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ABSTRACT

This paper investigates the determinants of political polarization, a phenomenon of increasing relevance in Western democracies. How much of polarization is driven by divergence in the ideologies of politicians? How much is instead the result of changes in the capacity of parties to control their members? We use detailed internal information on party discipline in the context of the U.S. Congress – whip count data for 1977-1986 – to identify and structurally estimate an economic model of legislative activity where agenda selection, party discipline, and member votes are endogenous. The model delivers estimates of the ideological preferences of politicians, the extent of party control, and allows us to assess the effects of polarization through agenda setting (i.e. which alternatives to a status quo are strategically pursued). We find that parties account for approximately 40 percent of the political polarization in legislative voting over this time period, a critical inflection point in U.S. polarization. We also show that, absent party control, historically significant economic policies, including Debt Limit bills, the Social Security Amendments of 1983, and the two Reagan Tax Cuts of 1981 and 1984 would have not passed or lost substantial support. Counterfactual exercises establish that party control is highly relevant for the probability of success of a given bill and that polarization in ideological preferences is instead more consequential for policy selection, resulting in different bills being pursued.

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1. Introduction

We focus on a set of open questions in the political economy literature on political polarization, a phenomenon that has taken a sharply increasing tack since the mid-1970s in the United States.[1] Other OECD countries have experienced similar trajectories recently, and deeply antagonistic political environments are commonplace across Western Europe today. To many observers, polarization has been linked to heightened policy uncertainty over government spending, regulation and taxes, with consequences for the pricing of financial assets and sovereign debt market volatility (Baker et al., 2014, 2016; Pastor and Veronesi, 2012; Kelly et al., 2016). Critically, this segmentation of legislatures across party lines may be the result of more than just exogenous shifts in the ideologies of elected representatives. The goal of this paper is to present a credibly identified method for unbundling polarization in outcomes, votes and policies, into its constituent determinants, polarization in ideologies and party control. We also quantitatively analyze the differential effects of these underlying mechanisms on expected equilibrium policy outcomes in the U.S. Congress.

A first question is how much of political polarization in votes is the result of more ideologically polarized politicians and how much is due to party leaderships forcing rank-and-file members to toe the party line.[2] The question of whether or not the current political polarization in Congress can be solely attributed to changes in the ideological composition of the legislative chambers, for example due to the progressive replacement of moderate representatives with extreme ones, remains unsettled (Theriault, 2008; Moskowitz et al., 2017).[3] Political parties, through changes in institutional rules and in their system of internal leadership (as in the aftermath of the 1994 Republican Revolution) may have contributed to polarization in outcomes and division across party lines by allowing parties to more effectively steer members in support of strategically set agendas.[4]

[1]For evidence of polarization in the U.S. Congress, see McCarty et al. (2006); McCarty (2017).
[2]See Ban et al. (2016) for a discussion of whether political polarization is the result of better internal enforcement by party leaders.
[3]To answer this question, one must first deal with the primitive problem of assessing the ideal points of politicians, a long-standing issue in the political economy and political science scholarship focused on the behavior of national legislatures (Levitt, 1996; Poole and Rosenthal, 2001; McCarty et al., 2006; Mian et al., 2010). Showing where politicians' preferences are located, absent any equilibrium disciplining by parties on floor votes (we will refer to this latter action as *"whipping"*), requires recovering the unbiased distribution of within-party individual ideologies, a problem which is known to be subject to severe identification issues (Krehbiel, 2000; Snyder and Groseclose, 2000).
[4]Seminal work from Cox and McCubbins (1993), Cox and McCubbins (2005) and Aldrich (1995) emphasizes the importance of parties for the functioning of Congress. It focuses on how parties use the available institutions to coordinate and set policies to their benefit, as well as how party leaders work towards their goals with their party members. Cox and McCubbins emphasize institutional mechanisms by which majority parties get their policies on the floor, blocking the minority's policies. They discuss incentives to do so, including the "brand" value

A second question is how polarization in the legislature affects the policies that are pursued and approved. Polarization may affect not only the details of the bills proposed, but also which status quo policies are contested in the first place (and which are instead left unpursued). Policy alternatives, including tax cuts, healthcare reforms, trade policy or tariffs bills, are endogenous and presented strategically based upon the likelihood that a given proposal will pass. The different drivers of polarization may affect the policy alternatives chosen ex ante by the agenda setter, who, based on how the equilibrium probability of bill passage varies, may respond differently to changes in the technology of party control relative to shifts in the ideological composition of fellow legislators.

The first contribution of this paper is to provide an economic model of legislative activity for a two-party system. The model is designed to capture strategic considerations on multiple nested dimensions. The first dimension is which issues (and for a given issue, which specific policy alternatives) are selected by proposing parties. Policies that are not sufficiently valuable vis-à-vis a specific status quo, or too difficult to pass given the extant chamber composition, may not be pursued at all. The second dimension is whether or not, once a certain alternative to a status quo is proposed, the leadership decides to invest in acquiring extra information about the prospects of that specific policy alternative (i.e. "*to whip count*" a bill). Policies that appear unpromising once more information is acquired may not be pursued further (i.e. not brought to the floor for an official vote). The 2017 repeal attempt of the Affordable Care Act is a salient example. A third dimension for consideration is, if a bill is eventually brought to the floor for a vote, which legislators can be disciplined (i.e. "*whipped*") in order to maximize the likelihood of passage. As our economic model formalizes, member voting decisions, the observable output of the model, are ultimately endogenous to all of these previous phases of the process. Quantitative approaches based on sincere voting or abstracting from party control, as in the vast majority of the political economy literature, overlook these important dimensions.

Empirically unbundling the multiple elements of this process is the second contribution of the paper. We identify and estimate our model structurally. We are able to resolve the identification problems previous researchers have faced thanks to the use of new data that

of a party, increasing re-election chances for politicians, increasing the coordination of policies that politicians may be unsure of, setting policy positions, as well as helping to enforce and coordinate policies and votes. Evidence, such as in Forgette (2004), has shown that these mechanisms of policy positioning and agenda-setting are present, as measured by the attendance rates and transcripts from party caucuses, and affect legislative roll call voting. Aldrich (1995) and his Conditional Party Government theory proposes that parties play an important role in pushing policies of interest to the rank and file. Economists such as Caillaud and Tirole (2002) have also taken a similar stance to party organization, emphasizing internal control issues, but with a focus on electoral success.

supplements standard floor voting (*"roll call"*) information, thus decoupling true individual ideological positions (before any party control is exerted) from party discipline targeted towards members on the fence of support for a bill.[5] We make use of a complete corpus of whip count votes compiled from historical sources by Evans (2012) for the U.S. House of Representatives. Whip counts are private records of voting intentions of party members, used by party leaders to assess the likelihood of success of specific bills under consideration.[6] Our sample period includes the 95th to 99th Congress (years 1977 to 1986). These Congresses occur at the inflection point of contemporary U.S. polarization dynamics (McCarty et al., 2006), allowing us to observe how ideological differences across parties and party discipline evolve over this critical time period.

Member's responses at the whip count stage are useful for recovering the true ideological positions of politicians *before* party control is exerted. Our argument is three-fold. First, the information revelation value of whip counts resides in the repeated interaction between members and the leadership, limiting the ability of rank-and-file politicians to systematically lie or deceive their own party leaders. These interactions are frequent and the stakes are typically high. Second, by a revealed preference argument, the fact that costly whip counts are systematically employed by the party leadership to ascertain the floor prospects of crucial bills bears witness to their usefulness and informational value. It is unclear why leaders would spend valuable time on these counts otherwise. Third, as we model explicitly, certain designated party

[5]The main difficulty lies in being able to compare outcomes with parties, to outcomes with none. In a series of works, Keith Krehbiel (Krehbiel (1993), Krehbiel (1999), Krehbiel (2000)) has argued that the previous literature failed to address the confounding issues of whether parties are effective, or whether they are only a grouping of like-minded politicians. This identification problem comes from using outcomes such as roll call votes, party cohesion, or party unity scores. These measures, of which Nominate (Poole and Rosenthal (1997)) and its variations rely upon, are a combination of politicians' preferences and of party effects. Politicians from the same party are likely to share similar ideologies, so could be voting in the same way regardless of party discipline. The paradox, as stated by Krehbiel (1999), is that this confound would make it seem that parties are strongest when they are most homogeneous ideologically (and hence, when they are needed the least). That, in turn, leads to an empirically difficult problem: how does one separate individual ideology measurements from party effects? In particular, how does one estimate party effects when ideology measures confound both parties and individual ideologies?

[6]The data structure of whip counts has been explored occasionally in the past, as in the works of Ripley (1964) and Dodd (1979) for example, but with different objectives. In both papers, the data was collected when the authors worked within the Whip Offices (as American Political Science Association Congressional Fellows). Our final data provides a comprehensive set-up: for many bills over different Congresses, we can track the voting intentions of politicians, how these changed at the final vote, and the whips who were responsible for making these changes happen. Two works in particular have looked at whip counts in the context of parties and party discipline. Burden and Frisby (2004) look at 16 whip counts and their roll calls and find that most of the switching of votes has gone in the direction of party leaders. They argue that even if this undermines the true impacts of whips (as many of the votes are guaranteed by leaders in equilibrium, without having them actually change), it still presents evidence of the high effectiveness of this measure. Evans and Grandy (2009) also use whip counts, and provide an extensive survey of whipping in he House of Representatives and the Senate, drawing attention to some historical examples.

members (called *whips*), who are responsible for ensuring some subset of members toe the party line, maintain constant relationships with their delegation and know their districts. This makes private preferences at least partially observable, reducing informational asymmetries (Meinke, 2008).[7]

In addition to providing information about politicians' true ideological positions, the whip count data offers identifying variation for assessing party discipline and agenda setting. Concerning party discipline, switching behavior in Yes/No between the whip count stage and the roll call stage provides the variation necessary to pin down the extent of whipping – how much control the party is able to exert. Concerning agenda setting, we exploit the fact that not all bills that are voted on the floor are whip counted, and that certain bills that are whip counted are subsequently dropped without a subsequent floor vote.[8] By explicitly modeling this selection process, we theoretically identify thresholds determining which bills are voted on and/or whip counted. Together with flexible assumptions on the distribution of latent status quo policies, these thresholds allow us to recover information on policies that are never proposed and never voted.

This paper establishes several findings. Our results show that standard approaches to the estimation of ideal points based on random utility models (or optimal classification) that employ roll call votes alone, such as the popular DW-Nominate approach (Poole and Rosenthal, 2001), miss important density in the middle of the support of the ideological distribution. These methods, which conflate party control with the estimation of individual ideologies (Snyder and Groseclose, 2000), show a polarization level of ideal points much larger than the actual one based upon our unbiased estimates. Across the 95th-99th Congresses, we find that the distance between party medians is on average about 60% of that based upon standard DW-Nominate estimates. According to our estimates, the share of total polarization attributed to party discipline, as opposed to ideological differences, varies from 34 percent in the 96th Congress to 44 percent in the 99th Congress. Importantly, these results do not rely on arbitrary assumptions about which bills may be whipped or not by the party (we operate under the assumption that parties can discipline votes on any bill) and without the omission of any floor votes from the analysis, including lopsided or unanimous votes.

[7]Multiple assistant and regional whips are part of the party leadership hierarchy and are typically appointed or elected within a delegation. As further testimony of the value of whips' activities, the Majority and Minority Whips, who organize these counts, are ranked second or third in importance within the party hierarchy.

[8]For a recent important example, consider early 2017 efforts to repeal the Affordable Care Act by the Republican leadership in the House. These attempts were repeatedly whip counted, but not voted.

In terms of agenda-setting, we show that for every 100 issues that the majority party (Democrats in our sample) could potentially deliberate within a congressional cycle, on average, 7 are never voted because they are not sufficiently valuable for the leadership; 86 are brought directly to the floor where they are whipped and voted; and 7 are whip counted. Of the 7 bills whip counted, 2 are whip counted and then dropped, while 5 are brought to the floor, where they are then whipped and voted.

With our structural estimates at hand, we show that party discipline matters substantially and has proven crucial for the passage of important bills. Eliminating party discipline in the form of whipping is precisely rejected relative to a model with party discipline using standard model selection tests. The extent of party discipline is statistically different from zero, quantitatively sizable, and growing between 1977 and 1986.

Given the specific time period over which our whip count data is available, we are also able to assess, through counterfactuals, the role of parties in steering particularly salient economic bills in the early 1980s, including the two Reagan Tax Reforms of 1981 and 1984, several Social Security Amendments, Debt Limit Increase Acts, the National Energy Act of 1977, and the implementation of the Panama Canal Treaty in 1979. Some of these bills would not have passed or would have substantially lost support absent party discipline. In counterfactual exercises that focus on agenda setting, we also establish that party control is highly relevant for the equilibrium probability of success of a given policy alternative against the status quo. Polarization in the ideological preferences of legislators is instead more consequential for setting the policy alternative for each status quo, resulting in substantially different bills being pursued.

This paper contributes to three broad strands of literature. First, it is concerned with the polarization of political elites. The empirical literature on political polarization has a rich history (Poole and Rosenthal, 1984), and has experienced a recent resurgence in interest due to glaring increases in partisanship in voting (McCarty, 2017, but also media reports[9]). Rising political polarization has been detected not only in legislator ideology assessments based on roll calls, but in candidate survey responses (Moskowitz et al., 2017), congressional speech scores (Gentzkow et al., 2017), and campaign contributions measures (Bonica, 2014). Considerations on polarization from an economic perspective, related to the seemingly increasing policy gridlock after the 2008 financial crisis, are offered in Mian et al. (2014). We contribute to this discussion from an empirical perspective by quantitatively unbundling some of the deep

[9]See, for instance, Philip Bump, December 21, 2016, "Farewell to the most polarized Congress in more than 100 years!" *Washington Post*.

determinants of polarization. In this respect our work complements other recent attempts, such as Moskowitz et al. (2017), but it differs in terms of theory, identification strategy, and in the use of a structural approach.

A second, closely related, literature considers the problem of separating politician's ideological preferences from party discipline. At the heart of the problem is the observation by Krehbiel (1999, 1993) that party unity in floor voting may not necessarily be conclusive evidence of discipline. This observation is, at its core, an identification critique. Politicians from the same party are likely to share a similar ideology, and hence may vote similarly even absent party control. Exemplifying one of the most popular existing procedures used to estimate legislator ideology[10], McCarty et al. (2006) offers a broad discussion of this research area and links it to parallel relevant phenomena, such as the co-determined evolution of U.S. income inequality (Piketty and Saez, 2003).

Decomposition efforts in problems of political agency are rooted in an older literature that seeks ways to separate a politician's true policy preferences from that of the party, by focusing on situations in which one or the other factor would not be present. Snyder and Groseclose (2000) propose one such method of separating party effects from politician ideology, which has been widely used and adapted (e.g. McCarty et al., 2001; Minozzi and Volden, 2013). Their argument is that parties concentrate their efforts on results that they can influence, such as close legislative votes. Seemingly, expected lopsided votes would not attract nor need party intervention. Absent party effects on lopsided votes, Snyder and Groseclose (2000) argue in favor of estimating individual ideologies from a first stage on lopsided roll calls alone. After recovering estimates of individual preferences, in a second stage they study close votes to recover party effects, given the previously estimated legislator true preferences. There are two main methodological obstacles to this this approach. First, which vote is lopsided and which is contested is endogenous to the choice of policy alternative by the agenda setter (see the discussion in Bateman et al., 2017). This selection mechanism is explicit in our framework. Secondly, McCarty et al. (2001) note that this method provides poor identifying variation due to minimal differences in vote choices within a party for lopsided votes. In contrast, our paper does not rely on an arbitrary selection of votes where parties are assumed to be inactive.[11]

[10]Among the standard approaches to estimation are Poole and Rosenthal (1997); Clinton et al. (2004); Heckman and Snyder (1997).

[11]Other closely related papers such as Clinton et al. (2004), who use Bayesian methods to estimate ideal points, also employ lopsided bills to recover party discipline. Another approach looks at politicians who change party to see how their voting behavior changes. As Nokken (2000) finds, congressmembers who switch party do change voting patterns, suggesting that ideology is not their sole decision factor. Our model microfounds this change in

Previous works have also discussed how polarization and agenda setting may interact (Clinton et al., 2014; Bateman et al., 2017), a point that our model clarifies.

A final literature to which we contribute deals with the consequences of polarization for the behavior of legislatures. Mian et al. (2014) offers a discussion of the effects of political polarization on government gridlock and lack of reform. They also discuss how gridlock may be particularly damaging in the contexts of the aftermath of deep economic crises, where political stalemate may trigger secondary adverse events (e.g. sovereign debt crises following banking crises). The relationship between slowdowns in legislative productivity and polarization is also a topic frequently discussed in political science (e.g. Binder, 2003 and references therein). None of these works, however, offers a theory for the analysis of the role of polarization in the context of strategic party control efforts and endogenous agenda setting decisions.

The rest of our work is organized as follows. Section 2 presents our model and Section 3 our main analytical results. Section 4 describes our data, with emphasis on our application of whip count information. Section 5 focuses on the identification of the model and our estimation procedure. Section 6 discusses our results, and Section 7 provides our counterfactual exercises and benchmarks our analysis to extant metrics of polarization. Section 8 concludes. The Appendix contains all proofs and additional empirical supporting material.

2. Model

We present a model with two main features: (i) party discipline, and (ii) agenda-setting. Two parties compete for votes on a series of issues that make up a congressional term. Each party employs a subset of their legislators (the whips) to discipline their members (including other whips).[12] For a given status quo policy, a (randomly-selected) proposing party chooses the alternative policy (if any) to be voted upon, accounting for both its own ability to discipline (whip) its members, as well as that of the other party, and on the value and likelihood of passage of the alternative policy. Because floor votes are costly, not all status quo policies will be pursued. If an alternative is pursued, the proposing party can employ a formal whip count,

behavior. An interesting historical approach is presented by Jenkins (2000). By studying congressmembers who initially served in the U.S. House and then served in the Confederate House during the American Civil War, he finds striking differences in the estimated ideologies for the same politician from voting behavior in the different Houses. Since the legislators were the same, and in very similar institutional settings, he concludes (with further evidence) that differences were due to agenda setting and party discipline rather than mere ideology. Finally, Ansolabehere et al. (2001)) use a survey directly targeted at candidate ideology (NPAT, also used in Moskowitz et al., 2017) to estimate ideal points, hence moving away from roll calls.

[12]To illustrate the size of the whip apparatus each party uses, we report data on the number of whips by party and Congress in Table 9 (data originally compiled by Meinke (2008)). These whips compose the Majority or Minority Whip as well as regional and assistant whips.

which allows it to obtain additional information about a bill's probability of success before a floor vote, and to drop bills that are unlikely to pass conditional on the count.[13] Whether the proposing party chooses to conduct a formal whip count depends upon its option value relative to the fixed cost of undertaking this process.

2.1. **Preliminaries.**

Party members vote on a series of policies at times $t = 1, 2, \ldots, T$ with the majority vote determining the winning policy. Each party, $p \in \{D, R\}$, has a mass of N_p members whose underlying ideologies, θ, are continuously distributed with cumulative distribution functions (CDFs), $F_p(\theta)$, in a single-dimensional space. We assume that the corresponding probability distribution functions (PDFs), $f_p(\theta)$, have unbounded support. The median member(s) of a party are identified by θ_p^m and represent the preference of the party overall. We assume without loss that $\theta_D^m < \theta_R^m$.

In each period, party D is randomly recognized with probability γ, allowing it to set the policy alternative, x_t, to be put to a vote. With the remaining probability, $1 - \gamma$, party R is recognized. The recognized party draws a status quo policy, q_t, from a continuous CDF, $W(q)$, with corresponding PDF, $w(q)$, which is also assumed to have unbounded support.[14]

2.2. **Preferences.**

There are three sets of actors for each party: non-whip members, whip members, and the party itself.

Whips are a 'technology' that a party uses to discipline its members. We take the mass and ideologies of whips as exogenous and assume an exogenous matching of whips to members for which they are responsible, such that each member is controlled by exactly one whip. Whips acquire information from members and are rewarded for obtaining votes that the party desires.

All party members (whips and non-whips) derive expressive utility from the policy, $k_t \in \{q_t, x_t\}$, that they vote for. This utility is given by $u(k_t, \omega_t^i)$, where $\omega_t^i = \theta^i + \delta_{1,t}^i + \delta_{2,t}^i + \eta_{1,t} + \eta_{2,t}$ determines their position on a particular bill. We assume a symmetric, strictly concave utility function: $u(k_t, \omega_t^i) = u(|k_t - \omega_t^i|)$ with $u(\omega_t^i, \omega_t^i) = u_k(\omega_t^i, \omega_t^i) = 0$, $u_{kk}(k_t, \omega_t^i) < 0$.

