Strategic Voting in Sequential Committees*

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Abstract

We consider strategic voting in sequential committees in a common value setting with incomplete information. A proposal is considered against the status quo in one committee, and only upon its approval advances for consideration in a second committee. Committee members *(i)* are privately and imperfectly informed about an unobservable state of nature which is relevant to their payoffs, and *(ii)* have a publicly observable bias with which they evaluate information. We show that the tally of votes in the originating committee can aggregate and transmit relevant information for members of the second committee in equilibrium, provide conditions for the composition and size of committees under which this occurs, and characterize all three classes of voting equilibria with relevant informative voting.

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1 Introduction

Voting of bills in bicameral legislatures has a sequential structure: a bill is originated in one chamber, and passes to the other chamber for consideration only after having been voted by a (possibly qualified) majority of representatives on the floor. This sequential arrangement of committees is in no way unique to bicameral legislatures. Still in the legislative arena, bills are typically considered by the floor of legislative bodies only after being approved by a majority of votes in the relevant standing committee. The decisions of Appeal Courts can then be elevated to the Supreme Court for consideration.[1] And in universities, faculty appointments typically require the approval of an "administrative" committee following the approval of a committee composed of faculty members of the relevant department.[2]

A stylized fact common to all these examples is that the outcome of the vote in the first committee can influence the outcome of the vote in the second committee *beyond* the binary decision of whether to approve or reject the alternative in the first committee: the larger the tally of votes in favor of the proposal in the initiating committee, the highest its success rate in the receiving committee.[3] The starting point of this paper is to propose a simple explanation for this stylized fact. If committee members have private information about the relative value of the alternatives under consideration, voting outcomes can aggregate and transmit relevant information to members of the receiving committee. What is less straightforward is whether members of the originating committee will have incentives to vote informatively in equilibrium, and if so under what conditions. Which compositions and sizes of committees facilitate or hinder the transmission and aggregation of information in this environment?

To assess these questions, we develop a simple model of strategic voting in sequential committees in a common value setting with incomplete information. The model builds on the seminal contributions of Austen-Smith and Banks (1996), and Feddersen and Pesendorfer (1997, 1998). As usual in the literature, committee members are privately and imperfectly informed about an unobservable state of nature which is relevant to their payoffs. Here, however, voting does not occur in single-committee systems. Instead, a proposal

[1] I thank Barry Weingast for suggesting this interesting application.

[2] Maug and Yilmaz (2002) consider the case of reorganization proposals under the U.S Federal Bankruptcy Reform Act of 1978, where claim holders are divided into classes, and decision-making appears to be simultaneous between committees.

[3] As Oleszek (2004) notes regarding committees in the U.S. House of Representatives, "Bills voted out of committee unanimously stand a good chance on the floor. A sharply divided committee vote presages an equally sharp dispute on the floor (pg. 102)"

can prevail only by defeating the status quo by (possibly qualified) majority voting first in one and, provided it is successful there, then in a second committee (whose members, we assume, can observe the vote outcome in the initiating committee).

What does and what does not change *vis-a-vis* the standard single-committee setting? Note first that the strategic problem of members of the receiving committee is essentially the same as that of members of a single committee: in deciding their vote, individuals of the receiving committee care only about the event in which they are pivotal, and they are pivotal in the traditional sense of being the decisive vote in a divided committee (the *standard-pivotal* motive). The possibility of observing the outcome of the vote in the originating committee, however, introduces two main differences in the incentives of members of both committees. First, members of the receiving committee can condition their behavior on the realization of votes in the originating committee. When some members of the originating committee vote informatively, the tally of the votes in favor of the alternative becomes an informative public signal for members of the receiving committee, allowing different voting strategies to be equilibria in the second committee for different voting outcomes in the first committee. Second, as opposed to members of the receiving committee, members of the originating committee can influence the outcome both in the traditional sense of killing or passing the proposal in their committee, and by influencing the beliefs of members of the receiving committee regarding the relative value of the two alternatives (what we call the *signal-pivotal* voting motive).

We show that there are two classes of voting equilibria in which the tally of votes in favor of the proposal in the originating committee transmits relevant information to members of the receiving committee. In the first class, the receiving committee unconditionally (independently of the private information of its members) kills the proposal following sufficiently low vote tallies in the originating committee, and unconditionally approves the proposal otherwise. In equilibria of this class, informative voting occurs only in the originating committee; the second committee acts only to raise the hurdle that the alternative has to surpass in the first committee to defeat the status quo in equilibrium. As a result, the strategic problem of members of the originating committee resembles that of members of a single committee: their vote decision is guided by the standard-pivotal voting motive, as amended by the endogenous majority rule implied by the equilibrium behavior of members of the receiving committee. We call equilibria of class *endogenous majority rule* (EMR) voting equilibria.

The second class encompasses voting equilibria in which not only members of the originating committee vote informatively, but so do - following some realizations of the vote in the originating committee - members of the receiving committee. In particular, we show that in any equilibrium of this class there is a *responsive* set of initiating-committee voting outcomes in which the probability of the proposal being accepted increases (strictly) with the tally of votes in favor of the proposal in the originating committee. This occurs for example when the number of individuals voting informatively in the receiving committee increases with higher tallies as a result of individuals switching from voting against the proposal unconditionally to voting informatively.[4] As a result, in voting equilibria with *relevant two-sided informative voting* (TSI), the voting behavior of members of the originating committee is guided by a signal-pivotal motive.

Voting equilibria with transmission of information between committees have to be of one of the classes above. But under what conditions, if any, do EMR and two-sided informative voting equilibria exist? What in particular are the implications for the size and composition of committees? We address these questions in a setting that allows for open conflicts of interests between committee members: individuals are biased for or against the status quo, and this bias is public information. The distinction boils down to a different threshold with which individuals of different types evaluate information: *conservatives* - those biased for the status quo - require overwhelming evidence in favor of the proposal to prefer it over the status quo, and similarly *liberals* require overwhelming evidence against the proposal to favor the status quo.[5] To make this distinction meaningful, we assume that an individual's own private information can never overturn the preference between alternatives implied by the bias.

In this setting, we establish existence of EMR *and* TSI voting equilibria for plausible conditions on the size and composition of committees. We show that a key determinant for existence of equilibria of these classes is the "partisan" (ideological) composition of the receiving committee, and specifically whether conservatives can or can not block the passage of the proposal in the receiving committee. When they can, there is always an EMR voting equilibrium with k conservatives in the originating committee voting informatively as long as the total number of conservatives in the originating committee is sufficiently large. When instead liberals are a winning coalition in the receiving committee, an equilibrium of this class can only exist if liberals are a winning coalition in *both* committees. Moreover, when this exists, the number of informative votes is bounded above by the majority premium of

[4]Alternatively, this occurs when the number of informative votes decreases with higher tallies as a result of individuals switching from voting informatively to voting for the proposal unconditionally.

[5]This is essentially without loss of generality, as we can capture the common interest case allowing for one type only.

liberals in the originating committee.

Endogenous Majority Rule voting equilibria have attractive properties - they are extremely simple and also robust to sequential voting within each committee - but they are also inefficient, as no information from members of the receiving committee is incorporated in the collective decision. Third, then, we show that under some conditions the relevant majority can do better than in the most informative EMR voting equilibrium by simply delegating all relevant decision making to the receiving committee. For simple majority rule, in particular, the condition boils down to a comparison between the majority premium of liberals in each committee when liberals are a winning coalition in the receiving committee, but between the majority premium of conservatives in the receiving committee and the *total number* of conservatives in the originating committee when instead conservatives are a blocking coalition in the receiving committee.

Finally, we address existence of TSI voting equilibria. We show that for an equilibrium of this class to exist it is sufficient that conservatives form a blocking coalition in the receiving committee and that the number of conservatives in the originating committee is sufficiently large. We also show, however, that there can exist a voting equilibrium with relevant two sided informative voting in which each of a small number of conservatives in the originating committee votes informatively. Moreover, this strategy profile remains an equilibrium when voting within each committee is allowed to be sequential as well. Last, we show that if we require TSI voting equilibria to be robust to sequential voting within each committee, then if liberals are a winning coalition in the receiving committee, liberals must also be a winning coalition in the originating committee for a TSI voting equilibrium to exist. Thus also in this class it is key whether conservatives can or cannot block the passage of the proposal in the receiving committee.

The paper is organized as follows. In section 2, we discuss the relation with the literature. In section 3, we describe the model. In section 4, we formalize the notions of *standard-pivotal* and *signal-pivotal* voting motivations, and characterize the equilibria of our model in the single-committee benchmark. Section 5 contains the main results of the paper. Section 6 concludes. All the proofs are relegated to the appendix.

2 Relation with the Literature

This paper builds on the pioneering contributions of Austen-Smith and Banks (1996) and Feddersen and Pesendorfer (1997, 1998), and connects at least three strands of related research.

First, Piketty (2000) and Razin (2003) also build around the idea of voting as communicating in a common-values setting, where voters have some type of *signal-pivotal* voting motive. In Piketty (2000), however, there are two outcomes corresponding to two stages of choices (an electorate chooses by plurality rule between two alternatives, the winner is implemented for one period, and then competes against a third alternative to be implemented in a second period), and the focus is on the inefficiency caused on the intermediate choice by the desire of voters to communicate information relevant to the second choice. In our sequential committees the problem faced by voters in the first committee is very different from this, as the alternative approved by the first committee does not become an outcome until also approved by the second committee, and thus the intermediate stage of payoffs simply does not exist. In Razin (2003), on the other hand, there is only one stage of voting, but the elected candidate uses the outcome of the vote to select the policy she will implement, in a single dimensional policy space. This richer space allows the outcome to be strictly responsive to the tally of votes for the winner in the election. In our setting, instead, this responsiveness comes with the probability of the proposal being passed in the receiving committee being increasing in the tally in the first committee.[6] More recently, Shotts (2006), and then Meirowitz and Shotts (2007) and Hummel (2007) also consider pivotal and signaling motivations in a model of voting with private values (the information transmitted here is about the location of the median voter in a unidimensional policy space).

Our paper also relates to several papers exploring an alternative kind of sequentiality in voting in committees. In Dekel and Piccione (2000), as in Fey (1998), Wit (1997), Battaglini (2005), Battaglini, Morton, and Palfrey (2007), Callander (2007), and Ali and Kartik (2006), the focus is on sequential voting among members of a single committee: individuals can vote after observing prior votes by other voters in the population, but all votes are then aggregated in the same tally and the collective choice is determined by majority rule. None of these papers, however, considers sequential voting between committees. The two approaches provide complementary lessons for the study of hybrid systems lying in between these models, as that employed in the US presidential primaries.

