Competing Gridlock Models, Party Influence, and Legislative Productivity

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Abstract

Formal models of lawmaking imply that legislative productivity is a function of the distribution of legislators' preferences, but disagreement about the role of parties leads to competing models that differ in terms of *which* legislators' preference matter. We solve a difficult problem in discriminating between competing theories that arises from the unobservability of status quo policies by constructing a theoretical-statistical model. The key innovation of our approach is that we account for *history dependence*—today's status quo policies evolved from lawmaking in prior periods—whereas previous research assumed it away. Our analysis suggests that legislative productivity depends on both parties and supermajority pivots, but that party influence stems from agenda power rather than voting pressure and is exercised only on highly salient legislation.

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> "The parties are not therefore merely appendages of modern government; they are in the center of it and play a determinative and creative role in it." (Schattschneider 1942, p. 1)

Political parties appear to be central to American democracy, but their influence on contemporary lawmaking relative to legislators' individual goals and the constraints imposed by institutions and rules remains a matter of substantial controversy. Are congressional parties not much more than collections of individual legislators who happen to have similar policy positions (Krehbiel 1993, Mayhew 1974)? Or are parties instead centralized organizations that confer significant power to their leaders (Aldrich and Rohde 2000, Cox and McCubbins 2005)? If the former, pivotal politics theories (Brady and Volden 2006, Krehbiel 1998) postulate that the key determinants of policy outcomes are legislators' preferences and supermajoritarian institutions. If the latter, theories of party influence imply that lawmaking outcomes will reflect majority party preferences to a greater extent than would have been the case in their absence. Understanding the role that parties play in shaping policy outcomes is central to understanding fundamental issues concerning the distribution of power and its consequences.

Cleanly differentiating between competing partisan and pivot theories, however, has proven to be quite difficult. Theoretically, models corresponding to alternative theories should be straightforward to compare because they share a common set of assumptions (unidimensional policy space, Euclidean preferences, and strategic behavior) and differ only on a few key dimensions (which players possess proposal power and veto power), but under many conditions the theories turn out to be observationally equivalent, or nearly so. Empirically, the unobservability of key elements of the theories raises challenging inferential problems, and the need to make identifying or auxiliary assumptions further compounds the difficulty of discriminating between theories.

A particularly vexing problem is the fact that the locations of current policies—referred to in the literature as "status quo policies"—relative to legislators' preferences are unknown and difficult to estimate (Poole and Rosenthal 1997). Researchers have taken several approaches to address this problem, with mixed results. One solution sidesteps the problem by deriving and testing predictions about roll-call cutpoints (the dividing lines between supporters and opponents of a bill), but the results are contradictory. Krehbiel, Meirowitz and Woon (2005) find weak support for the pivot theory over the alternatives; Clinton (2007) finds little empirical support for either theory; but Stiglitz and Weingast (2010) find greater support for a partisan model.

Another solution relies on auxiliary assumptions about the distribution of status quo policies. Assuming that status quo policies are normally distributed around the chamber median, Lawrence, Maltzman and Smith (2006) analyze roll call "win rates" and Cox and McCubbins (2005) analyze "roll rates." Assuming that status quo policies are instead uniformly distributed, Covington and Bargen (2004) analyze roll call-based measures of bill content. These analyses generally appear to support partisan models. Chiou and Rothenberg (2003, 2006, 2009) analyze changes in gridlock instead of roll-call measures, also assuming that status quo policies are uniformly distributed, and find support for a combined pivots plus party unity model.

The assumption of a static distribution of status quo policies may seem innocuous, akin to assuming an independent, normally distributed error term in a regression model. But the hypotheses generated from the theoretical models are sensitive to the exact form of the status quo distribution, just as the inferences from regression estimates are sensitive to assumptions about the error term. We show that more flexible assumptions about the distribution of status quo policies undermines the validity of inferences made from regression-based approaches. More important, assuming a static status quo distribution is substantively problematic because it embodies the position that *history is irrelevant*. That is, in order for the distribution to be fixed, policy-making at time t must be independent of policy-making at time $t + 1$. In contrast, both partisan and non-partisan theories of lawmaking recognize how previous outcomes—laws and their effects—shape current decisions. The conclusions of previous analyses that depend on fixed status quo distributions are therefore suspect.[1]

We propose a novel method for comparing alternative theories that incorporates an explicit, yet flexible, model of *history-dependent* status quo policies into a statistical model of legislative productivity, thus avoiding the theoretical problems that undermine the validity of inferences made in previous work.[2] Building on the analytical approach proposed by Krehbiel (1998, 2006*a*, 2006*b*), we assume that status quo policies are partly endogenous: they are inherited from policy-making in previous periods but subject to exogenous stochastic "shocks." By combining the model of stochastic "shocks" with various assumptions about the role of parties (positive agenda power, negative agenda power, direct pressure on roll call voting), we generate estimated distributions of status quo policies and outcomes, which lead to a series of statistical models of legislative productivity.[3] Importantly, our method does not rely on the need to measure the spatial location of bills or status quo points directly. We use Monte Carlo methods and Common Space ideal point estimates (Carroll et al. 2010) to generate likelihood distributions for counts of legislative productivity, and then we fit the models to Binder's (2003) and Mayhew's (1991) data on salient legislative enactments in the 80th-110th Congresses using maximum likelihood, which allows us to estimate parameters and to compare models.

Our analysis yields two key findings. First, hybrid pivots-plus-party agenda control models provide the best fit to the data for highly salient legislation. Thus, we find evidence consistent with party influence, but in contrast to Chiou and Rothenberg (2003) and Richman (2011), our approach locates the source of influence in agenda control rather than in some

[1]Richman (2011) avoids these problems by directly estimating status quo locations from survey measures of legislator preferences. His results support a pivots plus party unity model, but the time frame and set of issues are much more limited than in previous studies due to the reliance on survey data. Thus, although Richman's analysis provides an important methodological and substantive contribution, indirect methods are necessary for analyzing patterns of lawmaking over a longer historical time period and for a broader set of issues.

[2]Like Chiou and Rothenberg (2003, 2006, 2009), we focus on legislative productivity—in our case, the number of laws enacted—rather than roll call votes because the former are better measures of *outcomes* of the entire lawmaking process while latter reflect *behavior* that is specific to a single chamber.

[3]The variety of party influence that we consider in our set of models is more thorough than in previous work. Notably, we add a hybrid pivots-plus-party gatekeeping model not considered by Chiou and Rothenberg (2003) or Richman (2011).

form of pressure or inducements of party unity on roll call voting.[4] Interestingly, while our findings are also broadly consistent with Cox and McCubbins's (2005) argument about agenda control, they differ in that our results are more consistent with the exercise of positive agenda control, with weaker evidence of negative agenda control. Our second key finding is that the non-partisan pivot model provides the best fit to the data for the least salient legislation. Taken together, our analysis suggest that the "parties versus pivots" debate is misguided: the role of parties is not an "either-or" proposition. Parties and pivots *both* matter. Parties exercise agenda power, but they must do so within the constraints dictated by their members' preferences and by institutional voting rules. Furthermore, their power is not unlimited, and because they must choose when to exercise agenda power, they do so only on the most salient issues of the day.

Competing Models of Party Influence and Gridlock

Spatial models of lawmaking yield precise predictions about legislative outcomes and the frequency of policy change. We consider a series of models that vary in their assumptions about the nature of party influence, comparing a non-partisan pivotal politics baseline against a set of hybrid pivot-plus-party models. Each hybrid model involves a distinct form of party influence, as we distinguish direct pressure on roll-call voting from agenda control, and further distinguish positive from negative agenda control. Formally, each model is a sequential game that represents a single-period of lawmaking for a single issue and assumes a uni-dimensional policy space where legislators' preferences over policy outcomes are single-peaked and symmetric, assigns key players agenda power or veto power, and posits the existence of a status quo policy. [5] Our approach follows Chiou and Rothenberg (2003) and

[4]Indeed, Chiou and Rothenberg (2003, p. 503) explicitly claim that "models in which parties have no effect or an agenda-setting role do not explain policy gridlock".

[5]For ease of exposition, we assume a unicameral legislature in this section. In our statistical model and empirical analysis, we follow the implementation of Chiou and Rothenberg (2003), which allows for bicameralism. The differences between the unicameral and bicameral versions of the models are mainly technical and not substantively interesting.

Richman (2011) in considering combined pivots-plus-parties models, and the set of models we compare encompasses theirs. Indeed, three of the four models are identical to models considered by Chiou and Rothenberg (2003) while we the fourth model draws from the cartel agenda model of Cox and McCubbins (2005).

The baseline model in our analysis is the *non-partisan pivot* (NP) model, following the theory advanced by Brady and Volden (2006) and Krehbiel (1998). Parties have no explicit role in the model, which instead emphasizes that supermajoritarian voting rules constrain policy change. In the theory, any legislator may make a proposal (so that proposal rights are diffuse) and in order to pass, proposals must have enough support to overcome both a Senate filibuster (requiring a 3/5 Senate vote) and a presidential override (requiring 2/3 of each chamber). Outcomes implied by these assumptions are equivalent to those in a model in which the *median legislator* makes proposals subject to the approval of the *filibuster pivot* and the *veto pivot*.[6] Specifically, status quo policies outside of the gridlock interval will be brought inside the interval as close to the median legislator's preferred policy as the pivots will allow.

