c_1 3=(18/306)+\varepsilon$ to *F*3, which is the minimal offer from *F*1 that *F*3 would accept.[5] *F*2's expected utility from this $F1-F3$ rule is less than the utility it receives from $L=r_1=(12, 18)$. Hence, *F*2 accepts the offer from *F*1. *F*1, in turn, offers the rule to *F*2 because *F*1 prefers $L=(12, 18)$ to the policy consequence of the most favorable rule for it that could also gain *F*3's acceptance.[6]

Now, suppose that an election shifts the Senate's ideal point from *F*2 to *F*3. All other ideal points remain constant. As the bottom of Figure 4 shows, the shift radically reshapes the CS. Since *F*3 now shares the Senate's preferences, this faction's preferences now constrain any possible bicameral agreement. *F*2 remains both aligned with the President and large enough to prevent an override. Therefore, shifting the Senate's ideal point from *F*2 to *F*3 reduces the CS to the intersection of the set of points that both *F*2 and *F*3 prefer to *q*—a very small set.

5. This footnote and the next provide details about the best responses in part of the power-sharing game's extensive form that are not reached in equilibrium. The other examples in this section follow parallel logic. *F*3's utility from the offer that *F*2 would make if *F*1 failed to make a successful offer and *F*3's utility from the *F*1 to *F*3 rule specified here are just above −180, which is *F*3's utility from *q* and, hence, the minimum amount necessary to induce *F*3 to agree to a rule change. Were *F*1 to fail to make an acceptable offer, *F*2 would offer, and *F*3 would accept $c_2{}^3=(18/486)+\varepsilon$.

6. *F2's* utility from the *F*1 to *F*3 rule would be approximately −155. *F*2's utility from *r*1 is −36. –*F*1's utility from its offer to *F*2 is −36, whereas its utility from the offer that *F*3 would accept is approximately −86.

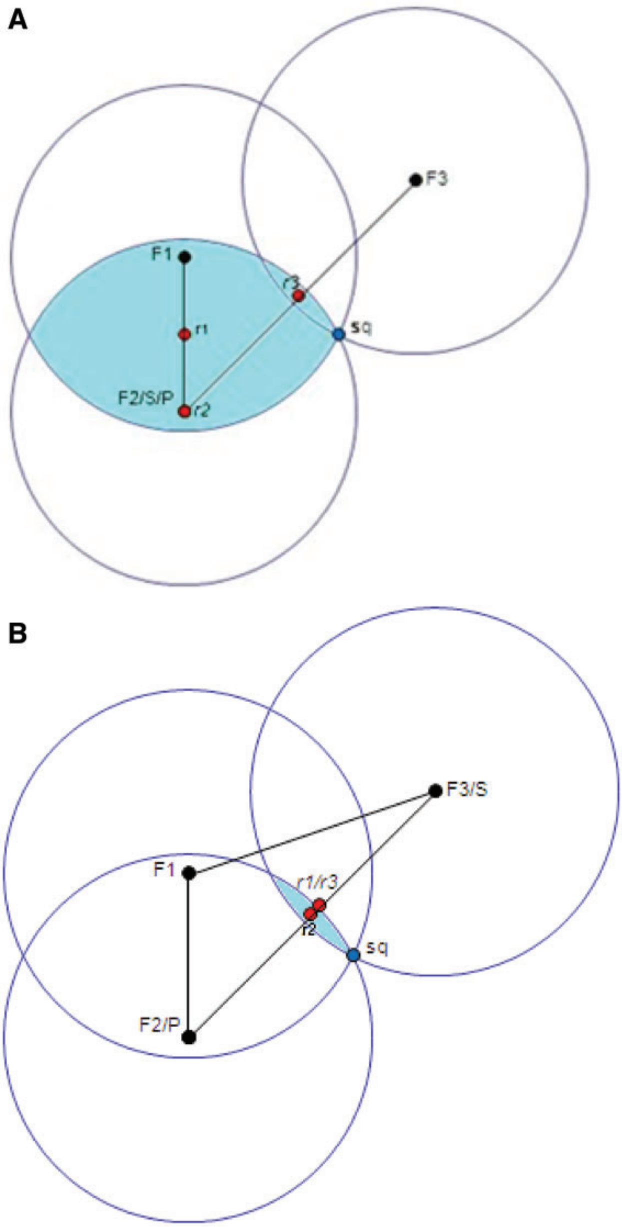

Figure 4. An Example with Shaded Constitutional Sets. In (B) The Senate Shifts to Faction F3's Ideal Point.

This shift in the Senate's ideal point causes House members to seek a new power-sharing rule. The outcome of this game is a power-sharing arrangement between $F1$ and $F2$, where $c_1^*2 = 0$ ($F2$ represents the House in all bicameral negotiations) and $L = r_2 = (21, 21)$. Were $F2$ to reject the offer, then $F2$ would offer $c_2^3 = 1$, which would give $F2$ total control. While that outcome would make $F3$ at least as well off as accepting the status quo, $F1$ makes the offer to $F2$ because the legislative outcome from that offer $r_2 = (21, 21)$ provides $F1$ with higher utility than the legislative outcome, $r_1 = (21.486, 21.486)$, that would result from partnering with $F3$.

Even though the policy preferences of all House members remained unchanged, the House chose to reallocate power among its factions. While $c_1^{*2} = 1$ was the initial power-sharing rule, a different rule emerges after the shift in Senate preferences. The Senate change altered the rules that House factions were willing to offer or accept. A change in the shape of the CS was sufficient to affect power sharing in the House.[7]

4. Empirical Implication: The Timing of Major Changes

Our model explains how shifting the Senate or President's preferences can cause House members to change power-sharing rules. An implication is that, all else constant, there will be more major House rule changes in sessions that follow a new President or a shift in partisan control of the Senate than in sessions where no such shift has occurred. This same implication cannot be derived from work that focuses on House members' preferences alone.

We now evaluate this implication by re-examining the timing of major House rule changes over the last 130 years. Our dependent variable is an updated version of a variable used in previous work by Binder (1997), Schickler (2000), and Cox and McCubbins (2005). The variable draws from a list of rules and procedural changes that had significant effects on how the House distributes power. Schickler's defines the list as including "any alterations in rules that were intended either to advantage or to undermine the majority party and its leaders in their efforts to shape the House agenda. . .." We added rule changes identified by Binder (1997) and Cox and McCubbins (2005), which were not incorporated in Schickler's original list but had significant effects on the distribution of power within the House. We also collected the data for the 105–110th Congresses, which are not covered in the previous data sets and followed the previous

7. Another element of this example is worth noting. Like us, Krehbiel (1998) incorporates the Senate and the President into a formal model of US lawmaking. A key difference between our models is dimensionality. Krehbiel assumes that the policy space over which legislators negotiate is one dimensional and finds that median legislators are powerful. Were we to restrict our model to one dimension, we could easily generate cases in which median actors' ideal points act as magnets that pull outcomes as close as the Senate and the President will allow. Without the restriction, our results show such dynamics are not generally robust to the introduction of a second policy dimension. When a second dimension is included, the CS can take on many different shapes and such changes can significantly alter the bargaining power underlying decisions to change House rules.

scholars' coding rules in using this data. In our analyses, any House with at least one such change is coded as one. Other Houses are coded as zero.[8]

We conducted two types of analyses. First, we analyze all sessions of Congress from 1879 to 2009 (46–110th Congress). Second, we restrict our examination to those Congresses in which the House majority remained constant from one period to the next. We use the two analyses to provide multiple views of how House member preference variations affect the relationship between House rule changes and shifts in senatorial and presidential preferences.

Our unit of analysis is an individual Congress. There are 65 cases when we analyze all Congresses from 1879 to 2009 and 51 cases when we select only those in which the House majority does not change from one Congress to the next. In what follows, we will first describe the analysis that takes all Congresses into account. Then, we will focus on the restricted sample.