θ^i is a member's fundamental ideology, a constant trait of i.[15] A member's position on a particular bill is determined by this ideology, two idiosyncratic shocks, $\delta_{1,t}^i$ and $\delta_{2,t}^i$, and

[13]The party not setting the agenda may also conduct a whip count, but this occurs less frequently in our data so we do not model its reason for doing so.

[14]In our application, D is the majority party. We do not model how the frequency of recognition is determined by the leadership of both parties.

[15]In this regard, we follow the discussion and evidence from Lee et al. (2004) and Moskowitz et al. (2017).

two aggregate shocks, $\eta_{1,t}$ and $\eta_{2,t}$. Multiple shocks are required to model the information acquisition problem of the proposing party, as will become clear below. The aggregate shocks are common across all members of both parties and are independent draws from a normal distribution with mean zero and standard deviation, σ_η. The idiosyncratic shocks $\delta^i_{1,t}$ and $\delta^i_{2,t}$ are identically and independently distributed across i and t according to the continuous, unbounded, and mean zero CDF, $G(\delta)$ with corresponding PDF, $g(\delta)$.

Whip members, in addition to their utility from voting, receive a payment of r_p (which may differ across parties) for each member i for whom the whip is responsible and that votes with the party. r_p may represent, for example, improved future career opportunities within the party hierarchy.[16] We model whip influence over the members for which she is responsible as an ability to persuade a member to change his position on a particular bill. To influence a member's position by an amount, y^i_t (i.e. to move his ideal point to $\omega^i_t + y^i_t$), a whip bears an increasing cost, $c(y^i_t)$ ($c' > 0$), which can be thought of, most simply, as an effort cost.[17] We assume $c(0) < r_p$ so that a whip optimally exerts a non-zero amount of influence. The contribution to a whip's utility from whipping is therefore given by $\sum_i \left(r_p I(i\ votes\ with\ party) - c(y^i_t)\right)$, where $I(.)$ is the indicator function and the summation is over all members for whom he is responsible.

Each party derives utility from that of its median member, $u(k_t, \theta^m_p)$ where $k_t \in \{q_t, x_t\}$ is the winning policy. For simplicity, we assume that the party's position, represented by their median member is not subject to idiosyncratic or aggregate shocks.[18] Because the party does not directly bear the cost of whipping members, whipping is costless to the party (and thus both parties always whip votes to the maximum extent possible).

2.3. **Information and Timing.**

The timing of the model is as follows (see Figure 1). At each time t:

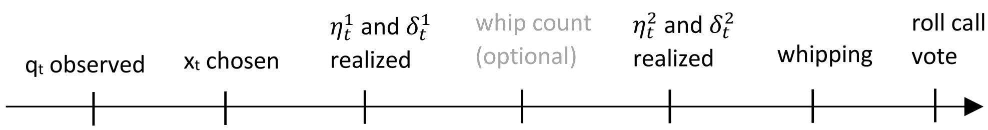
(1) The proposing party is randomly recognized and a status quo policy, q_t, is drawn.
(2) Whip count stage:

[16]Rewarding the whip only if he switches a member's vote does not change the results.

[17]Having the shocks and influence operate on the ideological bliss point rather than as changes in utility (i.e. $u(k_t, \theta^i) + \delta^i_{1,t} + \delta^i_{2,t} + \eta_{1,t} + \eta_{2,t} + y^i_t$) simplifies the model in two ways. First, it ensures that the maximum influence exerted by a whip (see Section 3.2) is a constant, independent of the locations of the policies and the distance between them. Second, it ensures the expected number of votes monotonically decreases in the extremeness of the alternative policy, x_t (see the proof of Proposition 1), which need not be the case for utility shocks.

[18]This assumption rules out the possibility that an aggregate shock causes the proposing party to prefer the status quo over the alternative they themselves proposed.

FIGURE 1. Timeline



(a) The proposing party chooses the policy x_t as an alternative to the status quo q_t and decides whether or not to conduct a whip count at a cost, $C_w > 0$.

(b) The first aggregate and idiosyncratic shocks, $\eta_{1,t}$ and $\delta^i_{1,t}$, are realized and observed noisily: each member observes his idiosyncratic shock, $\delta^i_{1,t}$, and the policy he prefers, $u(x_t, \theta^i + \delta^i_{1,t} + \eta_{1,t}) \lesseqgtr u(q_t, \theta^i + \delta^i_{1,t} + \eta_{1,t})$, but not the realization of $\eta_{1,t}$.

(c) If a whip count is undertaken, each member makes a report, $m^i_t \in \{Yes, No\}$, to his whip, answering the question of whether or not they intend to support the alternative policy, x_t. The outcome of the whip count is common knowledge.

(d) The proposing party (conditional on the whip count, if taken) decides whether or not to proceed with the bill, taking it to a roll call vote at a cost, $C_b > 0$.

(3) Roll call stage:

(a) The second aggregate and idiosyncratic utility shocks, $\eta_{2,t}$ and $\delta^i_{2,t}$, are realized and observed as in the case of the first shocks: each member observes his idiosyncratic shock, $\delta^i_{2,t}$, and the policy he prefers $u(x_t, \omega^i_t) \geq u(q_t, \omega^i_t)$, but not the the realization of $\eta_{2,t}$.

(b) Similar to a whip count, whips communicate with their members to learn the sum of the aggregate shocks, $\eta_{1,t} + \eta_{2,t}$.

(c) Whips learn the sum of the idiosyncratic shocks, $\delta^i_{1,t} + \delta^i_{2,t}$ of the members for whom they are responsible and choose the amount of influence to exert, y^i_t, over each member.

(d) The roll call vote occurs.

The information structure (who knows what and when) is a formalization of the role that whips play in obtaining and aggregating information by keeping close relationships with the rank-and-file members for which they are responsible. Information about individual member positions is important for determining (i) which members are most easily persuaded to toe the party line, and (ii) the aggregate position on a bill, which is important for determining the likelihood that a particular bill is going to pass the roll call.

3. Analysis

We solve the model via backward induction. In Sections 3.1 and 3.2, we determine the decisions of members and whips. These decisions are the same for each party, so we drop the party label for convenience. In Sections 3.3 through 3.5, we turn to the decisions unique to the proposing party: which alternative policy to pursue, if any, and whether or not to conduct a whip count and a floor vote.

3.1. **Roll Call Votes.**

Prior to the roll call vote, whips communicate with the members for whom they are responsible in order to learn the value of $\eta_{1,t}+\eta_{2,t}$, which is necessary for deciding how much influence to exert (see Section 3.2). To do so, each whip asks each member whether or not they intend to vote for the alternative policy, x_t. In the aggregate across politicians, this process reveals the aggregate shocks as in the case of a whip count (see Section 3.3). Whips then communicate the values of the aggregate shocks to all members, so that they have full information at the time of their vote.

A member votes for x_t if and only if $u(x_t, \omega_t^i + y_t^i) \geq u(q_t, \omega_t^i + y_t^i)$ where $\omega_t^i + y_t^i$ is the member's ideological bliss point after whip influence.[19] It is convenient to define the marginal voter as the ideological position of the voter who is indifferent between the two policies. Given symmetric utility functions, this voter is located at $\omega_t^i = MV_t = \frac{x_t+q_t}{2}$, absent party discipline and aggregate shocks.

3.2. **Whip Decisions.**

At the time of the whipping decision (just prior to roll call), each whip has full information about the ideological position of his members. He therefore knows whether or not a given (conditional) transfer induces a vote for a party's preferred policy or not, and so either exerts the minimal influence necessary to make the member indifferent between policies, or exerts no influence at all. The maximum influence he is willing to exert, y_p^{max}, is defined by $r_p = c(y_p^{max})$, or $y_p^{max} = c^{-1}(r_p)$. y_p^{max} is strictly greater than zero by assumption ($c(0) < r_p$).

Given y_P^{max}, Lemma 1 establishes that only members who would not otherwise vote for the party's preferred policy, and are within a fixed distance of the marginal voter are whipped.

[19] Ties have measure zero due to the continuous nature of the shocks and therefore the vote tie-breaking rule is immaterial.

Lemma 1: *Assume a party strictly prefers policy* k_t *over policy* $k_t^{'}$*. Then, only members,* i*, whose realized ideologies are on the opposite side of* MV_t *from* k_t *and such that* $|\omega_t^i - MV_t| \leq y_p^{max}$ are whipped.

3.3. **The Whip Count.**

If a whip count is conducted, whips receive reports, $m_t^i \in \{Yes, No\}$, from each member for whom they are responsible and subsequently make these reports public. If each member reports truthfully, he reports $m_t^i = Yes$ if $u(x_t, \theta^i + \delta_{1,t}^i + \eta_{1,t}) \geq u(q_t, \theta^i + \delta_{1,t}^i + \eta_{1,t})$ and $m_t^i = No$ otherwise. Given the continuum of reports, $\{m_t^i\}$, by the law of large numbers, $E[\eta_{1,t}|\{m_t^i\}] = \hat{\eta}_{1,t}$, where $\hat{\eta}_{1,t}$ is the realized value of $\eta_{1,t}$.

All members reporting truthfully forms part of an equilibrium strategy of the overall game because no single member can influence beliefs about $\hat{\eta}_{1,t}$, and hence cannot influence the eventual policy outcome by misreporting.[20] We therefore assume in what follows that members play a truth-telling strategy.[21]

We formalize these claims in Lemma 2.

Lemma 2: *Truth-telling at the whip count stage forms part of an equilibrium strategy. Under truth-telling, the realization of the first aggregate shock,* $\hat{\eta}_{1,t}$*, is known with probability one.*

3.4. **Optimal Policy Choices.**

After observing q_t, the proposing party can choose to do one of three things. One, it can decide not to pursue any alternative policy. Two, it can choose an alternative policy to pursue, x_t, without conducting a whip count. In this case, the party pays the cost, C_b, of pursuing the bill to the roll call stage. Three, the party can choose an alternative policy to pursue and conduct a whip count at a cost, C_w. In this case, after observing the results of the whip count, the party can decide whether or not to continue with the bill at a cost of C_b. Choosing to undertake the whip count is analogous to purchasing an option: the option to save the cost of pursuing the bill should the initial aggregate shock $\eta_{1,t}$ turn out unfavorably.

For status quo policies to the left of the proposing party's ideal point, θ_p^m, the alternative policy pursued (if any) must lie to the right of the status quo: any policy to the left of q_t is less

[20] In addition, misreporting does not change the amount of influence a member's whip exerts because the whip learns the member's true position before exerting influence.

[21] As usual, there also exists an equilibrium of the whip count subgame in which each member babbles, so that nothing is learned about $\hat{\eta}_{1,t}$. This equilibrium is not empirically plausible because in this case no costly whip count would ever be conducted.

preferred than q_t and q_t can be obtained at no cost. Similarly, for status quo policies to the right of θ_p^m, the proposed alternative policy must lie to the left of the status quo. In choosing how far from the status quo to set the alternative policy, the proposing party faces an intuitive trade-off: policies closer to its ideal point are more valuable, should they be successfully voted in, but are less likely to obtain the necessary votes to pass.

To formalize this intuition, define the number of votes that x_t obtains (with probability one) as $Y(\tilde{MV}_{2,t})$, where $\tilde{MV}_{2,t} \equiv MV_t - \eta_{1,t} - \eta_{2,t}$ is the *realized* marginal voter (after aggregate shocks) at roll call time (similarly the realized marginal voter at whip count time is defined by $\tilde{MV}_{1,t} \equiv MV_t - \eta_{1,t}$). Note that $Y(\tilde{MV}_{2,t})$ is stochastic only because of the random aggregate shocks – the idiosyncratic shocks average out because of a continuum of members. Using these definitions, the proof of Lemma 3 shows that more preferred policies obtain less votes on average.

Lemma 3: *The expected number of votes that the alternative policy, x_t, obtains strictly decreases with the distance between x_t and the proposing party's ideal point.*

The result of Lemma 3 guarantees that the alternative policy proposed must lie between the party's ideal point and the status quo policy. An alternative policy on the opposite side of the ideal point from the status quo is dominated by $x_t = \theta_p^m$, which is both more preferred and obtains more votes in expectation.

For the remainder of the analysis we present the case in which party D is the proposer – the case of party R is symmetric. Given the whipping technologies available to each party (defined by the maximum influence their whips are willing to exert, y_R^{max} and y_D^{max}) we can define the position of the marginal voter when the alternative policy is such that it obtains exactly half of the votes. Denote this position, $\hat{MV}_{i,j}$, where the subscripts $i, j \in \{L, R\}$ indicate the directions of the policy that parties D and R whip for, respectively.[22] Each $\hat{MV}_{i,j}$ is then given by $Y(\hat{MV}_{i,j}) = \frac{N_R+N_D}{2}$.

In the absence of a whip count, if party D pursues an alternative policy, the alternative policy x_t must maximize

$$EU_D^{no\ count}(q_t, x_t) = Pr(x_t\ wins)u(x_t, \theta_D^m) + Pr(x_t\ loses)u(q_t, \theta_D^m) - C_b$$

where the cost of of proceeding with the bill, C_b, is paid with certainty.

[22] Each $\hat{MV}_{i,j}$ is a function of many parameters of the model, so we suppress their dependencies for convenience. Note, however, that each is independent of q_t and x_t.

For status quo policies to the left of θ_D^m, since $x_t \in (q_t, \theta_D^m]$, both parties prefer and whip for x_t, the rightmost policy. Because $Y(\tilde{MV}_{2,t})$ is monotonically decreasing in x_t, and therefore in $\tilde{MV}_{2,t}$, x_t wins if and only if $\tilde{MV}_{2,t} < \hat{MV}_{R,R}$ so that $Pr(x_t \; wins) = Pr\left(\tilde{MV}_{2,t} < \hat{MV}_{R,R}\right)$.[23] The sum of the aggregate shocks, $\eta_{1,t}+\eta_{2,t}$, is normally distributed with a variance of $\sigma^2 = 2\sigma_\eta^2$ so that we can write $Pr(x_t \; wins|x_t > q_t) = 1 - \Phi\left(\frac{\tilde{MV}_{2,t} - \hat{MV}_{R,R}}{\sigma}\right)$, where Φ denotes the CDF of the standard normal distribution.

For status quo policies to the right of θ_D^m, we have $x_t \in [\theta_D^m, q_t)$. Party D therefore whips for the leftmost policy, x_t, but party R may whip for either policy depending on where q_t and x_t lie with respect to θ_R^m. As a simplification, we assume party R always whips for q_t in this case.[24] Under this assumption, x_t wins if and only if $\tilde{MV}_{2,t} > \hat{MV}_{L,R}$, so that $Pr(x_t \; wins|x_t < q_t) = \Phi\left(\frac{\tilde{MV}_{2,t} - \hat{MV}_{L,R}}{\sigma}\right)$.

Conducting a whip count provides the option value of dropping the bill and avoiding the cost, C_b , if the first aggregate shock makes it unlikely the bill will pass. After conducting the whip count, party D continues to pursue the bill if and only if $Pr(x_t \; wins|\eta_{1,t} = \hat{\eta}_{1,t})\left(u(x_t, \theta_D^m) - u(q_t, \theta_D^m)\right) + u(q_t, \theta_D^m) - C_b \geq u(q_t, \theta_D^m)$, where $\hat{\eta}_{1,t}$ is the realized value of $\eta_{1,t}$ and $u(q_t, \theta_D^m)$ is the party's utility from the outside option of dropping the bill. $Pr(x_t \; wins|\eta_{1,t} = \hat{\eta}_{1,t})$ is easily shown to be strictly monotonic in $\hat{\eta}_{1,t}$, so that we can define cutoff values of $\eta_{1,t}$, $\underline{\eta}_{1,t}$ and $\overline{\eta}_{1,t}$, such that party D continues to pursue the bill if and only if $\eta_{1,t} > \underline{\eta}_{1,t}$ (for status quo policies to the left of θ_D^m) or $\eta_{1,t} < \overline{\eta}_{1,t}$ (for status quo policies to the right).

Given these continuation policies, prior to the whip count, party D chooses x_t to maximize

$$\begin{aligned} EU_D^{count}(q_t, x_t) = \; & Pr(\eta_{1,t} > \underline{\eta}_{1,t})\Big[Pr(x_t \; wins|\eta_{1,t} > \underline{\eta}_{1,t})\left(u(x_t, \theta_D^m) - C_b\right) \\ & + \left(1 - Pr(x_t \; wins|\eta_{1,t} > \underline{\eta}_{1,t})\right)\left(u(q_t, \theta_D^m) - C_b\right)\Big] + Pr(\eta_{1,t} < \underline{\eta}_{1,t})u(q_t) \end{aligned}$$

for status quo policies to the left of θ_D^m and

[23] Ties occur with measure zero so any tie-breaking rule suffices.

[24] Similarly, if party R proposes an alternative to a status quo policy, $q_t < \theta_R^m$, we assume party D always whips for the status quo. We can solve the model without these assumptions, and the results are qualitatively similar. The difference is that the proposing party may choose to set the alternative policy such that the other party is exactly indifferent between policies in order to gain its support, rather than pushing for an alternative policy closer to the proposing party's ideal point. Thus, the model predicts a mass of bills for which the the marginal voter is at exactly the opposing party's ideal point. In reality, uncertainty about party positions is likely to prevent this fine-tuning of policies.

$$\begin{aligned} EU_D^{count}\ (q_t, x_t) = \ & Pr(\eta_{1,t} < \overline{\eta}_{1,t}) \left[Pr(x_t \ wins | \eta_{1,t} < \overline{\eta}_{1,t}) \left(u(x_t, \theta_D^m) - C_b \right) \right. \\ & \left. + \left(1 - Pr(x_t \ wins | \eta_{1,t} < \overline{\eta}_{1,t}) \right) \left(u(q_t, \theta_D^m) - C_b \right) \right] + Pr(\eta_{1,t} > \overline{\eta}_{1,t}) u(q_t) \end{aligned}$$

for status quo policies to the right of θ_D^m.

We define x_t^{count} and $x_t^{no\ count}$ to be the optimal alternative policies pursued (if any alternative is pursued) when a whip count is conducted and when it is not, respectively. Proposition 1 shows that, provided that the cost of pursuing a bill, C_b, is not too large, these optimal policies are unique and bounded away from the party's ideal point. Furthermore, the alternative policy pursued with a whip count is closer to the party's ideal policy. Intuitively, the fact that a whip count allows the party to drop bills that are unlikely to pass after observing the first aggregate shock allows it to pursue policies that are more difficult to pass.

Proposition 1: *There exists a strictly positive cutoff cost of pursuing a bill, $\hat{C}_b > 0$, such that for all $C_b < \hat{C}_b$, the optimal alternative policies, x_t^{count}* and *$x_t^{no\ count}$, are unique and contained in (q_t, θ_D^m) for $q_t < \theta_D^m$, contained in (θ_D^m, q_t) for $q_t > \theta_D^m$, and equal to θ_D^m for $q_t = \theta_D^m$.*

The requirement in Proposition 1 that C_b be sufficiently small is for analytical purposes only. Numerically, we have been unable to find a counterexample in which the proposition does not hold.

3.5. **The Whip Count and Bill Pursuit Decisions.**

To complete the analysis, we determine for which status quo policies alternative policies are pursued and, when they are pursued, whether or not a whip count is conducted. Define the value functions, $V_D^{count}(q_t) = EU_D^{count}(q_t, x_t^{count}) - u(q_t, \theta_D^m)$ and $V_D^{no\ count}(q_t) = EU_D^{no\ count}(q_t, x_t^{no\ count}) - u(q_t, \theta_D^m)$, as the gains from pursuing an alternative policy with and without conducting a whip count, respectively (note that these definitions account for the cost of pursuing a bill, C_b, but ignore the cost of the whip count, C_w). Lemma 4 characterizes the value functions as a function of the status quo policy.