The *party unity* (PU) model is a hybrid pivot-plus-party model with the strongest form of party influence, and in their analysis Chiou and Rothenberg (2003) find the greatest empirical support for this model. The model retains the pivotal politics assumption that lawmaking requires supermajority votes to overcome filibusters and stave off presidential vetoes but adds the idea that parties exert direct pressure on member behavior, such as roll-call voting (Cox and Poole 2002, Snyder and Groseclose 2000).[7] Such strong influence might be possible to the extent that parties can discipline their members through rewards and punishments (e.g., committee assignments, leadership positions, campaign funds, support for legislative proposals, or district-level spending). In the PU model, it is assumed that

[6]We emphasize that the "median as proposer" assumption does not mean the median is actually a monopoly agenda setter. A model with a monopoly agenda setter is isomorphic to a model with an open rule without time constraints or delay costs, so the assumption should instead be viewed as an equivalent analytic simplification rather than as anything that is substantively meaningful.

[7]For critiques of this literature see Krehbiel (1993, 2003) and Smith (2007).

members of each party act identically to its median member in all aspects of the legislative process so that the only relevant preferences are those of the majority and minority party medians. The spatial locations of the proposer and pivots will depend on the size of the majority and the locations of these two partisan players rather than on the entire distribution of preferences. Because the floor median behaves identically to the majority party median, it necessarily follows that the proposer in the PU model is the majority party median. In most cases, the veto pivot is the median of the president's party while the filibuster pivot is the median of the the non-presidential party. However, the majority party median will control both pivots if either the party has a veto-proof majority (regardless of the president's party affiliation) or if the president's party has a filibuster-proof majority. In these latter two cases, the PU model predicts a complete absence of gridlock, but in general, the PU model involves majority party proposal power and minority party blocking power and predicts that status quo policies will be brought as close as possible to the majority party median's ideal point so long as the minority party median prefers it to the status quo.

The degree of party influence that the PU model posits is extraordinarily strong, especially because it involves influence on roll call voting—one of the most visible manifestations of legislative behavior. Interest groups analyze and publicize voting behavior, and votes at odds with constituents' wishes are often highlighted by challengers, meaning that voting with the party will be electorally costly for many members (Canes-Wrone, Brady and Cogan 2002) and party unity will be very costly to achieve. Indeed, there is little to no evidence in the roll-call voting literature that party influence is as strong as what the PU model entails (e.g., McCarty, Poole and Rosenthal 2001). Acknowleding the difficulty of achieving instances of party discipline, some theorists have proposed that parties exert a weaker—though still consequential—form of party influence through control of the legislative agenda (Cox and McCubbins 2005). Such control is possible to the extent that voters and constituents pay less attention to policy proposals than they do to voting behavior. In our analysis, we distinguish between two distinct forms of agenda control.

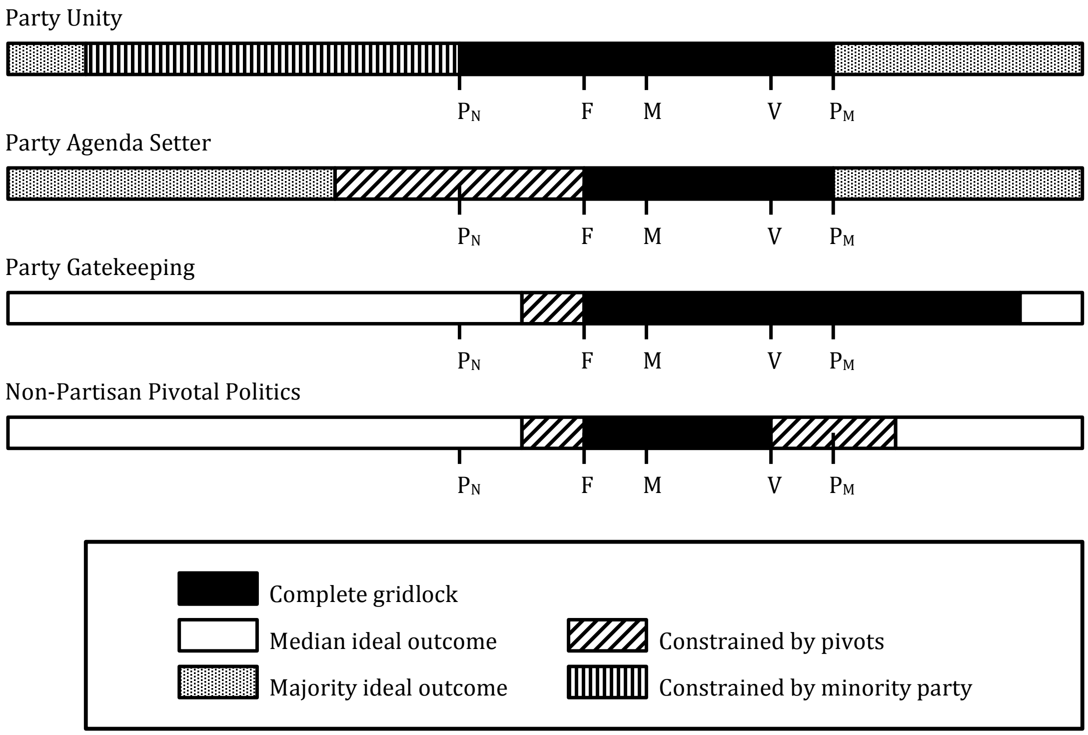
In the *party agenda setter* model (AS), the majority party has positive agenda power but cannot influence its members' voting behavior. That is, it has a monopoly on proposal power (e.g., as if it operates under a closed rule), so like the PU model, the proposer in the AS model is the majority party median. But like the NP model, heterogeneity in legislators' preferences, both within and between parties, is consequential. There are two critical differences between the AS and PU models. First, the minority party is less influential. It cannot block policies opposed by its median member but supported by the veto or filibuster pivots (even if one of those pivots is a co-partisan). Second, the majority party cannot force the floor median to accept outcomes preferred by the majority party median that it would otherwise oppose. As a consequence, the AS model predicts gridlock to the extent that there is heterogeneity within the majority party, even when the majority is veto-proof or filibuster-proof.

The *party gatekeeping* model (GK) involves the weakest form of party influence in our anaysis, and we follow Cox and McCubbins (2005) in assuming that parties' primary means of influence is through negative agenda power (otherwise known as gatekeeping, e.g., Denzau and Mackay 1983). Specifically, we assume that the majority party can use its scheduling power to keep issues off of the legislative agenda, but once it puts an issue on the agenda it cannot prevent the floor median from making proposals (i.e., operates under an open rule) nor can it pressure members to vote with the party. Formally, the GK model adds a prior stage to the NP model in which the majority party median acts as a gatekeeper, first deciding whether to retain the status quo or to play the baseline pivotal politics game.[8] The resulting hybrid pivots-cartel model predicts a greater frequency of gridlock, but when policies pass in the GK model they are the same as what would pass in the NP model.

Figure 1 illustrates the differences between the four models' basic predictions regarding outcomes as a function of the status quo, holding the ideal points of key players constant.

[8] Because the House is widely believed to be the more partisan chamber, we assume in our empirical analysis that the gatekeeper is the House majority party median. In other words, the House majority party moves before legislators play the fully bicameral NP game.

Figure 1: Comparison of Theoretical Models



The key players are the majority party median P_M, the minority party median P_N, the veto pivot V, the filibuster pivot F and the floor median M.[9] The figure shows the obvious differences between the models' predictions about the width of gridlock intervals. It also illustrates where the observational equivalence problem holds. For instance, all four models predict gridlock if the status quo lies between V and F while the AS, GK, and NP models predict the same outcomes for status quo points lying between $2V - M$ and V. Furthermore, the figure also highlights the fact that the models make different predictions about what will happen to policies when the status quo lies outside the gridlock interval. For example, the PU and AS models predict that extreme status quo policies lead to outcomes at the majority party median, while the GK and NP models imply that such outcomes will instead lie at the floor median. These differences provide additional leverage that our method uses

[9]The figure corresponds to unified Republican government. Similar figures can be made for other cases.

to discriminate between the models, unlike the gridlock interval test described in the next section.

We emphasize that our analysis involves a more comprehensive range of party influence than previous comparisons of spatial lawmaking models. Numerous papers compare only the non-partisan pivotal politics model (our baseline NP) with a "pure" version of the cartel agenda (gatekeeping) model that denies the role of supermajoritarian voting institutions (Clinton 2007, Krehbiel, Meirowitz and Woon 2005, Krehbiel 2006*a*, Krehbiel 2006*b*, Stiglitz and Weingast 2010). These papers do not consider hybrid models, nor do they consider alternative forms of party influence such as direct pressure (the PU model) or positive agenda power (the AS model). Chiou and Rothenberg's work (2003, 2006, 2009) is the most comprehensive to date as they consider a series of pivots-plus-party models, but in none of their work do they include a version of the gatekeeping model.[10] Nor does Richman (2011) include a gatekeeping model. Instead, he considers non-partisan pivotal politics (the NP model) and a "party cartel closed rule" model that is equivalent to the PU model. While his analysis considers variation in agenda power, he does not consider variation in party influence: in both of his partisan models, direct party pressure is a constant since he assumes that members of each party *vote* the same way as the party median.[11] In sum, previous work either fails to consider hybrid pivot-plus-party models or, when they do, fail to consider a gatekeeping version. Our analysis involves both.[12]

[10]Our NP, PU, and AS models are identical to theirs (Chiou and Rothenberg 2003, Chiou and Rothenberg 2006), and in later work they consider different gradations of direct party influence (Chiou and Rothenberg 2009) along the lines of Volden and Bergman (2006).

[11]Neither of Richman's (2011) formal implementations are consistent with a gatekeeping model. Instead, his "party cartel closed rule" model is equivalent to the PU model and his "party cartel open rule" model is equivalent to a model in which each party can *veto* proposals made by the median. Moreover, we view the "party cartel open rule" model as theoretically implausible. If the majority party can induce its members to vote the same way as its median member, why wouldn't it also be able induce its members to refrain from proposing bills or amendments located at the floor median or to vote with it on procedural votes, all of which is less visible (and hence less costly) behavior to induce than voting on final passage.