Third is the also very closely related paper by Maug and Yilmaz (2002), which studies *simultaneous* voting in two committees in a setting similar to the one considered here

[6] In both of these papers, a first stage of voting communicates information for a second stage relevant to the determination of policy. A similar phenomenon arises in this regard when players can explicitly deliberate prior to a voting stage. For models of voting with deliberation, see Coughlan (2000), Austen-Smith and Feddersen (2005), Austen-Smith and Feddersen (2006), and Gerardi and Yariv (2007). We return to the possibility of deliberation in the discussion.

(committees, however, are internally homogeneous, divided by type of voter). While the two papers are clearly complementary, simultaneous voting among committees leads to very different voting incentives to those faced by individuals in our setting, as there is no role for signaling to members of the receiving committee, and no way to condition behavior on history of play.[7]

Finally, this paper contributes to the literature on transmission of information from (standing) committees to the whole assembly pioneered by Gilligan and Krehbiel (1987). Gilligan and Krehbiel build - as do to our knowledge all subsequent contributions in the literature - on the seminal contribution of Crawford and Sobel (1982), and as a result treat both the committee and the floor (our originating and receiving committees) as unitary actors with the preferences of the respective median voters. Our analysis suggests that this assumption can be quite problematic. We do not handle here however information acquisition. This is a natural (and interesting) extension of the model that we leave for future research.

3 The Model

A group of individuals arranged in two committees, C_0 and C_1, choose between a proposal A and a status quo Q, both lying in an arbitrary policy space X. Committee C_j is populated by an odd number n_j of individuals, and the collective choice of each committee j is determined by voting under a R_j-majority rule without abstention. Formally, letting $v_i \in \{-1, 1\}$ denote i's vote against (-1) or in favor (1) of the proposal, $t(\mathbf{v}_j) \equiv \sum_{i \in C_j} v_i$ the net tally of votes in favor of the proposal in C_j, and $z_j \in \{Q, A\}$ the policy choice in C_j, $z_j = A$ if and only if $t(\mathbf{v}_j) \geq r_j$, for an odd integer r_j such that $1 \leq r_j \leq n_j$ (thus $R_j = \frac{n_j + r_j}{2}$). Voting is simultaneous in each committee, but sequential between committees. In particular, we assume the following simple institutional environment: the alternatives are first voted on in the *originating committee* C_0. If the proposal defeats the status quo in the originating committee, the alternatives are then voted on in the *receiving committee* C_1. The proposal is adopted if and only if it defeats the status quo in both committees, $t_j(\mathbf{v}_j) \geq r_j$ for $j = 0, 1$, and otherwise the status quo remains.

There are two equally likely realizations of an unobservable state of the world, $\omega \in$

[7] The emphasis in Maug and Yilmaz (2002) is on the efficiency comparison of unicameral and (simultaneous) bicameral systems, and not on the positive or behavioral properties. We address this in a separate paper, now in progress. The comparison of unicameralism and bicameralism calls a much broader literature to the one we can review here (but see Tsebelis and Money (1997), Cutrone and McCarty (2005), and references within).

$\{\omega_Q, \omega_A\}$, and each individual $i \in C_j$ receives a private, imperfectly informative signal $s_i \in \{-1, 1\}$, distributed independently conditional on the state, such that $\Pr(s_i = 1|\omega = \omega_A) = \Pr(s_i = -1|\omega = \omega_Q) = q > 1/2$ (the restriction to uninformative priors is without loss of generality). Individuals' preferences have an ideological and a common value component. Each individual $i \in C_j$ has a publicly known ideology bias either for or against the proposal, and we say that i is either a *liberal* or a *conservative*, respectively. Liberals and conservatives differ in their ranking of alternatives *conditional* on observing the same information. In particular, liberals prefer the proposal to the status quo whenever $\Pr(\omega = A|\mathcal{I}) > \pi_A$ for some $\pi_A < 1/2$, while conservatives prefer the proposal to the status quo whenever $\Pr(\omega = A|\mathcal{I}) > \pi_Q$ for some $\pi_Q > 1/2$. More formally, we normalize the payoff for both types if the proposal is not passed to zero, and denote the payoff of an individual of type $b \in \{Q, A\}$ if the proposal passes in state ω by U_b^ω, with $U_b^A = 1 - \pi_b > 0$ and $U_b^Q = -\pi_b < 0$. Thus the individual wants the proposal passed given $\mathcal{I}$ if $\Pr(\omega_A|\mathcal{I})[1 - \pi_b] + [1 - \Pr(\omega_A|\mathcal{I})](-\pi_b) \geq 0 \Leftrightarrow \Pr(\omega_A|\mathcal{I}) \geq \pi_b$.

Our equilibrium concept is Perfect Bayesian equilibria in pure strategies,[8] with a refinement. A (pure) strategy for an individual $i \in C_j$ is a mapping σ_i from the set of signals $\{-1, 1\}$ and feasible histories H_j to a vote $v_i \in \{-1, 1\}$. Since C_0 is the first to vote, $H_0 = \emptyset$, and we will write $\sigma_i(s_i, \emptyset)$ for $i \in C_0$ simply as $\sigma_i(s_i)$. Since C_1 only votes if the proposal wins in the first committee, $H_1 = \{\mathbf{v}_0 : t(\mathbf{v}_0) \geq r_0\}$. We denote the strategy profile of members of committee j by $\sigma_j(\mathbf{s}_j, h_j) \equiv \{\sigma_i(s_i, h_j)\}_{i \in C_j}$, and that of all committee members by $\sigma(\mathbf{s}_0, \mathbf{s}_1, h_1) \equiv (\sigma_0(\mathbf{s}_0), \sigma_1(\mathbf{s}_1, h_1))$. As the game stands, it is possible in equilibrium that all liberals vote against the proposal independently of their information even if they could collectively pass the proposal in both committees, simply because in this strategy profile they are never pivotal (and therefore have no profitable deviations). To rule out these possibilities we consider the following refinement of the set of equilibria. With probability $1 - \alpha$, a committee member i is a *moderate*, and has the preferences described above. With probability $\alpha > 0$, she is a *partisan* and always votes her bias. Whether i is moderate or partisan is private information. We will focus on equilibria of the game as

[8] While some papers in the literature take this approach, the most popular approach is to restrict the analysis to *symmetric* mixed strategies. To the best of our knowledge, however, there seems to be no clear ranking between these alternative approaches. In both cases, a "more conservative" strategy profile leads to a "more liberal" pivotal posterior probability (more favorable for the proposal): in the case of symmetric mixed strategies, a more conservative profile is attained by putting more probability on a vote against the proposal following a positive signal; in the case of pure strategies, this is attained by an asymmetric strategy profile in which some members voting against the proposal independently of their signals. We conjecture that a version of most (and possibly all) of our results would also continue to hold for symmetric mixed strategy profiles.

$\alpha \to 0$. We say that a strategy profile $\sigma(\cdot)$ is a *voting equilibrium* if there exists an $\overline{\alpha} > 0$ such that for all $\alpha < \overline{\alpha}$ there exist beliefs $\{\mu_i^\alpha(s_{-i}|s_i, h_j)\}$ such that (σ, μ^α) are a PBE of the game Γ_α in pure anonymous strategies.[9]

4 The Strategic Problem

This section has two goals. First we formalize the notions of *standard-pivotal* and *signal-pivotal* voting motivations that we alluded to in the introduction. We then establish a useful transformation of the probabilities and biases in the fundamentals of the problem to a simple counting of votes and signals that simplifies considerably the analysis to follow, and use this transformation to characterize the equilibria of our model in the single-committee benchmark.

4.1 Standard-Pivotal and Signal-Pivotal Voting Motivations

How does the problem of voters in the sequential committee setting change *vis-a-vis* that of voters in a single-committee setting ? Note first that the strategic problem of members of the receiving committee is exactly that of members of a single committee: they care only about the event in which they are pivotal, and they are pivotal by being the decisive vote in a divided committee (we call this the *standard-pivotal* motive). There are however two main differences between settings, that work together in equilibrium. First, as long as some member of the originating committee votes following her information, the tally of votes in the originating committee becomes a public signal, and members of the receiving committee can condition their behavior on its realization. Second, given this, members of the originating committee can also change the outcome by influencing the beliefs of members of the receiving committee regarding the relative value of the two alternatives (we call this a *signal-pivotal* voting motive).

Consider first a committee C_1, which after history h_1 has the sole authority over whether to approve or reject the proposal (this might be a single committee, in which case $h_1 = \emptyset$, or the receiving committee in a pair of committees moving sequentially, in which case $h_1 = \mathbf{v}_0$). For any $i \in C_1$, let $\mathbf{v}_{1,-i}|h$ denote the vote of all members of C_1 other than i following history h_1. The vote of i influences the outcome if and only if i is *standard-pivotal* in C_1 after h_1; i.e., if and only if $\mathbf{v}_{1,-i}|h \in \mathcal{P}_i(C_1, r_1) \equiv \{\mathbf{v}_{1,-i}|h : t(\mathbf{v}_{1,-i}|h) = r_1 - 1\}$. As a

[9]By anonymous we mean that $\sigma_i(s_i, h_0^1) = \sigma_i(s_i, h_1^1)$ whenever h_1^1 can be obtained from h_1^0 by only switching elements among lower committee members that play the same strategy.

result, i's voting decision is determined by her preference among alternatives as evaluated at the event $\mathcal{P}_i(C_1, r_1)$ given σ; i.e., prefers the proposal over the status quo if

$$\lambda_i^{\mathcal{P}_i(C_1,r_1)}(s_i, h_1) \equiv \lim_{\alpha \to 0} Pr^{(\sigma_{|h},\alpha)}(\omega_A | s_i, \mathcal{P}_i(C_1, r_1), h_1) \geq \pi_i \tag{1}$$

The fundamental difference with respect to voting in a single committee is entirely in the incentives of members of the originating committee, whose vote is guided by the signal-pivotal motivation. For any vote outcome of members of C_0 other than i, $\mathbf{v}_{0,-i}$, let $\mathbf{v}_{0,-i}^{-} \equiv (\mathbf{v}_{0,-i}, v_i = -1)$ and $\mathbf{v}_{0,-i}^{+} \equiv (\mathbf{v}_{0,-i}, v_i = +1)$. We say that an individual $i \in C_0$ is *signal-pivotal at k* if *(i)* the tally of votes of members of C_0 other than i equals k, and *(ii)* the proposal loses in the receiving committee if also i votes against the proposal in C_0, but wins in the receiving committee if i votes in favor of the proposal in C_0; i.e., if $(\mathbf{v}_{0,-i}; \mathbf{v}_1|\mathbf{v}_{0,-i}^{-}; \mathbf{v}_1|\mathbf{v}_{0,-i}^{+}) \in \mathcal{SP}_i(r_1, k)$, where

$$\mathcal{SP}_i(r_1, k) \equiv \{\mathbf{v} : t(\mathbf{v}_{0,-i}) = k, t(\mathbf{v}_1|\mathbf{v}_{0,-i}^{-}) \leq r_1 - 2, t(\mathbf{v}_1|\mathbf{v}_{0,-i}^{+}) \geq r_1\}$$

The vote of any member $i \in C_0$ influences the outcome (is *signal-pivotal*) if and only if i is *signal-pivotal at k* for some $k \geq$, and in this case her voting decision is determined by her preference among alternatives at $\mathcal{SP}_i(r_1) \equiv \cup_{k \in K(\sigma)} \mathcal{SP}_i(r_1, k)$, where $K(\sigma) \equiv \{k : \mathcal{SP}_i(r_1, k) \neq \emptyset\}$; i.e., prefers the proposal over the status quo if and only if

$$\lambda_i^{\mathcal{SP}}(s_i; r_1) \equiv \sum_{k \in K(\sigma)} \lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, k)) f(s_i, k) \geq \pi_i \tag{2}$$

where $f(s_i, k) \equiv \lim_{\alpha \to 0} Pr^{(\sigma_{0-i},\alpha)}(s_i, \mathcal{SP}_i(r_1, k)) | s_i, \mathcal{SP}_i(r_1))$.