To analyze all Congresses from 1879 to 2009, our focal explanatory variable is a dichotomous variable where one means a shift in the House majority party, Senate majority party, or a new President in the White House and zero represents the absence of such shifts. According to our theory, such shifts can change the shape of the CS and increase the probability of rule changes.

In Table 2, we compare Congresses in which there was a shift in the House's majority, Senate's majority party, or a new President to those in which no such shift occurred. The table shows that such shifts have a substantial effect on whether or not the House changes its power-sharing rules. Of the 37 Congresses that followed a House, Senatorial, or Presidential shift, 76% made a major change in the allocation of power. In the other 28 Houses, where no such shift occurred, only one-in-three Houses opted for change. This is a large and significant difference.

To account for the possibility that this difference is caused by changes in House members' preferences and not by changes in the preferences of the Senate and President, we present in Table 3 an analysis of the same data that incorporates variables from the existing literature that measure House member preference changes. *Proportion of New Members* (Fiorina et al. 1975, for 46–62nd Congress; Amer 2008 for 63–110th Congress) measures the proportion of new House members for each Congress, including those with prior service. ΔHomogeneity (Cox and McCubbins 1993, 2005; Aldrich and Rohde 2000) measures changes in preference similarity among majority party members since the previous Congress. ΔPolarization (Aldrich and Rohde 2000) measures changes in preference differences across parties since the previous Congress.

8. The coding speaks to our focus on the timing of rule changes. Ancillary work pursues the content of such changes in greater depth. Sin 2012 reveals important relationships between rules that centralize power in the Speaker (and his or her faction) and changes in senatorial and presidential preferences.

Table 2. Predictions and Empirical Findings for Major Rule Changes, 1879–2009

	Outcomes
Shift in partisan control of the House, Senate, and/or new President	76% of the Houses make major changes
No shift	32% of the Houses make major changes

Marginal predictions—Sin–Lupia Model: greater change in top cell. All other prominent theories mentioned in the text: no difference across cells.

ΔMedian (Schickler 2000) measures changes in the floor median's preferences relative to preferences of the majority and minority party medians. Party Capacity (Binder 1997) measures the difference in strength between the two parties. We followed Schickler (2000) when constructing the last four variables.[9]

The first four models in Table 3 include the results of regressions that include different combinations of ΔHomogeneity, ΔPolarization, ΔMedian, and Party Capacity as explanatory variables. What we find is that no matter the model specification, the results are the same: the relationship between whether or not a House adopts a major rule change and a change in the floor median is statistically significant. These four models are consistent with the results reported in the existing literature (e.g., Schickler 2000) and with the idea that changes in House members' preferences drive decisions to reallocate power.

The results change when we add the binary variable Shifts in the partisan control of House, Senate, or President, which equals one when any such change occurs and zero otherwise. When this variable is added in Model 5, the coefficient of ΔMedian is no longer significant. In fact, as Models 6–12 indicate, the *Shift* variable yields the only statistically significant coefficient regardless of how many of the other variables are included. We also conducted a likelihood ratio test for our *Shift* variable to test whether the coefficient associated with our variable is zero. The result indicates that the null hypotheses that the coefficient associated with the *Shift* variable is equal to zero can be rejected at the 0.01 level. These findings are consistent with our theory but not the existing literature.

9. Homogeneity is the ratio between the standard deviation of majority party members' DW-NOMINATE scores and the Floor's standard deviation. ΔHomogeneity is the difference between Homogeneity at times t and $t-1$. Polarization is the difference between the DW-NOMINATE scores of the majority and the minority party medians. ΔPolarization is the difference in Polarization at times t and $t-1$. Median is the difference among the distance between the floor median and the minority party median and the floor median and the majority party median. ΔMedian is the difference in Median at times t and $t-1$. Party Capacity is the difference between Majority and Minority Party capacity. Majority Party capacity is equal to the Majority Party Rice cohesion score times the percentage of Majority Party membership in the House. Minority Party capacity is calculated in an analogous way.

Table 3. Logit Predictions for Major Rule Changes, 1879–2009

Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Shift in partisan control of House, Senate, and/or new President					**1.75*** (0.567)**	**1.82*** (0.58)**	**1.83*** (0.583)**	**1.84*** (0.584)**	**1.75*** (0.567)**	**1.81*** (0.600)**	**1.84*** (0.607)**	**1.88*** (0.557)**
Proportion new house members										−0.007 (0.025)	−0.001 (0.025)	
ΔHomogeneity		−2.89 (4.01)		−2.26 (4.07)		−4.48 (4.43)	−3.79 (4.49)	−3.82 (4.49)			−3.79 (4.53)	
ΔPolarization				3.58 (5.94)			4.04 (6.32)	4.01 (6.32)			3.95 (6.43)	
ΔMedian (Schickler)	3.50* (1.83)	3.32* (1.84)	3.45* (2.04)	3.31* (1.84)	2.57 (1.97)	2.28 (1.99)	2.23 (1.98)	2.059 (2.23)	2.426 (2.19)	2.43 (2.19)	2.06 (2.24)	
Binder measure			0.001 (0.034)					0.006 (0.038)	0.005 (0.038)	0.005 (0.038)	0.006 (0.039)	
Constant	0.294 (0.258)	0.298 (0.26)	0.27 (0.511)	0.288 (0.261)	−0.65 (0.412)	−0.67 (0.413)	−0.69 (0.416)	−0.78 (0.663)	−0.73 (0.65)	−0.58 (0.82)	−0.75 (0.86)	−0.74* (0.404)
Number of observations	65	65	65	65	65	65	65	65	65	65	65	65
Log likelihood	−42.39	−42.12	−42.39	−41.94	−37.22	−36.69	−36.48	−36.47	−37.21	−37.16	−36.47	−38.11

DV: At least one major rule change. Cell entries are logit estimates. Standard errors are in parentheses. The bold coefficients correspond to our main independent variable.
$^{***}p < 0.01$, $^{*}p < 0.1$.

A more stringent test of our theory is to consider only the subset of Congresses in which there was no shift in the partisan control of the House from the previous term. This case distinguishes our theory from existing work more starkly—as our model implies that a preference shift in the Senate or President can lead House members to seek a power reallocation even though the House has no such shift. Of the 65 Congresses described above, 51 meet the criterion. In Table 4, we reproduce the results of Table 2 for this subset of Congresses.

When we restrict the analysis to the 51 Congresses in which the House remained constant, the results are still similar to those described above. Of the 23 Congresses with constant Houses that followed a Senatorial or Presidential shift, 74% made a major rule change. Only 32% of the Houses made such a move in the absence of a presidential or senatorial shift. This is a large and significant difference.

In Table 5, we analyze the same subset of Congresses and also incorporate the variables from the existing literature that uses to account for changes in the distribution of power in the House. This analysis allows us to account for changes in House members' preferences that occur even when partisan control of the chamber is unchanged.

Table 5 shows that once we account for a shift in the partisan control of the Senate or the President, relationships between the timing of House rule changes and the variables used to describe rule changes in the existing literature are no longer significant. The President/Senate shift variable is the only factor that survives such scrutiny. These findings are consistent with our theory, but not the existing literature.

To make these findings more concrete, we ask you to consider a few representative examples. One comes from 2009. In January, at the beginning of the 111th Congress, the House's Democratic majority adopted a package of rules and procedures that significantly reversed the rules and procedures the Democrats had adopted in just 2 years earlier upon recapturing the House. The 2009 rules, for example, relaxed "pay-go" budget requirements, which had stipulated that "any mandatory spending increases or tax cuts had to be offset with tax increases or spending cuts elsewhere."[10] Why did the 2009 Democratic majority relax the 2007 Democratic majority's "pay-go" requirements? We contend that while strict "pay-go" rules were useful as a bargaining tool for the 2007 Democratic majority in its negotiations with a Republican President, the rules were too rigid for the 2009 Democratic majority that wanted to support a newly elected Democratic President's agenda.