[12]Although we do not explicitly discuss them in our description of models, we also investigated Chiou and Rothenberg's (2003) "strong presidential leadership" (SPL) model and several alternative gatekeeping models such as Senate gatekeeping (Gailmard and Jenkins 2007), bicameral gatekeeping, and "pure" party (without pivots) gatekeeping models. Our results for the SPL model were nearly identical to those of the PU model (but with worse fit). In the results, we present and discuss some of the "pure" cartel gatekeeping model and compare them to the hybrid GK and purely non-partisan NP versions.

Status Quo Policies and Gridlock Predictions

The predictions of competing models are difficult to test directly because two quantities of interest (spatial locations of bills and status quo policies) cannot be reliably measured from roll call votes. Other studies that rely solely on roll call votes, such as the analysis of cut-points, roll rates, or win rates, are also problematic because they attempt to draw inferences from too little data about chamber-specific behavior rather than actual outcomes. However, the theories make predictions not only about bill locations but also about the conditions for legislative productivity and its inverse, gridlock, which suggests another possible method to test the theories. In this section, we review the gridlock interval test and explain why its implementation has typically been substantively and theoretically flawed.

The origin of the test is Krehbiel's insight that pivotal politics theory generates an *equilibrium gridlock interval*, the set of status quo policies for which attempted policy-making will be unsuccessful and that: "Policy change requires that the status quo must lie outside the gridlock interval" (1998, p. 47). Although not explicitly stated by Krehbiel, the following prediction is an immediate corollary.

Prediction 1 *Legislative productivity is increasing in the frequency with which status quo policies lie outside the gridlock interval.*

This prediction is the implicit basis for Krehbiel's (1998, chapter 2) hypothesis that changes in the width of the (non-partisan pivotal politics) gridlock interval are inversely related to legislative enactments. Although Krehbiel (1998) finds support for his hypothesis with respect to salient legislation, Chiou and Rothenberg (2003), who also note that the EGI concept applies to alternative models of lawmaking, point out that the hypothesized relationship between the width of the gridlock interval and legislative productivity requires assuming that "status quo policies in each period are identically and uniformly distributed, which makes comparing the widths of different gridlock intervals at the same time or different points in time possible" (2003, p. 511). Thus, the gridlock test is not quite a test of

Prediction 1, which cannot be tested directly unless status quo policies can be identified relative to the EGI. Rather, it is a test of a modified prediction that requires the *critical identifying assumption* that status quo policies are uniformly distributed.

Prediction 2 *If status quo policies are identically and uniformly distributed then gridlock is increasing in the width of the gridlock interval.*

To see formally why the assumption guarantees a negative, monotonic relationship between gridlock interval width and legislative enactments, let the gridlock interval be $EGI_t = [L_t, R_t]$ in period t and let status quo policies be uniformly distributed over the interval $[q_0, q_1]$, which is constant in every period. Define the predicted level of gridlock to be the proportion of status quo policies that fall within the interval, provided that $q_0 < L_t$ and $R_t < q_1$:

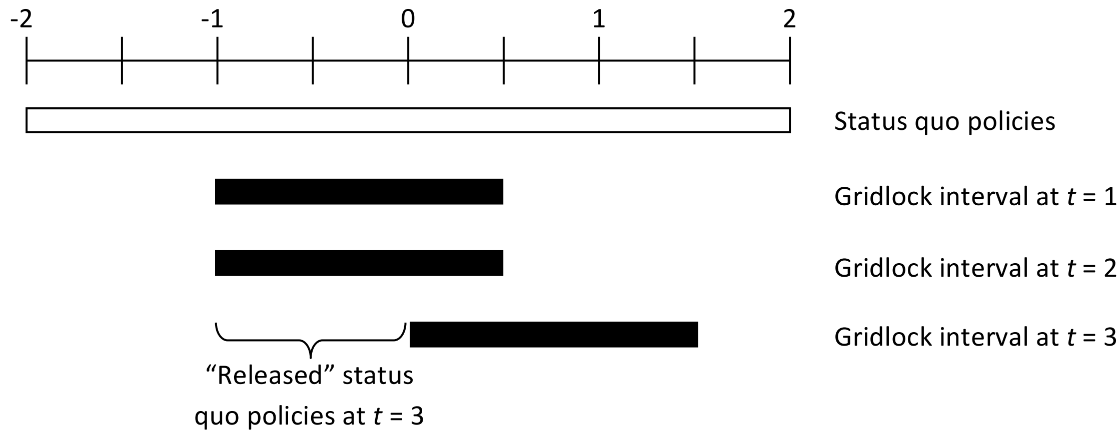
$$G_t = \frac{R_t - L_t}{q_1 - q_0}\,. \tag{1}$$

Since the denominator is a constant, it clearly follows that G_t is increasing in the width of the EGI, $R_t - L_t$. In a series of papers, Chiou and Rothenberg (2003, 2006, 2009) rely extensively on the assumption of uniformly distributed status quo policies and Prediction 2 as the basis for comparing a variety of generalized pivot-plus-party models, and they claim to find greater support for models with strong parties.

The Problem of History Independence

The assumption of a fixed distribution status quo policies may seem like a reasonable solution to the identification problem, but there are two flaws. First, it represents a strong substantive assumption of history independence that is inconsistent with the spirit and intent of spatial theories of lawmaking. Second, when plausible alternative assumptions are considered, the relationship between the width of gridlock intervals and legislative productivity varies depending on changes in the distribution of status quo policies. That is, Prediction 2 does not hold generally.

Figure 2: Shifting Gridlock Intervals

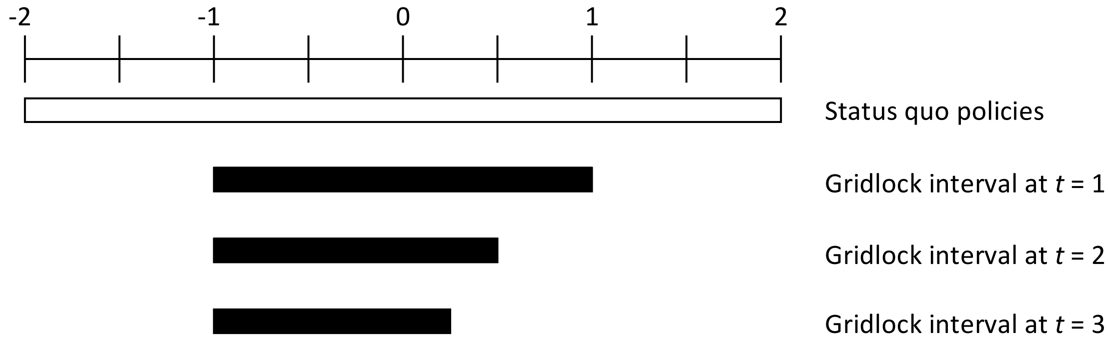


An exogenously fixed distribution of status quo policies means that policy-making at time t has *no bearing* on the extent of gridlock at time $t+1$. In contrast, spatial lawmaking theorists emphasize the *history dependence* of status quo policies (even if status quo policies are, strictly speaking, exogenous to the *formal* representations of the theories). For example, in applying the pivotal politics theory to interpret the broad historical countours of policy change from the late 1970s through the 1990s, Krehbiel writes that "Carter equilibria x_1 become Reagan-Bush status quo points q_2" and the "funneling effect of liberal policies toward the [Reagan-Bush] median creates Reagan-Bush outcomes x_2 which serve as status quo points q_3 for Clinton" (1998, p. 43). Brady and Volden are also explicit about the intertemporal dependence of status quo policies, emphasizing that "policy gridlock depends on both the *size* and the *shifting* of the gridlock region" (2006, p. 26, emphasis original). Even party theorists such as Cox and McCubbins explicitly recognize that "status quo policies reflect bills enacted in the previous legislative period, as well as exogenous shocks" (2005, p. 174).

To illustrate how history dependence and independence have drastically different implications for policy change and gridlock, consider the series of gridlock intervals for three periods of lawmaking depicted in Figure 2.[13] If status quo polices are history independent so that in every period they have the same distribution over the interval shown in the upper-

[13]Whether the gridlock model is partisan or non-partisan is immaterial. Our argument depends only on the existence of a gridlock interval.

Figure 3: Shrinking Gridlock Intervals



most (unshaded) horizontal bar, then the rate of gridlock will be the *same* in all three periods because the widths of the intervals are the same.[14]

Now suppose instead that status quo policies are history dependent so that all out-of-gridlock status quo policies are brought into the interior of the gridlock interval at time t. Thus, status quo policies at time $t+1$ must lie in the time t gridlock interval. In this case, there is complete gridlock at $t = 2$ because all of the status quo policies at $t = 2$ (which lie within the gridlock interval from $t = 1$) also fall within the gridlock interval at $t = 2$. But at $t = 3$, the gridlock interval shifts to the right, which "releases" a set of status quo policies (those that lie within the $t = 2$ interval but outside the $t = 3$ interval), which now meet the condition for policy change. Thus, in stark contrast with history independence, which predicts a constant rate of gridlock, and in contradiction with Prediction 2, gridlock *decreases* from $t = 2$ to $t = 3$ even though there is *no change* in its width because the gridlock interval *shifts*.

Another example illustrates the severity of the theoretical indeterminacy. Suppose that there are three periods and that $EGI_1 = [-1, 1], EGI_2 = [-1, 0.5]$, and $EGI_3 = [-1, 0.25]$, as depicted in Figure 3. Note that because each successive gridlock interval is strictly nested in, and therefore smaller than, the preceding gridlock interval, the uniform status quo assumption implies that gridlock is *strictly decreasing* from $t = 1$ to $t = 3$.

[14] In this case, the shape of the distribution is also irrelevant.