Expressions (1) and (2) summarize the decision-making problem for committee members in terms of represent the probabilities and biases in the fundamentals of the problem. It will be useful throughout the paper to transform these expressions into equivalent expressions written in terms of a simple counting of votes and signals. At the cost of some additional notation, this will considerably simplify the analysis. First, let $\mathcal{J} \subset C_j$ be an arbitrary subset of members of a committee C_j, and consider a given profile of signals $\mathbf{s}_\mathcal{J} \equiv \{s_i\}_{i \in \mathcal{J}}$. Since $\Pr(\omega = \omega_A | \mathbf{s}_\mathcal{J}) = \Pr(\omega = \omega_A | \mathbf{s}'_\mathcal{J})$ whenever $t(\mathbf{s}_\mathcal{J}) = t(\mathbf{s}'_\mathcal{J})$, we write $\beta(t(\mathbf{s}_\mathcal{J})) \equiv \Pr(\omega = \omega_A | \mathbf{s}_\mathcal{J})$.[10] Second, for $\{\mathbf{s}_\mathcal{J} : t(\sigma_\mathcal{J}(\mathbf{s}_\mathcal{J})) = t\} \neq \emptyset$, we define $\tau_{s_\mathcal{J}}(t, \sigma_\mathcal{J}) \equiv t - t_\mathcal{J}^N$, where $t_\mathcal{J}^N$ is the (net) tally of votes of members voting uninformatively; i.e., $\tau_{s_\mathcal{J}}(t, \sigma_\mathcal{J})$ is the (net) tally of *signals* of individuals voting informatively in $\mathcal{J}$ that is consistent with

[10] The definition of $t(\mathbf{s}_\mathcal{J})$ follows the same convention as with votes; i.e., $t(\mathbf{s}_\mathcal{J}) \equiv \sum_{i \in \mathcal{J}} s_i$.

a vote tally t given strategy profile $\sigma_{\mathcal{J}}$ if all members of $\mathcal{J}$ are moderates. Suppose for example that $\mathcal{J} = \{1, \ldots, 11\}$, and that in σ $i \in \mathcal{J}^I = \{1, \ldots, 7\}$ votes informatively and $i \in \mathcal{J}^N = \{8, \ldots, 11\}$ votes against the proposal. Then with a total of five votes against the proposal $t = 1$, and $\tau_{s_{\mathcal{J}}}(1, \sigma_{\mathcal{J}}) = 1 - (-4) = 5$, indicating that within the group of members voting informatively, five more of them voted for the proposal than against it. Finally, let ρ_A and ρ_Q be the smallest integers such that $\pi_b \leq \beta(\rho_b)$ for $b = A, Q$ respectively. The numbers ρ_Q and $(1 - \rho_A)$ measure the intensity of the bias of conservative (liberal) committee members in terms of the least number of positive (negative) signals that would reverse their policy preference (from our earlier assumption, $\rho_Q \geq 2$ and $1 - \rho_A \geq 2$).Then letting for any event E, $L(E) \equiv \lim_{\alpha \to 0} \frac{Pr^{\sigma,\alpha}(E|\omega_Q)}{Pr^{\sigma,\alpha}(E|\omega_A)}$, it follows that [11]

$$\lambda_i^{\mathcal{P}_i(C,r)}(s_i, h) = \frac{1}{1 + L(s_i)L(\mathcal{P}_i(C,r))L(h)} = \beta(s_i + \tau_{s_{-i}}(r-1; \sigma_{-i}) + \tau_0(h))$$

, where $\tau_0(h) = 0$ for single committees $(h = 0)$ and $\tau_0(h) = \tau_{s_0}(t_0(v_0), \sigma_0)$ for the case of sequential committees $(h = v_0)$. Therefore, a conservative member of C has an incentive to vote in favor of the proposal if and only if $\beta(s_i + \tau_{s_{-i}}(r-1; \sigma_{-i}) + \tau_0(h)) \geq \pi_Q$, or equivalently $\tau_{s_{-i}}(r - 1; \sigma_{-i} + \tau_0(h) + s_i \geq \rho_Q$ (similarly for a liberal member, substitute ρ_A).

4.2 Three Basic Results for Single-Committee Systems

We present here three basic results for single-committee settings, and an extension to the receiving committee for sequential committees. We begin with the simplest case of a single committee with common interests; i.e., $\pi_i = \pi \ \forall i \in C$, and therefore denote the least number of net positive signals that would induce any member to vote for the proposal simply by ρ (without subscript). Also here and in the remainder of the paper we will follow convention by saying that $i \in C$ votes informatively if $v_i(s, \emptyset) = s \ \forall s$, and that she votes her bias if $v_i(s, \emptyset) = b_i \ \forall s$. We start by pointing out a well known result due to Austen-Smith and Banks (1996)

Proposition 1 *Consider a committee composed of n members such that $\pi_i = \pi \ \forall i = 1, \ldots, n$, operating under a $\frac{r+n}{2}$ majority rule ($z = A$ if and only if $t(v) \geq r$). Then informative voting for all i is a voting equilibrium iff $r = \rho$.*[12]

[11] Note that if E_1 and E_2 are independent, then $\Pr(\omega_A|E_1, E_2) = [1 + L(E_1)L(E_2)]^{-1}$, and that for any $\mathcal{J} \subseteq C_j$, $L(\mathbf{s}_{\mathcal{J}} : \sum_{i \in \mathcal{J}} s_i = t) = \left(\frac{1-q}{q}\right)^t$.

[12] The result is stated for ρ is odd. If ρ is even the condition is $r = \rho + 1$.

As an example, with $n = 11$ and $\rho = 3$, we need $R = \frac{3+11}{2} = 7$, a 7/11 supemajority rule. The logic behind this result is straightforward. Since all committee members vote informatively, the net number of signals implied by standard pivotality is $\tau_{s_{-i}}(r-1, \sigma_{-i}) = r-1$ and therefore $\lambda_i^{\mathcal{P}_i(C,r)}(s_i) = \beta(r-1+s_i)$. Incentive compatibility of σ requires $\lambda_i^{\mathcal{P}_i(C,r)}(-1) \leq \pi \leq \lambda_i^{\mathcal{P}_i(C,r)}(1)$, and hence $\beta(r-2) \leq \pi \leq \beta(r)$. Then either $r = \rho+1$ (if ρ is even) or $r = \rho$ (if ρ is odd). On the other hand, suppose $r > \rho+2$. Then $\lambda_i^{\mathcal{P}_i(C,r)}(-1) = \beta(r-2) > \beta(\rho)$, and hence i has incentive to deviate and vote in favor of the proposal after a negative signal (a similar argument holds if $r < \rho - 1$).

More generally, in the case of a single committee with common interests, equilibria must fall in one of two outcome-relevant classes. First, there exists a class of non-informative equilibria in which the policy outcome is equal to the committee members' bias independently of the private information held by members of the committee. In these equilibria $\sigma_i(s_i) = b_i \; \forall s_i$ for some decisive majority in C (for all i in some set $\mathcal{J} \subseteq C$ such that $|\mathcal{J}| \geq \frac{r+n}{2}$). That this is in fact an equilibrium follows immediately, since in any such strategy profile no individual is ever pivotal, and therefore there are no profitable deviations.[13] We can typically also construct an asymmetric voting equilibrium in which *some* committee members vote informatively. Intuitively, here the number of informative votes k is chosen so that for any voting member, the information provided by the equilibrium strategies conditional on him being pivotal exactly compensates the imbalance between the effective rule and ρ. [14] Consider our previous example with simple majority rule, $r = 1$. Then in equilibrium $k = n - (\rho - r) = 11 - 2 = 9$ individuals vote informatively (say $i \leq 9$), and two (here $i = 10, 11$) vote unconditionally against the proposal. For $i \leq 9$ then $\tau_{-i}(r-1, \sigma_{-i}) = 0 - (-2) = 2$, and i wants to support the proposal if $s_i = 1$ and kill it if instead $s_i = -1$. This example suggests that different differences between r and ρ correspond to different bounds on the amount of information that can be used in equilibrium. This is in fact generally the case, as Proposition 2 shows:

Proposition 2 *Consider a committee composed of n members i such that $\pi_i = \pi \; \forall i$, $\rho(\pi) \leq n$, operating under a $\frac{r+n}{2}$ majority rule. Then (i) there exists a unique voting equilibrium with relevant informative voting if and only if $-(n-r) \leq \rho \leq R$, and (ii) the number of informative votes in this voting equilibrium is decreasing in the difference $|r - \rho|$.*

[13] Equilibria in which $\sigma_i(s_i) = -b_i \; \forall s_i$ for all i in some decisive set $\mathcal{J} \subseteq C$ are ruled out due to the existence of partisans.

[14] This is well known. See for example Dekel and Piccione (2000) or Persico (2004). The logic is essentially the same as that in symmetric equilibria in mixed strategies which are often considered in the literature (see for example Feddersen and Pesendorfer (1997)).

Proof. The proof is in the appendix. ■

The previous results are essentially unchanged - for the relevant population - if, as it is the case in our main model, we introduce two groups with different biases; i.e., there are n_Q members with bias $\pi_i = \pi_Q > q$ and $n - n_Q$ members with bias $\pi_i = \pi_A < 1 - q$. First, it is immediate to verify that given that $\pi_Q > q > 1 - q > \pi_A$, *(i)* there is no equilibrium in which both conservatives *and* liberals vote informatively, and that *(ii)* if in a voting equilibrium i votes informatively and $b_i \neq b_{i'}$, then i' must vote her bias. Note then that informative voting by liberals can only be outcome relevant if liberals are a *winning coalition* in C. Similarly, informative voting by conservatives can only be outcome relevant if conservatives are a *blocking coalition* in C (we say that individuals in a a subset $\mathcal{J}$ of committee C constitute a *winning coalition* in C, and denote this by $\mathcal{J} \in W(C)$, if $|\mathcal{J}| \geq R$. Alternatively, $\mathcal{J} \subset C$ is a *blocking coalition* in C, or $\mathcal{J} \in B(C)$, if $|\mathcal{J}| \geq n - R + 1$).