Another example comes from the 1961 presidential change from Republican Dwight D. Eisenhower to Democrat John F. Kennedy. Kennedy's election was followed by the enlargement of the Rules Committee. This major redistribution of power in the House made it so that the Rules Committee's "conservative members could not kill the

10. *CQ Weekly*, January 12, 2009.

Table 4. Predictions and Empirical Findings for Major Rule Changes when the House majority remains constant, 1879–2009

No change in House majority and	Outcomes
Shift in partisan control of the Senate and/or new President	74% of the Houses make major changes
No shift	32% of the Houses make major changes

Marginal predictions—Sin–Lupia Model: greater change in top cell. All other prominent theories mentioned in the text: no difference across cells.

president's New Frontier program" (Oleszek 2001: 119). What is noteworthy about the timing of this change is that neither the composition of the Senate nor the House changed much before and after the 1960 election. The DW-NOMINATE score for the Democratic median in the House was −0.269 in the 86th Congress (before Kennedy) and −0.261 in the 87th Congress (after Kennedy) (http://voteview.com/pmediant.htm). The House Republican Party and both Senate parties also changed very little. Shifts in House members' preferences do not explain the timing of the Rules Committee's enlargement. But, as Oleszek anticipated, and as our model now explains, Kennedy's election altered the kinds of power-sharing rules that House members would accept.[11]

A final example clarifies the timing of a sequence of recent events. Recall from the example above that the Democratic majority that gained the House in 2007 changed the rules when they took over and then changed the rules again in 2009. Also recall from the beginning of this article that there were major rule changes not only when the Republican majority took control of the House in 1995 and 2011, but also in 2001 and in 2003. What explains this pattern?

In 1995, the House and Senate changed partisan hands. In 1997 and 1999, there were no such changes. In 2001, the president's partisanship changed as did that of the Senate (after James Jeffords changed his partisan allegiance). In 2003, the Senate changed partisan hands again. In 2005, there were no such changes. In 2007, both chambers changed hands. In 2009, the president's partisanship changed. In 2011, the House changed hands.

So, in every Congress since 1994, there has been either a change in partisan control of the House, Senate, or Presidency followed by major House rule changes or no change in partisan control of House, Senate, or President followed by no major rule change in the House. It is difficult to explain this pattern without considering the possibility that

11. Sin 2012's case studies identify other important rule changes that are better explained by changes in the President and the Senate than by the House members' preferences alone. These changes include the revolt against Speaker Cannon, and changes in the discharge and Reed rules.

Table 5. Logit Predictions for Major Rule Changes when House Majority Remained Constant From one Period to the Next

Independent Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Shift in partisan control of Senate and/or new President					**1.67*** **	**1.7*** **	**1.7*** **	**1.7*** **	**1.68*** **	**1.74*** **	**1.74*** **	**1.78*** **
					(0.63)	**(0.643)**	**(0.645)**	**(0.646)**	**(0.63)**	**(0.666)**	**(0.675)**	**(0.623)**
Proportion new house members										−0.009	−0.006	
										(0.031)	(0.032)	
ΔHomogeneity		−7.24		−5.88		−8.28	−6.85	−6.82			−6.72	
		8.11)		(8.57)		(9.05)	(9.48)	(9.49)			(9.47)	
ΔPolarization				3.80			3.81	3.8			3.61	
				(7.76)			(8.1)	(8.1)			(8.17)	
ΔMedian (Schickler)	3.49	3.88*	3.51	3.83*	2.47	2.87	2.79	2.8	2.61	2.48	2.77	
	(2.21)	(2.28)	(2.47)	(2.29)	(2.33)	(2.4)	(2.39)	(2.65)	(2.58)	(2.61)	(2.68)	
Binder measure			−0.000					−0.002	−0.004	−0.005	−0.002	
			(0.035)					(0.04)	(0.039)	(0.039)	(0.04)	
Constant	0.081	0.08	0.09	0.07	−0.66	−0.67	−0.69	−0.66	−0.59	−0.39	−0.52	−0.74*
	(0.288)	(0.29)	(0.559)	(0.29)	(0.413)	(0.418)	(0.42)	(0.67)	(0.65)	(0.91)	(0.93)	(0.404)
Number of observations	51	51	51	51	51	51	51	51	51	51	51	51
Log likelihood	−33.98	−33.5	−33.9	−33.45	−30.20	−29.77	−29.66	−29.66	−30.2	−30.15	−29.64	−30.78

DV: At least one major rule change. Cell entries are logit estimates. Standard errors are in parentheses. In bold the coefficients corresponding to our main independent variable.
***$p < 0.01$, *$p < 0.1$.

forward-looking House members consider the altered preferences of the Senate and President when deciding whether or not to reallocate power among themselves.

5. Conclusion

If the House members are goal-oriented and forward-looking, then they have an incentive to integrate implications of Article I, Section 7 into the power-sharing decisions they make under Article I, Section 5. A consequence of such incentives is that shifts in Senatorial or Presidential preferences can affect the timing of major House rule changes. While previous studies of how the House allocates power assume that the preferences of the President or Senate are irrelevant, our work shows otherwise. A change in the ideological perspective of the Senate or the identity of President can alter House members' expectations about the consequences of power-sharing rules. These altered expectations can lead the House to change their rules. Hence, when attempting to explain the timing of organizational decisions made by the House under Article I, Section 5, analysts should take the requirements of Article I, Section 7 into account.

Appendix A

Proof of Proposition 1. By backward induction.

Lemma 1. The outcome of the final stage's override subgame is $L = r \Leftrightarrow s \neq p$ and $\%P \leqslant 1/3$ and $\min\ (|s-q|^2 - |s-r|^2 - v,\ \ |z-q|^2 - |z-r|^2) > 0$. Otherwise, $L = q$.

Proof. House and Senate supermajorities must agree to an override. In the House, 2/3 of the membership must support an override. In the Senate, we represent supermajority support for an override as the requirement that the bicameral agreement, r, be at least distance v closer to s than the status quo q is to s.

Reaching the override subgame implies that the President previously rejected r. This fact has an implication for the feasibility of an override. Let $p \in \{F1, F2, F3\}$ be the president's ideal point and $\%P$ be the percentage of House members who are from the President's faction. Since no group has a majority of House seats, $\%P \in [0, 0.5]$. Since the President preferred q to r, this faction has the same preference by definition. Therefore, if $\%P > 1/3$, the House will not override the President's rejection. The legislative outcome is $L = q$.

Now suppose $s = p$—the Senate and the President are from the same faction. Since getting to the override stage implies that the President preferred q to r, the Senate must have the same preference. Therefore, the Senate will not override. The legislative outcome is $L = q$.

The remaining case is $s \neq p$ and $|s-q|^2 - |s-r|^2 - v > 0$ and $\%P \leqslant 1/3$. Here, the Senate votes to override. Let $\%S$ denote the percentage of House members who are from the same faction as the Senate, where $\%S \in [0, 0.5]$. Since the Senate previously approved r, as a necessary condition for reaching the final stage, it must be that $|s-q|^2 - |s-r|^2 > 0$. Therefore, $\%S$ of the House also prefers r to q. Since $\%P \leqslant 1/3$ of the House members will not support an override and $\%S \leqslant 0.5$ will support it, the remaining faction is pivotal with respect to an override. As in the text's presentation of Proposition 1, let $Fi \neq s \neq p \in \{F1, F2, F3\}$ denote House members who are from a different faction than either the Senate or the president, where $\%Fi$ refers to the size of that faction and $\%P + \%S + \%Fi = 1$. If this faction prefers r to q (i.e., $|Fi-q|^2 - |Fi-r|^2 > 0$), then the rejection is overridden. *QED*.

Lemma 2. The final stage's presidential subgame outcome is $L = r \Leftrightarrow |p-q|^2 - |p-r|^2 > 0$ OR $[|p-q|^2 - |p-r|^2 \leqslant 0$ and $\%P \leqslant 1/3$ and $|s-q|^2 - |s-r|^2 - v > 0$ and $|Fi-q|^2 - |Fi-r|^2 > 0]$. Otherwise, $L = q$.