Alternatively, consider the case of complete history dependence. For purposes of illustration suppose that status quo policies at time $t+1$ are distributed uniformly over $[L_t, R_t]$, which is the previous period's EGI.[15] Under this assumption, the predicted level of gridlock is not proportional to the size of the EGI $[L_t, R_t]$ but instead depends on how much of the previous EGI at time t falls in the new EGI at time $t+1$. Given that the gridlock interval at $t = 1$ is $[-1, 1]$, the status quo policies at $t = 2$ are uniformly distributed over $[-1, 1]$. Since the gridlock interval at $t = 2$ is $[-1, 0.5]$, the proportion of gridlocked policies is 0.75. At time $t = 3$, status quos are distributed over $[-1, 0.5]$ and the gridlock interval is $[-1, 0.25]$, so the proportion of gridlock is 0.83. Thus, given these intervals and the alternative assumption that the distribution of status quos depends on the previous gridlock interval, gridlock is *increasing* even though the width of the intervals are decreasing—precisely the opposite of the Prediction 2!

These examples illustrate that predictions about the incidence of legislative productivity and their relationship to theoretical gridlock intervals depend critically on the distribution of status quo policies. Gridlock is unambiguously increasing in EGI width only if the fixed (uniform) status quo assumption holds—a strong assumption in which policy-making is completely independent of the past. But if the distribution of status quo points instead varies over time, depending on the collective choices made in previous Congresses as both pivotal politics and partisan theorists emphasize, the relationship can be increasing or decreasing. Regression analysis of gridlock or legislative productivity using the width of the gridlock interval is not an appropriate method for comparing competing models.

Linking Theory and Data

The gridlock interval test follows the common approach to the empirical evaluation of formal theories: derive predictions from a theoretical model, assume that a classical regression

[15] We use this assumption for ease of exposition. A slightly different assumption is that status quo policies at $t+1$ depend on equilibrium lawmaking outcomes from time t as in Krehbiel's approach, which is a special case of our theoretical-statistical model, but the gridlock predictions are more complicated to describe.

(or some other standard statistical model) describes the data generating process, fit the statistical model to the data, and then test hypotheses about relevant coefficients. If the static status quo assumption must be abandoned, then it seems as if we have reached a serious methodological dilemma. Without a clear hypothesis about the sign of coefficients, how is it possible to discriminate between competing models using legislative productivity data?

We solve this problem by avoiding the regression framework in which legislative productivity is assumed to be a linear, additive function of EGI width. Instead, our approach is flexible and allows the level of productivity to increase or decrease, depending not just on the EGI width but its size and position *relative* to the distribution of status quo policies. In other words, our method relies only on the weaker Prediction 1 as a maintained hypothesis rather than the stronger Prediction 2.

Instead of assuming that status quo policies come from a fixed distribution, we assume that the distribution of status quo policies varies and is itself stochastic. More specifically, the distribution depends on history: it is partially the result of prior lawmaking and partially the result of stochastic shocks. Policy change in this model therefore results from both changes in the gridlock interval (size and shift) as well as exogenous changes in policy (e.g., from policy implementation, advances in technology, or the resolution of policy uncertainty).[16]

To generate the potential distributions of status quo policies and their relative probabilities, we begin with a theoretical model of legislative productivity that embeds the generalized pivot-plus-party models within a stochastic, dynamic framework. This model generates a stochastic distribution of status quo policies, and each such distribution implies a different level of legislative productivity. By essentially integrating over the different distributions of status quo policies, we then generate a likelihood function for the dependent variable

[16] The stochastic shocks in our model differ from the uniform status quo assumption in a subtle, yet important, way. Generating Prediction 2 requires viewing the uniform status quo distribution as deterministic (i.e., there are an infinite or nearly infinite number of policy issues) or as stochastic but only in large samples (i.e., if the status quo is a random variable, Prediction 2 holds in the limit). In contrast, our method is more flexible, as it does not require an asymptotic or large sample argument, and generates likelihood distributions for any number of policy issues.

(levels of legislative productivity). Our solution is therefore one in which the theoretical and statistical models are much more closely integrated (e.g., Signorino 1999) than in the conventional formal model-hypothesis-regression approach (testing comparative statics, e.g., Carrubba, Yuen and Zorn 2007). Indeed, our model is both "theoretical" and "statistical" in the sense described by Signorino (2003) and a model of the complete data generating process in the sense described by Morton (1999).[17]

The theoretical-statistical model is a more precise implementation of the "quasi-dynamic" application of pivotal politics proposed and employed by Krehbiel (1998, 2006*a*, 2006*b*).[18] Although the model is not fully game theoretic, it incorporates the equilibrium results of spatial policy-making models (including, but not limited to, pivot models) as part of the stochastic model. In order to generate a likelihood function, the model assumes that there are many issues and that status quo policies are subject to random shocks. Using standard principles of maximum likelihood, we can fit the parameters of each generalized pivot model and then compare the different theoretical models.

The Model

We describe the details of the model in a generic form so that it can be applied to any version of a pivot model. Suppose there are N issues and T periods. For any period t, let the EGI be $[L_t, R_t]$, and the proposer be P_t, where $L_t \leq P_t \leq R_t$. In the NP model, L_t and R_t are the relevant filibuster and veto pivots while P_t is the floor median.[19] In the PU model, the

[17]Signorino (2003, p. 318) defines a "theoretical" model as one "that results from theory construction" while he defines a "statistical" model as one "that guarantees positive probability over all outcomes—for example, there is some random component in the model that induces a probability distribution over the outcomes." Thus, although Signorino's own theoretical-statistical models typically involve game theoretic equilibria, his definition of "theoretical" is quite broad and precludes neither partial equilibrium approaches like ours nor other non-equilibrium models.

[18]Our formalization is closest to that in Krehbiel (2006*b*), but differs in that he examines roll rates and uses a different empirical method. Krehbiel "bins", or discretizes, the policy space in his simulations, then evaluates model fit using deviations from predictions rather than maximum likelihood.

[19]We follow Chiou and Rothenberg's (2003) Propositions 1-4 for determining the locations of the pivots L_t and R_t in the NP, PU, and AS models, and we adopt their convention in assuming that the proposer P_t is the Senate floor median in the NP model and that it is the Senate majority party median in the PU and AS models.

endpoints of the gridlock interval are defined by the majority and minority party medians while P_t is the majority party median. In the AS model, P_t and one of the EGI endpoints are both defined as the majority party median while the other EGI endpoint is the relevant filibuster or veto pivot. Finally, in the GK model, L_t, R_t, and P_t are the same as in the NP model but there is an additional player G_t, which is the House majority party median.

For any issue $i \in \{1, \ldots, N\}$ and period $t \in \{1, \ldots, T\}$, denote the status quo by q_t^i and the policy outcome by x_t^i. In the initial period, $t = 1$, status quo policies are independently and identically distributed (according to distributions described below). Within every period t, policy-making is independent across issues and the outcome follows from standard subgame perfect equilibrium analysis of the model. In the NP, PU, and AS models, the outcome function is

$$x_t^i(q_t^i) = \begin{cases} P_t & \text{if} \quad q_t^i \leq 2L_t - P_t \\ 2L_t - q_t^i & \text{if} \quad 2L_t - P_t < q_t^i \leq L_t \\ q_t^i & \text{if} \quad L_t < q_t^i \leq R_t \\ 2R_t - q_t^i & \text{if} \quad R_t < q_t^i \leq 2R_t - P_t \\ P_t & \text{if} \quad 2R_t - P_t < q_t^i \end{cases}. \tag{2}$$

In the GK model, the outcome function depends on the location of G_t relative to the (NP) gridlock interval. If $L_t \leq G_t \leq R_t$, then the outcome is the same as in (2) because the gatekeeper always weakly prefers the outcome of the lawmaking game to the status quo. However, if G_t lies outside of the interval $[L_t, R_t]$, then there is an additional region of gridlocked status quo points. If $G_t < L_t$, the outcome function is

$$x_t^i(q_t^i) = \begin{cases} P_t & \text{if} \quad q_t^i \leq 2G_t - P_t \\ q_t^i & \text{if} \quad 2G_t - P_t < q_t^i \leq R_t \\ 2R_t - q_t^i & \text{if} \quad R_t < q_t^i \leq 2R_t - P_t \\ P_t & \text{if} \quad 2R_t - P_t < q_t^i \end{cases}, \tag{3}$$

and while if $G_t > R_t$, it is

$$x_t^i(q_t^i) = \begin{cases} P_t & \text{if} \quad q_t^i \leq 2L_t - P_t \\ 2L_t - q_t^i & \text{if} \quad 2L_t - P_t < q_t^i \leq L_t \\ q_t^i & \text{if} \quad L_t < q_t^i \leq 2G_t - P_t \\ P_t & \text{if} \quad 2G_t - P_t < q_t^i \end{cases} . \tag{4}$$

Once the policy outcome $x_t^i(q_t^i)$ is determined in period t, the status quo for issue i in period $t+1$ is a function of the previous policy and a random shock. Substantively, if Congress enacts a new law, the location of the outcome x_t^i should be thought of as a statute or law while the random shock should be thought of as changes that occur outside of the legislative process that affect the location of policy relative to legislators' preferences. Such changes can occur for many reasons: technical or scientific breakthroughs, economic changes, judicial rulings, bureaucratic implementation, shifts in public attitudes, or because experience showed that the policy did not work quite as intended.

We consider two alternative assumptions about the nature of status quo policies involving the distribution from which the shocks are drawn and the way in which shocks combine with previous policy. Under the *normal additive* assumption, the status quo is an additive function of the policy outcome and a normally distributed shock,

$$q_{t+1}^i = x_t^i(q_t^i) + \varepsilon_t^i \,, \tag{5}$$

where ε_t^i is independently and identically distributed following a normal distribution with mean 0 and standard deviation σ. We assume that in the initial period (without prior lawmaking) that q_1^i is also distributed normally with mean 0 and standard deviation σ. The normal distribution is reasonable because it is natural to assume that most exogenous shocks are relatively small while allowing large shocks to occur with positive probability.