Since in any equilibrium with relevant informative voting individuals voting informatively must be conservatives when conservatives are a blocking coalition in C (liberals when instead liberals are a winning coalition in C), then liberals (conservatives) vote their bias in equilibrium and therefore just act so as to relax (tighten) the effective hurdle to passed the proposal faced by the group of individuals voting informatively. What rests to be determined is then formally equivalent to the analysis in Proposition 2 with majority rule $R_\mathcal{D} \equiv \frac{r_\mathcal{D}+n_\mathcal{D}}{2}$ and committee size $n_\mathcal{D}$, where $r_\mathcal{D} = r - n_A$ and $n_\mathcal{D} = n_Q$ when $\mathcal{Q} \in B(C)$ and $r_\mathcal{D} = r + n_Q$ and $n_\mathcal{D} = n_A$ when $\mathcal{A} \in W(C)$: i.e., the number of informative votes in this voting equilibrium is decreasing in the difference between the effective hurdle $r_\mathcal{D}$ and the bias of the relevant majority $\rho_\mathcal{D}$. The same logic holds, moreover, if the committee is the second of two committees moving sequentially if we incorporate the information contained in the tally into *ex-post* biases $\rho'_b(t(\mathbf{v}_0), \sigma_0) \equiv \rho_b - \tau_{s_0}(t(\mathbf{v}_0), \sigma_0)$ for $b = A, Q$ (note that a more favorable public signal for the proposal makes both conservatives and liberals *more liberal* ex post). Here $\lambda_i^{\mathcal{P}_i(C_1, r_1)}(s_i, \mathbf{v}_0, \sigma_0) = \beta(\tau_{s_{-i}}(r_1 - 1; \sigma_{-i}) + \tau_{s_0}(t_0, \sigma_0) + s_i)$, and a conservative (liberal) will vote for the proposal if and only if $\beta[\tau_{s_{-i}}(r_1 - 1; \sigma_{-i}) + \tau_{s_0}(t_0, \sigma_0) + s_i] \geq \pi_Q \ \ (\pi_A)$. Or equivalently (focusing on conservatives) if and only if

$$\tau_{s_{-i}}(r_1 - 1; \sigma_{-i}) + s_i \geq \rho'_Q(v_0, \sigma_0) \equiv \rho_Q - \tau_{s_0}(t_0, \sigma_0)$$

We summarize these results in the next Proposition.

Proposition 3 *(1) Suppose Conservatives are a Blocking Coalition in C_1. Then there exists a unique voting equilibrium with relevant informative voting in $\Gamma(\mathbf{v}_0)$ if and only if $-(R_1^Q - r_1^Q) \leq \rho'_Q(\mathbf{v}_0, \sigma_0) \leq R_1^Q$.*

(i) If conservatives' ex post bias is sufficiently high ($r_1^Q \leq \rho'_Q(\mathbf{v}_0, \sigma_0)$), then $\tilde{k}^0(t(\mathbf{v}_0)) \equiv n_1^Q - [\rho'_Q(\mathbf{v}_0, \sigma_0) - r_1^Q]$ conservatives vote informatively and all others vote their bias.

(ii) If instead $r_1^Q > \rho'_Q(\mathbf{v}_0, \sigma_0)$, then $\tilde{k}^1(t(\mathbf{v}_0)) = n_1^Q - [r_1^Q - \rho'_Q(\mathbf{v}_0, \sigma_0)] + 1$ conservatives vote informatively and all other committee members vote in favor of the proposal.

(2) Suppose Liberals are a Winning Coalition in C_1. Then there exists a unique voting equilibrium with relevant informative voting in $\Gamma(\mathbf{v}_0)$ if and only if $-[(R_1 - 1) - r_1] \leq 1 - \rho'_A(\mathbf{v}_0, \sigma_0) \leq [R_1^A - (r_1^A - 1)]$.

(i) If liberals' ex post bias is sufficiently high ($-[1-\rho'_A(\mathbf{v}_0, \sigma_0)] < r_1^A$), then $\tilde{k}^1(t(\mathbf{v}_0)) = n_1^A - [r_1^A - (1 - \rho'_A(\mathbf{v}_0, \sigma_0))] + 1$ liberals vote informatively and all other committee members vote their bias.

(ii) If instead $-[1 - \rho'_A(\mathbf{v}_0, \sigma_0)] \geq r_1^A$, then $\tilde{k}^0(t(\mathbf{v}_0)) \equiv n_1^A - [(1 - \rho'_A(\mathbf{v}_0, \sigma_0)) - r_1^A]$ liberals vote informatively and all other committee members vote against the proposal.

Note, in particular, that the number of informative votes in the receiving committee is decreasing in the difference between the effective hurdle $r'_{\mathcal{D}}$ for individuals voting informatively in the receiving committee and their *ex post* bias $\rho'_{\mathcal{D}}(v_0, \sigma_0)$ after observing the public signal $\tau_{s_0}(t_0, \sigma_0)$.

5 Main Results

Proposition 3 completely characterizes informative strategic voting in a single committee. We turn next to the analysis of voting in sequential committees. Note that as for single committees, here the uninformative strategy profile in which individuals in *each* committee j vote unconditionally for the alternative when liberals are a winning coalition in their committee ($\mathcal{A}_j \in W(C_j)$) and for the status quo when conservatives are a blocking coalition in their committee ($\mathcal{Q}_j \in B(C_j)$) is a voting equilibrium. In this voting equilibrium, however, there is no transmission of information (or even more, no use of information of any sort). We focus from here on on voting equilibria in which the equilibrium outcome is responsive to private information; i.e., given σ, there exist two realizations of private signals $\mathbf{s}, \mathbf{s}' \in S$ such that $z = A$ under $\mathbf{s}$ but $z = Q$ under $\mathbf{s}'$.

The equilibrium outcome can be responsive to private information in (broadly) three different ways, and we categorize classes of equilibria accordingly. In the first class of equilibria, all informative voting occurs in the originating committee; the second committee acts only to raise the hurdle that the proposal has to surpass in the first committee to defeat the status quo in equilibrium. We call these *Endogenous Majority Rule* (EMR) voting equilibria.[15] In *Delegation Equilibria*, instead, members of the originating committee approve the proposal independently of their information, and all informative voting occurs in the receiving committee. Finally, the equilibrium outcome can be responsive to private information in both committees. In these *Two-Sided Informative Voting equilibria* (TSI), the number of individuals voting informatively in the receiving committee changes with the voting outcome in the originating committee in such a way so that the probability of success of the proposal is strictly increasing in the tally of votes in the originating committee. We consider each in turn.

5.1 An Endogenous Majority Rule

EMR voting equilibria is the simplest class of equilibria in which the tally of votes in the originating committee transmits relevant information to members of the receiving committee. In equilibria of this class, the second committee acts only to modify the hurdle that the alternative has to surpass in the first committee to defeat the status quo in equilibrium (from, say, a simple majority to a two thirds majority), in such a way as to induce informative voting by *some* of its members in equilibrium: the new threshold introduced by the receiving committee "replicates" endogenously the effect of the optimal fixed rule in Austen-Smith and Banks (1996).

The main idea is the following: Suppose that the receiving committee kills the proposal - independently of the realization of private information - for all voting outcomes in the lower committee $\mathbf{v}_0$ with tally $t(\mathbf{v}_0)$ below some critical number θ_0, and unconditionally approves the proposal otherwise. For members of the initiating committee voting informatively [16], this situation is equivalent to a unicameral system with a modified majority rule θ_0. In particular, $\lambda_i^{\mathcal{SP}}(s_i; r_1)$ boils down to

$$\lambda_i^{\mathcal{SP}}(s_i; r_1) = \beta(\tau_{s_{0-i}}(\theta_0, \sigma_{0-i}^*) + s_i) \tag{3}$$

[15] Lemma 3 in the appendix shows that all voting equilibria in which all informative voting occurs in the originating committee must be EMR voting equilibria.

[16] This is not necessarily the case for members of the originating committee voting uninformatively. Recall that beliefs off the equilibrium path will be constrained by the existence of partisans. We return to this point below.

It follows from this and the results in section 4.2 that if we can induce members of the relevant decisive coalition in the receiving committee to choose the cutoff θ_0 in such a way that the ensuing endogenous majority rule *for individuals voting informatively* in the originating committee is equal to ρ_Q (if they are conservatives) or $(1-\rho_A)$ (for liberals), then these individuals would have an incentive to vote informatively in the first place.[17] We show that a key determinant for existence of an EMR voting equilibrium is the "partisan" (ideological) composition of the receiving committee, and specifically whether conservatives can or can not block the passage of the proposal in the receiving committee. When they can, there is always an EMR voting equilibrium with k conservatives in the originating committee voting informatively as long as the total number of conservatives in the originating committee is sufficiently large. When instead liberals are a winning coalition in the receiving committee, an equilibrium of this class can only exist if liberals are a winning coalition in *both* committees. Moreover, when this exists, the number of informative votes is bounded above by the majority premium of liberals in the originating committee.

Theorem 1 *(1) If conservatives can block the proposal in the receiving committee, then there exists an EMR voting equilibrium if and only if $n_0^Q > \rho_Q$. Moreover,*

(i) the number of informative votes in an EMR voting equilibrium is bounded above by n_0^Q and $1+\rho_Q+n_0-r_0$, and

(ii) if in an EMR voting equilibrium $i \in C_0$ votes informatively, then $i \in \mathcal{Q}_0$

(2) If liberals are a winning coalition in the receiving committee, then there exists an EMR voting equilibrium if and only if $1-\rho_A \leq \frac{n_0^A-n_0^Q-r_0}{2}$. Moreover,

(i) the number of informative votes in any EMR voting equilibrium is at most $(n_0^A - n_0^Q)-(1-\rho_A)-(r_0-1)$, and

(ii) if in an EMR voting equilibrium $i \in C_0$ votes informatively, then $i \in \mathcal{A}_0$.

Proof. The proof is in the appendix. ■

Theorem 1 has several implications. First, note that when conservatives are a blocking coalition in the receiving committee there exists under some conditions - when the number of liberals and conservatives in the originating committee is sufficiently large - an EMR voting

[17] Note that because of the existence of partisans, conservatives (liberals) in the receiving committee are pivotal with positive probability when they are a blocking (winning) coalition in C_1 and they collectively play to pass (kill) the bill according to σ.

equilibrium in which all conservatives in the originating committee vote informatively. These conditions assure that the maximum informativeness of the aggregate public signal for individuals in the receiving committee is larger than the bias of conservatives ($n_0^Q > \rho_Q$) and that the majority rule in the originating committee is not too demanding relative to the size of liberals in the originating committee so as to make any tally that passes this threshold an overwhelming positive signal for conservatives in the receiving committee ($n_0^A \geq (r_0 - 1) - \rho_Q$).[18] When liberals are a winning coalition in the receiving committee, instead, there is no size or composition of committees, or decision rules (r_0, r_1), for which all liberals in the originating committee vote informatively in an EMR voting equilibrium.