Proof. First, we need a way of describing what the President will do when the House and the Senate will override. In such, the President's choice is inconsequential to the game's outcome, $L = r$. For this purpose, let $\pi_p \in \{-\infty, \infty\}$ represent the President's rhetorical preference when he knows that he would be overridden. $\pi_p > 0$ represents cases where the President wants to be seen approving r. $\pi_p < 0$ represents cases where, s/he prefers to be seen opposing r. These terms are inconsequential to our claims, but allow us to characterize other players' behaviors when the President's choice does not affect the final outcome.

If the president anticipates an override, then the relevant utilities are $U_p(q,\pi_p) = -|p-r|^2$ and $U_p(r,\pi_p) = -|p-r|^2 + \pi_p$. If $\pi_p > 0$, then the president chooses r. If $\pi_p \leqslant 0$, then the president chooses q. If a rejection will not be overridden, then the relevant utilities are $U_p(q) = -|p-q|^2$ and $U_p(r) = -|p-r|^2$. If $|p-q|^2 - |p-r|^2 > 0$, then the president chooses r. If $|p-q|^2 - |p-r|^2 \leqslant 0$, then he or she chooses q. By implication:

- If $s \neq p$ and $\%P \leqslant 1/3$ and $\min(|s-q|^2 - |s-r|^2 - v, |Fi-q|^2 - |Fi-r|^2) > 0$ and $\pi_p > 0$, then the president approves r under threat of override and the game ends with $L = r$.
- If $s \neq p$ and $\%P \leqslant 1/3$ and $\min(|s-q|^2 - |s-r|^2 - v, |Fi-q|^2 - |Fi-r|^2) > 0$ and $\pi_p \leqslant 0$, then the president rejects r under threat of override and the game goes to the override stage (where the rejection is overridden).
- If $[s = p$ or $\%P > 1/3$ or $\max(|s-q|^2 - |s-r|^2 - v, |Fi-q|^2 - |Fi-r|^2) \leqslant 0]$ and $|p-q|^2 - |p-r|^2 > 0$, then the president approves r with no override threat and the game ends with $L = r$.
- If $[[s = p$ or $\%P > 1/3$ or $\max(|s-q|^2 - |s-r|^2 - v, |Fi-q|^2 - |Fi-r|^2) \leqslant 0]$ and $|p-q|^2 - |p-r|^2 \leqslant 0]$, then the

president rejects r and the game goes to the override stage (where the rejection survives). *QED*.

Lemma 3. The final stage's Senate subgame outcome is $L=r \Leftrightarrow$ $[|s-q|^2-|s-r|^2>0$ and $|p-q|^2-|p-r|^2>0]$ OR $[|p-q|^2-|p-r|^2 \leqslant 0$ and $\%P \leqslant 1/3$ and $|s-q|^2-|s-r|^2-v>0$ and $|Fi-q|^2-|Fi-r|^2>0]$. Otherwise, $L=q$.

Proof. Let $\pi_s \in \{-\infty,\infty\}$ represent the Senate's rhetorical preference when it anticipates a veto that will not be overridden (i.e., when the Senate is not pivotal), where the values are defined equivalently to π_p. For the Senate, the relevant utilities are $U_s(q)=-\ |s-q|^2$ and $U_s(r)=-$ $|s-r|^2$, if $L=r$ is the outcome of the presidential subgame just described, and $U_s(r)=-\ |s-q|^2+\pi_S$, if $L=q$ is the outcome of the subgame.

If $L=q$ is the outcome of the presidential subgame and $\pi_S>0$, the Senate approves r. If $\pi_S \leqslant 0$, the Senate defeats r. If $L=r$ is the outcome of the presidential subgame and $|s-q|^2-|s-r|^2>0$, then the Senate approves r. But if $|s-q|^2-|s-r|^2 \leqslant 0$, the Senate defeats r. *QED*.

We complete the proof of Proposition 1 by examining the House factions' final stage decisions. Let $\pi_i \in \{-\infty,\infty\}$ represent Fi's ($i \in \{1,2,3\}$) public stance in conditions where it anticipates a rejection that will stand. For Fi, the relevant utilities are $U_i(q)=-\ |Fi-q|^2$, $U_i(r)=-\ |Fi-r|^2$, if $L=r$ is the outcome of the Senate subgame, and $U_i(r)=-\ |Fi-q|^2+\pi_i$, if $L=q$ is the outcome of the Senate subgame. If $L=q$ is the outcome of the Senate subgame, or if $|Fj-q|^2-|Fj-r|^2>0$ for House factions $Fj \neq Fi$ ($j \in \{1,2,3\} \backslash i$), then if $\pi_i>0$, then Fi votes for r. If $\pi_i \leqslant 0$, Fi votes against r. If $L=r$ is the outcome of the Senate subgame, then if $|Fi-q|^2-|Fi-r|^2>0$, then Fi approves r and if $|Fi-q|^2-|Fi-r|^2 \leqslant 0$, then Fi votes against r.

Two of the three factions must approve r for the game to proceed to the Senate subgame. A necessary condition for $L=r$ in Lemma 3 is $|s-q|^2-|s-r|^2>0$. If this condition is satisfied, then the House faction whose members are from the same ideological group as the Senate also support r by definition—therefore, only one other group's support is needed. Let $Fi \neq s$ be such a faction. Then, the House supports r, if $[s \neq p$ and $\%P \leqslant 1/3$ and $\min(|s-q|^2-|s-r|^2-v,\ |Fi-q|^2-|Fi-r|^2)>0]$. In the case, $s=p$, let $Fj \neq Fi \neq s=p \in \{F1,\ F2,\ F3\}$ denote the set of House members who are not in faction Fi and not in the faction that shares the Senate and the President's ideal point. Fj is pivotal in the case $[s=p$ and $|s-q|^2-|s-r|^2>0$ and $|Fi-q|^2-|Fi-r|^2 \leqslant 0]$, which completes all contingencies described in the proposition. *QED*.

Henceforth, let CS refer generically to the CS as defined in Proposition 1.

A.1 Bicameral Agreement

The bicameral agreement is the result of an algorithm. The algorithm uses the Nash Bargaining Solution to characterize the outcome of a negotiation between House faction i and the Senate. If this solution is in the CS, then it is designated to be the bicameral agreement. Otherwise, the bicameral agreement is the point in CS that maximizes the product of the utility gain to the Senate and the House faction i that results from changing the status quo (i.e., the algorithm applies the Nash Bargaining Solution formula to all points in CS). This outcome, denoted as r_i, for House faction i, is as follows:

Let $r_i = \max_{x \in \mathrm{CS}} = (|Fi-q|^2 - |Fi-x|^2)*(|s-q|^2 - |s-x|^2) \Leftrightarrow [|s-q|^2 - |s-x_i|^2 > 0$ and $|p-q|^2 - |p-x_i|^2 > 0$ and $s \neq p]$ **OR** $[s=p$ and $|s-q|^2 - |s-x_i|^2 > 0$ and $(|Fj-q|^2 - |Fj-x_i|^2 > 0$ *or* $|Fi-q|^2 - |Fi-x_i|^2 > 0)]$ **OR** $[|p-q|^2 - |p-x_i|^2 \leqslant 0$ and $\%P \leqslant 1/3$ and $|s-q|^2 - |s-x_i|^2 - v > 0$ and $|Fi-q|^2 - |Fi-x_i|^2 > 0]$

Let $r_i = q \Leftrightarrow \forall_{x \in \mathrm{CS}}\ |s-q|^2 - |s-x_i|^2 \leqslant 0$ **OR** $[s=p$ and $|s-q|^2 - |s-x_i|^2 > 0$ and $|Fj-q|^2 - |Fj-x_i|^2 \leqslant 0$ and $|Fi-q|^2 - |Fi-x_i|^2 \leqslant 0]$ **OR** $[|s-q|^2 - |s-x_i|^2 > 0$ and $|p-q|^2 - |p-x_i|^2 \leqslant 0$ and $(\%P > 1/3$ or $|s-q|^2 - |s-x_i|^2 - v \leqslant 0$ or $|Fi-q|^2 - |Fi-x_i|^2) \leqslant 0.)]$

A.2 Power-sharing Game

Again, we proceed by backward induction.