Under the *uniform weighted average* assumption, the location of the status quo is a weighted average of the outcome and a uniformly distributed shock,

$$q_{t+1}^i = \alpha x_t^i(q_t^i) + (1-\alpha)\upsilon_t^i\,, \tag{6}$$

where υ_t^i is independently and identically distributed uniformly over the interval $[-\delta, \delta]$ and $\alpha \in [0,1]$. In the initial period, q_1^i is also distributed uniformly over $[-\delta, \delta]$. Although the additive assumption in (5) seems most reasonable to us, the weighted average in (6) has a nice property in that it encompasses both a model of complete status quo dependence (i.e., $q_t^i = x_{t-1}^i$ when $\alpha = 1$) and the fixed, uniform status quo assumption (i.e., $q_t^i \sim U[-\delta, \delta]$ when $\alpha = 0$). Our estimate of α therefore serves to measure how close the data are to one of the two extreme models.[20]

Finally, in order to apply the model to legislative productivity (our dependent variable), we must aggregate across all issues $i \in \{1, \ldots, N\}$. Let b_t^i be an indicator variable denoting whether or not a bill passes. Formally, $b_t^i = 1$ if $x_t^i \neq q_t^i$ and 0 otherwise, and let the total number of bills that pass at time t be $B_t = \sum_{i=1}^N b_t^i$. Since the model is stochastic and $\varepsilon_t^i, \upsilon_t^i, q_t^i$, and x_t^i are all random variables, it follows that b_t^i and B_t are random variables as well. Thus, the model implies a probability distribution for B_t for each period t that depends on the relevant ideal points L_t, R_t, P_t, and G_t, as well as the ideal points in periods prior to t, the number of issues N, and the stochastic shock parameters σ (for the normal additive version) or α and δ (for the uniform weighted average version).

Estimation

We compute the distribution of B_t using Monte Carlo simulation methods. While it is possible in principle to derive the distribution of B_t analytically, the results would be quite

[20] We reiterate that there is an important distinction between a uniform distribution of *status quo policies* versus a uniform distribution of *random shocks*. In addition, in the absence of new law, the normal additive assumption is equivalent to a random walk while the uniform weighted average assumption is similar to an AR(1) process.

complicated—there certainly would not be a single parametric equation that holds for any configuration of preferences. In order to set the ideal points L_t, R_t, P_t, and G_t we use Common Space scores to compute the values corresponding to each pivot-plus-party model. The time periods $t \in \{1, \ldots, T\}$ are the Congresses corresponding to those for which we have legislative productivity data. In addition, we use one Congress immediately preceding the earliest one in the data as $t = 0$ as a starting period. This ensures that the distribution of status quos for the first period of data is not entirely random but dependent on previous lawmaking to some extent. For example, if the actual legislative productivity data correspond to the 80th ($t = 1$) through 106th ($t = 27$) Congresses, then the initial values (for $t = 0$) correspond to the 79th Congress.

The number of issues N and the status quo parameters σ and δ are free parameters.[21] For each shock assumption and set of parameters, (N, σ) or (N, δ, α), we run $K = 10,000$ iterations of the simulation and then we use the results to compute the probability mass function for each B_t. Let $m_t(n)$ denote the number of iterations for which $B_t = n$. The PMF is computed as

$$p_t(B_t = n) = \frac{m_t(n) + 1}{K + N} \tag{7}$$

for each $n \in \{1, \ldots, N\}$ where the t subscript for p indicates that each p_t is a distinct distribution. The calculation of the likelihood is a version of Laplace's Law of Succession. It differs from a simple proportion in order to deal with a computational issue known as the "zero frequency problem" (Witten and Bell 1991) in which a rare event may not be observed in a finite number of trials even though it is known to occur with positive probability.[22]

Once we compute the likelihood function for a given set of parameters, we can then compute the likelihood for any data set on legislative productivity. Given a set of count data

[21] In our analysis, N is essentially a "nuisance" parameter. We treat it as a free parameter to be estimated so that our results do not depend on an arbitrarily imposed value.

[22] In practice, we frequently encounter the zero frequency problem. If we were to use the simple proportion $m_t(n)/K$, we often end up with likelihoods of 0 because one or more of the frequencies $m_t(n)$ corresponding to some observed value n is 0.

$y_1, \ldots, y_T$, the log likelihood is

$$\ln L(y_1, \ldots, y_T) = \sum_{t=1}^{T} \ln p_t(B_t = y_t)\,. \tag{8}$$

In our analysis, we use several measures of legislative productivity summarized in Table 1. We use counts of legislative enactments from Binder (2003), which span the 80th through 106th Congresses (1947-2000) and for which there are five different levels of salience. An enactment is counted as salient and included in the data if there is at least one *New York Times* editorial mentioning the issue, and higher levels of salience correspond to a greater number of editorial mentions. We also use a count of enactments based on the updated version of Mayhew's (1991) Sweep One series, which covers the 80th through 110th Congresses (1947-2008). A legislative enactment is included in the series if it is discussed in end-of-year assessments of legislative accomplishments. Note that the average and maximum number of enactments are relatively small, especially for the higher salience measures, which suggests that it is important to take into account variation due to uncertainty in small samples, which our method does.

We maximize the likelihood function using a simple grid search for each pivot-plus-party model and for each assumption about the stochastic shocks. For parameters, N ranges from 25 to 105 in increments of 5, σ ranges from 0.025 to 0.55 in increments of 0.025, δ ranges

Table 1: Summary Statistics for Legislative Productivity Measures

Measure	N	Mean	St. Dev.	Min.	Max.
Binder 1	27	50.11	13.26	31	82
Binder 2	27	28.93	9.85	11	52
Binder 3	27	19.52	7.28	4	34
Binder 4	27	14.93	5.58	4	24
Binder 5	27	11.56	4.37	3	21
Mayhew	31	10.13	3.62	4	19

from 0.35 to 1.25 in increments of 0.025, and α ranges from 0 to 1 in increments of 0.05.[23]

Results

As a starting point, Table 2 shows the fit of our four theoretical-statistical models to Binder's level 4 productivity data, which is the level of salience used in Chiou and Rothenberg's (2003) analysis. Several findings are noteworthy. First, the single best-performing gridlock model is the party agenda setter (AS) model, in which the majority party has a moderate degree of party influence. This holds for both shock assumptions. Second, the model with the strongest level of party influence (PU) performs the worst, again regardless of the shock assumption.[24] The non-partisan baseline (NP) and the weakest version of party influence (GK) fall in between. Under the normal additive assumption, GK clearly outranks NP, while under the uniform weighted average assumption, NP just barely outperforms GK. These results contrast with the results of Chiou and Rothenberg's (2003) gridlock interval tests, which ranks PU the highest.

Table 2: Maximum Likelihood Results, Binder Measure (Salience 4), $80^{th} - 106^{th}$ Congresses

Shock	Model	LL	Issues	σ or δ	α
Normal Add.	Party Agenda Setter	-92.25	40	0.200	
Normal Add.	Gatekeeping	-96.32	30	0.475	
Normal Add.	Non-partisan Pivot	-101.03	30	0.275	
Normal Add.	Party Unity	-108.70	45	0.200	
Uniform WA	Party Agenda Setter	-90.44	35	0.525	0.15
Uniform WA	Non-partisan Pivot	-94.61	35	0.375	0.05
Uniform WA	Gatekeeping	-95.28	30	0.900	0.20
Uniform WA	Party Unity	-107.71	60	0.925	0.60

[23]To make the length of time needed to run the simulations manageable, we conducted the grid search in a two-step process. First, we used a "coarse" grid search with larger increments. We then performed a "finer" grid search with the smaller increments in neighborhoods around the maxima from the "coarse" search.

[24]These results also hold if we assume that the shock distribution is logistic additive instead of normal additive. The results for the logistic distribution are substantially similar to those for the normal distribution, so we omit them from the presentation.

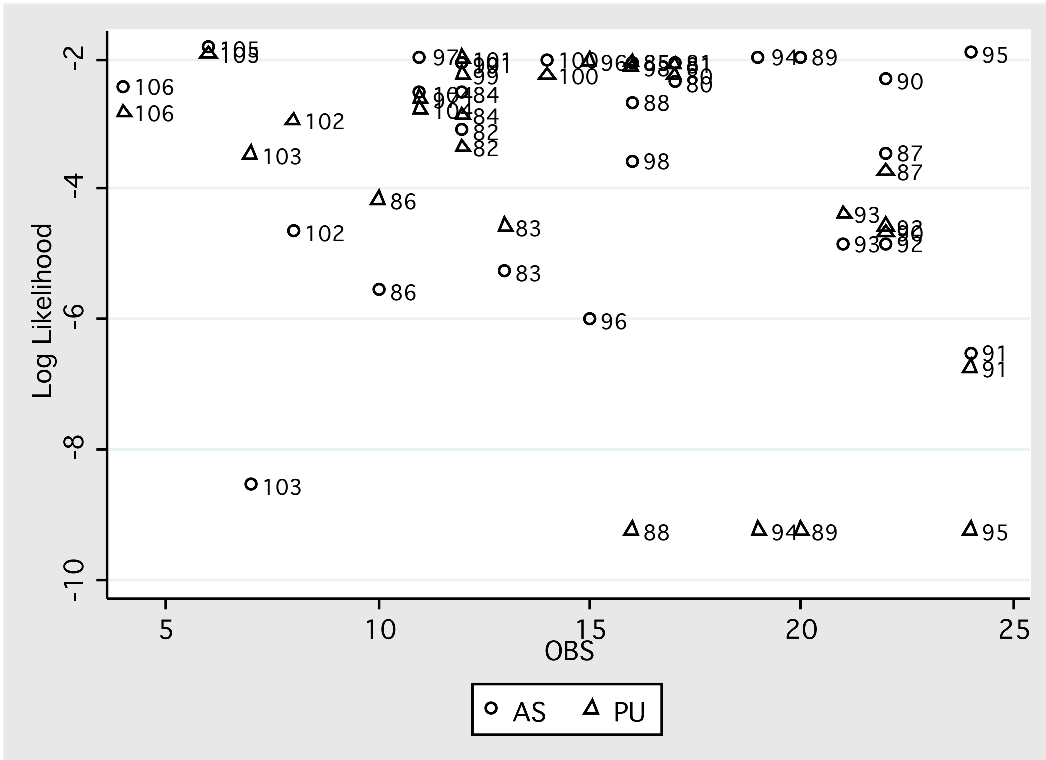
Because all of the models in Table 2 are estimated using the same data, it is appropriate to compare shock assumptions by comparing the likelihoods while holding the theoretical assumptions about party strength constant. For three of the four theoretical models, the uniform weighted assumption produces a better fit. Also, the values of α are low for the AS, GK, and NP models (0.05 to 0.20) and high for the PU model (0.60). The relatively low values of α for the AS model suggest that most status quo policies are more random than inherited, but the fact that they are non-zero nevertheless also suggests that inherited status quos do play some role in generating the data.[25]