The intuition for this contrast is as follows. Suppose to the contrary that liberals control the receiving committee and that in an EMR equilibrium all liberals in C_0 vote informatively. First, note that the relevant incentive compatibility constraint in the receiving committee is that of liberals voting against their bias for "low tallies" (i.e., for $\mathbf{v}_0 : t(\mathbf{v}_0) \leq \theta_0 - 1$). Since the inference of an individual i in the originating committee cannot be too different than that of a member of the receiving committee in equilibrium (see the proof for details), members of the originating committee voting informatively must be liberals too. Next, we show that in equilibrium conservatives in the originating committee can't be voting against their bias (for the proposal).[19] This means that they must be voting their bias. But this is not possible either, for in this case every positive net tally would carry favorable information for the proposal, and the liberal winning coalition (which is already biased in favor of the proposal), would never have an incentive to vote against it.

It is now apparent why it is not a problem to construct a EMR voting equilibrium when conservatives are a blocking coalition in the receiving committee. The same logic explains, moreover, why it's possible to have an EMR voting equilibrium in which *some* liberals in the originating committee vote informatively when liberals are a winning coalition in the receiving committee: the asymmetry in the strategy profile of liberals in the originating committee solves the previous problem by making unnecessary that conservatives in the originating committee vote against their bias in order for some positive tally to transmit unfavorable information for the proposal. This requires, however, liberals to be a winning coalition not only in the receiving but also in the originating committee as well. Moreover,

[18] When conservatives vote informatively and liberals vote their bias in the originating committee, these conditions on committee composition are equivalent to requiring that there exist tallies $t_0 \geq r_0$ and $t_0' \leq n_0$ such that $t_0 = t(\sigma_0(\mathbf{s}_0))$ and $t_0' = t(\sigma_0(\mathbf{s}_0'))$ for some $\mathbf{s}_0$ and $\mathbf{s}_0'$ and $\tau_{s_0}(t_0, \sigma_0) < \rho_Q < \tau_{s_0}(t_0', \sigma_0)$. Note that $n_0^A \geq (r_0 - 1) - \rho_Q$ is always satisfied under simple majority rule, in which case it is enough that $n_0^Q > \rho_Q$.

[19] Here is relevant again the probability of individuals being partisan, which pins down beliefs of members of the receiving committee off the equilibrium path.

as Theorem 1 shows, the number of informative votes can never be larger than the majority premium of liberals in C_0. The theorem also shows that for an EMR voting equilibrium where *some* conservatives vote informatively we need only assure that conservatives are a blocking coalition in the receiving committee and that the number of conservatives in C_0 is larger than ρ_Q.

The previous paragraph emphasizes the behavioral differences in EMR voting equilibria when liberals are or are not a winning coalition in the receiving committee. But there is a also a difference in terms of efficiency of equilibria in the two cases. While EMR voting equilibria are inherently inefficient - since no information from members of the receiving committee influences the choice of policy - the most informative EMR voting equilibria when conservatives are a blocking coalition in the receiving committee selects the "right" alternative (for conservatives) almost surely as the number of conservatives and liberals in the originating committee is sufficiently high ("right" here means the alternative that conservatives would prefer if all the private information were made public). This is not the case, however, when liberals are a winning coalition in the receiving committee, as the number of informative votes in the most informative EMR voting equilibria is bounded above by the majority premium of liberals in the originating committee (Proposition 4 in the appendix makes this point formally).

5.2 Delegation to the Receiving Committee

In EMR voting equilibria, the role of members of the receiving committee is limited to modifying the effective majority rule faced by members of the initiating committee. The receiving committee approves the proposal when the tally of votes in the originating committee carries sufficient favorable information for the proposal, and rejects it otherwise, but does not use the private information of its members. While under some conditions this will lead the relevant decisive majority to achieve payoffs close to the maximum possible attainable payoffs under perfect information, in other cases it will lead to mistakes occurring with high probability. In this section we take a slight detour from our main objective to show that under some conditions the relevant majority can improve upon the most informative EMR voting equilibrium by simply delegating all relevant decision making to the receiving committee.

The main intuition is straightforward. Suppose for concreteness that both committees are entirely composed by liberals, and that the first committee is small in size (say it has three members) and the second committee is large. Then a EMR voting equilibrium wastes a large amount of information, and incurs in mistakes with very high probability. All committee members would do better in this case if members of the first committee delegated the decision to members of the second committee by voting uninformatively in favor of the proposal. Facing an uninformative history, members of the receiving committee could play a strategy profile with relevant informative voting that allows much more information to be of use (all but $|(1-\rho_A)-r_1|$ members could vote informatively). In general, the ranking between equilibria with one-sided relevant informative voting will depend on the composition of committees. For simplicity, we focus here on the case of simple majority rule. We show that for simple majority rule, the relevant comparison is between the majority premium of liberals in each committee when liberals are a winning coalition in the receiving committee, but between the majority premium of conservatives in the receiving committee and the *total number* of conservatives in the originating committee otherwise.

Consider first the case in which liberals don't have a majority in the receiving committee. Let σ_0 be an uninformative strategy profile in the originating committee with associated vote outcome $\mathbf{v}_0$ and tally $t(\mathbf{v}_0) \geq 1$. Then Proposition 3 implies that if (and only if) the bias of conservatives ρ_Q is lower than the effective majority rule for conservatives when liberals vote in favor of the proposal (R_1^Q), then there exists a unique voting equilibrium with relevant informative voting in the continuation $\Gamma(\mathbf{v}_0)$, in which $k = n_1^Q - [\rho'_Q(v_0, \sigma_0) - r_1^Q] = n_1^Q - [\rho_Q - (1 - n_1^A)]$ conservatives vote informatively and all other committee members vote their bias. But then note that since passage of the proposal implies that $\sum_{i \in Q_1^I} s_i \geq \rho_Q$, there exists a voting equilibrium in which members of the originating committee vote in favor of the proposal uninformatively, and on the equilibrium path members of the receiving committee play the voting equilibrium with relevant informative voting.[20] The comparison between this and the most informative EMR voting equilibrium is now immediate. In essence, the comparison hinges between the size of the population possibly voting informatively in a EMR voting equilibria (n_0^Q) and the majority premium of conservatives in C_1, $n_1^Q - n_1^A$.

Corollary 1 *Suppose that both committees operate under simple majority rule, and that conservatives are a blocking coalition in C_1.*

[20] Suppose that C_1 members treat any deviation from σ_0 as uninformative (note that this should always be the case for conservatives), and play the voting equilibrium with relevant informative voting following any $\mathbf{v}_0$ such that $t(\mathbf{v}_0) \geq r_0 = 1$. Note that $i \in C_0$'s vote can only be outcome relevant if there are $\frac{n_0-1}{2}$ conservative partisans - which in particular is not possible if $\mathcal{A}_0 \in W(C_0)$ - so that $t_{0,-i} = 0$. But then i's vote changes the outcome if and only if almost surely $\sum_{i=1}^{k} s_i \geq \rho_Q$, and hence no individual in C_0 prefers to deviate and vote against the proposal.

(i) If the number of conservatives in C_0 is larger than the majority premium of conservatives in C_1 (i.e., $n_0^Q > n_1^Q - n_1^A$), then whenever there exists a Delegation Equilibrium σ^*, there also exists a EMR voting equilibrium σ^{**} that improves the welfare of conservatives vis a vis σ^*, and

(ii) for any majority premium of conservatives in C_1 for which there exists a Delegation Equilibrium σ^* , there is a low enough n_0^Q ($n_0^Q < n_1^Q - n_1^A + 1 - \rho_Q$) such that if a EMR voting equilibrium σ^{**} exists, it is dominated by σ^* in terms of conservatives' welfare.

Suppose on the other hand that liberals are a winning coalition in the receiving committee. Then again assuming that σ_0 is uninformative (and letting $\mathbf{v}_0 = \sigma_0(\mathbf{s}_0)$ be the associated voting outcome), Proposition 3 implies that there exists a unique voting equilibrium with relevant informative voting in the continuation $\Gamma(\mathbf{v}_0)$ if and only if $(1-\rho_A) \leq R_1^A - r_1^A + 1$, and in this equilibrium $k = n_1^A - [r_1^A - (1-\rho'_A(v_0, \sigma_0))] + 1 = n_1^A - [(1+n_1^Q) - (1-\rho_A)] + 1$ liberals vote informatively and all other committee members vote their bias. Here, however, inducing conservatives in the originating committee to unconditionally "defer" the decision to the receiving committee is not always possible (at least not when they can block the passage of the proposal in C_0). A necessary and sufficient condition for this is that the bias of both conservatives *and* liberals are small enough relative to the size of the receiving committee. However, when liberals are a winning coalition in the receiving committee, whenever there exists an EMR voting equilibrium, liberals must control the originating committee as well (and the number of informative votes in EMR voting equilibria is bounded above by the majority premium in the originating committee). As a result, the relevant comparison now is entirely between majority premiums in each committee:

Corollary 2 *Suppose that both committees operate under simple majority rule, and that $\mathcal{A}_1 \in W(C_1)$.*

(i) If the majority premium of liberals in C_0 is larger than in C_1 (i.e., $n_0^A - n_0^Q > n_1^A - n_1^Q$), then whenever there exists a Delegation Equilibrium σ^*, there also exists a EMR voting equilibrium σ^{**} that improves the welfare of conservatives vis a vis σ^*.

(ii) Conversely, if $n_0^A - n_0^Q \leq n_1^A - n_1^Q$, then whenever there exists a EMR voting equilibrium σ^{**}, there also exists a Delegation Equilibrium σ^*, which improves the welfare of conservatives vis a vis σ^{**}.

5.3 Relevant Informative Voting in Both Committees

We consider next candidate equilibria in which some members of *both* committees vote informatively, restricting ourselves to profiles that are *monotonically responsive.* Say that the tally $t(\sigma_0(\mathbf{s}_0))$ is informative if *(i)* $\sigma_i(s, \emptyset) = s$ for all s for some $i \in C_0$, and *(ii)* $\exists\ \mathbf{s}_0$ such that $t(\sigma_0(\mathbf{s}_0)) \geq r_0$.