A.2.1 $F3$'s Reaction to $F2$'s Offer

Here, the consequence of $F2$ failing to offer an acceptable rule is $L=q$. $F3$ accepts rule c_2^3, if and only if $-c_2^3|F3-r_2|^2 - (1-c_2^3)|F3-r_3|^2 \geqslant -|F3-q|^2$. So, to gain $F3$'s acceptance $F2$ must offer

- $c_2^3 \geqslant [|F3-r_3|^2 - |F3-q|^2]/[(|F3-r_3|^2 - |F3-r_2|^2)]$, if $|F3-r_3|^2 > |F3-r_2|^2$
- $c_2^3 \leqslant [|F3-r_3|^2 - |F3-q|^2]/[(|F3-r_3|^2 - |F3-r_2|^2)]$, if $|F3-r_3|^2 < |F3-r_2|^2$
- If $|F3-r_3|^2 = |F3-r_2|^2$, $F3$ will accept any offer (by the tiebreaker) and the fact that r_3 is at least as close to $F3$ as is q (by definition of the bicameral agreement algorithm).

Two lemmas simplify further steps in the backward induction process.

Lemma 4. If $|F3-r_3|^2 \geqslant |F3-r_2|^2$, then $F3$ will accept any offer from $F2$.

Proof. Since r_3 is at least as close to $F3$ as is q (by the bicameral agreement definition), $|F3-r_3|^2 - |F3-q|^2 \leqslant 0$. If $|F3-r_3|^2 \geqslant |F3-r_2|^2$, then $(|F3-r_3|^2 - |F3-q|^2)/(|F3-r_3|^2 - |F3-r_2|^2)$ is nonpositive. Since, $c_2^3 \in [0,1]$, the condition for $F2$ to gain $F3$'s acceptance is satisfied for any c_2^3. *QED.*

Lemma 5. Factions cannot strictly prefer one another's bicameral agreements simultaneously.

Proof. A bicameral agreement between two factions, A and B, is the point in the CS that maximizes the product of the utility gain to the factions that comes from moving the legislative outcome away from q. Since each faction has a quadratic utility function whose value is decreasing in distance between the faction's ideal point and the legislative outcome, any bicameral agreement must lie on the subset of the line connecting the two factions' ideal points that is in the CS. Suppose that two points on one such line, r_A and r_B, represents two bicameral agreements. If A gets greater utility from r_A than from r_B, then B cannot obtain higher utility from r_B than from r_A. Therefore, B cannot prefer r_A when A strongly prefers r_B. *QED*.

A.2.2 *F*2's Offer

$F2$'s chooses a rule c_2^3 that maximizes its utility subject to three constraints. One constraint is $c_2^3 \in [0,1]$. The second (acceptability) constraint is that $F3$ will accept it. The parameters of this constraint are listed under "$F3$'s reaction to $F2$'s offer" and Lemma 4. The third constraint pertains to incentive compatibility. Since, $F2$ can prefer q to r_3, there exist values of c_2^3 that, if accepted, will make $F2$ worse off than if $F3$ rejects. Therefore, $F2$'s incentive constraint is U_2 (c_2^3, $F3$ accepts) $= -c_2^3|F2 - r_2|^2 - (1 - c_2^3)|F2 - r_3|^2 \geqslant U_2$ (c_2^3, $F3$ rejects) $= -|F2 - q|^2$.

No acceptable offer assumption. We assume, without a loss of generality, that if no rule in $c_x^{\ y} \in [0,1]$ satisfies the acceptability constraint for any relevant Fy, then Fx offers $c_x^{\ y} = 1$, if $|Fx - r(Fy,s)|^2 \geqslant |Fx - r\,(Fx,s)|^2$ and offers $c_x^{\ y} = 0$, otherwise.

Lemma 6. $F2$'s offer and $F3$'s response are as follows:

- If $\min(|F3 - r_3|^2 - |F3 - r_2|^2,\ |F2 - r_3|^2 - |F2 - r_2|^2) \geqslant 0$, then $c_2^{\ 3} = 1$. $F3$ accepts.
- If $|F2 - r_3|^2 \leqslant |F2 - r_2|^2$, then $c_2^3 = 0$. $F3$ accepts.
- If $|F2 - r_3|^2 - |F2 - r_2|^2 > 0 > |F3 - r_3|^2 - |F3 - r_2|^2$ and $\min([|F3 - r_3|^2 - |F3 - q|^2]/[|F3 - r_3|^2 - |F3 - r_2|^2],\ 1) \geqslant (|F2 - q|^2 - |F2 - r_3|^2)/(|F2 - r_2|^2 - |F2 - r_3|^2)$, then $c_2^3 = \min([|F3 - r_3|^2 - |F3 - q|^2]/[|F3 - r_3|^2 - |F3 - r_2|^2],\ 1)$. $F3$ accepts.
- If $|F2 - r_3|^2 - |F2 - r_2|^2 > 0 > |F3 - r_3|^2 - |F3 - r_2|^2$ and $\min([|F3 - r_3|^2 - |F3 - q|^2]/[|F3 - r_3|^2 - |F3 - r_2|^2],\ 1) < (|F2 - q|^2 - |F2 - r_3|^2)/(|F2 - r_2|^2 - |F2 - r_3|^2)$, then $c_2^3 = 1$. $F3$ rejects.

Proof. In the first bulleted case, $F3$ prefers r_2 to r_3, so the acceptability constraint is not binding. Since $|F2 - r_3|^2 > |F2 - r_2|^2$, $\max U_2(c_2^3) = 1$. In the second bulleted case, $F2$ prefers r_3 to r_2. Since $|F2 - r_3|^2 - |F2 - r_2|^2 < 0$, $\max U_2(c_2^3) = 0$. If $|F3 - r_3|^2 < |F3 - r_2|^2$, $F3$ accepts the offer because it shares $F2$'s preferences over other bicameral agreements. Since $|F2 - r_3|^2 \leqslant |F2 - r_2|^2$, Lemma 5 renders $|F3 - r_3|^2 > |F3 - r_2|^2$ impossible. In the third and fourth bullets, each faction prefers its own bicameral agreement. Since $|F2 - r_3|^2 - |F2 - r_2|^2 > 0$, max $U_2\,(c_2^3) = 1$. However, $F3$'s acceptability constraint is binding. In the third bullet, $\exists\ c_2^3 \in [0,1]$ that satisfies the acceptability and incentive compatibility constraints, so $F2$ offers the largest value of c_2^3 that $F3$ will accept. In the fourth bullet, there exists no such offer, so $c_2^3 = 1$ *QED*.

A.2.3 *F*2 and *F*3's Response to *F*1's Offer

There are four cases to consider. Note that with respect to acceptability constraints, the cases $c_2^3 = 0$ and $c_2^3 = 1$ are mirror images of one another.