To get a better sense of why the model with party agenda setting power (AS) fares better than the strongest party unity model (PU), Figure 4 presents observation-specific likelihoods using uniform weighted average shocks, plotted against the observed productivity levels. Overall, there are 17 observations for which the AS likelihood (circle) is higher than the PU likelihood (triangle). Both models appear to fit well with the middle-range of productivity levels as well as for extremely low levels (high gridlock), and for many observations the difference in fit between the two models is small. The PU model appears to do somewhat better for a few congresses with observed productivity in the mid-to-low range (6-10 bills) while the AS appears to do much better when observed productivity is high (more than 18 bills).

Note that the fit of the PU model for four observations (88th, 89th, 94th, and 95th) is especially poor, as the trianglees are at the bottom of the figure. Each of these observations corresponds to unified Democratic government with filibuster-proof Senate majorities, which implies that the PU model gridlock interval is essentially zero for these observations, so the distributions of B_t for these congresses put *all* of the mass at the maximum level of productivity, $B_t = N$. But since the value of the parameter N selected by maximum likelihood differs from the observed productivity level, the probability mass put on the observed level is

[25] This result might be due to time constraints and the possibility that the agenda setter chooses some subset of policies outside the gridlock interval to place on the agenda rather than placing all such policies on the agenda. Such a model would be an interesting extension for future work but introduces additional parameters and requires additional assumptions about the agenda setting process.

Figure 4: Observation-Specific Log Likelihoods for Binder Productivity Measure and Uniform Weighted Average Shocks



zero. Thus, these are observations for which the zero-likelihood problem is relevant, although the root cause of the zero-likelihoods is theoretical rather than computational: under unified government with a filibuster-proof Senate majority, the PU model predicts congresses with EGI widths of zero and therefore predicts full productivity with certainty.[26]

In contrast, the fit of the AS model for each of these Congresses (88th, 89th, 94th, and 95th) is very high, which suggests that the observed level of legislative productivity is close to the mode of the probability mass function. Moreover, the AS model fits very poorly for only one congress (103rd). There is also only one observation (96th) for which the PU model does substantially better than the AS model. Overall, Figure 4 suggests that the AS model has the best overall fit because it predicts all levels of observed productivity well.

[26]The value of N is therefore most relevant for fitting this model.

Table 3: Maximum Likelihood Results, Mayhew Productivity, $80^{th} - 110^{th}$ Congresses

Shock	Model	LL	Issues	σ or δ	α
Normal Add.	Gatekeeping	-103.35	25	0.375	
Normal Add.	Party Agenda Setter	-105.19	25	0.250	
Normal Add.	Non-partisan Pivot	-116.16	25	0.225	
Normal Add.	Party Unity	-121.63	25	0.275	
Uniform WA	Gatekeeping	-108.63	25	1.050	0.45
Uniform WA	Party Agenda Setter	-115.52	25	1.175	0.65
Uniform WA	Non-partisan Pivot	-124.46	25	1.025	0.65
Uniform WA	Party Unity	-133.16	30	1.250	0.65

In Table 3, we present the maximum likelihood results using counts from Mayhew's Sweep One data as the productivity measure. Mayhew's measure tends to count fewer pieces of legislation as highly significant than Binder does, and his data span a longer time period that includes the four Congresses during George W. Bush's administration. Table 3 shows that the ranking of the AS, NP, and PU models are identical to Table 2: the AS model clearly outperforms the basline NP, which outperforms the (worst-fitting) PU model. However, in contrast to the results using the Binder level 4 measure, we find that for the most salient legislation, the GK model—the pivot-cartel hybrid–consistently does the best. These results suggest that parties might exercise a mix of positive and negative agenda control, though our method does not allow us to make distinctions between individual bills.

There are also a few other differences between the results for the Binder and Mayhew measures. For the Mayhew measure, the normal additive shocks outperform their uniform weighted average counterparts for each model. For the GK model, the normal additive shock does better by 5 points in the log likelihood scale, and for the AS model, it does better by over 10 points. In terms of the α parameter, our estimates put much greater weight on α for the Mayhew measure ($\alpha = 0.65$ for AS) than for the Binder measure ($\alpha = 0.15$). This provides evidence against the fixed uniform status quo assumption, but we view it tentatively since there is no clear "winner" across both two data series in terms of the random shock assumptions.

We also fit the models to several additional measures of gridlock from Binder (2003) in which the level of salience for inclusion in the count vary. While this analysis serves partly as a robustness check to see whether the ranking of models and the parameter estimates hold across the different measures, it also allows us to examine whether party influence might vary with the salience of legislation. To the extent that party resources are scarce and party leaders wield them primarily to enhance the party's electoral reputation (as emphasized by, e.g., Aldrich 1995, Cox and McCubbins 2005), we would expect the party to conserve its influence only for the most salient legislation. We caution that while our analysis may shed some light on this possibility, it does not serve as a rigorous test of the hypothesis.

Table 4: Summary of Results, Varying Levels of Salience

Data Source	Shock	Model	LL	Issues	σ or δ	α
Binder 1	Normal Add.	Non-partisan Pivot	-156.02	90	0.325	
Binder 2	Normal Add.	Party Unity	-123.44	80	0.200	
Binder 3	Normal Add.	Party Agenda Setter	-112.06	45	0.225	
Binder 4	Normal Add.	Party Agenda Setter	-92.25	40	0.200	
Binder 5	Normal Add.	Party Agenda Setter	-81.98	25	0.250	
Mayhew	Normal Add.	Gatekeeping	-103.35	25	0.375	
Binder 1	Uniform WA	Non-partisan Pivot	-155.46	85	0.725	0.25
Binder 2	Uniform WA	Non-partisan Pivot	-119.17	55	0.45	0.10
Binder 3	Uniform WA	Non-partisan Pivot	-106.30	40	0.475	0.20
Binder 4	Uniform WA	Party Agenda Setter	-90.44	35	0.525	0.15
Binder 5	Uniform WA	Party Agenda Setter	-80.87	25	1.050	0.55
Mayhew	Uniform WA	Gatekeeping	-108.35	25	1.050	0.45

The results for the best fitting model for each data series are summarized in Table 4.[27] Interestingly, it does appear that party influence varies with the salience of legislation.[28] At the lowest level of salience (Binder 1), the model without party influence does the best for both shock assumptions. At the next two levels, the results are not entirely consistent across shock assumptions. The non-partisan model fits the best for Binder 2 and Binder 3 under the

[27]Full results for each salience level, like those given in Tables 2 and 3, can be found in the Supporting Information.

[28]It is also reassuring that the estimated value of N is decreasing in salience.

uniform weighted average assumption, which outperforms the PU model for Binder 2 and the AS model for Binder 3 under the normal additive assumption. For both Binder 4 and Binder 5, the AS model fits the best, with the results again consistent across shock assumptions, and the only data for which the GK model fits best is Mayhew's. Also, with one exception (Binder 2), the PU model does worse than the NP, AS, and GK models, but the preference only NP model is a *very close* second for Binder 2, with a log likelihood of −123.91.) Overall, these results are consistent with the interpretation that if parties' resources are limited, they will use their influence only on high profile and significant legislation.

Table 5: Pivots, Cartels, and Hybrids

Data Source	Shock	Hybrid Pivots-Cartel	Pivots Only	Cartel Only
Binder 1	Normal Add.	-164.26	-156.02*	-181.82
Binder 2	Normal Add.	-135.91	-123.91*	-172.38
Binder 3	Normal Add.	-120.34	-113.65*	-141.15
Binder 4	Normal Add.	-96.32*	-101.03	-123.00
Binder 5	Normal Add.	-86.47*	-89.80	-119.19
Mayhew	Normal Add.	-103.35*	-116.16	-134.53
Binder 1	Uniform WA	-164.56	-155.46*	-156.18
Binder 2	Uniform WA	-134.08	-119.17*	-145.73
Binder 3	Uniform WA	-117.91	-106.63*	-131.62
Binder 4	Uniform WA	-95.28	-94.61*	-110.01
Binder 5	Uniform WA	-87.92	-83.02*	-104.56
Mayhew	Uniform WA	-108.63*	-124.46	-119.18

* indicates best fit

To facilitate comparison with work that compares "pure" non-partisan with "pure" partisan lawmaking models, we also computed likelihoods for a non-hybridized party gatekeeping model. In this model, which is Cox and McCubbins's (2005) cartel agenda model for the House, we assume that if the majority party chooses to allow an issue on the agenda, the outcome will be the floor median's ideal point (i.e., under an open rule).[29] Table 5 presents results that compare the NP and GK results with those from the pure cartel model. When restricted to these three possibilities, the non-partisan pivots only model does the best for

[29]See the Supporting Information for results for alternative gatekeeping models.

the three lowest levels of salience (Binder 1, 2, and 3 for both shock assumptions, and also for Binder 4 and 5 under the uniform weighted average assumption). The hybrid pivots-cartel model does the best for the highest levels of salience (Mayhew for both shock assumptions and Binder 4 and 5 under the normal additive assumption). Importantly, we note that the pure cartel gatekeeping model performs the worst for all of the data. The results in Table 5 reinforce the importance of supermajoritarian pivots and suggest that party influence plays a role above and beyond, but does not supplant, these basic institutional constraints.