Lemma 4: *Fix $C_b < \hat{C}_b$ such that the optimal alternative policies, x_t^{count}* and *$x_t^{no\ count}$, are unique. Then, for all $q_t \neq \theta_D^m$, the value of pursuing an alternative policy with a whip count, $V_D^{count}(q_t)$, strictly exceeds that without, $V_D^{no\ count}(q_t)$. Furthermore, both value functions* *strictly decrease with* $|q_t - \theta_D^m|$, *but the difference between them,* $V_D^{count}(q_t) - V_D^{no\ count}(q_t)$ *strictly increases.*

Intuitively, both value functions decrease as the status quo approaches the proposing party's ideal point because there is less to gain from an alternative policy. More interestingly, the difference between the value functions increases as the status quo approaches the party's ideal point because the whip count is an option that allows the proposing party to initially pursue a bill, but drop it if the initial aggregate shock turns out to be unfavorable (thus avoiding the cost, C_b). This option value is always positive because the party could always ignore the result of the whip count. It increases as the status quo nears the party's ideal point because passing an alternative policy becomes more difficult (fixing x_t, as q_t approaches θ_D^m, the marginal voter approaches θ_D^m, resulting in a lower probability of passing). Therefore, exercising the option becomes more likely, and hence more valuable.

Using the nature of the value functions, Proposition 2 shows which bills are pursued with and without a whip count, accounting for the fact that whipping is costly.

Proposition 2: *Fix* $C_b < \hat{C}_b$ *such that the optimal alternative policies,* x_t^{count} and $x_t^{no\ count}$, *are unique and fix the cost of a whip count,* $C_w > 0$. *Then, we can define a set of cutoff status quo policies,* $\underline{q}_l, \overline{q}_l, \underline{q}_r$, *and* $\overline{q}_r$, *with* $\underline{q}_l \leq \overline{q}_l < \theta_D^m < \underline{q}_r \leq \overline{q}_r$ *such that:*

(1) *for* $q_t \in [-\infty, \underline{q}_l] \cup [\overline{q}_r, \infty]$, *the optimal alternative policy,* $x_t^{no\ count}$, *is pursued without conducting a whip count.*

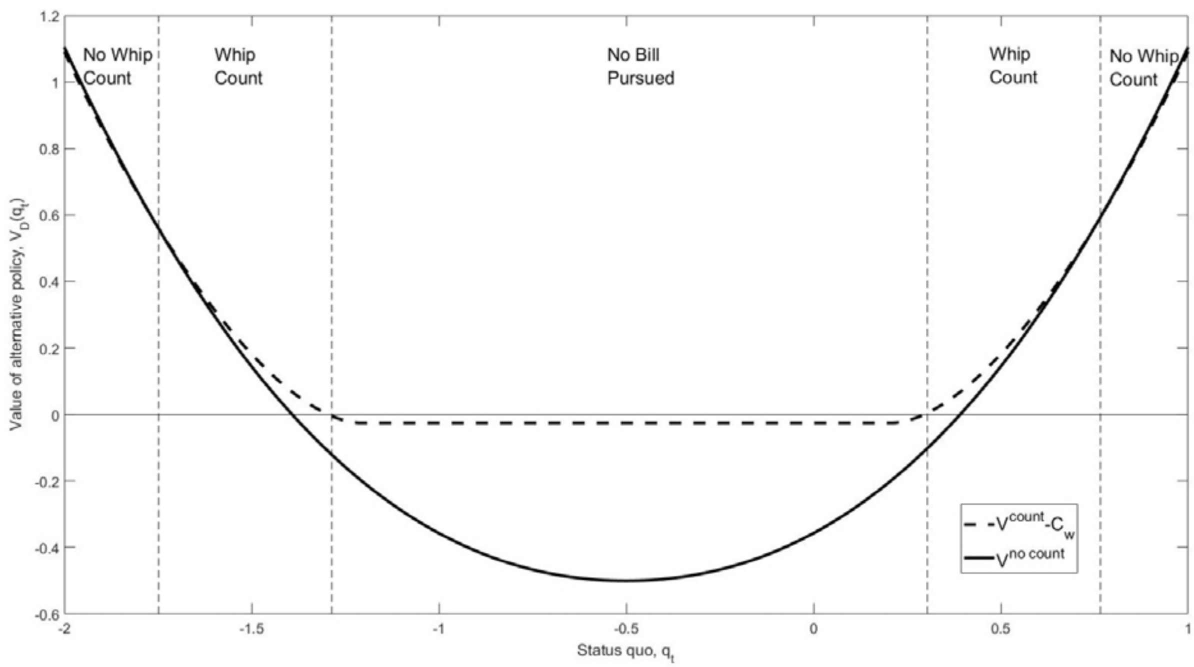
(2) *for* $q_t \in (\underline{q}_l, \overline{q}_l] \cup [\underline{q}_r, \overline{q}_r)$, *the optimal alternative policy,* x_t^{count}, *is pursued and a whip count is conducted.*

(3) *for* $q_t \in (\overline{q}_l, \underline{q}_r)$, *no alternative policy is pursued.*

We illustrate Proposition 2 via an example in Figure 2.

For status quo policies nearest to party D's ideal policy, alternative policies are never pursued because the value of such an alternative over the existing status quo is small. For status quo policies farther away, alternative policies may be pursued with or without a whip count, but when both are possible (as in the empirically relevant case illustrated), it is always policies farthest from the party's ideal policy that are pursued without a whip count, because they have a higher probability of passing ex ante (lower option value).

FIGURE 2. Example of Value Functions



Note: Value functions of pursuing an alternative policy with and without a whip count. Party D is the proposing party. The value functions are simulated using $\theta_D^m = -0.5$, $\theta_R^m = 0.5$, $M\hat{V}_{R,R} = M\hat{V}_{L,R} = -0.5$, $\sigma_\eta = 1$, $C_b = 0.5$, $C_w = 0.025$, and quadratic utility.

4. DATA

We use data from two main sources. The whip count data was compiled from historical sources by Evans (Evans (2012)), and the roll call voting data come from VoteView.org (Poole and Rosenthal, 1997, 2001).

The whip count data collected by Evans is a comprehensive set of whip counts retrieved from a variety of historical sources, mostly from archives that hold former whip and party leaders' papers. Evans (2012) describes the data collection procedure in depth. We use data from 1977-1986, as whip count data for other Congresses are not as comprehensive and complete as those for the 95th-99th Congresses, mainly due to idiosyncratic differences in the diligence of record-keeping by the Majority and Minority Whips. Importantly, however, the period under analysis is particularly interesting because, according to most narratives, it sits at the inflection point of modern political polarization in U.S. politics (e.g. McCarty et al., 2006).

For the Republican Party, we have data from 1977-1980, originating from the Robert H. Michel Collection, in the Dirksen Congressional Center, Pekin, Illinois, Leadership Files, 1963-1996. This part of the data "appears to be nearly comprehensive about whip activities on that side of the partisan aisle, 1975-1980" (Evans (2012)). Data for the Democratic Party covers 1977 to 1986, and originates from the Congressional Papers of Thomas S. Foley, Manuscripts, Archives and Special Collections Department, Holland Library, Washington State University, Boxes 197-203. Although John Brademas was the Majority whip from 1977 to 1980, his papers are collected within the Thomas Foley Collection (his successor). According to Evans (2012), "the Brademas records are extensive and very well organized, and I am confident that they are nearly comprehensive. For that matter, I also have a similar sense of the archival file from Foley's time in the position".

We rely on the matching of Evans (2012) to associate each whip count with a bill voted on the floor (if the latter was sufficiently close to the one that had a whip count). In total, we have 340 bills with whip counts covering the period of 1977 to 1986, of which 238 can be directly associated with a subsequent floor vote in the House. 70 of the whip counts are Republican and the remaining 270 are Democratic. For each whip count, we have data on the Yes or No responses of each congressmember to the party's particular question. Several bills include further whip counts (i.e. a second, third whip count), in which case we use the first whip count, as it is most representative of a member's position pre-whipping.

Our analysis relies on whip count responses being more accurate signals of true legislator ideologies than floor votes. We justify this argument on the basis of the repeated interaction between the whips and rank-and-file members over time. This interaction both reduces the asymmetry between the principal and the agent concerning true agent types (their preferences for a policy) and makes systematic lying implausible. Empirically, we highlight that costly and time consuming internal whip counts are run routinely by both parties, indicating that they must they must be of use, requiring that truth-telling be the norm. Furthermore, the outcome of whip counts appears to guide decisions by the leadership in moving forward or abandoning a policy alternative, as in the case of the GOP effort in repealing the ACA.

To demonstrate the differences between whip counts and roll calls in the raw data, Figure 3 plots the distribution of individual vote choices aligned with the party leadership at each phase (for bills proposed by the majority party that have both whip count and roll call votes). The number of members voting with the leadership dramatically increases at roll call time - a shift from approximately 160 votes with leadership at whip count time to 218 at roll call time.

Notice that 218 is the simple majority threshold for the chamber - what is needed to pass a bill at roll call. Around 58 members are persuaded to toe the party line on average, moving in the direction supported by the party leaders, in accordance with our theory.

Table 1 provides aggregate statistics on the number of bills for which we have: (i) whip counts only (subsequently dropped), (ii) whip counts and roll calls, and (iii) roll calls only. Key bills in our time-frame address a variety of questions about economic policy, foreign aid, and domestic policy, among others. Examples include the Reagan Tax Reforms of 1981 and of 1984, the National Energy Act of 1977, the Healthcare for the Unemployed Act of 1983, the Contra affair in Nicaragua of 1984, the implementation of the Panama Canal Treaty in 1979, and multiple votes for increasing the debt limit.

5. Identification and estimation

5.1. Identification.

We provide a formal proof of identification in Appendix B. Here, we state the necessary assumptions and provide intuition about the identifying variation.

The first assumption provides a normalization of the location of ideal points:

Assumption 1 (Ideal Point Locations): We normalize the ideal point of one member (without loss of generality, member '0'), $\theta^0 = 0$.

As with a discrete choice model, we must choose the distribution, G, for the idiosyncratic shocks, δ_t. The 'scale' of the ideal points is pinned down by a normalization of the variance of this distribution. We assume G is standard normal so that the convolution of the two shocks, $\delta_1 + \delta_2$, which we denote G_{1+2}, is a normal distribution with a variance of two.[25]

Assumption 2 (Ideal Point Scale): G is standard normal, with CDF denoted by $\Phi(\cdot)$.

The following two assumptions (Assumptions 3 and 4) are needed solely for the analysis of agenda setting and are not required for our theory or for estimation of ideal points and party discipline.

In order to be able to determine the mass of status quo policies that are never pursued (which we do not observe), we must make a parametric assumption about the distribution of status quo policies, $W(q)$. We assume a normal distribution, $\mathcal{N}(\mu_q, \sigma_q^2)$ for the status quo policies themselves, but note that the resulting distribution of marginal voters (as determined

[25] A Normal distribution, while not essential, is convenient because it has a simple closed form for the convolution G_{1+2}.

by the proposing party) is generally very different from normal. For the purpose of allowing the status quo distribution to change over time, we allow $W(q)$ to vary by Congress.

Assumption 3 (Status Quo Distributions): The distribution of status quo policies is $W(q) \sim \mathcal{N}(\mu_q, \sigma_q^2)$. μ_q and σ_q^2 may vary by Congress.

Lastly, in order to determine the optimal alternative policy and hence marginal voter, we assume each party has a quadratic loss utility function around its ideal point.

Assumption 4 (Utility): The utility a party derives from a policy, k_t, is given by a quadratic loss function around the ideal point of its median member, $u(k_t, \theta_p^m) = -(k_t - \theta_p^m)^2$.

Under Assumption 2, the probability that a member of party D votes Yes at the whip count is given by

$$\begin{aligned} P(Yes_t^i = 1) &= P(\delta_{1,t}^i + \theta^i \leq MV_t - \eta_{1,t}) \\ &= P(\delta_{1,t}^i \leq \tilde{MV}_{1,t} - \theta^i) \\ &= \Phi(\tilde{MV}_{1,t} - \theta^i), \end{aligned} \tag{5.1}$$

and at roll call time it is given by

$$\begin{aligned} P(Yes_t^i = 1) &= P(\delta_{1,t}^i + \delta_{2,t}^i \leq MV_t - \eta_{1,t} - \eta_{2,t} - \theta^i \pm y_D^{max}) \\ &= P(\delta_{1,t}^i + \delta_{2,t}^i \leq \tilde{MV}_{2,t} - \theta^i \pm y_D^{max}) \\ &= \Phi(\frac{\tilde{MV}_{2,t} - \theta^i \pm y_D^{max}}{\sqrt{2}}). \end{aligned} \tag{5.2}$$

In (5.2), the sign with which y_D^{max} enters depends upon the direction that party D whips (see Section 5.2).

We seek to identify the parameter vector,

$$\Theta = \{\{\{\theta_p^i\}, y_p^{max}, \underline{q}_{l,p}, \overline{q}_{l,p}, \underline{q}_{r,p}, \overline{q}_{r,p}\}_{p\in\{D,R\}}, \gamma, \mu_q, \sigma_q, \{\tilde{MV}_{1,t}\}, \{\tilde{MV}_{2,t}\}, \sigma_\eta\}$$

As is standard in ideal point estimation, the member ideal points, $\{\theta_p^i\}$, are identified relative to each other by the frequencies at which the members vote Yes and No over a series of whip count votes. Namely, they are proportional to their probabilities of voting Yes over the same set of bills. Their absolute positions are then pinned down by the normalization assumptions (Assumptions 1 and 2). Given the ideal points, the realized marginal voter at each whip count, $\{\tilde{MV}_{1,t}\}$, is then identified as the 'cutpoint' that best divides the Yes and No votes.

At roll call time, each party has a different cutpoint (because of different party discipline parameters) given by $\{\tilde{MV}_{2,t}\} \pm y_p^{max}$. The two cutpoints are identified by the locations that best divide Yes and No votes within a party. We determine the sign of the party discipline parameter using a proxy for the whipping direction (see Section 5.2). With whip count data, we can separately identify each party discipline parameter by the average change in votes between the whip count and roll call.[26] Then, because the estimated cutpoint at roll call time within a party is given by $\{\tilde{MV}_{2,t}\} \pm y_p^{max}$, we can recover the realized marginal voters, $\{\tilde{MV}_{2,t}\}$. The variance in the second aggregate shock, η_2, is given by the variance of the differences between realized marginal voters at whip count and at roll call.

Identification of the parameters governing agenda-setting, $\{\gamma, \mu_q, \sigma_q, \{\underline{q}_{l,p}, \overline{q}_{l,p}, \underline{q}_{r,p}, \overline{q}_{r,p}\}_{p\in\{D,R\}}\}$, requires the distributional assumption, Assumption 3. Under this assumption, the status quo distribution that the parties draw from is normal, which, from the theory, means that the bills with only roll calls are drawn from a truncated normal.[27] The resulting distribution of marginal voters is pinned down by the relationship between status quo policies and optimal alternative policies (Lemma A1 in the Appendix shows that the relationship between status quo and marginal voter is one-to-one), assuming each party has a quadratic loss utility function around its ideal point (Assumption 4). Convolving the distribution of marginal voters with those of the first and second aggregate shocks (whose variances have already been identified) provides a distribution over the realized marginal voters, $\{\tilde{MV}_{2,t}\}$, which we then match to the data.

Intuitively, the mean, variance, and cutoffs of the truncated normal distribution all provide independent effects on the distribution of realized marginal voters for bills with roll calls only,

[26]To identify the individual party discipline parameters from the change between whip count and roll requires that the aggregate shock between these stages be mean zero. Alternatively, given that the two parties agree on some proposals (whip in the same direction), but disagree on others (whip in opposite directions), the difference between their cutpoints may be either the difference or the sum of the individual discipline parameters, providing a second source of identification of the individual parameters. Given this additional source of identification, we do not need to impose the mean zero assumption in estimation.

[27]For computational reasons, we estimate the status quo cutoffs directly rather than the cost parameters, C_b and C_w, that determine them. The cutoffs are complex, implicit functions of the cost parameters making it infeasible to calculate them within the optimization loop. By allowing the cutoffs to be different on either side of each party's median, we are implicitly allowing the costs to be potentially different in each case. This assumption therefore allows the cost of pursuing a bill to depend upon whether or not parties agree or disagree over the alternatives.

but we verify this intuition with extensive Monte Carlo simulations. Once the status quo distribution is identified, the cutoffs, $\overline{q}_{l,p}$ and $\underline{q}_{r,p}$, that determine the range of status quo policies for which whip counts are conducted are pinned down by the number of whip counted bills. Finally, the probability that D proposes a bill, γ, is determined by a proxy for the party proposing the bill, as discussed in the following subsection.

5.2. **Two Step Estimation.**

We observe votes for both parties, $p \in \{D, R\}$, at both the whip count stage (denoted $Yes^{i,wc}_{t,p}$) and at the roll call stage (denoted $Yes^{i,rc}_{t,p}$), for each politician $i \in \{1, ..., N\}$ and period $t \in \{1, ..., T\}$. We estimate the model in two steps.

In the first step, we take the distribution of status quo policies as given, which is possible because we estimate the realized marginal voters as fixed effects. We estimate the set of parameters, $\Theta_1 = \{\{\{\theta^i_p\}, y^{max}_p\}_{p\in\{D,R\}}, \{\tilde{MV}_{1,t}\}, \{\tilde{MV}_{2,t}\}, \sigma_\eta\}$, by maximum likelihood, allowing the party discipline parameters, y^{max}_p, to vary by Congress.

Replacing the conditional probability of observing a Yes vote at roll call given a Yes vote at whip count by its unconditional probability, we can define the pseudo-likelihood for the first step:

$$\mathcal{L}(\Theta_1; Yes^{i,wc}_{t,p}, Yes^{i,rc}_{t,p}) =$$

$$\prod_{p\in\{D,R\}} \prod_{t=1}^{T} \prod_{n=1}^{N_p} P(Yes^{i,wc}_{t,p} = 1)^{Yes^{i,wc}_{t,p}} P(Yes^{i,wc}_{t,p} = 0)^{1-Yes^{i,wc}_{t,p}} \times P(Yes^{i,rc}_{t,p} = 1)^{Yes^{i,rc}_{t,p}} P(Yes^{i,rc}_{t,p} = 0)^{1-Yes^{i,rc}_{t,p}} \quad (5.3)$$

Using the pseudo-likelihood as opposed to the more cumbersome original likelihood has no effect on consistency of the estimation (Gourieroux et al. (1984), Wooldridge (2010)), because our model is identified despite the nuisance of the dependence between the roll call and the whip count stages.

For the Democratic Party, we can use equations (5.1) and (5.2), together with our parametrization to re-express the likelihood of a series of votes by member of party D in (5.3) as:

(5.4)

$$\mathcal{L}_D(\Theta_1; Yes_{t,p}^{i,wc}, Yes_{t,p}^{i,rc}) = \prod_{t=1}^{T}\prod_{n=1}^{N_D}\Phi(\tilde{MV}_{1,t}-\theta^i)^{Yes_{t,p}^{i,wc}}\left(1-\Phi(\tilde{MV}_{1,t}-\theta^i)\right)^{1-Yes_{t,p}^{i,wc}} \times \Phi\left(\frac{\tilde{MV}_{2,t}-\theta^i \pm y_D^{max}}{\sqrt{2}}\right)^{Yes_{t,p}^{i,rc}}\left(1-\Phi\left(\frac{\tilde{MV}_{2,t}-\theta^i \pm y_D^{max}}{\sqrt{2}}\right)\right)^{1-Yes_{t,p}^{i,rc}}$$

using $P(Yes_{t,p}^{i,phase} = 1) = 1 - P(Yes_{t,p}^{i,phase} = 0)$, for $phase \in \{wc, rc\}$. An analogous expression for the likelihood of votes by member of party R holds (see Appendix B).

We estimate (5.3), subject to $\theta^0 = 0$ (Assumption 1).[28] To do so, we must first make Yes or No votes comparable between whip counts and roll calls (whip count questions may be framed opposite to that of the roll call).[29] To do so, we use party leadership votes to assign the party's preferred direction on a particular whip count/roll call. In order of priority, we use the (majority/minority) party leader's vote, the (majority/minority) party whip's vote, and, for the small set of votes for which neither are available, the direction that the majority of the party voted.

For each roll call vote, we also need a proxy for the direction in which each party whips. We again rely on the direction that party leadership votes. For the majority of bills, this revealed preference, together with guidance from the theory, pins down the whipping directions. In particular, if the two party leaderships vote differently, we know from the theory that the status quo must have originated between the party's preferred positions. In this case, each party whips in the direction its party leadership prefers. If the leadership of both parties votes Yes, then the status quo could either be left of both medians with the Democrats proposing, or right of both medians with the Republicans proposing. In the former case, we expect a greater fraction of Republicans to support the bill, and vice versa in the latter case. Therefore, when the party leaderships both vote Yes, we assign the proposing party to the party that has the *least* support for the bill. Finally, a small minority of bills are supported by neither party, which cannot be reconciled with our theory. In order to avoid any selection issues, we include

[28]In practice, we set member 0 in our sample to be the member with DW-Nominate score closest to 0 to facilitate comparison.