- If $|F2 - r_3|^2 - |F2 - r_2|^2 > 0 > |F3 - r_3|^2 - |F3 - r_2|^2$, and min $([|F3 - r_3|^2 - |F3 - q|^2]/[|F3 - r_3|^2 - |F3 - r_2|^2],\ 1) \geqslant (|F2 - q|^2 - |F2 - r_3|^2)/(|F2 - r_2|^2 - |F2 - r_3|^2)$, then the policy consequence of rejecting $F1$'s offer stems from $c_2^3 = \min\ ([|F3 - r_3|^2 - |F3 - q|^2]/[|F3 - r_3|^2 - |F3 - r_2|^2],\ 1)$.
  - $F2$ acceptability constraint: If $|F2 - r_2|^2 \geqslant |F2 - r_1|^2$, accept any offer. If $|F2 - r_2|^2 < |F2 - r_1|^2$, then $F1$ must offer $c_1^2 \leqslant [(1 - c_2^3)(|F2 - r_2|^2 - |F2 - r_3|^2)]/(|F2 - r_2|^2 - |F2 - r_1|^2)$.
  - $F3$ acceptability constraint: If $|F3 - r_3|^2 \geqslant |F3 - r_1|^2$, accept any offer. If $|F3 - r_3|^2 < |F3 - r_1|^2$, then $F1$ must offer $c_1^3 \leqslant c_2^3(|F3 - r_3|^2 - |F3 - r_2|^2)/(|F3 - r_3|^2 - |F3 - r_1|^2)$.
- If $|F2 - r_3|^2 - |F2 - r_2|^2 > 0 > |F3 - r_3|^2 - |F3 - r_2|^2$, and min $([|F3 - r_3|^2 - |F3 - q|^2]/[|F3 - r_3|^2 - |F3 - r_2|^2], 1) < (|F2 - q|^2 - |F2 - r_3|^2)/(|F2 - r_2|^2 - |F2 - r_3|^2)$, then the policy consequence of rejecting $F1$'s offer is $L = q$ (i.e., $c_2^3 = 1$ and $F3$ rejects).
  - $F2$ acceptability constraint: If $|F2 - r_2|^2 \geqslant |F2 - r_1|^2$, accept any offer. If $|F2 - r_2|^2 < |F2 - r_1|^2$, then $F1$ must offer $c_1^2 \leqslant [|F2 - r_2|^2 - |F2 - q|^2]/[|F2 - r_2|^2 - |F2 - r_1|^2]$ and
  - $F3$ acceptability constraint: If $|F3 - r_3|^2 \geqslant |F3 - r_1|^2$, accept any offer. If $|F3 - r_3|^2 < |F3 - r_1|^2$, then $F1$ must offer ${c_1}^3 \leqslant [|F3 - r_3|^{\mathbf{2}} - |F3 - q|^2]/[|F3 - r_3|^2 - |F3 - r_1|^2]$.
- If min $(|F3 - r_3|^2 - |F3 - r_2|^2,\ |F2 - r_3|^2 - |F2 - r_2|^2) \geqslant 0$, then the policy consequence of rejecting $F1$'s offer is $L = r_2$ (i.e., $c_2^3 = 1$ and $F3$ accepts).
  - $F2$ acceptability constraint: If $|F2 - r_2|^2 \geqslant |F2 - r_1|^2$, accept any offer. If $|F2 - r_2|^2 < |F2 - r_1|^2$, reject any offer $c_1^2 > 0$ and
  - $F3$ acceptability constraint: If $|F3 - r_3|^2 > |F3 - r_1|^2$, then $F1$ must offer ${c_1}^3 \geqslant (|F3 - r_3|^2 - |F3 - r_2|^2)/(|F3 - r_3|^2 - |F3 - r_1|^2)$. If $|F3 - r_1|^2 \geqslant |F3 - r_3|^2 \geqslant |F3 - r_2|^2$, then reject any offer. If $|F3 - r_3|^2 = |F3 - r_1|^2 = |F3 - r_2|^2$, then accept any offer.
- If $|F2 - r_3|^2 \leqslant |F2 - r_2|^2$, then the policy consequence of rejecting $F1$'s offer is $L = r_3$ (i.e., $c_2^3 = 0$ and $F3$ accepts).
  - $F2$ acceptability constraint: If $|F2 - r_2|^2 > |F2 - r_1|^2$, then $F1$ must offer $c_1^2 \geqslant (|F2 - r_2|^2 - |F2 - r_3|^2)/(|F2 - r_2|^2 - |F2 - r_1|^2)$.

If $|F2-r_1|^2 \geqslant |F2-r_2|^2 > |F2-r_3|^2$, then reject any offer. If $|F2-r_2|^2 = |F2-r_1|^2 = |F2-r_3|^2$, then accept any offer and

- $F3$ acceptability constraint: If $|F3-r_3|^2 \geqslant |F3-r_1|^2$, accept any offer. If $|F3-r_3|^2 < |F3-r_1|^2$, reject any offer $c_1^3 > 0$.

A.2.4 *F*1's Offer

$F1$'s chooses to make an offer that maximizes its utility subject to three constraints. One constraint is $\{c_1^2, c_1^3\} \in [0,1]$. The second (acceptability) constraint is that $F2$ or $F3$ will accept it. A third constraint is incentive compatibility. This constraint is min ($U_1(c_1^2$, $F2$ accepts), $U_1(c_1^3$, $F3$ accepts)) $\geqslant U_1$(offer rejected), where $U_1(c_1^2$, $F2$ accepts) $= -c_1^2|F1-r_1|^2-(1-c_1^2)|F1-r_2|^2$, $U_1(c_1^3$, $F3$ accepts) $= -c_1^3|F1-r_1|^2-(1-c_1^3)|F1-r_3|^2$ and then U_1(offer rejected) depends on the consequence of $F2$'s offer to $F3$. Below, we determine $F1$'s offer with respect to the four mutually exclusive and collectively exhaustive consequences listed in Lemma 6.

Case 1. If $|F2-r_3|^2-|F2-r_2|^2 > 0 > |F3–r_3|^2-|F3-r_2|^2$ and min $([|F3-r_3|^2-|F3-q|^2]/[|F3-r_3|^2-|F3-r_2|^2],1) \geqslant (|F2-q|^2-|F2-r_3|^2) / (|F2-r_2|^2-|F2-r_3|^2)$, then the consequence of a failed offer from $F1$ is: $c_2^3 = \min([|F3-r_3|^2-|F3-q|^2]/[|F3-r_3|^2-|F3-r_2|^2],1)$ and $F3$ accepts.

This case has four collectively exhaustive subcases, A–D.

A. If $|F2-r_2|^2 \geqslant |F2-r_1|^2$ and $|F3-r_3|^2 \geqslant |F3-r_1|^2$, $F2$ and $F3$ will accept any offer. So, if $|F2-r_2|^2 \geqslant |F2-r_1|^2$ and $|F3-r_3|^2 \geqslant |F3-r_1|^2$ and $|F1-r_1|^2 \leqslant \min(|F1-r_2|^2, |F1-r_3|^2)$, then $c_1^2 = 1$ and $F2$ accepts. If $|F2-r_2|^2 > |F2-r_1|^2$, Lemma 5 renders $|F1-r_2|^2 < |F1-r_1|^2$ impossible. If $|F2-r_2|^2 = |F2-r_1|^2$ and $|F3-r_3|^2 \geqslant |F3-r_1|^2$ and $|F1-r_2|^2 < |F1-r_1|^2$ and $|F1-r_2|^2 \leqslant |F1-r_3|^2$, then $c_1^2 = 0$ and $F2$ accepts. If $|F3-r_3|^2 > |F3-r_1|^2$, Lemma 5 renders $|F1-r_3|^2 < |F1-r_1|^2$ impossible. And if $|F2-r_2|^2 \geqslant |F2-r_1|^2$ and $|F3-r_3|^2 = |F3-r_1|^2$ and $|F1-r_3|^2 < \min(|F1-r_1|^2, |F1-r_2|^2)$, then $c_1^3 = 0$ and $F3$ accepts.