Definition 1 *We say that a strategy profile σ^* is a monotonically responsive voting equilibrium if (i) it is a voting equilibrium, (ii) $t(\sigma_0^*(\mathbf{s}_0))$ is informative, and (iii) $\forall\ \mathbf{s}_1$, $t(\sigma_0^*(\mathbf{s}_0)) \geq t(\sigma_0^*(\mathbf{s}_0')) \Rightarrow t(\sigma_1^*(\mathbf{s}_1, \mathbf{s}_0)) \geq t(\sigma_1^*(\mathbf{s}_1, \mathbf{s}_0'))$, with strict inequality for some $\mathbf{s}_1, \mathbf{s}_0$ and $\mathbf{s}_0'$.*

We start our analysis of voting equilibria with relevant two-sided informative voting (TSI) by exploiting the implications of our results for single-committee systems to offer a partial characterization of equilibria of this class. Having restricted the set of strategies in this way, we then offer conditions for existence of equilibria of this class, and provide a full characterization of these voting equilibria.

Recall first from our analysis in section 4.2 (see Proposition 3) that for any voting outcome $\mathbf{v}_0$ in the originating committee, the number of informative votes in the receiving committee in the unique equilibrium with relevant informative voting in the continuation game $\Gamma(\mathbf{v}_0)$ is decreasing in the difference between the effective hurdle r' that individuals voting informatively must surpass, and their *ex post* bias ρ' after observing the public signal $\tau_{s_0}(t_0, \sigma_0)$. Now, by monotonicity, if there is relevant informative voting in the receiving committee following voting outcomes $\mathbf{v}_0$ and $\mathbf{v}_0'$ in the originating committee, then there must also be relevant informative voting in C_1 following $\mathbf{v}_0''$ whenever $t(\mathbf{v}_0) \leq t(\mathbf{v}_0'') \leq t(\mathbf{v}_0')$. But - and this is the key - since the only relevant difference for individuals in the receiving committee between voting outcomes $\mathbf{v}_0'$ and $\mathbf{v}_0''$ with adjacent tallies ($t(\mathbf{v}_0'') = t(\mathbf{v}_0') + 2$) lies almost surely in the (different) realization of the signal of a member of C_0 voting informatively, then $\tau_{s_0}(t(\mathbf{v}_0''), \sigma_0) - \tau_{s_0}(t(\mathbf{v}_0'), \sigma_0) = 2$, and therefore also $\rho_{\mathcal{D}}'(\mathbf{v}_0'', \sigma_0) - \rho_Q'(\mathbf{v}_0', \sigma_0) = 2$. But then the number of individuals voting informatively in the respective continuation games in the receiving commitee, $\tilde{k}(t(\mathbf{v}_0))$, must increase or decrease linearly with t_0 and in particular must satisfy $|\tilde{k}(t(\mathbf{v}_0'')) - \tilde{k}(t(\mathbf{v}_0'))| = 2$. In fact, as Proposition 3 also shows, if $\tilde{k}(t(\mathbf{v}_0))$ is increasing at some t and decreasing at t', then $t < t'$, with individuals initially switching from voting against the proposal unconditionally to voting informatively - for tallies in some range $\underline{\theta}_0 < t_0 < \theta_0$ - and then from voting informatively to voting in favor of the proposal in some range $\theta_0 < t_0 < \overline{\theta}_0$. We then have,

Proposition 4 *Suppose liberals (conservatives) are a winning (blocking) coalition in* C_1*. If* σ *is a TSV, then there exist* $\underline{\theta}_0$*,* θ_0 *and* $\overline{\theta}_0$ *(* $r_0 - 1 \leq \underline{\theta}_0 \leq \theta_0 \leq \overline{\theta}_0 \leq n_0 + 1$*), and linear functions* $\tilde{k}^0(t_0)$*,* $\tilde{k}^1(t_0)$ *such that:*

(i) $\tilde{k}^0(t_0(v_0))$ *liberals (conservatives) vote informatively, all other committee members vote against the proposal for all* $v_0 : \underline{\theta}_0 + 1 \leq t_0(v_0) \leq \theta_0 - 1$*, and* $\tilde{k}^1(t_0(v_0))$ *liberals (conservatives) vote informatively, all other committee members vote in favor of the proposal for all* $v_0 : \theta_0 + 1 \leq t_0(v_0) \leq \overline{\theta}_0 - 1$*.*

(ii) Moreover, $\tilde{k}^0(t_0 + 2) = \tilde{k}^0(t_0) + 2$*, and* $\tilde{k}^1(t_0 + 2) = \tilde{k}^1(t_0) - 2$

(iii) A decisive majority of individuals in C_1 *votes uninformatively against the proposal if* $t_0(v_0) < \underline{\theta}_0$ *and for the proposal if* $t_0(v_0) > \overline{\theta}_0$*.*

It follows from this, in particular, that in any voting equilibrium with relevant two-sided informative voting there exists a set of voting outcomes in the originating committee for which the likelihood of the proposal defeating the status quo in the receiving committee is strictly increasing in the tally of votes in favor of the proposal in the originating committee (as opposed to a step function under an EMR voting equilibrium). Figure 1 represents a sketch of the probability of success of the proposal in the receiving Committee conditional on the tally of votes in the originating committee in EMR and TSI voting equilibria (drawn here as a continuous function for convenience only). Figure 2 shows the tally of votes in the originating and receiving committees in simulations of TSI voting equilibria for given sizes and compositions of committees.

Proposition 4 offers a partial characterization of a voting equilibrium with relevant two-sided informative voting, assuming that such a voting equilibrium exists. But is it at all possible to have a TSI voting equilibrium? We show below that this is indeed the case. In particular, we show that for an equilibrium of this class to exist it is sufficient that conservatives form a blocking coalition in the receiving committee and that the number of conservatives in the originating committee is sufficiently large. We also show, however, that a large number of conservatives in the originating committee is a sufficient but not necessary condition, and that there also exists a TSI voting equilibrium in which each of a small number of conservatives in the originating committee (but at least ρ_Q) votes informatively when liberals are sufficiently numerous (moreover, this strategy profile remains an equilibrium when voting within each committee is allowed to be sequential as well). The main result is the following:

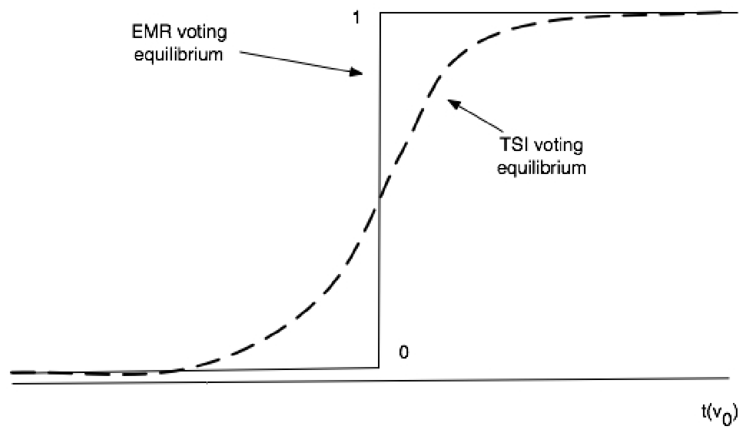

Figure 1: Probability of Success of the Proposal in the Receiving Committee in EMR and TSV voting equilibria

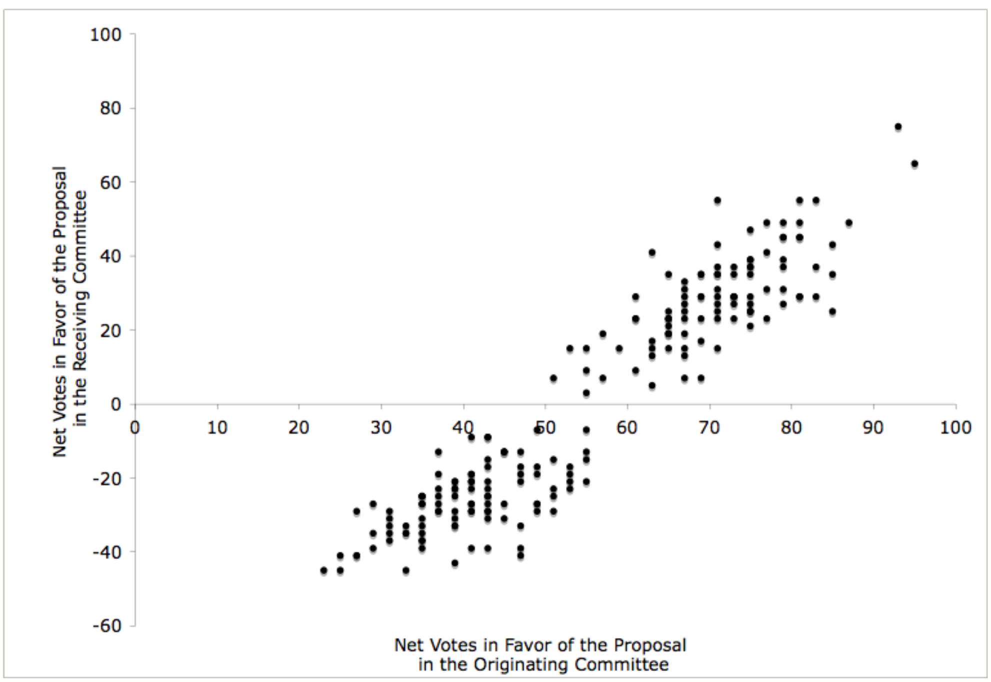

Figure 2: Voting Outcomes in TSI Voting Equilibria (Simulations)

Theorem 2 *Suppose that Conservatives are a Blocking Coalition in the Receiving Committee, and that* $n_0^Q \geq \rho_Q$*, and consider a strategy profile* σ_0^k *for members of the originating committee in which* $k : \rho_Q \leq k \leq n_0^Q$ *conservatives vote uninformatively and all other members vote unconditionally in favor of the proposal.*

(1) If $\rho'_Q(\mathbf{v}_0, \sigma_0^k) > R_1^Q$ *for some vote outcome* $\mathbf{v}_0$ *such that* $t(\mathbf{v}_0) \geq r_0 - 1$*, there exists a TSI voting equilibrium in which members of the originating committee behave according to* σ_0^k*. Moreover, there exists a TSI voting equilibrium that is robust to sequential voting within each committee.*

(2.i) If also $\rho'_Q(\mathbf{v}_0, \sigma_0^{n_0^Q}) < -(R_1^Q - r_1^Q)$ *for some vote outcome* $\mathbf{v}_0$ *such that* $t(\mathbf{v}_0) \geq r_0 - 1$*, there exists a TSI voting equilibrium in which all conservatives in the originating committee vote informatively.*

(2.ii) If instead $\rho'_Q(\mathbf{v}_0, \sigma_0^{n_0^Q}) \geq r_1^Q$ *for all* $\mathbf{v}_0$ *such that* $t(\mathbf{v}_0) \geq r_0 - 1$*, then there exists a TSI voting equilibrium in which all conservatives in the originating committee vote informatively that is robust to sequential voting within each committee.*