[29]For example, often for the minority party, but not always, a whip count is framed in the negative, "Will you vote against...?" .

them by treating them as a 'tremble' by one of the party leaderships, assigning the proposing party to be that with greater support of the bill.

Completing the first step, after estimating (5.4), we obtain an estimate of σ_η^2 from the variance of the difference between the realized marginal voters at whip count and roll call (for those bills which have both).

In the second step, we estimate the remaining parameters, $\Theta_2 = \{\gamma, \mu_q, \sigma_q, \{\underline{q}_{l,p}, \overline{q}_{l,p}, \underline{q}_{r,p}, \overline{q}_{r,p}\}_{p\in\{D,R\}}\}$, using both the realized marginal voters, $\{\tilde{MV}_{2,t}\}$, for bills with only roll calls and the number of whip counts (whether pursued to roll call or not).[30] In each period, we observe either a whip count ($WC_t = 1$) or the realized marginal voter for a roll call without whip count ($RC_t = 1$) so that the likelihood can be written

$$\mathcal{L}^{second\ step}(\Theta_1; \tilde{WC}_t, \tilde{MV}_{2,t}) = \prod_{t=1}^{T} P(WC_t)^{WC_t} P(\tilde{MV}_{2,t})^{RC_t}$$

The probability of observing a whip count is simply the probability that a status quo is drawn from the appropriate interval of the q support. Because for some status quo policies (those between $\overline{q}_{l,p}$ and $\underline{q}_{r,p}$) we observe neither a whip count nor a roll call, we must condition on the probability that we observe either. For example, for a whip count for a status quo to the right of a party's median, we have, using Proposition 2:

$$P(WC_t) = \frac{\Phi(\frac{\overline{q}_{r,p}-\mu_q}{\sigma_q}) - \Phi(\frac{\underline{q}_{r,p}-\mu_q}{\sigma_q})}{P(WC_t \cup RC_t)}$$

where

$$P(WC_t \cup RC_t) = \gamma\left(\Phi(\frac{\overline{q}_{l,D}-\mu_q}{\sigma_q}) + 1 - \Phi(\frac{\underline{q}_{r,D}-\mu_q}{\sigma_q})\right) + (1-\gamma)\left(\Phi(\frac{\overline{q}_{l,R}-\mu_q}{\sigma_q}) + 1 - \Phi(\frac{\underline{q}_{r,R}-\mu_q}{\sigma_q})\right)$$

A realized marginal voter can come from a range of status quo policies. For example, the probability of observing a particular realized marginal voter for a status quo drawn from the right of the Democrats median (conditional on observing either a whip count or roll call) is:

$$P(\tilde{MV}_{2,t}) = \int_{\overline{q}_{r,D}}^{\infty} \phi\left(\frac{\tilde{MV}_{2,t} - MV(q_t)}{\sigma}\right) \frac{\phi\left(\frac{q_t-\mu_q}{\sigma_q}\right)}{P(WC_t \cup RC_t)} dq_t$$

[30] Although the first step also recovers the realized marginal voters at the time of the whip count, $\{\tilde{MV}_{1,t}\}$, they are a function of the unobserved cost parameter, C_b, and so are not easily incorporated into the likelihood function. They are not necessary, however, as the number of whip counts themselves are sufficient to recover the associated cutoffs.

The term, $\frac{\phi\left(\frac{q_t-\mu_q}{\sigma_q}\right)}{P(WC_t \cup RC_t)}$, is the conditional probability of drawing a particular q_t. A given q_t determines the marginal voter, $MV_t = MV(q_t)$, through the first-order condition.[31] The term, $\phi\left(\frac{\tilde{MV}_{2,t}-MV(q_t)}{\sigma}\right)$ is then the probability of observing a particular realized marginal voter, $\tilde{MV}_{2,t}$, for the given MV_t. Integrating over all possible q_t's that could generate the observed realized marginal voter gives the probability.

In order to estimate the second step likelihood, we need to identify for each whip count and realized marginal voter, the associated range of status quo policies. Our theoretical model, combined with the votes of party leadership provide this identification for the roll calls. If the Democratic leadership votes Yes and Republican leadership votes No, the bill must have been proposed by the Democrats and originated from a status quo to the right of the Democrat's median. In the opposite case, the bill must have been proposed by the Republicans and the status quo must be left of the Republican's median. If both leaderships vote Yes, then it could have been proposed by the Democrats for a status quo left of their median or by the Republicans for a status quo to their right. We assign the proposing party as in the first step, based upon the fraction of each party supporting the bill. Finally, if both party leaderships vote No, we assign the proposing party as in the first step, assuming the leader whose party provided the most support for the bill 'trembled'. In this case, the appropriate range of status quo policies lies between the party medians as in the case in one party's leadership votes Yes and the other No.

For whip counts with roll calls, we identify the associated range of status quo policies for the whip counts based upon the corresponding range of status quo policies associated with the roll call (as described above). For whip counts without roll calls, there is no way to determine the leadership stance of the party that didn't conduct a whip count. The natural assumption is that a party is more likely to conduct a whip count when it expects opposition from the other party, so we assume that the party conducting the whip count is the proposer and that the status quo is right of the party's median for Democratic proposals and left of the party's median for Republican proposals.

In estimating the second step likelihood, we allow the cutoff status quo policies, $\{\underline{q}_{l,p}, \overline{q}_{l,p}, \underline{q}_{r,p}, \overline{q}_{r,p}\}_{p\in\{D,R\}}$ and the distribution (μ_q and σ_q) to vary by Congress, but hold

[31]Importantly, the first-order condition in case of no whip count does not depend on the unobserved cost parameters. For each Congress, we calculate the optimal policy alternatives for each party using estimates of the party medians, the standard deviation of the sum of the aggregate shocks, and the $\hat{MV}_{i,j}$ parameters calculated from the estimates obtained in the first step.

the probability that the Democrats propose the bill, γ, constant. As such, we are implicitly allowing the costs, C_b and C_w, to vary by Congress.

6. Results

6.1. First Step Estimates: Ideologies and Party Discipline.

Table 2 presents our first step estimates using maximum likelihood. In this step, we recover, from 315 whip counts and 5424 roll call votes, the estimated ideologies, θ^i, for 711 members of Congress. We report the party medians for each congressional cycle. We also recover the party discipline parameters, y_D^{max} and y_R^{max}, for each Congress, and the standard deviation of the aggregate shocks, σ_η. All parameters are precisely estimated.

In our first main result, Table 2 shows that both party discipline parameters, y_D^{max} and y_R^{max}, are positive and statistically different from zero in each Congress, rejecting the null of a model without party discipline (i.e. with no whipping). This party discipline results in additional polarization in votes, above and beyond that due to ideological polarization itself. Under standard methods that use roll calls only and assume sincere voting by politicians, this additional polarization in votes incorrectly loads on the ideologies, producing *perceived* ideological polarization that is too large. In fact, party discipline results in the party medians being exactly $y_D^{max}+ y_R^{max}$ too far apart when party discipline is ignored.[32] To illustrate this fact, Figure 4 plots kernel densities of the estimated legislator ideologies, θ^i, by party and over time from our full model (solid lines). For comparison purposes, it also plots the corresponding ideological distributions (dashed lines) which result from estimates of a misspecified model in which we impose no party discipline, $y_D^{max} = 0$ and $y_R^{max} = 0$.

Differences in our methodology from standard methods (i.e. DW-Nominate random utility, optimal classification scores, Heckman-Snyder linear probability model scores, or Markov Chain Monte Carlo approaches) are not driving our results. As evidence, Figure 5 compares the estimated ideologies from our full model (right panel) and misspecified model with no party discipline (left panel) to the standard DW-Nominate estimates. The misspecified model and DW-Nominate estimates are very nearly the same, demonstrating that the two methods produce comparable results. Our full model, however, reveals a gap in density over the ideological middle ground, driven by DW-Nominate's loading of party discipline on legislator

[32] One may think that party discipline results in a 'hollowing out' of the middle of the distribution. However, party discipline simply shifts the cutpoint between Yes and No (see equation 5.2), which, under the assumption of unbounded idiosyncratic shocks, affects the estimates of all ideologies in the same way.

ideology. This misspecification results in a sizable bias in DW-Nominate estimates, amounting to around 0.20 in DW-Nominate units.

Tracing across Congresses, Table 2 shows that party polarization, in terms of the distance between party medians $\theta_R^m - \theta_D^m$, widens over time. Thus, even controlling for party discipline, we confirm the previous view that ideologies are segregating across party lines. However, Figure 6 illustrates that party discipline is also becoming more important over time for both parties: the trend in y_p^{max} for each party is clearly positive, tracing an increase in the reach of party leaders over rank-and-file members. The null hypothesis of a constant y_p^{max} across Congresses is rejected via a likelihood ratio test after obtaining estimates from the constrained model (see Table 10 in Appendix C for details).

The perceived ideological polarization in a misspecified model increases not only because of actual increases in ideological polarization, but also due to stronger party discipline. Table 3 shows that party discipline accounts for 34 to 44 percent of perceived ideological polarization, and is increasing in importance over time.

This rise in party discipline in the mid 1970s coincides with large reforms conducted in the House of Representatives, in particular among the majority Democratic party. During this period, power was heavily concentrated in the party leadership's hands. Among the changes, leaders became responsible for committee assignments (including the Rules Committee), the Speaker gained larger control of the agenda progress, new tactics emerged (such as packaging legislation into 'megabills'), and the Democratic Steering and Policy Committee was formed. The latter met regularly to gather information and determine tactics and policies, with the leadership controlling half of the votes. One strong motivation for these reforms was policy: to guarantee that more liberal policies would pass rather than be held back by Committee chairmen. See Rohde (1991) for a thorough description of the reforms and their motivation.[33]

Our first step estimates also allow us to address model fit. Table 4 reports in-sample model fit: individual vote choices correctly predicted by the model. The overall fit for roll call votes (with and without whip counts) is 85.5 percent. For whip count votes, the fit is lower, at 63 percent. Because whip count votes are much fewer in number and maximum likelihood does not weight whip count votes more heavily than roll call votes, the average fit is higher in the more numerous roll call sample. Overall, the fit of the model is very good, especially

[33]One can also observe polarization in votes in the Senate, starting in the mid to late 1970's. Although the Senate did not face institutional changes as extensive as those in the House of Representatives, their leaders also adopted "technological innovations" such as megabills, omnibus legislation, and time-limitation agreements, allowing more control over their party members and the agenda. See Deering and Smith (1997) for a discussion.

considering that we don't drop a single roll call (we include both lopsided and close votes). This approach differs from extant approaches that condition on (occasionally hard to justify) selected subsamples of votes. For comparison, over our sample, the DW-Nominate prediction rate is 85.9 percent, but the procedure drops 892 roll calls that we include.

Lastly, our first step produces an estimate of the size of the aggregate shock between whip count and roll call, $\eta_{2,t}$. In the theory, we assume that $\eta_{2,t}$ follows a mean-zero normal distribution which is important for characterizing the solution for the alternative policy, x_t, that is used empirically in the second step of estimation. In practice, we recover the distribution of $\eta_{2,t}$ semi-parametrically. Figure 7 shows graphically that a normal distribution fits the recovered distribution of these aggregate shocks very well, providing empirical support for our assumption.

6.2. **Second Step Estimates: Agenda Setting.**

Table 5 presents the results of maximum likelihood estimation of the second step. This step estimates the parameters of the distribution $W(q)$ from which status quo policies are drawn. We find that the mean of status quo policy, q_t, is between the party medians, with a standard deviation similar to the estimated distance between the party medians.[34] The empirical identification of these latent probability distributions and their truncation points is a more complex exercise relative to the first step, but Monte Carlo simulations provide extensive validation. In addition, our results prove to be stable across starting points.

In addition to the distribution of status quo policies itself, we are interested in identifying the status quo policies, q_t, that are: (i) never brought to the floor; (ii) whip counted and then brought to the floor with a corresponding alternative, x_t, and (iii) brought directly to the floor with a corresponding alternative. Figures 8 and 9 present the estimated distributions of the status quo policies. Status quo policies under the dashed line are brought directly to the floor. Those shaded in gray are preceded by whip counts. Finally, the gaps in the distributions around the party medians represent the 'missing mass': those status quo policies that are never pursued. As reported in Table 6, the fraction of such policies hovers around 10 percent across Congresses for the minority party and ranges from from 1 to 25 percent for the majority party. Bill that are first whip counted may also never see a floor vote, a form of agenda setting made

[34]We do not model explicitly intertemporal linkages across Congresses in terms of policy alternatives today that become tomorrow's status quo policies, or any dynamic considerations in this respect on the part of party leaders. These extensions appear completely intractable. However, our parametric time-varying distribution of status quo policies allows the model to capture these dynamic considerations across Congresses, to a reasonable extent.

explicit in our model. In the data, across all Congresses, on average two out of seven whip counted bills are abandoned before reaching the floor (Table 1). Overall, our results suggest substantial censoring of the status quo policies pursued, indicating selection is an important role of parties in legislative activity.

Lastly, agenda setting works not only through selection, but through choosing the policy alternative to pursue. Figures 10 and 11 report the implied distributions of marginal voters based upon the estimated status quo distribution and the optimal policy alternatives, x_t^*, from theory.[35] Each graph illustrates both parties' efforts to move policy closer to their ideal points across the entire distribution of status quo policies. The reduction in the variance of the marginal voter distribution relative to that of the status quo policies is substantial, indicating sizable changes in policy. In addition, the variance in the marginal voter distribution narrows over time, consistent with the finding that parties are increasingly able to discipline members, and can thus pursue policy alternatives closer to their ideal points.

7. Counterfactuals

We study the impact of polarization on policy outcomes with three counterfactual exercises. Importantly, we are able to independently assess the effects of the two determinants of polarization: party discipline and ideological polarization.

7.1. **Salient Bills.**

In the first exercise, we analyze the role of party discipline for the approval of historically salient legislation, focusing on a series of economically consequential bills from our sample. To do so, we maintain the policy alternatives to be voted on as they were proposed in Congress (including realized aggregate shocks), but assume that parties cannot discipline members' votes - legislators vote solely according to their ideologies. Specifically, we calculate the predicted votes for a bill setting $y_D^{max} = y_R^{max} = 0$.

Among the bills we consider are the lifting of the arms embargo to Turkey, the Panama Canal Treaty, several increases to the Debt Limit, the Social Security Amendments of 1983, and the Reagan Tax Reforms of 1981 and 1984. The first and second columns of Table 7 show that our baseline model fits these votes well. The third column presents the results of the counterfactual exercise, showing that party discipline is quantitatively important for the outcomes of these bills as, in some cases, their passage would have been reverted. In

[35] We plot the marginal voters, $\frac{q_t + x_t^*}{2}$, rather than the distribution of alternative policies, x_t^*, because the latter is a non-monotone function of q_t which is difficult to depict graphically.

particular, a lack of party discipline would have reversed the approval of increases to the Debt Limit and significantly decreased support for the Social Security Amendments of 1983 and the 1984 Reagan Tax bill. The reversal of the Debt Limit bills (the same class of legislative acts that have produced government shutdowns in the aftermath of 2010) is particularly interesting because, in this case, the party does not control the actual content of the bill (it defines one figure for the ceiling of all U.S. public debt) and so could not have altered the bill because of a lack of ability to discipline. This endogeneity of bills is an issue we turn to in the following section.

Although many bills lose support, Table 7, shows that others actually gain support, a consequence of differences in the location of the marginal voter and the directions each party whips their members. Consider H.R. 5399 banning aid to the Contras. For this bill, the Democrats whipped in favor and the Republicans against. The estimated marginal voter at roll call time is 0.288, right of both party medians.[36] Shutting down the ability of Democrats to whip for support of this bill changes a limited number of votes, as very few Democrats lie to the right of the marginal voter. On the other hand, shutting down the ability of the Republicans to whip against the bill increases its support substantially, because many Republican ideologies lie near the marginal voter. Thus, absent party discipline by either party, the number of Yes votes actually increases. An analogous argument, with opposite signs, leads to a decrease in support for the National Energy Act and for the 1984 Tax Reform. When parties whip in the same direction, there can also be large effects. H.R. 9290, which increased the temporary debt limit in the 95th Congress, loses about 35 Yes votes absent whipping. The estimated marginal voter is -1.20, a point sufficiently to the left that only a small minority of politicians would have voted Yes without both parties whipping for its support. In this case, a loss of 35 votes is sufficient to flip the observed outcome.

The results in this section point to the quantitative importance of party discipline in determining policy outcomes. Our exercise here is, however, only a partial equilibrium exercise: absent the ability to discipline members, the equilibrium policy alternatives would have changed. We consider the full equilibrium effects of a lack of ability to discipline in the following section.

7.2. **Agenda Setting.**

[36]This number rationalizes the large number of both Democrats and Republicans voting Yes, even if the Republican leadership voted against it.

7.2.1. *No Party Discipline.* We consider a counterfactual exercise with no whipping ($y_D^{max} = y_R^{max} = 0$), but unlike in the previous section, we allow the proposing party to re-optimize. This entails choosing which status quo policies to pursue, whether to perform a whip count or not, and selecting the optimal alternative policy, x_t. Because we can't identify the status quo associated with a particular bill (due to aggregate shocks), in this section we focus on averages across bills. In particular, we calculate the average probability that a bill will pass and the average distance between the status quo and the proposed alternative, focusing on status quo policies that lie between the party medians (as estimated with our main model).

Table 8 reports these two measures for the estimates from our main model, as well as under the counterfactual of no whipping. From these results, we see that party discipline impacts the probability of approval of a bill more so than it affects the choice of the policy alternative. For bills proposed by the Democrats, we observe a decrease in the approval rate of approximately 5 percentage points on average, relative to a baseline probability of 43 percent. For Republicans, however, when neither party whips there is an increase in bill approval of approximately 4 percentage points on a baseline of 22 percent. The reasons the Republicans benefit from a lack of whipping by both parties, but the Democrats suffer, are that the Democrats exert more discipline (see first step estimates in Table 2) and are the majority party. For both reasons, when discipline is shut down for *both* parties, the Democrats lose more votes than the Republicans do, making proposals by Republicans more likely to pass and proposals by Democrats less so.

The lack of ability to discipline also impacts the size of the mass of bills that are never pursued (see Table 6). For the Democrats, we observe small increases in the missing mass, consistent with it being more difficult for them to pass legislation, lowering the value of pursuing a policy alternative. For the Republicans, the opposite occurs - the value of pursuing a bill increases because bills are passed more easily, enlarging the set of status quo policies that it pursues.

7.2.2. *Increased Ideological Polarization.* Our final counterfactual consider the effects of an increase in ideological polarization. In particular, holding everything else constant, we shift the Democratic party median left the the Republican party median right, increasing the distance between medians by $\frac{y_D^{max}+y_R^{max}}{2}$. We consider the same measures as in the previous section: probability of bill approval, distance between alternative and status quo policies, and missing mass. Table 8 presents the results for the first two measures and Table 6 reports the missing mass results.

We find that an increase in ideological polarization has very different effects from changes in party discipline. The probability that a bill passes is relatively unchanged, but alternative policies are set further left by Democrats and further right by Republicans. The polarization in ideologies translates directly to polarization in the bills pursued. The magnitudes of these changes are quantitatively significant, ranging from six to fifteen percent of the distance between the party medians, an order of magnitude larger than the changes resulting from a lack of party discipline, relative to where they would have been. Interestingly, the missing mass changes are also opposite to those under the counterfactual of no party discipline. The missing mass decreases for the Democrats and increases for the Republicans, suggesting that the value of pursuing a policy alternative increases for the majority party, but decreases for the minority party as ideological polarization increases.

Taken together, our counterfactual results suggest that an increase in polarization, either through an increase in party discipline (opposite to our first exercise) or through ideological polarization, increases the value of pursuing an alternative policy for the majority party (lowers the missing mass for the Democrats), but decreases the value for the minority party (increases the missing mass for the Republicans). The results therefore suggest that increases in polarization via either channel benefit the majority party at the expense of the minority party. However, the channel matters - ideological polarization produces more polarized policies while party discipline affects many the probability of bill approval. The benefit of explicitly modeling party discipline, optimal policy selection, and bill pursuit decisions simultaneously is that it demonstrates the complex interactions between these factors. Omitting any single factor would lead to very different and biased conclusions.