B. If $|F2-r_2|^2 \geqslant |F2-r_1|^2$ and $|F3-r_3|^2 < |F3-r_1|^2$, $F2$ will accept any offer. So, if $|F2-r_2|^2 \geqslant |F2-r_1|^2$ and $|F3-r_3|^2 < |F3-r_1|^2$ and $|F1-r_1|^2 \leqslant \min(|F1-r_2|^2, |F1-r_3|^2)$, then $c_1^2 = 1$ and $F2$ accepts. If $|F2-r_2|^2 > |F2-r_1|^2$, Lemma 5 renders $|F1-r_2|^2 < |F1-r_1|^2$ impossible. If $|F2-r_2|^2 = |F2-r_1|^2$ and $|F3-r_3|^2 < |F3-r_1|^2$ and $|F1-r_2|^2 < |F1-r_1|^2$ and $|F1-r_2|^2 \leqslant |F1-r_3|^2$, then $c_1^2 = 0$ and $F2$ accepts. If $|F2-r_2|^2 \geqslant |F2-r_1|^2$ and $|F3-r_3|^2 < |F3-r_1|^2$ and $|F1-r_3|^2 < \min(|F1-r_1|^2, |F1-r_2|^2)$, then $c_1^3 = 0$ and $F3$ accepts.

C. If $|F2-r_2|^2 < |F2-r_1|^2$ and $|F3-r_3|^2 \geqslant |F3-r_1|^2$, $F3$ will accept any offer. So, if $|F2-r_2|^2 < |F2-r_1|^2$ and $|F3-r_3|^2 \geqslant |F3-r_1|^2$ and $|F1-r_1|^2 \leqslant \min(|F1-r_2|^2, |F1-r_3|^2)$, then $c_1^3 = 1$ and $F3$ accepts. If $|F2-r_2|^2 < |F2-r_1|^2$ and $|F3-r_3|^2 \geqslant |F3-r_1|^2$ and $|F1-r_2|^2 < \min(|F1-r_1|^2, |F1-r_3|^2)$, then $c_1^2 = 0$ and $F2$ accepts.

If $|F3 - r_3|^2 > |F3 - r_1|^2$, Lemma 5 renders $|F1 - r_3|^2 < |F1 - r_1|^2$ impossible. If $|F2 - r_2|^2 < |F2 - r_1|^2$ and $|F3 - r_3|^2 = |F3 - r_1|^2$ and $|F1 - r_3|^2 < \min(|F1 - r_1|^2, |F1 - r_2|^2)$, then $c_1^3 = 0$ and $F3$ accepts.

If $|F2 - r_2|^2 < |F2 - r_1|^2$ and $|F3 - r_3|^2 < |F3 - r_1|^2$, $F2$ and $F3$ require minimum power shares to enter agreements. For notational simplicity, let $c_2^{*3} = \min\{[|F3 - r_3|^2 - |F3 - q|^{\mathbf{2}}]/[|F3 - r_3|^2 - |F3 - r_2|^{\mathbf{2}}], 1\}$, $M_1{}^2(c_2^{*3}) = \min\{(1 - c_2^{*3})((|F2 - r_3|^2 - |F2 - r_2|^2)/(|F2 - r_1|^2 - |F2 - r_2|^2)), 1\}$ and $M_1{}^3(c_2^{*3}) = \min\{c_2^{*3}((|F3 - r_2|^2 - |F3 - r_3|^2)/(|F3 - r_1|^2 - |F3 - r_3|^2)), 1\}$. The last two terms are the minimal acceptable offer for the case where all three factions most prefer their own faction's bicameral agreement, r.

If $|F2 - r_2|^2 < |F2 - r_1|^2$ and $|F3 - r_3|^2 < |F3 - r_1|^2$ and $|F1 - r_1|^2 < \min(|F1 - r_2|^2, |F1 - r_3|^2)$, and

- $M_1{}^2(c_2^{*3})|F1 - r_1|^2 + (1 - M_1{}^2(c_2^{*3}))|F1 - r_2|^2 \leqslant \min(c_2^{*3}|F1 - r_2|^2 + (1 - c_2^{*3})|F1 - r_3|^2,\ M_1{}^3(c_2^{*3})|F1 - r_1|^2 + (1 - M_1{}^3(c_2^3))|F1 - r_3|^2)$, then $c_1{}^2 = M_1{}^2(c_2^{*3})$ and $F2$ accepts.
- $M_1{}^3(c_2^{*3})|F1 - r_1|^2 + (1 - M_1{}^3(c_2^{*3}))|F1 - r_3|^2 < M_1{}^2(c_2^{*3})|F1 - r_1|^2 + (1 - M_1{}^2(c_2^{*3}))|F1 - r_2|^2$ and $M_1{}^3(c_2^{*3})|F1 - r_1|^2 + (1 - M_1{}^3(c_2^{*3}))|F1 - r_3|^2 \leqslant c_2^{*3}|F1 - r_2|^2 + (1 - c_2^{*3})|F1 - r_3|^2$, then $c_1^3 = M_1{}^3(c_2^{*3})$ and $F3$ accepts.
- $c_2^{*3}|F1 - r_2|^2 + (1 - c_2^{*3})|F1 - r_3|^2 < \min([M_1{}^2(c_2^{*3})|F1 - r_1|^2] + [(1 - M_1{}^2(c_2^{*3}))|F1 - r_2|^2],\ [M_1{}^3(c_2^{*3})|F1 - r_1|^2] + [(1 - M_1{}^3(c_2^{*3}))|F1 - r_3|^2])$, then $c_1^2 = 0$ and $F2$ rejects.

If $|F2 - r_2|^2 < |F2 - r_1|^2$ and $|F3 - r_3|^2 < |F3 - r_1|^2$ and $|F1 - r_2|^2 < |F1 - r_1|^2$ and $|F1 - r_2|^2 \leqslant |F1 - r_3|^2$, then $c_1^2 = 0$ and $F2$ accepts. If $|F2 - r_2|^2 < |F2 - r_1|^2$ and $|F3 - r_3|^2 < |F3 - r_1|^2$ and $|F1 - r_3| < \min(|F1 - r_1|^2, |F1 - r_2|^2)$, then $c_1^3 = 0$ and $F3$ accepts.

Case 2. If $|F2 - r_3|^2 - |F2 - r_2|^2 > 0 > |F3 - r_3|^2 - |F3 - r_2|^2$ and $\min([|F3 - r_3|^2 - |F3 - q|^2]/[|F3 - r_3|^2 - |F3 - r_2|^2], 1) < (|F2 - q|^2 - |F2 - r_3|^2)/(|F2 - r_2|^2 - |F2 - r_3|^2)$, then the consequence of a failed offer from $F1$ is $L = q$ (i.e., $c_2^3 = 1$and $F3$ rejects).

This case has the same four subcases as case 1. The first three subcases of case 2 are identical to subcases A, B, and C of case 1. Let $M_1{}^2(q) = \min(((|F2 - r_2|^2 - |F2 - q|^2)/(|F2 - r_2|^2 - |F2 - r_1|^2), 1)$ and let $M_1{}^3(q)$ be defined analogously. These terms are the minimal acceptable offer for the case where all three factions most prefer their own faction's bicameral agreement, r.

D'. If $|F2 - r_2|^2 < |F2 - r_1|^2$ and $|F3 - r_3|^2 < |F3 - r_1|^2$, $F2$ and $F3$ require minimum power shares to enter agreements. If $|F2 - r_2|^2 < |F2 - r_1|^2$ and $|F3 - r_3|^2 < |F3 - r_1|^2$ and $|F1 - r_1|^2 < \min(|F1 - r_2|^2, |F1 - r_3|^2)$, and

- $M_1{}^2(q)|F1 - r_1|^2 + (1 - M_1{}^2(q))|F1 - r_2|^2 \leqslant \min(|F1 - q|^2,\ M_1{}^3(q)|F1 - r_1|^2 + (1 - M_1{}^3(q))|F1 - r_3|^2)$, then $c_1^2 = M_1{}^2(q)$ and $F2$ accepts.

- ${M_1}^3(q)|F1-r_1|^2+(1-{M_1}^3(q))|F1-r_3|^2<{M_1}^2(q)|F1-r_1|^2+(1-{M_1}^2(q))|F1-r_2|^2$ and ${M_1}^3(q)|F1-r_1|^2+(1-{M_1}^3(q))|F1-r_3|^2\leqslant|F1-q|^2$, then $c_1^2={M_1}^3(q)$ and $F3$ accepts.
- $|F1-q|^2<\min([{M_1}^2(q)|F1-r_1|^2]+[(1-{M_1}^2(q))|F1-r_2|^2], [{M_1}^3(q)|F1-r_1|^2]+[(1-{M_1}^3(q))|F1-r_3|^2])$, then $c_1^2=0$ and $F2$ rejects.