Conclusion

Models, whether theoretical or statistical, have become essential tools for producing and refining scientific knowledge about parties and legislative processes. Formalization ensures that assumptions and derivations are transparent and that the logic of a theory is internally consistent. This is no less true when moving from theoretical models to testing their empirical implications. In some cases comparative statics can be derived without additional assumptions, but it is often the case that deriving clear predictions requires auxiliary hypotheses.

In the case of spatial models of lawmaking and legislative productivity, theory testing requires auxiliary assumptions about the nature of status quo policies. The gridlock interval test assumes that status quo policies are fixed and uniformly distributed, but this assumption is restrictive and *substantively* incompatible with the theories of lawmaking that the models represent because it denies historical dependence. We demonstrate how under less restrictive assumptions, the relationship between gridlock interval width and observed gridlock cannot be tested in a regression framework. We solve this problem by constructing general theoretical-statistical model of legislative productivity in which status quo policies depend on both prior lawmaking and exogenous stochastic shocks, and the flexibility of our model increases confidence in the inferences that we can draw from it.

Our methodological innovation leads to substantive results that, while consistent with the overall pivots-plus-party story in previous work, yield distinct conclusions about the nature of party influence. We are in broad agreement with Chiou and Rothenberg (2003) and Richman (2011) that there is room for a theoretical middle ground in which parties play an important role within the context of supermajoritarian decision-making. Models of pivotal politics are sometimes presented as incompatible with partisan politics, but this is not the case. Our evidence suggests that both kinds of models capture important aspects of the lawmaking process. But we also show that the party influence is not unlimited. The results of our analysis suggest that parties wield influence through agenda control rather than by inducing their members to behave cohesively. Not only does this result reinforce our conclusion that parties face (at least some) limits on their power, but it also implies that party influence will affect outcomes rather than behavior and that there is substantial asymmetry between majority and minority party influence. We also find that the majority party is influential on highly salient legislation but plays little or no role in shaping outcomes on less significant issues. It therefore appears that parties are selective in exerting their influence.

These findings suggest two directions for continued research. One possibility is to extend our model by incorporating various constraints on scheduling or agenda power. For instance, an extended model might explicitly limit the number of bills that can be placed on the agenda, the number of bills that the majority party can bring up under a closed rule, or the number of bills that the legislative median will allow the majority party median to block. Such extensions would add additional parameters and require an explicit model of agenda choice. Another related direction would be to investigate the types of issues or political conditions under which parties will choose to exert their influence, for which our approach and other existing methods for analyzing aggregate outcomes are not well-suited. That is, it may be that party influence varies not only across time (in terms of preference shifts caused by elections), but also across issues and policy areas (in terms of relevance to parties and their constituents).[30] Pursuing this avenue of research will require advances in theory as well as new data.

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[30] Although this claim seems to resemble the theory of "conditional party government" (Aldrich and Rohde 2000), the central claim of CPG is that party leaders exert greater influence when there is greater polarization (intra-party cohesion and inter-party distance). We suggest instead that party theories need to explain parties' issue priorities: why some issues are more salient to a party than others.

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Supporting Information

Additional Pivot Model Results

NOTE: SPL denotes "strong presidential leadership" and corresponds to the results in Chiou and Rothenberg's (2003) Proposition 5.

Table A1: Maximum Likelihood Results, Binder Salience Level 1, $80^{th} - 106^{th}$ Congresses

Shock	Model	LL	Issues	σ or δ	α
Normal Add.	PN	-156.02	90	0.325	
Normal Add.	AS	-158.94	100	0.375	
Normal Add.	PU	-160.02	100	0.325	
Normal Add.	GK	-164.24	90	0.425	
Normal Add.	SPL	-169.67	100	0.35	
Uniform WA	PN	-155.46	85	0.725	0.25
Uniform WA	PU	-159.32	85	1.075	0.2
Uniform WA	AS	-162.34	95	0.675	0.1
Uniform WA	GK	-164.56	90	1.15	0.2
Uniform WA	SPL	-176.87	105	1.075	0.15

Table A2: Maximum Likelihood Results, Binder Salience Level 2, $80^{th} - 106^{th}$ Congresses

Shock	Model	LL	Issues	σ or δ	α
Normal Add.	PU	-123.44	80	0.2	
Normal Add.	PN	-123.91	55	0.275	
Normal Add.	AS	-124.98	55	0.275	
Normal Add.	SPL	-125.01	85	0.2	
Normal Add.	GK	-135.91	60	0.35	
Uniform WA	PN	-119.17	55	0.45	0.1
Uniform WA	AS	-126.9	55	1.125	0.55
Uniform WA	PU	-132.85	95	1.0	0.6
Uniform WA	GK	-134.08	70	0.5	0.0
Uniform WA	SPL	-146.58	105	1.15	0.65

Table A3: Maximum Likelihood Results, Binder Salience Level 3, $80^{th} - 106^{th}$ Congresses

Shock	Model	LL	Issues	σ or δ	α
Normal Add.	AS	-112.06	45	0.225	
Normal Add.	PN	-113.65	45	0.225	
Normal Add.	PU	-118.07	55	0.2	
Normal Add.	GK	-120.34	40	0.425	
Normal Add.	SPL	-125.01	55	0.225	
Uniform WA	PN	-106.3	40	0.475	0.2
Uniform WA	AS	-108.69	45	0.525	0.15
Uniform WA	PU	-117.15	70	0.975	0.6
Uniform WA	GK	-117.91	40	0.85	0.15
Uniform WA	SPL	-129.99	100	1.1	0.7

Table A4: Maximum Likelihood Results, Binder Salience Level 5, $80^{th} - 106^{th}$ Congresses

Shock	Model	LL	Issues	σ or δ	α
Normal Add.	AS	-81.981	25	0.25	
Normal Add.	GK	-86.471	25	0.425	
Normal Add.	PN	-89.797	25	0.25	
Normal Add.	PU	-104.16	30	0.25	
Normal Add.	SPL	-109.35	35	0.225	
Uniform WA	AS	-80.868	25	1.05	0.55
Uniform WA	PN	-83.024	25	0.525	0.3
Uniform WA	GK	-87.919	25	1.15	0.45
Uniform WA	PU	-101.92	45	1.05	0.65
Uniform WA	SPL	-110.11	50	1.05	0.6

Gatekeeping Models

Gatekeeping With Pivots

We first consider the generic version of the model with a single gatekeeper G_t. As noted in the model section of the main paper, the pivots are L_t and R_t and the proposer is P_t. At the start of the game, the gatekeeper can block policy (exercise gatekeeping) or allow policymaking to proceed. If policymaking is allowed to proceed, then the outcome of the pivot subgame is given in equation (2) from the main paper. If policymaking is blocked, the outcome is the status quo q_t^i.

The gatekeeper will block policy if $x_t^i(q_t^i)$ is further from G_t than q_t^i. Equivalently, gatekeeping will be exercised if $x_t^i(q_t^i)$ is not between the interval defined by q_t^i and $2G_t - q_t^i$. This will occur only if G_t is outside the EGI $[L_t, R_t]$. If $G_t < L_t$, then the gatekeeper strictly prefers to leave an issue off the agenda if $q_t^i \in [2G_t - P_t, L_t]$ and the policy outcome for the game in this case is described by

$$y_t^i(q_t^i) = \begin{cases} P_t & \text{if} \quad q_t^i \leq 2G_t - P_t \\ q_t^i & \text{if} \quad 2G_t - P_t < q_t^i \leq R_t \\ 2R_t - q_t^i & \text{if} \quad R_t < q_t^i \leq 2R_t - P_t \\ P_t & \text{if} \quad 2R_t - P_t < q_t^i \end{cases} . \tag{A1}$$

Similarly, if $G_t > R_t$, then the gatekeeper strictly prefers to block an issue if $q_t^i \in [R_t, 2G_t - P_t]$ and the policy outcome is

$$y_t^i(q_t^i) = \begin{cases} P_t & \text{if} \quad q_t^i \leq 2L_t - P_t \\ 2L_t - q_t^i & \text{if} \quad 2L_t - P_t < q_t^i \leq L_t \\ q_t^i & \text{if} \quad L_t < q_t^i \leq 2G_t - P_t \\ P_t & \text{if} \quad 2G_t - P_t < q_t^i \end{cases} . \tag{A2}$$

But if $G_t \in [L_t, R_t]$ then the outcome $x_t^i(q_t^i)$ is always closer to G_t than q_t^i, so gatekeeping power in this case will never be used and $y_t^i(q_t^i) = x_t^i(q_t^i)$ where $x_t^i(q_t^i)$ is given in equation (2) from the main paper.