8. Conclusion

Polarization of political elites is an empirical phenomenon that has recently reached historical highs. It has consequential implications, ranging from heightened policy uncertainty (and its deleterious consequences on investment and trade) to gridlock and the inability of political elites to respond to shocks and crises.

The literature has suggested competing views of the drivers of polarization and what can be done to counter this phenomenon. Some researchers point squarely at the ideological polarization of legislator types, arguing that it is a result of more polarized electorates electing extremists. In this view, polarization is a result of deep drivers linked to secular trends in the electorate for which policy response seems arduous, if at all, warranted. Other researchers caution about the role of ideology and instead emphasize changes in the rules of controlling the legislative agenda, gains in the leadership's grip over policy, and the capacity of parties to more precisely reward and punish their own members through committee appointments and campaign donations. Differently from ideology, these drivers appear more technologically driven and amenable to reversal.

We provide an identification strategy useful for separating these different drivers, both of which, we show, are at play. We provide a theoretical and structural economic assessment of the role of preferences and parties over the initial phase of modern congressional polarization, at its inflection point between the 95th to 99th Congresses. This exercise requires an effort to solve extant political economy problems speaking to the internal organization of parties – particularly internal aggregation of the information from the rank-and-file, and persuasion of party members on the fence. Our theoretical setting attempts to rationalize these problems within an internally coherent and unified structure. It offers a tractable, but realistic environment that we estimate based on a novel identification approach. A series of counterfactual exercises indicate a quantitative relevant role for party discipline, almost as important as legislator ideology in explaining polarization dynamics, and a crucial role of parties in driving endogenous agenda setting. Empirically, we also show that the policies pursued by parties depend upon the sources of polarization. Therefore, studies of the economic effects of policy uncertainty may differ in their conclusions, depending upon the prevailing mechanism at the time of the study.

Future research should pursue the possibility of extending our estimation methodology to time periods where identifying information as precise and comprehensive as that we employ here is not available. In a separate paper, we are working on an approach to project some of the methods developed in this paper beyond the 99th Congress. With more extensive data coverage, one would also be able to apply our analysis to the relationship between political polarization and financial crises. In this case, our methodology offers a structure for predicting policy changes and legislative success in the presence of changing party strengths and ideological extremism.

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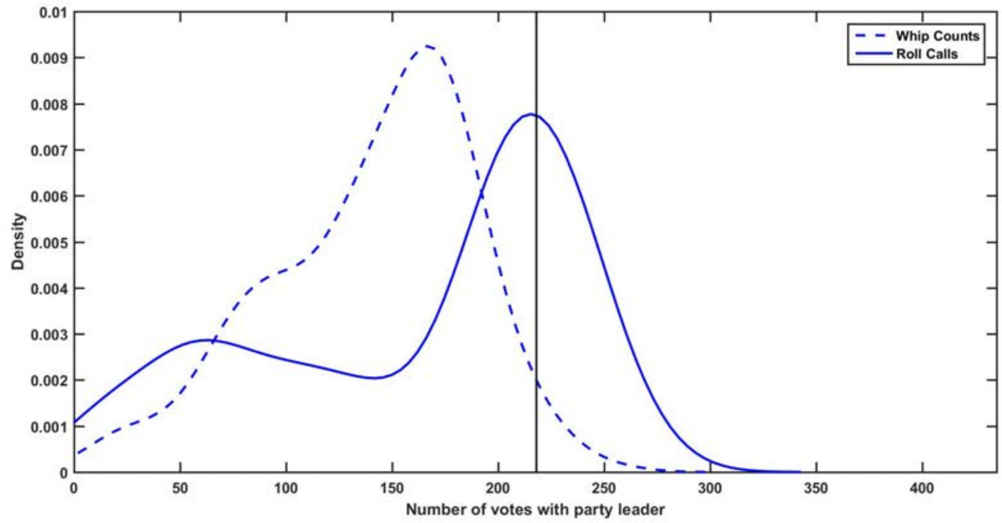
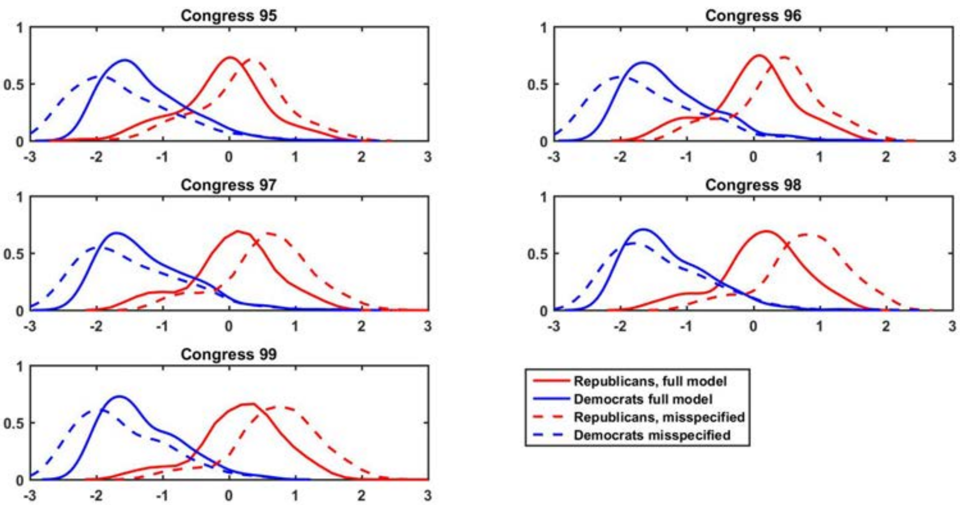
9. Tables and Figures

Figure 3. Majority Party Votes with Leadership



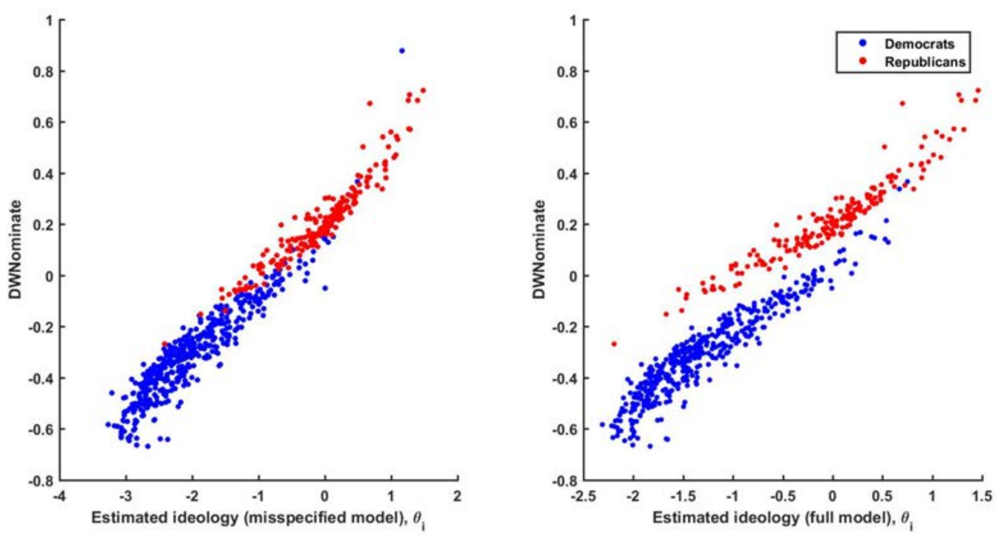
Notes: Kernel densities of the number of Democratic votes with their party leadership at the whip count and roll call stages. Includes only bills with both whip counts and roll call.The vertical line at 218 indicates the majority needed to pass a bill in the House of Representatives.

Figure 4. Estimates of Ideological Points



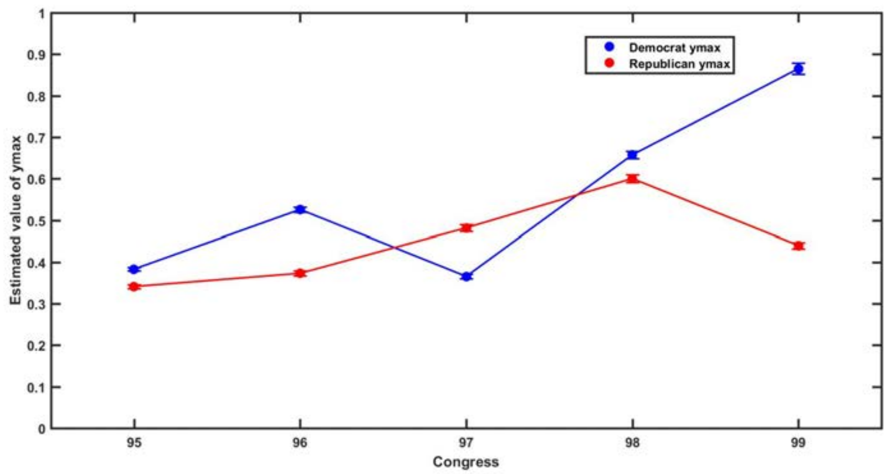
Notes: Each graph (one per Congress) provides the kernel density of the estimated ideological points for each party (solid lines). For comparison (dashed lines), the graphs show the kernel density estimates under a misspecified model that assumes no party discipline.

Figure 5. Estimated Ideologies Compared to DW-Nominate Estimates



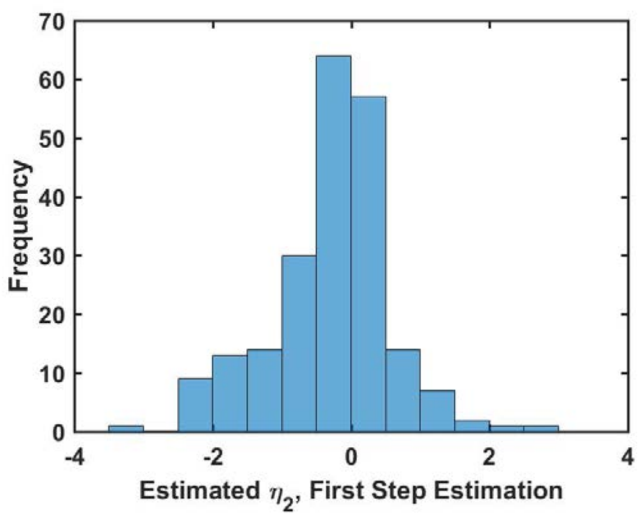
Notes: Correlations between our estimates of ideologies to those of DW-Nominate. In the left panel, the estimates are for a misspecified model with no party discipline (correlation = 0.976). In the right panel, the estimates are for the full model (correlation = 0.957).

Figure 6. Estimates of Party Discipline



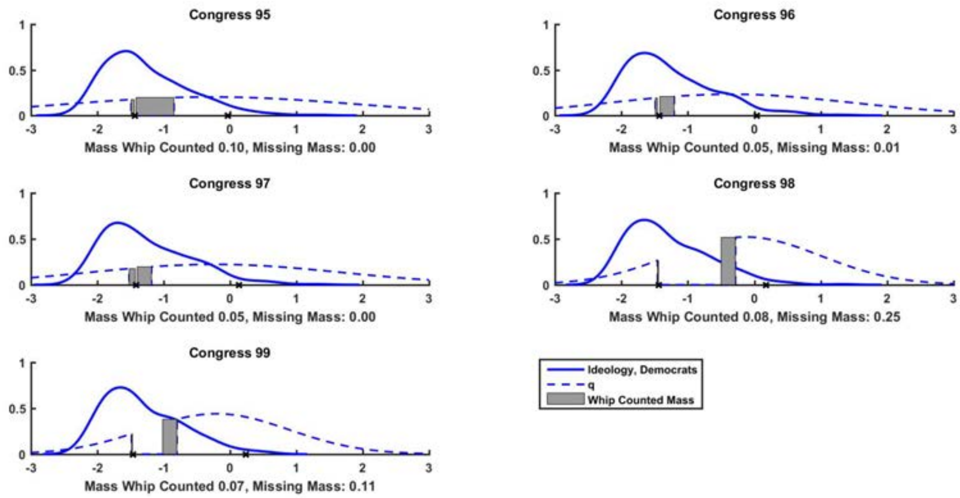
Notes: Time series of the estimates of the party discipline (whipping) parameters for each party. Each parameter is in units of the single-dimension ideology.

Figure 7. Estimated Aggregate Shocks



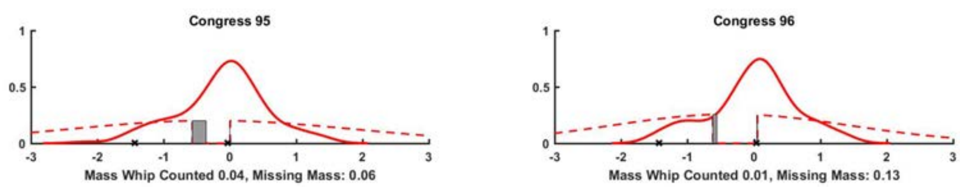
Notes: Histogram of the estimated aggregate shocks between whip count and roll call.

Figure 8. Pursued Status Quo Policies: Democrats



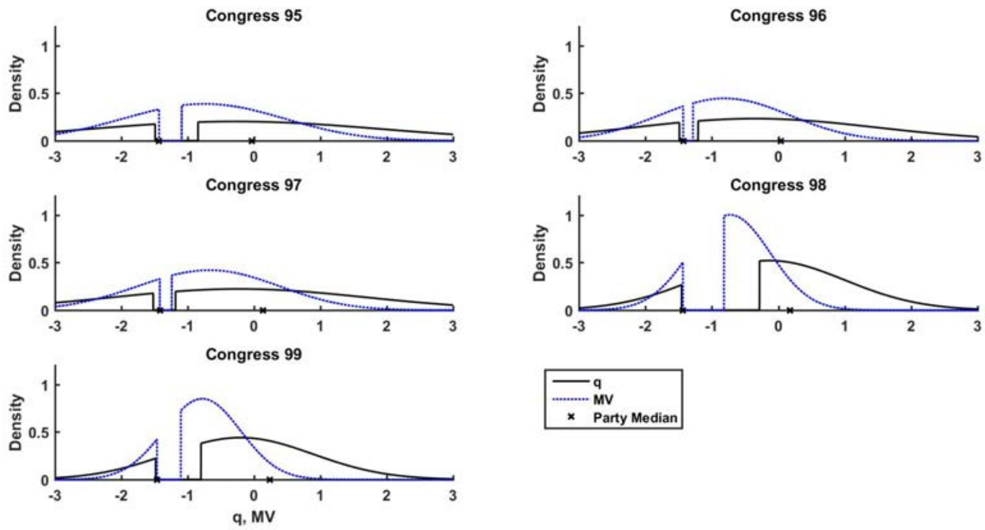
Notes: Estimated status quo distributions by Congress (dashed lines). Status quo policies that are pursued by the Democrats with whip counts are shown in gray. The remaining gap in the distribution is the 'missing mass' of status quo policies that are not pursued by the Democrats at all. For reference the ideologies of Democrats are shown as solid lines.

Figure 9. Pursued Status Quo Policies: Republicans



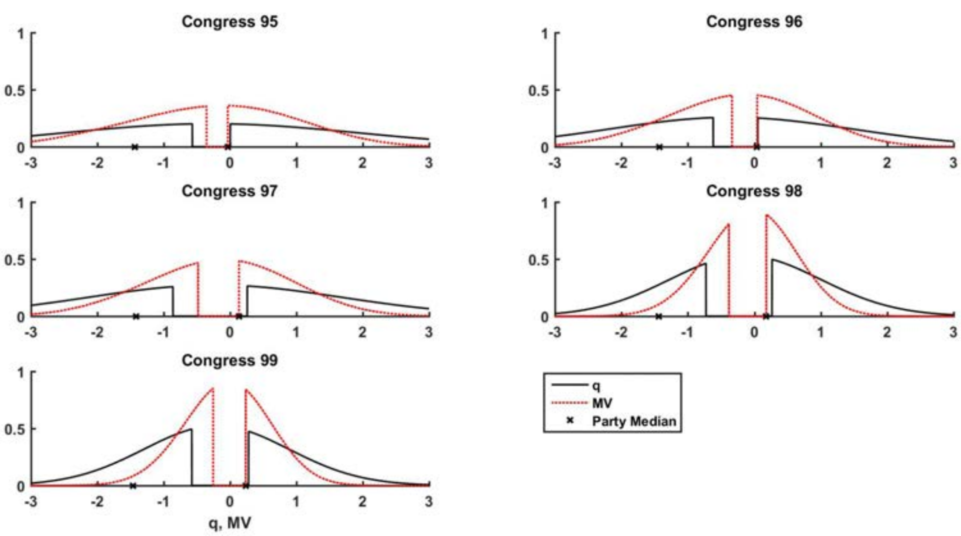
Notes: Estimated status quo distributions by Congress (dashed lines). Status quo policies that are pursued by the Republicans with whip counts are shown in grey. The remaining gap in the distribution is the 'missing mass' of status quo policies that are not pursued by the Republicans at all. For reference the ideologies of Republicans are shown as solid lines.

FIGURE 10. Marginal Voter Distributions: Democrats



Notes: Optimal marginal voters (voters indifferent between status quo and optimal alternative) for Democrats as proposer (solid lines), with the status quo distribution (dashed lines) for reference.

FIGURE 11. Marginal Voter Distributions: Republicans



Notes: Optimal marginal voters (voters indifferent between status quo and optimal alternative) for Republicans as proposer (solid lines), with the status quo distribution (dashed lines) for reference.

Table 1. Summary Statistics on Bill Selection

	Congress 95	96	97*	98*	99*
A: Total Number of Bills Whip Counted	131	58	28	50	48
B: Number of Bills Whip Counted, but not Roll Called	50	16	8	15	13
C: Total Number of Bills Roll Called	1540	1276	812	906	890

Notes: Number of bills whip counted, whip counted but not roll called, and roll called over Congresses 95-99. *We do not have data for Republican Whip Counts for Congresses 97-99 (see Section 4).

Table 2. First Step Estimates

Parameter	Congress 95	96	97	98	99
Party Discipline y^{max}, Democrats	0.383 (0.002)	0.526 (0.003)	0.366 (0.003)	0.658 (0.005)	0.865 (0.007)
Party Discipline y^{max}, Republicans	0.342 (0.003)	0.373 (0.003)	0.482 (0.004)	0.600 (0.005)	0.440 (0.004)
Standard Deviation of Aggregate Shock σ_η			0.859 (0.230)		
Party Median - Democrats, θ_D^m	-1.431 (0.038)	-1.431 (0.038)	-1.420 (0.042)	-1.435 (0.040)	-1.462 (0.095)
Party Median - Republicans, θ_R^m	-0.036 (0.049)	0.042 (0.138)	0.134 (0.139)	0.181 (0.034)	0.236 (0.049)
N: 711 T: 315 Whip Counted bills, 5424 Roll Called bills					

Notes: Estimates of the first step parameters. Asymptotic standard errors are in parentheses. Non time-varying parameters are centered in the table, but apply to all five Congresses.

Table 3. Decomposition of Polarization

	Congress				
	95	96	97	98	99
Implications of Table 2 for Polarization					
A: Polarization due to ideology ($\theta_R^m - \theta_D^m$)	1.395	1.473	1.554	1.615	1.698
B: Polarization due to whipping ($y_R^{max} + y_D^{max}$)	0.725	0.899	0.848	1.258	1.305
C: Share of Perceived Ideological Polarization due to whipping (B/(A+B))	0.342	0.379	0.353	0.438	0.435

Notes: Decomposition of perceived polarization (polarization in ideologies from a misspecified model that ignores party discipline) into that due to ideological polarization and that due to party discipline, by Congress.

Table 4. Model Fit

Model	Variable	% Correctly Predicted Votes ("Yes/No")
Full Model	Roll Call Votes	0.855
	Whip Count Votes	0.628

Notes: Fraction of correctly predicted votes at the whip count and roll call stages.

Table 5. Second Step Estimates

	Congress				
	95	96	97	98	99
Probabililty Democrat is Proposer, γ			0.427		
			(0.018)		
Status Quo Distribution (Mean), μ_q	-0.285	-0.353	-0.226	-0.136	-0.205
	(0.107)	(0.106)	(0.148)	(0.137)	(0.108)
Status Quo Distribution (Standard Deviation), σ_q	2.206	1.813	1.905	1.136	1.095
	(0.146)	(0.132)	(0.168)	(0.177)	(0.129)

Notes: Estimates of the second step parameters. Asymptotic standard errors, accounting for estimation error from the first step, in parentheses. Standard errors are computed by drawing 100 samples from the asymptotic distribution of first step estimates, recomputing the second step estimates, and using the Law of Total Variance.