Proof. The proof is in the appendix. ■

For application, note that when all conservatives in the originating committee vote informatively, the conditions in *(1)* and *(2.ii)* can be written in terms of the composition and size of the committees as:

$$n_0^Q - \rho_Q \leq n_1^A - r_1 \text{ and } n_0^A \geq \frac{n_1^Q - n_1^A + r_1}{2} + (r_0 - \rho_Q), \tag{4}$$

so that a sufficiently large number of liberals and a small number of conservatives in the originating committee is a sufficient condition for a TSI voting equilibrium that is robust to sequential voting within each committee in which all conservatives in the originating committee vote informatively. Moreover, the small number of conservatives in C_0 - which ensures that $\rho'_Q(\mathbf{v}_0, \sigma_0^{n_0^Q}) \geq r_1^Q$ whenever the proposal passes the originating committee - is not a relevant constraint for the existence of a TSI in which *some* conservatives in C_0 vote informatively, for we can show that if $n_0^Q - k_0$ conservatives in C_0 vote uninformatively in favor of the proposal, the previous analysis applies with the relabeling $n_0'^A = n_0^A + (n_0^Q - k_0)$ and $n_0'^Q = k_0$ (since in this case conservatives voting uninformatively for the proposal in C_0 have no profitable deviations). As a result we may conclude that

Corollary 3 *Suppose that Conservatives are a Blocking Coalition in C_1, and that $n_0^Q \geq \rho_Q$. If the number of liberals in C_0 is sufficiently large (the relevant inequality in (4)), there exists a TSI voting equilibrium that is robust to sequential voting within each committee.*

Similarly, when all conservatives in the originating committee vote informatively, the conditions in *(1)* and *(2.i)* can be written in terms of the composition and size of the committees as:

$$n_0^Q - \rho_Q \geq \left(\frac{n_1 - 1}{2}\right) \text{ and } n_0^A \geq \frac{n_1^Q - n_1^A + r_1}{2} + (r_0 - \rho_Q) \tag{5}$$

As a result we may also conclude that

Corollary 4 *Suppose that Conservatives are a Blocking Coalition in C_1. If the number of liberals and conservatives in C_0 is sufficiently large (as in (5)), there exists a TSI voting equilibrium in which all conservatives in the originating committee vote informatively.*

To see the intuition for Theorem 2, we begin by part *(2.ii)*. So consider the problem of an individual $i \in C_0$ voting informatively. Note that given the responsiveness of equilibrium policy to the tally of votes in the originating committee in TSI voting equilibria implied by Proposition 4, $i \in C_0$'s vote matters not only according to whether it is necessary to pass the proposal or not in the initiating committee (the *standard-pivotal* motive), but also as a way to transmit information to members of the receiving committee (the *signal-pivotal* motive). As a result, while in a voting equilibrium with one sided informative voting in the originating committee there is only one way of being pivotal (absent name-flipping), when individuals in the receiving committee also vote informatively this is generically no longer the case; i.e., the set $K(\sigma) \equiv \{k : \mathcal{SP}_i(r_1, k) \neq \emptyset\}$ has typically more than one element.

Now, fix any voting outcome of the remaining members of the initiating committee such that $\underline{\theta}_0 + 2 \leq t(\mathbf{v}_{0,-i}) \leq \theta_0 - 2$. For i's vote to be payoff relevant, it must be that the proposal loses against the status quo in $\Gamma(\mathbf{v}_{0,-i}^-)$ but defeats it in $\Gamma(\mathbf{v}_{0,-i}^+)$. But from Proposition 4, this must be due to the vote of two members of the receiving committee who vote uninformatively against the proposal in $\Gamma(\mathbf{v}_{0,-i}^-)$ but vote informatively in $\Gamma(\mathbf{v}_{0,-i}^+)$, in response to the (almost sure) reversal of a negative signal in the originating committee leading from $t(\mathbf{v}_{0,-i}) - 1$ to $t(\mathbf{v}_{0,-i}) + 1$. Thus $i \in C_0$'s equilibrium inference about the private information of individuals voting informatively in C_1 after both tallies is "not too different" than the standard pivotal inference of an individual voting informatively in C_1 after a vote outcome $\mathbf{v}_0$ in the originating committee. But this in turn must satisfy

$\tau_{s_{1,-i}}(r_1-1;\sigma^*_{-i})-1 \leq \rho'_Q(\mathbf{v}_0,\sigma^*_0) \leq \tau_{s_{1,-i}}(r_1-1;\sigma^*_{-i})+1$. This implies (as we show in Lemma 6 in the appendix) that here $\beta(\rho_Q-1+s_i) \leq \lim_{\alpha\to 0} Pr^{(\sigma,\alpha)}(\omega_A|s_i,\mathcal{SP}_i(r_1,t(\mathbf{v}_{0,-i}))) \leq \beta(\rho_Q+s_i)$, and therefore that, conditional on any $\mathbf{v}_{0,-i}$ with a tally in $(\underline{\theta}_0,\theta_0)$, a conservative in the originating committee has incentives to vote informatively (and therefore also a liberal in the originating committee to vote his bias).

The same is true therefore in expectation if all possible voting outcomes in the originating committee have tallies in $\underline{\theta}_0+2 \leq t_{0-i}(v_{0-i}) \leq \theta_0-2$. So suppose that in fact liberals in C_0 vote their bias, and (all) conservatives in C_0 vote informatively. Proposition 3 showed that there can only exist a voting equilibrium with informative voting in a continuation $\Gamma(v_0)$ if $\rho'_Q(v_0,\sigma_0) \leq R^Q_1$, or equivalently $\tau_{s_0}(t_0(v_0),\sigma_0) \geq \rho_Q - \left(\frac{n^Q_1-n^A_1+r_1}{2}\right)$. Lemma 5 in the appendix shows that if given σ_0, this inequality holds as an equality for a $t_0(v_0)$ such that $r_0-1 \leq t_0(v_0) \leq n_0-1$, then we can always find $\underline{\theta}_0$ such that no individual in C_0 would want to deviate from playing according to σ_0 conditional on knowing $t_{0-i}(v_{0-i}) = \underline{\theta}_0$. If in addition $\rho'_Q(v_0,\sigma_0) \geq r^Q_1$ for all v_0, or equivalently $\tau_{s_0}(n_0,\sigma_0)-\rho_Q \leq n^A_1-r_1$, then Proposition 3 shows that for all feasible voting outcomes in C_0, if there is a voting equilibrium in $\Gamma(v_0)$ with informative voting, it must be that conservatives in C_1 who are voting uninformatively are voting against the proposal (i.e., for all feasible v_{0-i}, $t_{0-i}(v_{0-i}) \leq \theta_0-1$). In terms of the composition and size of the committees, the previous conditions can be written as in (4). Our previous argument then suggests that if conditions (4) hold, there will exist a voting equilibrium with relevant two-sided informative voting in which all conservatives in the originating committee vote informatively.

Note moreover, that we have argued above that conservatives in the originating committee have incentives to vote informatively not only in expectation but also conditional on any v_{0-i} with a tally in $(\underline{\theta}_0,\theta_0)$. But together with the results of Dekel and Piccione (2000) this directly implies that the previous strategy profile is also a voting equilibrium for sequential voting within each committee (as are voting equilibria with one sided informative voting). The intuition for this result is that since in a static equilibrium players best respond to beliefs that are conditional on them being pivotal, and all committee members playing informatively are equally informative, observing the identity of who voted for or against the status quo only allows players to distinguish between payoff equivalent events, and doesn't add valuable information. The same logic applies that applies in the single-committee setting applies here as well because even if in principle there are multiple possibly non payoff-equivalent pivotal events for members of the originating committee, the construction of TSI voting equilibria in part *(2.ii)* of Theorem 2 implies that informative voting is a best response not only in expectation but also ex post for any one of these events.

These results, however, hold for committee compositions that assure that $\rho'_Q(\mathbf{v}_0, \sigma_0^{n_0^Q}) \geq r_1^Q$ whenever the proposal passes the originating committee so that in the equilibrium with informative voting in the receiving committee following $\mathbf{v}_0$ conservatives voting uninformatively vote against the proposal. When this is not the case, the ex-post incentive compatibility of a conservative voting informatively in the originating committee conditional on $\underline{\theta}_0 + 2 \leq t(\mathbf{v}_{0,-i}) \leq \theta_0 - 2$ can't be guaranteed, and neither can therefore the existence of a TSI voting equilibria that is robust to sequential voting within each committee.[21] If on the other hand we relax the requirement, then it is not necessary for the behavior prescribed by σ_0 to be incentive compatible conditional on each feasible $t(\mathbf{v}_{0,-i})$, and it is enough instead to provide incentives to members of C_0 in expectation. Part *(2.i)* of Theorem 2 then shows that if $\rho'_Q(\mathbf{v}_0, \sigma_0^{n_0^Q}) < -(R_1^Q - r_1^Q)$ for *a* vote outcome that passes the originating committee - or equivalently, when all conservatives in C_0 vote informatively, if the number of conservatives is sufficiently large, as in (5) - we can (generically) choose θ_0 and $\overline{\theta}_0$ so that σ_0 is incentive compatible in expectation.

Theorem 2 establishes sufficient conditions for the existence of a TSI voting equilibrium. While a complete characterization of the set of TSI voting equilibria is beyond the scope of this paper, we close this section with a negative result. We show that if we require TSI voting equilibria to be robust to sequential voting within each committee, then if liberals are a winning coalition in the receiving committee, liberals must also be a winning coalition in the originating committee for a TSI voting equilibrium to exist. For completeness, we also provide a sufficient condition for existence of an equilibrium of this class when liberals are a winning coalition in the receiving committee. The condition requires the majority premium of liberals in the originating committee $n_0^A - n_0^Q - r_0$ to be small enough.[22]

Proposition 5 *Suppose that liberals are a winning coalition in the receiving commitee. Then there exists a TSI voting equilibrium that is robust to sequential voting within each committee only if $\mathcal{A}_0 \in W(C_0)$. Moreover, provided that $\frac{n_0^A - n_0^Q - r_0}{2} \leq (1 - \rho_A) + r_1^A$, there exists an equilibrium of this class with $\frac{n_0^A - n_0^Q - r_0}{2}$ informative votes in the originating committee.*

[21] Lemma 6 shows that for $\theta_0 + 2 \leq t_{0-i}(v_{0-i}) \leq \overline{\theta}_0 - 2$,

$$\beta(\rho_Q + s_i) \leq \lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, t_{0-i}(v_{0-i}))) \leq \beta(\rho_Q + 1 + s_i)$$

[22] Recall that liberals are a winning coalition in committee j if $n_j^A \geq R_j = \frac{n_j + r_j}{2} \Leftrightarrow n_j^A - n_j^Q - r_j \geq 0$

Proof. The proof is in the appendix. ■

The role of the requirement that the voting equilibrium be robust to sequential voting within each committee is to assure that only liberals vote informatively in the originating committee, as we have not proved that this must be the case in TSI when incentives can hold only in expectation. As such, it is not necessary for the result, and other assumptions (such as the "disagreement" between liberals and conservatives being sufficiently large, as expressed in ρ_A and ρ_Q) would also lead to the same result.