Extending the model to two gatekeepers is straightforward. Let the gatekeepers be $\underline{G}_t$ and $\overline{G}_t$ where, without loss of generality, $\underline{G}_t \leq \overline{G}_t$. Each gatekeeper will weakly prefer to block policymaking under the same conditions as in the single gatekeeper model. The presence of the second gatekeeper only affects whether a gatekeeper has a strict preference for blocking policy or is indifferent (when the other gatekeeper will also block the issue). If both gatekeepers are on the same side of the EGI or at least one gatekeeper is in the interior of the EGI, then outcomes are identical to the single gatekeeper model. More specifically, if $\underline{G}_t < L_t$ and $\overline{G}_t < R_t$ then the outcome is given by equation (A1) with $\underline{G}_t$ in place of G_t; if $L_t < \underline{G}_t$ and $R_t < \overline{G}_t$ then the outcome is given by equation (A2) with $\overline{G}_t$ in place of G_t. If both gatekeepers are in the interior of the EGI, $L_t < \underline{G}_t \leq \overline{G}_t < R_t$,then gatekeeping power is never exercised and the outcome is given by equation (2) of the main paper.

The key difference from the model with a single gatekeeper is when the gatekeepers are on opposite sides of the EGI. In this case, the outcome is

$$y_t^i(q_t^i) = \begin{cases} P_t & \text{if} \quad q_t^i \leq 2\underline{G}_t - P_t \\ q_t^i & \text{if} \quad 2\underline{G}_t - P_t < q_t^i \leq 2\overline{G}_t - P_t \\ P_t & \text{if} \quad 2\overline{G}_t - P_t < q_t^i \end{cases} . \tag{A3}$$

Gatekeeping Without Pivots

In the model without a president or supermajority pivots, the proposer P_t only needs to gain the vote of a median legislator M_t for a bill to pass. (As noted above, in our implementation of the theoretical-statistical model, we continue to account for bicameralism so that P_t is the Senate floor median while M_t is the House floor median.) Suppose that $P_t < M_t$ for purposes of exposition. (The case where $P_t > M_t$ is symmetric.) Without pivots, gatekeepers anticipate that if an issue is placed on the agenda, the outcome will be

$$\tilde{x}_t^i(q_t^i) = \begin{cases} P_t & \text{if} \quad q_t^i \leq P_t \\ q_t & \text{if} \quad P_t < q_t^i \leq M_t \\ 2M_t - q_t & \text{if} \quad M_t < q_t^i \leq 2M_t - P_t \\ P_t & \text{if} \quad 2M_t - P_t < q_t^i \end{cases} . \tag{A4}$$

The analysis follows the same basic reasoning as the models with pivots. With a single gatekeeper such that $G_t < P_t$ or if there are two gatekeepers such that $G_t = \underline{G}_t$ and $\overline{G}_t < M_t$, then

$$\tilde{y}_t^i(q_t^i) = \begin{cases} P_t & \text{if} \quad q_t^i \leq 2G_t - P_t \\ q_t^i & \text{if} \quad 2G_t - P_t < q_t^i \leq M_t \\ 2M_t - q_t^i & \text{if} \quad M_t < q_t^i \leq 2M_t - P_t \\ P_t & \text{if} \quad 2M_t - P_t < q_t^i \end{cases} . \tag{A5}$$

Similarly, if there is a single gatekeeper such that $P_t < G_t$ or if there are two such that $G_t = \overline{G}_t$ and $P_t < \underline{G}_t$, then

$$\tilde{y}_t^i(q_t^i) = \begin{cases} P_t & \text{if} \quad q_t^i \leq P_t \\ q_t^i & \text{if} \quad P_t < q_t^i \leq 2G_t - P_t \\ P_t & \text{if} \quad 2G_t - P_t < q_t^i \end{cases} . \tag{A6}$$

With two gatekeepers that are more extreme than the proposers and median, that is $\underline{G}_t < P_t$ and $M_t < \overline{G}_t$, the outcome is the same as in (A3). If both gatekeepers are between the proposer and the median, $P_t < \underline{G}_t$ and $\overline{G}_t < M_t$, then the outcome is the same as in (A4).

For the purposes of testing, we consider several versions of gatekeeping models, varying two components: which chambers grant the majority party gatekeeping power (House, Senate, or both) and whether or not there are supermajority pivots (to facilitate comparison with a "pure" or non-hybrid cartel model). We are interested in gatekeeping models without pivots because they are closest to the model proposed by Cox and McCubbins (2005). In order to make the gatekeeping models comparable to Chiou and Rothenbergs generalized pivot models, we assume that the Senate floor median is the agenda setter. In models without supermajority pivots, we assume that the House floor median has veto power to account for bicameralism. Each variety of model is designated by the chamber (H, S, or B), and by the lack of pivots (N). (The designation GKH is the same as GK in the main text of the paper.) The results for these models follow.

Additional Gatekeeping Model Results

Table A5: Gatekeeping Results: Binder Salience Level 1, $80^{th} - 106^{th}$ Congresses

Shock	Model	LL	Issues	σ or δ	α
Normal Add.	GKS	-159.59	90	0.475	
Normal Add.	GKH	-164.26	90	0.475	
Normal Add.	GKB	-165.75	90	0.425	
Normal Add.	GKNB	-181.43	85	0.3	
Normal Add.	GKNH	-181.82	85	0.35	
Normal Add.	GKNS	-182.3	85	0.325	
Uniform WA	GKNS	-155.57	85	0.5	0.1
Uniform WA	GKNH	-156.18	85	0.5	0.0
Uniform WA	GKNB	-159.4	85	0.45	0.0
Uniform WA	GKS	-159.99	85	0.9	0.1
Uniform WA	GKH	-164.56	90	1.15	0.2
Uniform WA	GKB	-168.33	85	0.95	0.15

Table A6: Gatekeeping Results: Binder Salience Level 2, $80^{th} - 106^{th}$ Congresses

Shock	Model	LL	Issues	σ or δ	α
Normal Add.	GKS	-129.37	55	0.375	
Normal Add.	GKH	-135.91	60	0.35	
Normal Add.	GKB	-137.9	55	0.35	
Normal Add.	GKNH	-172.38	55	0.475	
Normal Add.	GKNS	-184.06	55	0.35	
Normal Add.	GKNB	-184.4	55	0.175	
Uniform WA	GKS	-128.07	55	1.0	0.4
Uniform WA	GKH	-134.08	70	0.5	0.0
Uniform WA	GKB	-140.27	55	1.05	0.45
Uniform WA	GKNH	-145.73	55	0.5	0.0
Uniform WA	GKNS	-150.66	55	0.45	0.0
Uniform WA	GKNB	-162.1	55	0.5	0.0

Table A7: Gatekeeping Results: Binder Salience Level 3, $80^{th} - 106^{th}$ Congresses

Shock	Model	LL	Issues	σ or δ	α
Normal Add.	GKS	-117.3	35	0.425	
Normal Add.	GKH	-120.34	40	0.425	
Normal Add.	GKB	-132.59	45	0.3	
Normal Add.	GKNH	-141.15	35	0.525	
Normal Add.	GKNS	-147.92	35	0.475	
Normal Add.	GKNB	-158.66	35	0.525	
Uniform WA	GKS	-110.23	50	0.45	0.05
Uniform WA	GKH	-117.91	40	0.85	0.15
Uniform WA	GKNS	-126.1	40	0.5	0.0
Uniform WA	GKB	-128.27	50	0.5	0.1
Uniform WA	GKNH	-131.62	40	0.5	0.0
Uniform WA	GKNB	-147.04	40	0.5	0.0

Table A8: Gatekeeping Results: Binder Salience Level 4, $80^{th} - 106^{th}$ Congresses

Shock	Model	LL	Issues	σ or δ	α
Normal Add.	GKH	-96.324	30	0.475	
Normal Add.	GKS	-100.16	30	0.425	
Normal Add.	GKB	-103.76	30	0.425	
Normal Add.	GKNH	-123.00	25	0.475	
Normal Add.	GKNS	-128.36	25	0.525	
Normal Add.	GKNB	-130.38	25	0.525	
Uniform WA	GKH	-95.277	30	0.90	0.20
Uniform WA	GKS	-95.358	30	0.75	0.20
Uniform WA	GKB	-106.37	25	1.10	0.15
Uniform WA	GKNH	-110.01	30	0.50	0.00
Uniform WA	GKNS	-113.82	30	0.50	0.00
Uniform WA	GKNB	-123.24	25	1.00	0.00

Table A9: Gatekeeping Results: Binder Salience Level 5, $80^{th} - 106^{th}$ Congresses

Shock	Model	LL	Issues	σ or δ	α
Normal Add.	GKH	-86.471	25	0.425	
Normal Add.	GKS	-88.618	25	0.35	
Normal Add.	GKB	-90.837	25	0.425	
Normal Add.	GKNH	-119.19	25	0.325	
Normal Add.	GKNS	-132.34	25	0.3	
Normal Add.	GKNB	-132.66	25	0.35	
Uniform WA	GKS	-84.572	25	1.1	0.5
Uniform WA	GKH	-87.919	25	1.15	0.45
Uniform WA	GKB	-97.591	25	1.25	0.4
Uniform WA	GKNH	-104.56	25	0.45	0.05
Uniform WA	GKNS	-106.56	25	0.45	0.0
Uniform WA	GKNB	-124.09	25	0.5	0.05

Table A10: Gatekeeping Results: Mayhew, $80^{th} - 110^{th}$ Congresses

Normal Add.	GKH	-103.35	25	0.375	
Normal Add.	GKB	-104.86	25	0.375	
Normal Add.	GKS	-109.65	25	0.35	
Normal Add.	GKNH	-134.53	25	0.25	
Normal Add.	GKNS	-143.86	25	0.25	
Normal Add.	GKNB	-145.08	25	0.30	
Uniform WA	GKH	-108.63	25	1.050	0.45
Uniform WA	GKS	-109.73	25	0.50	0.00
Uniform WA	GKB	-116.9	25	0.50	0.00
Uniform WA	GKNH	-119.18	25	0.65	0.40
Uniform WA	GKNS	-125.89	25	0.65	0.35
Uniform WA	GKNB	-143.35	25	0.80	0.50

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