Table 6. Missing Mass

	Congress				
	95	96	97	98	99
Democrats					
Main Model	0.004	0.007	0.005	0.248	0.105
Counterfactual: No Whipping	0.004	0.006	0.004	0.262	0.116
Counterfactual: Polarized Ideologies	0.004	0.006	0.005	0.203	0.071
Republicans					
Main Model	0.064	0.132	-	-	-
Counterfactual: No Whipping	0.060	0.122	-	-	-
Counterfactual: Polarized Ideologies	0.069	0.147	-	-	-

Notes: Mass of status quo policies ('missing mass') that are not pursued by the party at all. For the counterfactuals, C_b and C_w are determined from the second step estimates and held fixed, allowing new thresholds to be calculated.

Table 7. Counterfactual: Voting Outcomes on Salient Bills

Bill	Yes Votes (Data)	Yes Votes (Model Predicted)	Yes Votes (Counterfactual, No Whipping)
Security, International Relations and Other Policies			
Aid to Turkey/Lifting of Arms Embargo (H.R. 12514, Congress 95)	212	193	147
Foreign Intelligence Surveillance Act of 1978 (H.R. 7308, Congress 95)	261	283	280
National Energy Act, 1978 (H.R. 8444, Congress 95)	247	271	258
Panama Canal Treaty, 1979 (H.R. 111, Congress 96)	224	243	180
Contra Aid, 1984 (H.R. 5399, Congress 98)	294	279	343
Economic Policies			
Increase of Temporary Debt Limit, (H.R.9290, Congress 95)	221	242	185
Increase of Temporary Debt Limit, (H.R.13385, Congress 95)	210	235	201
Increase of Temporary Debt Limit, (H.R.2534, Congress 96)	220	239	208
Depository Institutions Deregulation and Monetary Control Act of 1980, (H.R. 4986, Congress 96)	369	404	391
Increase of Public Debt Limit,Make it part of Budget Process (H.R. 5369, Congress 96)	225	244	217
Economic Recovery Tax Act of 1981 (H.R. 4242, Congress 97)	284	329	276
Garn-St. Germain Depository Institutions Act of 1982 (H.R.6267, Congress 97)	263	279	327
Social Security Amendments of 1983 (H.R.1900, Congress 98)	282	299	230
Tax Reform Act of 1984 (H.R. 4170, Congress 98)	319	370	292

Notes: Counterfactual vote outcomes on certain key bills absent party discipline (whipping). The policies are assumed fixed.

Table 8. Counterfactual: Agenda Setting

	Congress				
	95	96	97	98	99
Panel A: Average Change in the Probability of Bill Approval					
Democrats					
Baseline Probability (Main Model)	0.378	0.492	0.437	0.314	0.502
Main Model - No Whipping	0.035	0.066	0.009	0.037	0.098
Main Model - Polarized Ideology	-0.006	-0.011	0.011	-0.009	-0.022
Republicans					
Baseline Probability (Main Model)	0.237	0.210	-	-	-
Main Model - No Whipping	-0.033	-0.040	-	-	-
Main Model - Polarized Ideology	0.027	0.030	-	-	-
Panel B: Average Change in Pursued Policies, x_t					
Democrats					
Main Model - No Whipping	-0.011	-0.017	-0.003	-0.020	-0.041
Main Model - Polarized Ideology	0.093	0.178	0.119	0.113	0.254
Republicans					
Main Model - No Whipping	-0.010	-0.015	-	-	-
Main Model - Polarized Ideology	-0.058	-0.045	-	-	-

Notes: Estimated and counterfactual probabilities of bill approval and average distance between the proposed policy alternative and the status quo, for status quo policies that lie between the party medians.

Appendix A. Proofs

Proof of Lemma 1:

Consider first $k_t > k_t^{'}$. Given the increasing cost of exerting influence, a whip exerts the minimum amount of influence necessary to ensure a vote for k_t, provided this amount is less than or equal to y_p^{max}. The minimum amount of influence is such that the member is indifferent, $u(k_t, \omega_t^i + y_t^i) = u(k_t^{'}, \omega_t^i + y_t^i)$ or $|\omega_t^i + y_t^i - k_t| = |\omega_t^i + y_t^i - k_t^{'}|$. This equality is satisfied if and only if $\omega_t^i + y_t^i = MV_t = \frac{k_t + k_t^{'}}{2}$. If $\omega_t^i \geq MV_t$, the required influence is weakly negative (absent influence, the member votes for k_t) and so no influence is exerted. If $\omega_t^i < MV_t$, a positive amount of influence, $y_t^i = MV_t - \omega_t^i > 0$ is required which increases linearly in $MV_t - \omega_t^i$. Therefore, a member is whipped if and only if their ideology is such that $MV_t - y_p^{max} \leq \omega_t^i < MV_t$. For $k_t < k_t^{'}$, the argument is reversed: only members for which $MV_t < \omega_t^i \leq MV_t + y_p^{max}$ are whipped.□

Proof of Lemma 2:

Consider the mass, $f(\theta)$, of members at some θ, each of whom has an independent signal of $\hat{\eta}_{1,t}$ due to their independent ideological shocks. The average number of Yes reports from N at θ members is given by $\lim_{N\to\infty} \frac{f(\theta)}{N} \sum_{i=1}^{N} I\left(u(x_t, \theta + \delta_{1,t}^i + \hat{\eta}_{1,t}) \geq u(q_t, \theta + \delta_{1,t}^i + \hat{\eta}_{1,t})\right)$ where $I()$ represents the indicator function. By the law of large numbers, as $N \to \infty$, this average converges to:

$$
\begin{aligned}
f(\theta)E\left[I\left(u(x_t, \theta + \delta_t^1 + \hat{\eta}_{1,t}) \geq u(q_t, \theta + \delta_t^1 + \hat{\eta}_{1,t})\right)\right] &= f(\theta)Pr\left(u(x_t, \theta + \delta_t^1 + \hat{\eta}_{1,t}) \geq u(q_t, \theta + \delta_t^1 + \hat{\eta}_{1,t})\right) \\
&= f(\theta)Pr\left(\theta + \delta_t^1 + \hat{\eta}_{1,t} \geq MV_t\right) \\
&= f(\theta)\left(1 - G(MV_t - \theta - \hat{\eta}_{1,t})\right).
\end{aligned}
$$

Therefore, after observing the number of Yes reports for a given θ, $\hat{\eta}_{1,t}$ is known with probability one.□

Proof of Lemma 3:

Consider $x_t > q_t$. Let $G_{1+2}()$ denote the cdf of $\delta_{1,t}^i + \delta_{2,t}^i$ (with corresponding pdf, $g_{1+2}()$). For a given MV_t, the number of votes for x_t from a given party's members is known with probability one due to independent idiosyncratic shocks and a continuum of members. To see this fact, consider the continuum of party p's members located at each θ, each with independent shocks, $\delta_{1,t}^i$ and $\delta_{2,t}^i$. With N voters at θ, the average number of votes from these members is given by $\lim_{N\to\infty}\frac{f(\theta)}{N}\sum_{i=1}^{N} I(\theta^i + \eta_{1,t} + \eta_{2,t} + \delta^i_{1,t} + \delta^i_{2,t} \geq MV_t \pm y_p^{max})$, where the sign with which y_p^{max} enters depends upon the direction that party p whips. By the law of large numbers, as $N \to \infty$, this average converges to:

$$\begin{aligned} f(\theta)E[I(\theta + \eta_{1,t} + \eta_{2,t} + \delta^1_t + \delta^2_t \geq MV_t \pm y_p^{max})] &= f(\theta)Pr(\theta + \eta_{1,t} + \eta_{2,t} + \delta^1_t + \delta^2_t \geq MV_t \pm y_p^{max}) \\ &= f(\theta)(1 - G_{1+2}(MV_t - \eta_{1,t} - \eta_{2,t} \pm y_p^{max} - \theta)). \end{aligned}$$

Given the realized marginal voter after the aggregate shocks, $\tilde{MV}_t = MV_t - \eta_{1,t} - \eta_{2,t}$, the number of votes for x_t from party D's members is given by $Y_D(\tilde{MV}_t) = N_D\left[\int_{-\infty}^{\infty}\left(1 - G_{1+2}(\tilde{MV}_t - \theta \pm y_D^{max})\right)f_D(\theta)d\theta\right]$. The corresponding expression for party R is $Y_R(\tilde{MV}_t) = N_R\left[\int_{-\infty}^{\infty}\left(1 - G_{1+2}(\tilde{MV}_t - \theta \pm y_R^{max})\right)f_R(\theta)d\theta\right]$. The total number of votes for x_t is then given by $Y(\tilde{MV}_t) \equiv Y_D(\tilde{MV}_t) + Y_R(\tilde{MV}_t)$.

$Y(\tilde{MV}_t)$ is strictly decreasing in x_t. To see this, consider the votes from party D's members, $Y_D(x_t)$:

$$\begin{aligned} \frac{\partial Y_D(\tilde{MV}_t)}{\partial x_t} &= \frac{1}{2}\frac{\partial}{\partial \tilde{MV}_t} N_D\left[\int_{-\infty}^{\infty}\left(1 - G_{1+2}(\tilde{MV}_t - \theta \pm y_D^{max})\right)f_D(\theta)d\theta\right] \\ &= -\frac{N_D}{2}\int_{-\infty}^{\infty} g_{1+2}(\tilde{MV}_t - \theta \pm y_D^{max})f_D(\theta)d\theta \end{aligned} \tag{A.1}$$

(A.1) is strictly less than zero given that that ideological shocks are unbounded, independent of the (finite) amount or direction of whipping. The same is true of the derivative of $Y_R(\tilde{MV}_t)$, ensuring $Y(\tilde{MV}_t)$ strictly decreases in x_t for $x_t > q$. For $x_t < q_t$, we have $Y_D(\tilde{MV}_t) = N_D\left[\int_{-\infty}^{\infty} G_{1+2}(\tilde{MV}_t - \theta \pm y_D^{max})f_D(\theta)d\theta\right]$ and $Y_R(\tilde{MV}_t) = N_R\left[\int_{-\infty}^{\infty} G_{1+2}(\tilde{MV}_t - \theta \pm y_R^{max})f_R(\theta)d\theta\right]$ so that $Y(\tilde{MV}_t)$ increases in x_t. Since for $q_t < \theta_p^m$ we must have $x_t > q_t$ and for $q_t > \theta_p^m$ we must have $x_t < q_t$, we see that the number of votes for x_t strictly decreases the closer it gets to the proposing party's ideal point.□

Proof of Proposition 1:

For $q_t = \theta_D^m$, clearly $x_t^{count} = x_t^{no\ count} = \theta_D^m$ are the unique optimal alternative policies because party D can do no better than its ideal point.

In the case of no whip count, and $q_t < \theta_D^m$ so that $x_t > q_t$, we can rewrite party D's expected utility as

$$EU_D^{no\ count}(q_t, x_t) = \left(1 - \Phi\left(\frac{MV_t - \hat{MV}_{R,R}}{\sigma}\right)\right)(u(x_t, \theta_D^m) - u(q_t, \theta_D^m)) + u(q_t, \theta_D^m) - C_b$$

The derivative with respect to x_t is given by

$$\left(1 - \Phi\left(\frac{MV_t - \hat{MV}_{R,R}}{\sigma}\right)\right) u_x(x_t, \theta_D^m) - \frac{1}{2\sigma}\phi\left(\frac{MV_t - \hat{MV}_{R,R}}{\sigma}\right)(u(x_t, \theta_D^m) - u(q_t, \theta_D^m))$$

where $\phi()$ denotes the pdf of the standard normal distribution. At $x_t = q_t$, the derivative is strictly positive given $q_t < \theta_D^m$ and the fact that $\hat{MV}_{R,R}$ is finite. At $x_t = \theta_D^m$, it is strictly negative given $u(q_t, \theta_D^m) < 0$. Together these facts ensure an interior solution, which we now show is unique. Any interior solution must satisfy the first-order condition,

$$\begin{aligned} &\left(1 - \Phi\left(\frac{MV_t^{no\ count} - \hat{MV}_{R,R}}{\sigma}\right)\right) u_x(x_t^{no\ count}, \theta_D^m) \\ &- \frac{1}{2\sigma}\phi\left(\frac{MV_t^{no\ count} - \hat{MV}_{R,R}}{\sigma}\right)\left(u(x_t^{no\ count}, \theta_D^m) - u(q_t, \theta_D^m)\right) = 0 \end{aligned} \tag{A.2}$$

Defining $z_t^{no\ count} \equiv \frac{MV_t^{no\ count} - \hat{MV}_{R,R}}{\sigma}$, we can re-write the first-order condition as:

$$\frac{1 - \Phi(z_t^{no\ count})}{\phi(z_t^{no\ count})} = \frac{1}{2\sigma}\frac{u(x_t^{no\ count}, \theta_D^m) - u(q_t, \theta_D^m)}{u_x(x_t^{no\ count}, \theta_D^m)} \tag{A.3}$$

The left-hand side of (A.3) is the inverse hazard rate of a standard normal distribution and so is strictly decreasing in $z_t^{no\ count}$ (and therefore $x_t^{no\ count}$ since $x_t^{no\ count}$ strictly increases in $z_t^{no\ count}$). The sign of the derivative of the right-hand side with respect to $x_t^{no\ count}$ is given by $u_x(x_t^{no\ count}, \theta_D^m)^2 - u_{xx}(x_t^{no\ count}, \theta_D^m)\left(u(x_t^{no\ count}, \theta_D^m) - u(q_t, \theta_D^m)\right)$ which is strictly positive because $u_{xx}(x_t^{no\ count}, \theta_D^m) < 0$ and $u(x_t^{no\ count}, \theta_D^m) > u(q_t, \theta_D^m)$. Thus, the right-hand side is strictly increasing in $x_t^{no\ count}$. Together, these facts guarantee a unique solution, $x_t^{no\ count} \in (q_t, \theta_D^m)$.[37]

In the case of a whip count and and $q_t < \theta_D^m$, we can rewrite the party's expected utility:

[37]The second-order condition at $x_t^{no\ count}$ is also easily checked, but must be satisfied given that marginal expected utility is increasing at $x_t = q_t$, decreasing at $x_t = \theta_D^m$ and the solution is unique.

$$
\begin{aligned}
& EU_D^{count}(q_t, x_t) \\
= \; & Pr(\eta_{1,t} \geq \underline{\eta}_{1,t}) \Big(Pr(x_t \; wins | \eta_{1,t} \geq \underline{\eta}_{1,t}) \, (u(x_t, \theta_D^m) - u(q_t, \theta_D^m)) + u(q_t, \theta_D^m) - C_b \Big) \\
& + Pr(\eta_{1,t} < \underline{\eta}_{1,t}) u(q_t, \theta_D^m) \\
= \; & Pr(\eta_{1,t} \geq \underline{\eta}_{1,t}, x_t \; wins) \, (u(x_t, \theta_D^m) - u(q_t, \theta_D^m)) - Pr(\eta_{1,t} \geq \underline{\eta}_{1,t}) C_b + u(q_t, \theta_D^m) \\
= \; & \int_{\underline{\eta}_{1,t}}^{\infty} \left(1 - \Phi(\frac{MV_t - \hat{MV}_{R,R} - \eta}{\sigma_\eta}) \right) \frac{1}{\sigma_\eta} \phi(\frac{\eta}{\sigma_\eta}) d\eta \, (u(x_t, \theta_D^m) - u(q_t, \theta_D^m)) \\
& - \left(1 - \Phi(\frac{\underline{\eta}_{1,t}}{\sigma_\eta}) \right) C_b + u(q_t, \theta_D^m)
\end{aligned}
$$

Taking the derivative with respect to x_t yields:[38]

$$
\begin{aligned}
\frac{dEU_D^{count}(q_t, x_t)}{dx_t} = \; & -\frac{d\underline{\eta}_{1,t}}{dx_t} \frac{1}{\sigma_\eta} \phi(\frac{\underline{\eta}_{1,t}}{\sigma_\eta}) \left(1 - \Phi(\frac{MV_t - \hat{MV}_{R,R} - \underline{\eta}_{1,t}}{\sigma_\eta}) \right) (u(x_t, \theta_D^m) - u(q_t, \theta_D^m)) \\
& - \frac{1}{2\sigma_\eta^2} \int_{\underline{\eta}_{1,t}}^{\infty} \phi(\frac{MV_t - \hat{MV}_{R,R} - \eta}{\sigma_\eta}) \phi(\frac{\eta}{\sigma_\eta}) d\eta \, (u(x_t, \theta_D^m) - u(q_t, \theta_D^m)) \\
& + \frac{1}{\sigma_\eta} u_x(x_t, \theta_D^m) \int_{\underline{\eta}_{1,t}}^{\infty} \left(1 - \Phi(\frac{MV_t - \hat{MV}_{R,R} - \eta)}{\sigma_\eta} \right) \phi(\frac{\eta}{\sigma_\eta}) d\eta \\
& + \frac{1}{\sigma_\eta} \frac{d\underline{\eta}_{1,t}}{dx_t} \phi(\frac{\underline{\eta}_{1,t}}{\sigma_\eta}) C_b \\
= \; & \frac{1}{\sigma_\eta} u_x(x_t, \theta_D^m) \int_{\underline{\eta}_{1,t}}^{\infty} \left(1 - \Phi(\frac{MV_t - \hat{MV}_{R,R} - \eta)}{\sigma_\eta} \right) \phi(\frac{\eta}{\sigma_\eta}) d\eta \\
& - \frac{1}{2\sigma_\eta^2} \int_{\underline{\eta}_{1,t}}^{\infty} \phi(\frac{MV_t - \hat{MV}_{R,R} - \eta}{\sigma_\eta}) \phi(\frac{\eta}{\sigma_\eta}) d\eta \, (u(x_t, \theta_D^m) - u(q_t, \theta_D^m))
\end{aligned}
\tag{A.4}
$$

where the second equality uses the fact that $\underline{\eta}_{1,t}$ satisfies

$$
\left(1 - \Phi(\frac{MV_t - \hat{MV}_{R,R} - \underline{\eta}_{1,t}}{\sigma_\eta}) \right) (u(x_t, \theta_D^m) - u(q_t, \theta_D^m)) = C_b \tag{A.5}
$$

[38]The necessary conditions for applying the Leibniz Integral Rule with an infinite bound are satisfied. Specifically, the integrand and its partial derivative with respect to x_t are both continuous functions of x_t and η, and it is possible to find integrable functions of η that bound the integrand and it's partial derivative with respect to x_t.

Consider the limit as $C_b \to 0$. From (A.5), we can see that, provided x_t is bounded away from q_t so that $u(x_t, \theta_D^m) - u(q_t, \theta_D^m) > 0$ (which we subsequently confirm), we must have $\underline{\eta}_{1,t} \to -\infty$ as $C_b \to 0$. But, as $\underline{\eta}_{1,t} \to -\infty$, the party always continues to pursue the bill after the first aggregate shock. In this case, the optimal alternative policy is identical to the case of no whip count. Formally,

$$\begin{aligned}
\lim_{\underline{\eta}^t_t \to -\infty} \frac{dEU_D^{count}(q_t, x_t)}{dx_t} &= \frac{1}{\sigma_\eta} u_x(x_t, \theta_D^m) \int_{-\infty}^{\infty} \left(1 - \Phi(\frac{MV_t - \hat{M}V_{R,R} - \eta)}{\sigma_\eta}\right) \phi(\frac{\eta}{\sigma_\eta}) d\eta \\
&\quad - \frac{1}{2\sigma_\eta^2} \int_{-\infty}^{\infty} \phi(\frac{MV_t - \hat{M}V_{R,R} - \eta}{\sigma_\eta}) \phi(\frac{\eta}{\sigma_\eta}) d\eta \, (u(x_t, \theta_D^m) - u(q_t, \theta_D^m)) \\
&= u_x(x_t, \theta_D^m) \left(1 - \Phi(\frac{MV_t - \hat{M}V_{R,R}}{\sigma})\right) \\
&\quad - \frac{1}{2\sigma} \phi(\frac{MV_t - \hat{M}V_{R,R}}{\sigma}) \, (u(x_t, \theta_D^m) - u(q_t, \theta_D^m))
\end{aligned} \tag{A.6}$$

where the equality follows from the fact that the convolution of two standard normal distributions is a normal distribution with the sum of the variances and using $\sigma^2 = 2\sigma_\eta^2$. Comparing (A.6) with (A.2), we can see immediately that, in the limit, the first-order condition for the whip and no whip cases are identical, and it therefore follows that x_t^{count} is unique and interior as in the no whip case. This fact ensures that $u(x_t, \theta_D^m) - u(q_t, \theta_D^m) > 0$ in the limit, confirming that we must have $\underline{\eta}_{1,t} \to -\infty$ as $C_b \to 0$.