If $|F2-r_2|^2<|F2-r_1|^2$ and $|F3-r_3|^2<|F3-r_1|^2$ and $|F1-r_2|^2<|F1-r_1|^2$ and $|F1-r_2|^2\leqslant|F1-r_3|^2$, then $c_1^2=0$ and $F2$ accepts. And if $|F2-r_2|^2<|F2-r_1|^2$ and $|F3-r_3|^2<|F3-r_1|^2$ and $|F1-r_3|^2<\min(|F1-r_1|^2,|F1-r_2|^2)$, then $c_1^3=0$ and $F3$ accepts.

Case 3. If $\min(|F3-r_3|^2-|F3-r_2|^2, |F2-r_3|^2-|F2-r_2|^2)\geqslant 0$, then ${c_2}^3=1$ and $F3$ accepts.

Since, $c_2^3=0$ and $c_2^3=1$ are mirror images with respect to acceptability constraints, we can characterize the dynamics of both using a single case.

If $|F2-r_2|^2\geqslant|F2-r_1|^2$ and $|F3-r_3|^2=|F3-r_1|^2=|F3-r_2|^2$, $F2$ and $F3$ will accept any offer. So, if $|F2-r_2|^2\geqslant|F2-r_1|^2$ and $|F3-r_3|^2=|F3-r_1|^2=|F3-r_2|^2$ and $|F1-r_1|^2\leqslant\min(|F1-r_2|^2,|F1-r_3|^2)$, then $c_1^2=1$ and $F2$ accepts. If $|F2-r_2|^2>|F2-r_1|^2$, Lemma 5 renders $|F1-r_2|^2<|F1-r_1|^2$ impossible. If $|F2-r_2|^2=|F2-r_1|^2$ and $|F3-r_3|^2=|F3-r_1|^2=|F3-r_2|^2$ and $|F1-r_2|^2<\min(|F1-r_1|^2,|F1-r_3|^2)$, then ${c_1}^2=0$ and $F2$ accepts. And if $|F2-r_2|^2\geqslant|F2-r_1|^2$ and $|F3-r_3|^2=|F3-r_1|^2=|F3-r_2|^2$ and $|F1-r_3|^2<\min(|F1-r_1|^2,|F1-r_2|^2)$, then $c_1^3=0$ and $F3$ accepts.

B. If $|F2-r_2|^2<|F2-r_1|^2$ and either $|F3-r_3|^2<|F3-r_1|^2$ or $|F3-r_3|^2=|F3-r_1|^2>|F3-r_2|^2$, all offers >0 will be rejected (since the consequence of rejection is r_2). Therefore, $c_1^2=0$, $F2$ rejects and $L=r_2$.

C. If $|F2-r_2|^2\geqslant|F2-r_1|^2$ and $|F3-r_3|^2<|F3-r_1|^2$ or $|F3-r_3|^2=|F3-r_1|^2>|F3-r_2|^2$, only $F2$ will accept an offer. So, if $|F2-r_2|^2\geqslant|F2-r_1|^2$ and $|F3-r_3|^2<|F3-r_1|^2$ or $|F3-r_3|^2=|F3-r_1|^2>|F3-r_2|^2$ and $|F1-r_1|^2\leqslant|F1-r_2|^2$, then $c_1^2=1$ and $F2$ accepts. If $|F2-r_2|^2=|F2-r_1|^2$ and $|F3-r_3|^2<|F3-r_1|^2$ or $|F3-r_3|^2=|F3-r_1|^2>|F3-r_2|^2$ and $|F1-r_2|^2<|F1-r_1|^2$, then $c_1^2=0$ and $F2$ accepts. And if $|F2-r_2|^2>|F2-r_1|^2$, Lemma 5 renders $|F1-r_2|^2<|F1-r_1|^2$ impossible.

If $|F2-r_2|^2<|F2-r_1|^2$ and $|F3-r_3|^2=|F3-r_1|^2=|F3-r_2|^2$, only $F3$ will accept a nonzero offer. $F1$ coalesces with $F3$ unless it strictly prefers r_2 to any other r. So, if $|F2-r_2|^2<|F2-r_1|^2$ and $|F3-r_3|^2=|F3-r_1|^2=|F3-r_2|^2$ and $|F1-r_1|^2\leqslant\min(|F1-r_2|^2,|F1-r_3|^2)$, then $c_1^3=1$ and $F3$ accepts. If $|F2-r_2|^2<|F2-r_1|^2$ and $|F3-r_3|^2=|F3-r_1|^2=|F3-r_2|^2$ and $|F1-r_2|^2<|F1-r_1|^2$ and $|F1-r_1|^2\leqslant|F1-r_3|^2$, then $c_1^2=0$. And if $|F2-r_2|^2<|F2-r_1|^2$ and $|F3-r_3|^2=|F3-r_1|^2=|F3-r_2|^2$ and $|F1-r_3|^2<\min(|F1-r_1|^2,|F1-r_2|^2)$, then $c_1^3=0$ and $F3$ accepts.

If $|F2-r_2|^2\geqslant|F2-r_1|^2$ and $|F3-r_3|^2>|F3-r_1|^2$, then $F2$ accepts any offer. $F1$ coalesces with $F2$ unless it strictly prefers r_3 to any other r. So if

$|F2-r_2|^2 \geqslant |F2-r_1|^2$ and $|F3-r_3|^2 > |F3-r_1|^2$ and $|F1-r_1|^2 \leqslant \min(|F1-r_2|^2, |F1-r_3|^2)$, then $c_1^2=1$ and $F2$ accepts. If $|F3-r_3|^2 > |F3-r_1|^2$, Lemma 5 renders $|F1-r_3|^2 < |F1-r_1|^2$ impossible. If $|F2-r_2|^2 > |F2-r_1|^2$, Lemma 5 renders $|F1-r_2|^2 < |F1-r_1|^2$ impossible. If $|F2-r_2|^2 = |F2-r_1|^2$ and $|F3-r_3|^2 > |F3-r_1|^2$ and $|F1-r_2|^2 < |F1-r_1|^2$ and $|F1-r_1|^2 \leqslant |F1-r_3|^2$, then $c_1^2=0$ and $F2$ accepts.

If $|F2-r_2|^2 < |F2-r_1|^2$ and $|F3-r_3|^2 > |F3-r_1|^2$, then $F2$ will reject any nonzero offer. So, if $|F2-r_2|^2 < |F2-r_1|^2$ and $|F3-r_3|^2 > |F3-r_1|^2$ and $|F1-r_1|^2 \leqslant \min(|F1-r_2|^2, |F1-r_3|^2)$, then $c_1^3=1$ and $F3$ accepts. If $|F2-r_2|^2 < |F2-r_1|^2$ and $|F3-r_3|^2 > |F3-r_1|^2$ and $|F1-r_2|^2 < |F1-r_1|^2$ and $|F1-r_2|^2 \leqslant |F1-r_3|^2$, then $c_1^2=0$ and $F2$ accepts. And if $|F3-r_3|^2 > |F3-r_1|^2$, then Lemma 5 renders $|F1-r_1|^2 > |F1-r_3|^2$ impossible.

Proof of Proposition 2. The equilibrium described above is unique. From the equilibrium, it follows that if all of the game's parameters remain constant at any set of initial values, there can be no change in the offers or the outcome. As the examples in the text indicate, there exist shifts in s or p that are sufficient to change the bicameral agreement that at least one potential coalition would produce. Some of these shifts are sufficient to change at least one House faction's preferences over the three bicameral agreements that can emerge and to change the offer that factions will make and accept in equilibrium. Therefore, shifts in s or p can cause the House to choose different power-sharing rules.

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