We now show that x_t^{count} is unique and interior for strictly positive C_b. From (A.4), we see that $\frac{dEU_D^{count}(q_t, x_t)}{dx_t}$ is strictly positive at $x_t = q_t$ and strictly negative at $x_t = \theta_D^m$, ensuring an interior optimum, x_t^{count} which must satisfy the first-order condition[39]

$$\frac{\int_{\underline{\eta}_{1,t}}^{\infty} \left(1 - \Phi(\frac{MV_t^{count} - \hat{M}V_{R,R} - \eta}{\sigma_\eta})\right) \phi(\frac{\eta}{\sigma_\eta}) d\eta}{\frac{1}{2\sigma_\eta} \int_{\underline{\eta}_{1,t}}^{\infty} \phi(\frac{MV_t^{count} - \hat{M}V_{R,R} - \eta}{\sigma_\eta}) \phi(\frac{\eta}{\sigma_\eta}) d\eta} = \frac{\left(u(x_t^{count}, \theta_D^m) - u(q_t, \theta_D^m)\right)}{u_x(x_t^{count}, \theta_D^m)} \tag{A.7}$$

As in the case of no whip count, the right-hand side of (A.7) strictly increases in x_t^{count}. It remains to show that, in the limit as $C_b \to 0$, the left-hand side of (A.7) strictly decreases in x_t^{count}, which, by continuity of the left-hand side in C_b, ensures there exists a strictly positive value of C_b, $\hat{C}_b > 0$, such that for all $C_b < \hat{C}_b$, the left-hand side continues to strictly decrease.

[39]These statements require $\underline{\eta}_{1,t} < \infty$, which, by continuity, is true for C_b sufficiently small given that $\underline{\eta}_{1,t} \to -\infty$ as $C_b \to 0$.

It then follows that x_t^{count} is unique for all $C_b < \hat{C}_b$. The sign of the derivative of the left-hand side of (A.7) with respect to x_t^{count}, is determined by [40]

$$
\begin{aligned}
&-\frac{d\underline{\eta}_{1,t}}{dx_t^{count}}\phi(\frac{\underline{\eta}_{1,t}}{\sigma_\eta})\left(1-\Phi(\frac{MV_t-\hat{MV}_{R,R}-\underline{\eta}_{1,t}}{\sigma_\eta})\right)\frac{1}{2\sigma_\eta}\int_{\underline{\eta}_{1,t}}^{\infty}\phi(\frac{MV_t^{count}-\hat{MV}_{R,R}-\eta}{\sigma_\eta})\phi(\frac{\eta}{\sigma_\eta})d\eta\\
&+\frac{d\underline{\eta}_{1,t}}{dx_t^{count}}\frac{1}{2\sigma_\eta}\phi(\frac{MV_t^{count}-\hat{MV}_{R,R}-\underline{\eta}_{1,t}}{\sigma_\eta})\phi(\frac{\underline{\eta}_{1,t}}{\sigma_\eta})\int_{\underline{\eta}_{1,t}}^{\infty}\left(1-\Phi(\frac{MV_t^{count}-\hat{MV}_{R,R}-\eta}{\sigma_\eta})\right)\phi(\frac{\eta}{\sigma_\eta})d\eta\\
&-\left(\frac{1}{2\sigma_\eta}\int_{\underline{\eta}_{1,t}}^{\infty}\phi(\frac{MV_t^{count}-\hat{MV}_{R,R}-\eta}{\sigma_\eta})\phi(\frac{\eta}{\sigma_\eta})d\eta\right)^2\\
&-\frac{1}{4\sigma_\eta}\int_{\underline{\eta}_{1,t}}^{\infty}\phi'(\frac{MV_t^{count}-\hat{MV}_{R,R}-\eta}{\sigma_\eta})\phi(\frac{\eta}{\sigma_\eta})d\eta\int_{\underline{\eta}_{1,t}}^{\infty}\left(1-\Phi(\frac{MV_t^{count}-\hat{MV}_{R,R}-\eta}{\sigma_\eta})\right)\phi(\frac{\eta}{\sigma_\eta})d\eta
\end{aligned}
\tag{A.8}
$$

By the implicit function theorem, $\frac{d\underline{\eta}_{1,t}}{dx_t}$ must satisfy (from (A.5))

$$
\begin{aligned}
&-\phi\left(\frac{MV_t^{count}-\hat{MV}_{R,R}-\underline{\eta}_{1,t}}{\sigma_\eta}\right)\frac{1}{\sigma_\eta}\left(\frac{1}{2}-\frac{d\underline{\eta}_{1,t}}{dx_t^{count}}\right)\left(u(x_t^{count},\theta_D^m)-u(q_t,\theta_D^m)\right)\\
&+\left(1-\Phi\left(\frac{MV_t^{count}-\hat{MV}_{R,R}-\underline{\eta}_{1,t}}{\sigma_\eta}\right)\right)u_x(x_t^{count},\theta_D^m)=0
\end{aligned}
$$

or

$$
\frac{d\underline{\eta}_{1,t}}{dx_t^{count}}=\frac{1}{2}-\frac{\sigma_\eta\left(1-\Phi\left(\frac{MV_t^{count}-M\hat{V}_{R,R}-\underline{\eta}_{1,t}}{\sigma_\eta}\right)\right)u_x(x_t^{count},\theta_D^m)}{\phi\left(\frac{MV_t^{count}-\hat{MV}_{R,R}-\underline{\eta}_{1,t}}{\sigma_\eta}\right)\left(u(x_t^{count},\theta_D^m)-u(q_t,\theta_D^m)\right)}
\tag{A.9}
$$

In the limit as $C_b \to 0$, $\underline{\eta}_{1,t} \to -\infty$, in which case the second term of (A.9) approaches zero because x_t^{count} is bounded away from q_t and θ_D^m, and the inverse hazard rate of a standard normal random variable approaches zero as its argument approaches infinity.[41] The limit of (A.8) as $C_b \to 0$ is then determined by the limit of its second two terms because the first two terms approach zero. Defining $z_t^{count} \equiv \frac{MV_t^{count}-\hat{MV}_{R,R}}{\sigma}$, this limit is given by

[40] Again, the necessary conditions for applying the Leibniz Integral Rule with an infinite bound are satisfied.

[41] $\lim_{x\to\infty}\frac{1-\Phi(x)}{\phi(x)}=\lim_{x\to\infty}\frac{-\phi(x)}{\phi'(x)}=\lim_{x\to\infty}\frac{-\phi(x)}{-x\phi(x)}=0$ where the first equality uses L'Hôpital's rule.

$$
\begin{aligned}
& \lim_{\underline{\eta}_{1,t}\to-\infty} -\left(\frac{1}{2\sigma_\eta}\int_{\underline{\eta}_{1,t}}^{\infty}\phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\phi(\frac{\eta}{\sigma_\eta})d\eta\right)^2 \\
& -\frac{1}{4\sigma_\eta}\int_{\underline{\eta}^t_t}^{\infty}\phi'(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\phi(\frac{\eta}{\sigma_\eta})d\eta\int_{\underline{\eta}_{1,t}}^{\infty}\left(1-\Phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\right)\phi(\frac{\eta}{\sigma_\eta})d\eta \\
= \; & -\left(\frac{1}{2\sigma_\eta}\int_{-\infty}^{\infty}\phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\phi(\frac{\eta}{\sigma_\eta})d\eta\right)^2 \\
& -\frac{1}{4\sigma_\eta}\int_{-\infty}^{\infty}\phi'(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\phi(\frac{\eta}{\sigma_\eta})d\eta\int_{-\infty}^{\infty}\left(1-\Phi(\frac{MV_t^{count}-M\hat{V}_{R,R}-\eta}{\sigma_\eta})\right)\phi(\frac{\eta}{\sigma_\eta})d\eta \\
= \; & -\left(\frac{1}{2\sigma}\phi(\frac{MV_t^{count}-M\hat{V}_{R,R}}{\sigma})\right)^2-\frac{1}{4\sigma^2}\phi'(\frac{MV_t^{count}-\hat{M}V_{R,R}}{\sigma})\left(1-\Phi(\frac{MV_t^{count}-\hat{M}V_{R,R}}{\sigma})\right) \\
= \; & -\left(\frac{1}{2\sigma}\phi(z_t^{count})\right)^2-\frac{1}{4\sigma^2}\phi'(z_t^{count})\left(1-\Phi(z_t^{count})\right) \\
= \; & -\left(\frac{1}{2\sigma}\phi(z_t^{count})\right)^2+\frac{1}{4\sigma^2}z_t^{count}\phi(z_t^{count})\left(1-\Phi(z_t^{count})\right) \\
< \; & -\left(\frac{1}{2\sigma}\phi(z_t^{count})\right)^2+\frac{1}{4\sigma^2}\phi(z_t^{count})^2 \\
= \; & 0
\end{aligned}
$$

where the second equality uses properties of the convolution of normal distributions, and the inequality follows from the fact that, for a standard normal random variable, $x\left(1-\Phi(x)\right) < \phi(x)$.

For $q_t > \theta_D^m$ so that $x_t < q_t$, we assume party R whips against the bill (supports q_t). In case of no whip count, we can write party D's expected utility as

$$EU_D^{no\ count}(q_t,x_t)=\Phi\left(\frac{MV_t-\hat{M}V_{L,R}}{\sigma}\right)\left(u(x_t,\theta_D^m)-u(q_t,\theta_D^m)\right)+u(q_t,\theta_D^m)-C_b$$

With a whip count, it is

$$
\begin{aligned}
& EU_D^{count}(q_t, x_t) \\
= \; & \int_{-\infty}^{\overline{\eta}_{1,t}} \Phi(\frac{MV_t - \hat{MV}_{L,R} - \eta}{\sigma_\eta}) \frac{1}{\sigma_\eta} \phi(\frac{\eta}{\sigma_\eta}) d\eta \, (u(x_t, \theta_D^m) - u(q_t, \theta_D^m)) \\
& - \Phi(\frac{\overline{\eta}_{1,t}}{\sigma_\eta}) C_b + u(q_t, \theta_D^m)
\end{aligned}
$$

Using these expressions, the optimal policy candidates, x_t^{count} and $x_t^{no\ count}$, can be shown to be unique (provided C_b is not too large) as in the previous case.□

To prove Lemma 4, we first define and prove Lemma A1.

Lemma A1: *Fix $C_b < \hat{C}_b$ such that the optimal alternative policies, x_t^{count} and $x_t^{no\ count}$, are unique. Then, the alternative policies that satisfy the first-order conditions with and without a whip count ((A.7) and (A.3) are such that:*

(1) *For $q_t \neq \theta_D^m$, the optimal alternative policy with a whip count, x_t^{count}, lies strictly closer to party D's ideal point, θ_D^m, than that without, $x_t^{no\ count}$.*
(2) *$MV_t^{count}(q_t)$ and $MV_t^{no\ count}(q_t)$ strictly increase for $q_t < \theta_D^m$ and strictly increase for $q_t > \theta_D^m$.*

Proof of Lemma A1:

Part 1. Consider the case of $q_t < \theta_D^m$. We can write the first-order condition in the case of no whip count as an integration over the second aggregate shock (as in the case of the whip count):

$$
\begin{aligned}
& \textstyle\int_{-\infty}^{\infty} \Big[1 - \Phi(\frac{MV_t^{no\ count} - \hat{MV}_{R,R} - \eta}{\sigma_\eta}) \\
& - \frac{1}{2\sigma_\eta} \phi(\frac{MV_t^{no\ count} - \hat{MV}_{R,R} - \eta}{\sigma_\eta}) \left(\frac{u(x_t^{no\ count}, \theta_D^m) - u(q_t, \theta_D^m)}{u'(x_t^{no\ count}, \theta_D^m)} \right) \Big] \phi(\frac{\eta}{\sigma_\eta}) d\eta \quad = 0
\end{aligned}
$$

Consider the left-hand side of this expression, evaluated instead at x_t^{count}:

$$
\begin{aligned}
&\int_{-\infty}^{\infty}\Big[1-\Phi(\tfrac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\\
&-\tfrac{1}{2\sigma_\eta}\phi(\tfrac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\left(\tfrac{u(x_t^{count},\theta_D^m)-u(q_t,\theta_D^m)}{u'(x_t^{count},\theta_D^m)}\right)\Big]\phi(\tfrac{\eta}{\sigma_\eta})d\eta\\
=\;&\int_{\underline{\eta}_{1,t}}^{\infty}\Big[1-\Phi(\tfrac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\\
&-\tfrac{1}{2\sigma_\eta}\phi(\tfrac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\left(\tfrac{u(x_t^{count},\theta_D^m)-u(q_t,\theta_D^m)}{u'(x_t^{count},\theta_D^m)}\right)\Big]\phi(\tfrac{\eta}{\sigma_\eta})d\eta\\
&+\int_{-\infty}^{\underline{\eta}_{1,t}}\Big[1-\Phi(\tfrac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\\
&-\tfrac{1}{2\sigma_\eta}\phi(\tfrac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\left(\tfrac{u(x_t^{count},\theta_D^m)-u(q_t,\theta_D^m)}{u'(x_t^{count},\theta_D^m)}\right)\Big]\phi(\tfrac{\eta}{\sigma_\eta})d\eta\\
=\;&+\int_{-\infty}^{\underline{\eta}_{1,t}}\Big[1-\Phi(\tfrac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\\
&-\tfrac{1}{2\sigma_\eta}\phi(\tfrac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\left(\tfrac{u(x_t^{count},\theta_D^m)-u(q_t,\theta_D^m)}{u'(x_t^{count},\theta_D^m)}\right)\Big]\phi(\tfrac{\eta}{\sigma_\eta})d\eta
\end{aligned}
\tag{A.10}
$$

where the last equality follows from the fact that x_t^{count} satisfies the first-order condition for the case of a whip count. Consider the sign of the integrand in (A.10):

$$
\begin{aligned}
&\Big[1-\Phi(\tfrac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})-\tfrac{1}{2\sigma_\eta}\phi(\tfrac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\left(\tfrac{u(x_t^{count},\theta_D^m)-u(q_t,\theta_D^m)}{u'(x_t^{no\ count},\theta_D^m)}\right)\Big]\phi(\tfrac{\eta}{\sigma_\eta}) \gtrless 0\\
\iff\;& \frac{1-\Phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})}{\frac{1}{2\sigma_\eta}\phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})}-\left(\frac{u(x_t^{count},\theta_D^m)-u(q_t,\theta_D^m)}{u_x(x_t^{no\ count},\theta_D^m)}\right) \gtrless 0
\end{aligned}
$$

The left-hand side of this inequality is a strictly increasing function of η, so that there is at most one value of η at which the integrand is zero. As $\eta \to \infty$, the integrand approaches 1. Thus, to satisfy the first-order condition for the case of a whip count at x_t^{count}, the integrand evaluated at $\underline{\eta}_{1,t}$ must be strictly negative so that the single zero-crossing is contained in $[\underline{\eta}_{1,t}, \infty)$ (otherwise the integrand is positive over the whole range and cannot integrate to zero). Thus, the integrand in (A.10) must be strictly negative over $[-\infty, \underline{\eta}_{1,t}]$ so that the integral is strictly negative: the marginal expected utility for the case of no whip count must be negative when evaluated at the optimal alternative policy for the case of a whip count. But, then we must have $x_t^{no\ count} < x_t^{count}$ to ensure that the first-order condition for the case of no whip count is satisfied (given that $x_t^{no\ count}$ is the unique optimum, for every $x_t < x_t^{no\ count}$, the marginal expected utility is positive). The case of $q_t > \theta_D^m$ can be shown similarly.

Part 2. Consider the case of $q_t < \theta_D^m$ when a whip count is conducted. MV_t^{count} is determined implicitly by the first-order condition, (A.7). Taking its derivative with respect to q_t, we have

$$\frac{\partial}{\partial q_t}\left[\frac{\int_{\underline{\eta}_{1,t}}^{\infty}\left(1-\Phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\right)\phi(\frac{\eta}{\sigma_\eta})d\eta}{\frac{1}{2\sigma_\eta}\int_{\underline{\eta}_{1,t}}^{\infty}\phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\phi(\frac{\eta}{\sigma_\eta})d\eta}-\frac{\left(u(x_t^{count},\theta_D^m)-u(q_t,\theta_D^m)\right)}{u_x(x_t^{count},\theta_D^m)}\right] = 0$$

$$\begin{aligned}
\iff \frac{\partial}{\partial MV_t^{count}}&\left(\frac{\int_{\underline{\eta}_{1,t}}^{\infty}\left(1-\Phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\right)\phi(\frac{\eta}{\sigma_\eta})d\eta}{\frac{1}{2\sigma_\eta}\int_{\underline{\eta}_{1,t}}^{\infty}\phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\phi(\frac{\eta}{\sigma_\eta})d\eta}\right)\frac{\partial MV_t^{count}}{\partial q_t} \\
&-\frac{\partial}{\partial x_t^{count}}\left(\frac{u(x_t^{count},\theta_D^m)-u(q_t,\theta_D^m)}{u_x(x_t^{count},\theta_D^m)}\right)\frac{\partial x_t^{count}}{\partial q_t} = 0 \\
\iff \frac{\partial}{\partial MV_t^{count}}&\left(\frac{\int_{\underline{\eta}_{1,t}}^{\infty}\left(1-\Phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\right)\phi(\frac{\eta}{\sigma_\eta})d\eta}{\frac{1}{2\sigma_\eta}\int_{\underline{\eta}_{1,t}}^{\infty}\phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\phi(\frac{\eta}{\sigma_\eta})d\eta}\right)\frac{\partial MV_t^{count}}{\partial q_t} \\
&-\frac{\partial}{\partial x_t^{count}}\left(\frac{u(x_t^{count},\theta_D^m)-u(q_t,\theta_D^m)}{u_x(x_t^{count},\theta_D^m)}\right)\left(2\frac{\partial MV_t^{count}}{\partial q_t}-1\right) = 0 \\
\iff \frac{\partial MV_t^{count}}{\partial q_t}&\left[\frac{\partial}{\partial MV_t^{count}}\left(\frac{\int_{\underline{\eta}_{1,t}}^{\infty}\left(1-\Phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\right)\phi(\frac{\eta}{\sigma_\eta})d\eta}{\frac{1}{2\sigma_\eta}\int_{\underline{\eta}_{1,t}}^{\infty}\phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\phi(\frac{\eta}{\sigma_\eta})d\eta}\right)\right. \\
&\left.-2\frac{\partial}{\partial x_t^{count}}\left(\frac{u(x_t^{count},\theta_D^m)-u(q_t,\theta_D^m)}{u_x(x_t^{count},\theta_D^m)}\right)\right] \\
&-\frac{\partial}{\partial x_t^{count}}\left(\frac{u(x_t^{count},\theta_D^m)-u(q_t,\theta_D^m)}{u_x(x_t^{count},\theta_D^m)}\right) = 0
\end{aligned}$$

As shown in the proof of Proposition 1, the term in brackets on the left-hand side is strictly negative for $C_b < \hat{C}_b$. But, the term on the right-hand side is also strictly negative so that $\frac{\partial MV_t^{count}}{\partial q_t} > 0$. Similarly, $\frac{\partial MV_t^{no\ count}}{\partial q_t} > 0$. For $q_t > \theta_D^m$, we can similarly establish $\frac{\partial MV_t^{count}}{\partial q_t} < 0$ and $\frac{\partial MV_t^{no\ count}}{\partial q_t} < 0$. □

Proof of Lemma 4:

$V_D^{count}(q_t) > V_D^{no\ count}(q_t)$ because, for C_b sufficiently small, $\underline{\eta}_{1,t} < \infty$ and $\overline{\eta}_{1,t} > -\infty$ (see footnote 39) so that an alternative policy is pursued for a non-zero measure of the support of $\eta_{1,t}$. Therefore, for the same alternative policy, party D's expected utility with a whip count must strictly exceed that without because over this support of $\eta_{1,t}$, the cost, C_b, is avoided and the probability of the alternative passing is the same. If party D pursues a different alternative policy with a whip count (which it generally does), then it must because it does even better.

Consider the case of $q_t < \theta_D^m$. We claim both value functions decrease with q_t, but the difference $V_D^{count}(q_t) - V_D^{no\ count}(q_t)$ increases. By the envelope theorem, the derivative of the value function for the case of no whip count with respect to q_t is given by

$$\begin{aligned}
\frac{\partial V_D^{no\ count}(q_t)}{\partial q_t} &= -\left(1-\Phi(\frac{MV_t^{no\ count}-\hat{M}V_{R,R}}{\sigma})\right)u_q(q_t,\theta_D^m) \\
&\quad -\frac{1}{2\sigma}\phi\left(\frac{MV_t^{no\ count}-\hat{M}V_{R,R}}{\sigma}\right)\left(u(x_t^{no\ count},\theta_D^m)-u(q_t,\theta_D^m)\right) \\
&= -\left(1-\Phi(\frac{MV_t^{no\ count}-\hat{M}V_{R,R}}{\sigma})\right)u_q(q_t,\theta_D^m) \\
&\quad -\left(1-\Phi(\frac{MV_t^{no\ count}-\hat{M}V_{R,R}}{\sigma})\right)u_x(x_t^{no\ count},\theta_D^m) \\
&= -\left(1-\Phi(\frac{MV_t^{no\ count}-\hat{M}V_{R,R}}{\sigma})\right)\left(u_q(q_t,\theta_D^m)+u_x(x_t^{no\ count},\theta_D^m)\right)
\end{aligned}$$

where the first equality follows from applying the first-order condition. With unbounded aggregate shocks and $q_t, x_t^{no\ count} < \theta_D^m$, this derivative is strictly negative so that the value of pursuing an alternate policy strictly decreases with q_t.

In a similar manner, for the case of a whip count, we have

$$\begin{aligned}
\frac{\partial V_D^{count}(q_t)}{\partial q_t} &= -\frac{1}{2\sigma_\eta^2}\int_{\underline{\eta}_{1,t}}^{\infty}\phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\phi(\frac{\eta}{\sigma_\eta})d\eta\left(u(x_t,\theta_D^m)-u(q_t,\theta_D^m)\right) \\
&\quad -\frac{1}{\sigma_\eta}u_q(q_t,\theta_D^m)\int_{\underline{\eta}_{1,t}}^{\infty}\left(1-\Phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\right)\phi(\frac{\eta}{\sigma_\eta})d\eta \\
&= -\frac{1}{\sigma_\eta}\left(u_q(q_t,\theta_D^m)+u_x(x_t^{count},\theta_D^m)\right)\int_{\underline{\eta}_{1,t}}^{\infty}\left(1-\Phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\right)\phi(\frac{\eta}{\sigma_\eta})d\eta
\end{aligned}$$

which is also strictly negative, given $\underline{\eta}_{1,t} < \infty$.

Finally, consider the marginal difference in the value functions:

$$
\begin{aligned}
&\frac{\partial\left(V_D^{count}(q_t) - V_D^{no\ count}(q_t)\right)}{\partial q_t} \\
= &-\frac{1}{\sigma_\eta}\left(u_q(q_t,\theta_D^m) + u_x(x_t^{count},\theta_D^m)\right)\int_{\underline{\eta}_{1,t}}^{\infty}\left(1-\Phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\right)\phi(\frac{\eta}{\sigma_\eta})d\eta \\
&+\left(u_q(q_t,\theta_D^m) + u_x(x_t^{no\ count},\theta_D^m)\right)\left(1-\Phi(\frac{MV_t^{no\ count}-\hat{M}V_{R,R}}{\sigma})\right)
\end{aligned}
$$

From the first part of Lemma A1, $x_t^{no\ count} < x_t^{count}$, which ensures $u_x(x_t^{no\ count},\theta_D^m) > u_x(x_t^{count},\theta_D^m)$. Furthermore,

$$
\begin{aligned}
&1-\Phi(\frac{MV_t^{no\ count}-\hat{M}V_{R,R}}{\sigma}) \\
> &\ 1-\Phi(\frac{MV_t^{count}-\hat{M}V_{R,R}}{\sigma}) \\
= &\ \frac{1}{\sigma_\eta}\int_{-\infty}^{\infty}\left(1-\Phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\right)\phi(\frac{\eta}{\sigma_\eta})d\eta \\
> &\ \frac{1}{\sigma_\eta}\int_{\underline{\eta}_{1,t}}^{\infty}\left(1-\Phi(\frac{MV_t^{count}-\hat{M}V_{R,R}-\eta}{\sigma_\eta})\right)\phi(\frac{\eta}{\sigma_\eta})d\eta \\
> &\ 0
\end{aligned}
$$

given $\underline{\eta}_{1,t} < \infty$. Therefore, the difference in expected utility strictly increases with q_t.

For $q_t > \theta_D^m$, we can establish that both value functions increase in q_t, but their difference decreases, in an identical manner. □

Proof of Proposition 2:

Assume $C_b < \hat{C}_b$ so that, from Proposition 1, x_t^{count} is unique. Consider $q_t < \theta_D^m$. We first show that as $q_t \to \theta_D^m$, $V_D^{no\ count}(q_t) \to -C_b$ and $V_D^{count}(q_t) \to 0$. The first follows from simple inspection of $EU_D^{no\ count}(q_t, x_t)$, noting that $x_t^{no\ count}$ must approach θ_D^m as $q_t \to \theta_D^m$ because it is contained in the interval, (q_t, θ_D^m), by Proposition 1. Similarly, inspecting $EU_D^{count}(q_t, x_t)$, we see that $V_D^{count}(q_t) \to -\left(1-\Phi(\frac{\underline{\eta}_{1,t}}{\sigma_\eta})\right)C_b$. But, as $q_t \to \theta_D^m$, we can see from (A.5) that $\underline{\eta}_{1,t}$ must approach infinity such that $\Phi(\frac{\underline{\eta}_{1,t}}{\sigma_\eta}) \to 1$.

Given these facts, strictly positive costs, and the result of Lemma 4 that both value functions strictly decrease with $|q_t - \theta_D^m|$, there exists a status quo cutoff, $\overline{q}_l < \theta_D^m$, such that for all $q_t \in (\overline{q}_l, \theta_D^m)$, no alternative policy is pursued. Specifically, $\overline{q}_l$ is given by the larger of the two policies, q_1 and q_2 which satisfy $V_D^{no\ count}(q_1) = 0$ and $V_D^{count}(q_2) = C_w$, respectively.

For $q_t < \overline{q}_l$, there are two possibilities. If $q_1 > q_2$, then set $\underline{q}_l = \overline{q}_l = q_1$ with $V_D^{count}(q_1) < C_w$ and $V_D^{no\ count}(q_1) = 0$. In this case, for any $q_t < q_1$, an alternative policy is pursued without a whip count: by Lemma 4, over this range,$V_D^{no\ count}(q_1) > 0$ so that an alternative policy without a whip count is preferred over not pursuing an alternative policy and, as q_t decreases from q_1, $V_D^{count}(q_t) - V_D^{no\ count}(q_t)$ decreases so that not conducting a whip count remains more valuable than conducting one.

If $q_1 < q_2$, then set $\overline{q}_l = q_2$ and define $\underline{q}_l < \overline{q}_l$ to be the policy for which $V_D^{count}(\underline{q}_l) - C_w = V_D^{no\ count}(\underline{q}_l)$. Such a point must exist because, by Lemma 4, as q_t decreases from $\overline{q}_l$, $V_D^{count}(q_t) - V_D^{no\ count}(q_t)$ decreases and so must eventually approach zero. Thus, for q_t sufficiently small, $V_D^{count}(q_t) - C_w < V_D^{no\ count}(q_t)$. With these cutoffs, for $q_t \in (-\infty, \underline{q}_l]$, an alternative policy is pursued without a whip count because $V_D^{no\ count}(q_t) > V_D^{count}(q_t) - C_w > 0$ for all $q_t < \underline{q}_l$. For $q_t \in (\underline{q}_l, \overline{q}_l]$, an alternative policy is pursued with a whip count because $V_D^{count}(q_t) - C_w > 0$ and, by Lemma 4, $V_D^{count}(q_t) - V_D^{no\ count}(q_t)$ increases with q_t over this range so that $V_D^{count}(q_t) - C_w > V_D^{no\ count}(q_t)$.

Symmetric arguments establish cutoffs, $\underline{q}_r$ and $\overline{q}_r$, for the bill pursuit decisions over the range $q_t > \theta_D^m$.□

Appendix B. Identification and Estimation Supplementary Material

B.1. **Formal Treatment of Identification.**

We provide a more formal treatment of the proof of identification of the parameters governing voting decisions (member ideal points, party discipline, and the variances of the aggregate shocks). From equation (5.1), we have that, at the time of the whip count, for every i and t:

$$\Phi^{-1}(P(Yea_{t,p}^{i,wc} = 1)) = \tilde{MV}_{1,t} - \theta^i. \tag{B.1}$$

The difference of equation (B.1) across politicians i and 0 in period t is:

$$\Phi^{-1}(P(Yea_{t,p}^{0,wc} = 1)) - \Phi^{-1}(P(Yea_{t,p}^{i,wc} = 1)) = \theta^i, \tag{B.2}$$

where we have used that $\theta^0 = 0$ (Assumption 1). Because θ^i is known, we have that $\tilde{MV}_{1,t}$ is known for an arbitrary t from equation (B.1). At roll call, equation (5.2) can be rewritten

$$\Phi^{-1}(P(Yea^{i,rc}_{t,p} = 1)) = \frac{\tilde{MV}_{2,t} - \theta^i \pm y^{max}_D}{\sqrt{2}}, \tag{B.3}$$

for every i, t. By definitions of the realized marginal voters,

$$\tilde{MV}_{1,t} - \tilde{MV}_{2,t} = \eta_{2,t} \tag{B.4}$$

Therefore, using equations (B.1), (B.3) and (B.4), we have that for an arbitrary bill t:

$$\begin{aligned} \Phi^{-1}(P(Yea^{i,wc}_{t,p} = 1)) - \sqrt{2}\Phi^{-1}(P(Yea^{i,rc}_{t,p} = 1)) &= \tilde{MV}_{1,t} - \theta^i - (\tilde{MV}_{2,t} - \theta^i \pm y^{max}_D) \\ &= \eta_{2,t} \pm y^{max}_D \end{aligned} \tag{B.5}$$

Taking the expectation over t of both sides implies that:

$$\mathbb{E}_t\left(\Phi^{-1}(P(Yea^{i,wc}_{t,p} = 1)) - \sqrt{2}\Phi^{-1}(P(Yea^{i,rc}_{t,p} = 1))\right) = \pm y^{max}_D, \tag{B.6}$$

since $\eta_{2,t}$ is mean zero. Thus, the party discipline parameters are identified up to their sign which is pinned down by the direction of whipping (known from the theory).

Given y^{max}_D, we obtain the individual values of $\tilde{MV}_{2,t}$ from equation (B.3). Then, once $\tilde{MV}_{1,t}$ and $\tilde{MV}_{2,t}$ have been identified, equation (B.4) implies that the distribution of $\eta_{2,t}$ is semiparametrically identified. It follows that we can recover its variance, σ_η.

We can also formally demonstrate the criticality of the whip count data. In its absence, y^{max}_D is not identified (the essence of Krehbiel's critique (Krehbiel (1993)). From (5.2), if we do not know θ^i and had to estimate it from roll call data only, we could redefine $\tilde{\theta}_i = \theta^i \pm y^{max}_D$ so that:

$$\begin{aligned} P(Yea^{i,rc}_{t,p} = 1) &= \Phi\left(\frac{\tilde{MV}_{2,t} - \theta^i \pm y^{max}_D}{\sqrt{2}}\right) \\ &= \Phi(\tilde{MV}_{2,t} - \tilde{\theta}_i). \end{aligned} \tag{B.7}$$

Hence, with roll call data alone, we cannot separate a shift in everyone's (true) ideology from the party discipline effect due to whipping.

B.2. **Governing Equations for Party R.**

In our description of the theory and estimation, we focused on party D. Here we provide the key equations for party R, beginning with the probabilities of observing a member of party R voting Yes (corresponding to (5.1) and (5.2) for party D). The difference stems from the fact that, when the two parties prefer different policies, members of D to the left of the marginal voter vote Yes while members of R to the left vote No. At the whip count stage:

$$\begin{aligned} P(Yea_{t,p}^{i,wc}=1) &= P(\delta_{1,t}^{i}+\theta^{i}\geq MV_{t}-\eta_{1,t}) \\ &= 1-\Phi(\tilde{MV}_{1,t}-\theta^{i}). \end{aligned} \tag{B.8}$$

At the roll call stage,

$$\begin{aligned} P(Yea_{t,p}^{i,rc}=1) &= P(\delta_{1,t}^{i}+\delta_{2,t}^{i}+\theta^{i}\geq MV_{t}-\eta_{1,t}-\eta_{2,t}\pm y_{R}^{max}) \\ &= 1-\Phi\left(\frac{\tilde{MV}_{2,t}-\theta^{i}\pm y_{R}^{max}}{\sqrt{2}}\right), \end{aligned} \tag{B.9}$$

The likelihood of a sequence of votes by members of party R is therefore derived from (5.3) by substituting these expressions for the probabilities.

The other key equation is that which governs the optimal policy alternative chosen by party R in case of no whip count (corresponding to (A.3) for party D). For a status quo policy to the left of party R's median, party R chooses an alternative further to the right so that the first-order condition is identical to (A.3) except that $\hat{MV}_{R,R}$ is replaced by $\hat{MV}_{L,R}$ because the parties whip in opposite directions. For a status quo policy to the right of party R's median (so that the alternative is left of the status quo and both parties whip left), It is given by

$$\frac{-\Phi\left(\frac{MV_{t}^{no\ count}-\hat{MV}_{L,L}}{\sigma}\right)}{\phi\left(\frac{MV_{t}^{no\ count}-\hat{MV}_{L,L}}{\sigma}\right)} = \frac{1}{2\sigma}\frac{\left(u(x_{t}^{no\ count},\theta_{R}^{m})-u(q_{t},\theta_{R}^{m})\right)}{u_{x}(x_{t}^{no\ count},\theta_{R}^{m})} \tag{B.10}$$

Appendix C. Additional Tables and Figures

Table 9. Number of Whips per Party

Whips	Congress				
	95	96	97	98	99
Democrats (appointed)	14	14	20	26	41
Democrats (elected)	21	23	23	23	23
Republicans (appointed)	16	17	23	22	25

Notes: The table presents the number of whips per Party over the different Congresses. Data is from Meinke (2008). Both party leaderships appointed whips, however, the Democrats also elected a number of whips. Between the 95th and 106th Congresses, the Democrats also elected assistant/zone whips independently of the party leaders (Meinke (2008)).

Table 10. Likelihood Ratio Test for Constant y_{max}

Model	Estimated y_{max}	Log-Likelihood
Time Varying y_{max}	See Table 3	-7.940×10^5
Constant y_{max}	Dem: 0.523, Rep: 0.439	-8.441×10^5
p-value for LR test, with 8 degrees of freedom: 0.00		

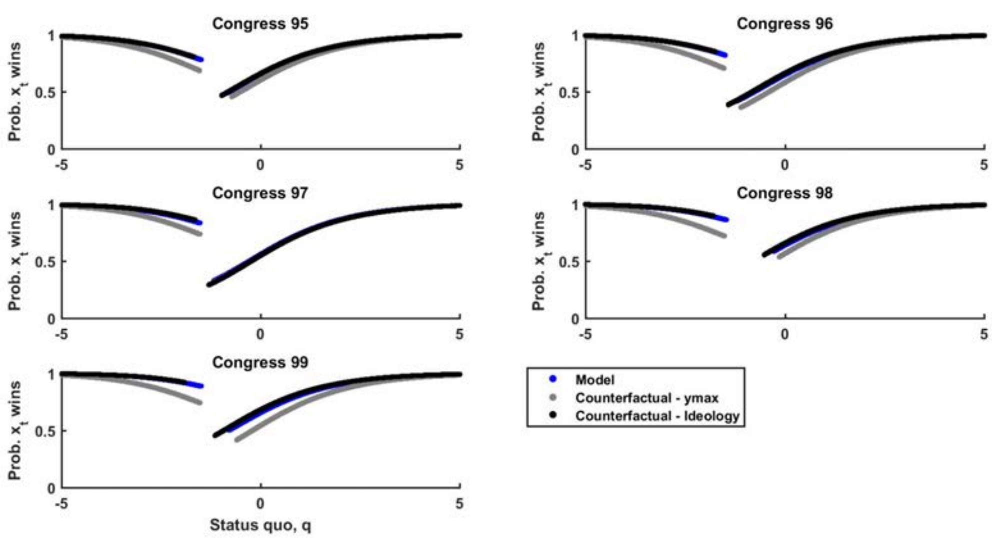
Notes: We test whether the whipping parameter, y^{max}, is constant across all Congresses in our sample. To do so, we fit a restricted version of our model where each party's y^{max} is the same throughout all periods. We compare it to our original model, and reject the hypothesis of a constant y^{max} with a Likelihood Ratio test.

Table 11. **Counterfactual with polarized ideologies:** Decomposition

	Congress				
	95	96	97	98	99
A: Polarization due to ideology ($\theta_R^m - \theta_D^m$)	1.758	1.923	1.978	2.244	2.351
B: Polarization due to whipping ($y_R^{max} + y_D^{max}$)	0.725	0.899	0.848	1.258	1.305
C: Share of Polarization due to whipping (B/(A+B))	0.292	0.319	0.300	0.359	0.357

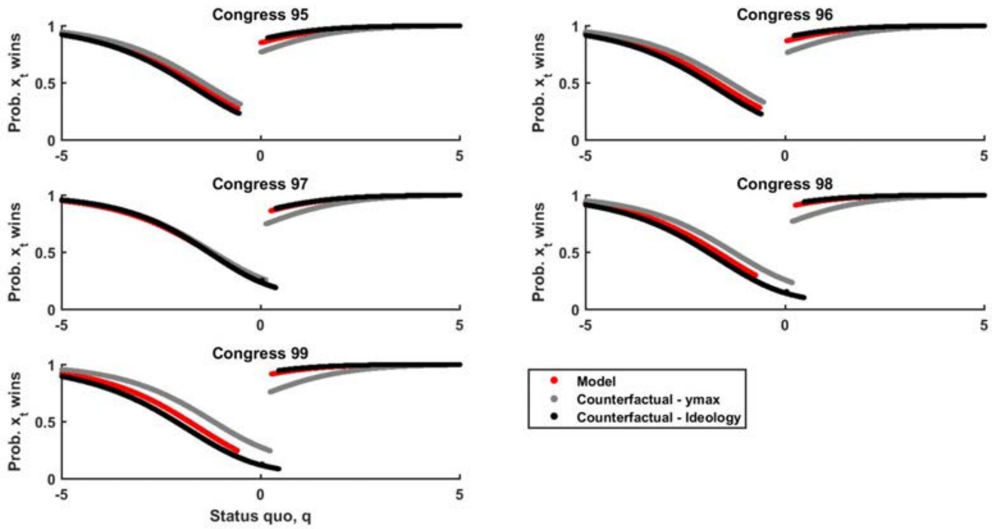
Notes: The table shows how polarization changes over Congresses, in the counterfactual where we assume ideologies are further away than they actually are (we add $y_P^{max}/2$ to each partymembers' ideologies). The change in polarization may be driven by both party discipline and by ideological drifts across parties. The counterfactual that we consider has party discipline accounting for around 30% of polarization, compared to 40% in the main model (See Table 3).

Figure 12. Probability of Bill Approval for the Democrats, Main Model and Counterfactuals



Notes: We show the distribution of the predicted probability of the alternative policy proposed by the Democrats, $x(q)$, winning at each value of q for each Congress 95-99. We show the results for both the main model and the counterfactuals. The counterfactuals are: (i) keep the estimated ideologies and set $y^{max} = 0$ for both parties, and (ii) keep the estimated y^{max} and set the ideologies to more polarized values (new ideology equals $\theta_i + y_R^{max}/2$ for Republicans, $\theta_i - y_D^{max}/2$ for Democrats).

FIGURE 13. Probability of Bill Approval for the Republicans, Main Model and Counterfactuals



Notes: We show the distribution of the predicted probability of the alternative policy proposed by the Republicans, $x(q)$, winning at each value of q for each Congress 95-99. We show the results for both the main model and the counterfactuals. Compared to our main model, the absence of whipping increases the probability of winning for values to the left of the Republican party median, but decreases it for those on the right.