6 Discussion

In this paper, we develop a simple model of strategic voting in sequential committees in a common value setting with incomplete information. The model has stark empirical implications for the analysis of voting in bicameral legislatures, as well as for the interactions between (standing) committees and the floor of legislative bodies and a variety of similar institutional settings in universities and business. It also offers suggestive results for the analysis of sequential electoral systems such as the US presidential election, and sequential referenda such as the one conducted for the ratification of the proposed european constitution.

The model accounts for the basic stylized fact that the outcome of the vote in the first committee typically influences the outcome of the vote in the second committee *beyond* the binary decision of whether to approve or reject the alternative in the first committee: higher tallies in the first committee are associated with higher success rates of the alternative in the second committee. We show that this can happen in one of two ways, with the probability of success of the alternative in the receiving committee being either a "smooth" strictly increasing function of the tally of votes in the originating committee, or a step function, in which the proposal is killed for low tallies in the first committee and approved otherwise.

We emphasize three main results. First, we show that the receiving committee can act as to modify the effective majority rule for the originating committee, inducing informative voting by *some* of its members in equilibrium. This is an important feature in settings in which the voting rules do not adjust from issue to issue to the optimal rule à la Austen-Smith and Banks (1996). A key determinant of whether this can in fact occur in equilibrium is the "partisan" composition of the receiving committee, and in particular whether conservatives (biased for the status quo) can block the passage of the proposal in the receiving committee. Second, we show that under some conditions voting equilibria with relevant informative voting in the receiving committee are dominated (for members of the relevant decisive coalition) by equilibria in which all relevant informative voting takes place in the receiving committee, after the alternative is passed unconditionally in the originating committee. Finally, we provide conditions for the existence of an equilibrium with relevant informative voting in both committees, and provide a partial characterization of equilibria of this class. In contrast to voting equilibria with one-sided relevant informative voting in the originating committee (EMR), we show that in voting equilibria with relevant two-sided informative voting (TSI) the conditional probability of the alternative being chosen is strictly increasing in the tally of votes in the originating committee. Moreover, the number of individuals voting informatively in the receiving committee decreases with the difference between the effective majority rule faced by individuals voting informatively in the receiving committee and their effective bias (to evaluate additional information) following a voting outcomes in the originating committee.

We close with two remarks about the model. First, note that while our model assumes that members of the originating and receiving committee receive signals with the same precision, in some circumstances (e.g., committee-floor) it would be desirable to allow for a lower precision of signals of members of the receiving committee. This is, however, a straightforward extension of the previous framework, and all our results continue to hold with minor amendments in this case. A more challenging objection is the possibility of deliberation prior to the vote, which our model ignores completely. We can of course interpret the model as a description of the environment after such communication took place. The question in this case is whether it is plausible to assume that at this point there would still be relevant private information, or whether instead all private information would be transmitted by *cheap talk*. This will depend on the way we assume players can communicate, and on the criteria for equilibrium selection that is used. We leave this as an empirical question, to be considered in the application of interest. If it is, then the vote in the receiving committee should be independent of the outcome of the vote in the originating committee, and behavior in line with the central stylized fact would be due to factors other than the ones considered in this paper. The testable implications developed in this paper will hopefully contribute to disentangle alternative explanations, and ultimately to aid our understanding of decision-making in committees.

7 Appendix

Proof of Proposition 2. We first show that σ^*, given by *(i)* $\sigma_i^*(s_i) = s_i$ for $i \leq k$, and *(ii)* $\sigma_i^*(s_i) = -1$ for $i \geq k+1$, is a voting equilibrium if and only if $k = n-(\rho-r)$ and $r \leq \rho \leq R$. Note first that $\tau_{s_{-i}}(r-1, \sigma_{-i}^*) = r-1+n-k$, and therefore $\lambda_i^{\mathcal{P}_i(C,r)}(s_i) = \beta(r-1+n-k+s_i)$. Incentive compatibility then requires $\lambda_i^{\mathcal{P}_i(C,r)}(-1) = \beta(r+n-k-2) \leq \pi \leq \beta(r+n-k) = \lambda_i^{\mathcal{P}_i(C,r)}(1)$. By definition of ρ then either $k = n+(r-\rho)-1$ or $k = n+(r-\rho)$. Proceeding similarly, we can show that the incentive constraint for $i \geq k+1$ implies $k \geq n-(\rho-r)$. Feasibility requires $k \leq n$, and relevant informative voting (that $z = A$ for some $\mathbf{s}$) that $k \geq R$. With $k = n-(\rho-r)$, these imply that $r \leq \rho \leq R$. It then follows that this strategy profile is a voting equilibrium iff $k = n-(\rho-r)$ and $r \leq \rho \leq R$. Similarly, we can show that σ^{**} such that *(i)* $\sigma_i^{**}(s_i) = s_i$ for $i \leq k$, and *(ii)* $\sigma_i^{**}(s_i) = 1$ for $i \geq k+1$ is a voting equilibrium if and only if $k = n+1-(r-\rho)$ and $-(n-r) \leq \rho \leq r-1$. The result follows, since a voting equilibrium with informative voting must be of one of these classes. ■

Proof of Theorem 1. The proof follows from Lemma 1 and Lemma 2 below. ■

Lemma 1 *If $\mathcal{A}_1 \in W(C_1)$, then for any k such that $(1-\rho_A)+1 \leq k \leq (n_0^A - n_0^Q) - (1-\rho_A) - (r_0 - 1)$, there exists an EMR voting equilibrium characterized by the pair $(k, \theta_0(k)) = (k, (n_0^A - k) - n_0^Q - (1-\rho_A))$ if and only if $(1-\rho_A) \leq \frac{n_0^A - n_0^Q - r_0}{2}$.*

Proof of Lemma 1. First we prove that if σ^* is a EMR voting equilibrium when $\mathcal{A}_1 \in W(C_1)$, then it must be the case that conservatives in C_0 are voting their bias, and liberals are playing a k-informative strategy profile with liberal bias. So suppose then that σ^* is a EMR voting equilibrium. Then there exists an (even) integer θ_0, $r_0 - 1 \leq \theta_0 \leq n_0 - 1$, such that $t(\sigma_1^*(\mathbf{s}_1, \sigma_0^*(\mathbf{s}_0))) \leq r_1 - 1 \ \forall \mathbf{s}_1$ whenever $t(\sigma_0^*(\mathbf{s}_0)) \leq \theta_0 - 1$. This implies, in particular, that for any $\mathbf{v}_0 = \sigma_0^*(\mathbf{s}_0)$ such that $t(\mathbf{v}_0) \leq \theta_0 - 1$ there is a $i \in A_1$ such that $\sigma_i^*(t(\mathbf{v}_0), 1) = -1$. Now given that a R_1-majority is voting against the proposal independently of their signals, then $\lambda_i^{\mathcal{P}_i(C_1,r_1)}(s_i, \mathbf{v}_0) = \beta(\tau_{s_0}(t(\mathbf{v}_0), \sigma_0^*) + s_i)$, and therefore incentive compatibility for $i \in A_1$ following $\mathbf{v}_0 = \sigma_0^*(\mathbf{s}_0)$ such that $t(\mathbf{v}_0) \leq \theta_0 - 1$ requires $\beta(\tau_{s_0}(t(\mathbf{v}_0), \sigma_0^*) + 1) \leq \pi_A$, or equivalently that $\tau_{s_0}(\theta_0 - 1, \sigma_0^*) \leq \rho_A - 2$.

Next we argue that if $i \in Q_0$, then i doesn't vote informatively. Suppose to the contrary that for some $i \in Q_0$, $\sigma_i(\emptyset, s_i) = s_i$. Since in a EMR voting equilibrium $\lambda_i^{\mathcal{SP}}(s_i; r_1) = \beta(\tau_{s_{0,-i}}(\theta_0, \sigma_{0,-i}^*) + s_i)$, for incentive compatibility we need either $\tau_{s_{0,-i}}(\theta_0; \sigma_{0,-i}) = \rho_Q$ or $\tau_{s_{0,-i}}(\theta_0; \sigma_{0,-i}) = \rho_Q - 1$. But then $\tau_{s_0}(\theta_0 - 1; \sigma_0) \geq \tau_{s_{0,-i}}(\theta_0; \sigma_{0,-i}) - 1 \geq \rho_Q - 2 > -1 \geq \rho_A - 2$, which is a contradiction since we have established that $\tau_{s_0}(t_0, \sigma_0) \leq \rho_A - 2$ for all

$t_0 \leq \theta_0 - 1$. Then there must exist an $i \in \mathcal{A}_0$ who is voting informatively. From this it follows that in equilibrium conservatives in C_0 must vote their bias; i.e., $\sigma_i(s_i) = -1$ for all $s_i \; \forall \; i \in \mathcal{Q}_0$.

To see this note that since some liberal is voting informatively, no conservative can be voting informatively as well. Now suppose that at least one conservative in C_0 is voting for A, and let t_0^N the net tally of conservatives and liberals voting uninformatively in C_0. Then $\tau_{s_0}(t_0) = t_0 - t_0^N$. Now suppose $i \in \mathcal{Q}_0$ voting for A according to σ deviates and votes for Q. Conditional on reaching C_1, i is taken as a partisan. The deviation therefore only matters if $t_{0,-i} = r_0 - 1$ (and it does matter here, since the outcome following $\mathbf{v}_0$ such that $t_{0,-i} = r_0$ is A with positive probability). This is a profitable deviation for i iff $\beta(\tau_{s_{0,-i}}(r_0 - 1) - 1) = \beta(r_0 - 1 - (t_0^N - 1) - 1) \leq \beta(\rho_Q - 1) \Leftrightarrow r_0 \leq \rho_Q + t_0^N$. So assume instead that $r_0 > \rho_Q + t_0^N$. For liberals in C_1 to vote for Q following $t_0 = \theta_0 - 1$ we need $\tau_{s_0}(\theta_0 - 1) \leq -(1 + (1 - \rho_A)) \Leftrightarrow \theta_0 \leq t_0^N - (1 - \rho_A)$. For a liberal voting informatively not to have incentives to deviate we need $\beta(\tau_{s_{0,-i}}(\theta_0) - 1) \leq \pi_A \leq \beta(\tau_{s_{0,-i}}(\theta_0) + 1)$, and from this it follows that in fact $\theta_0 = t_0^N - (1 - \rho_A)$. But since we have assumed that $r_0 > \rho_Q + t_0^N$, then $r_0 > \theta_0 + 1$, which is a contradiction with our hypothesis that $\theta_0 \geq r_0 - 1$.

Thus in equilibrium conservatives in C_0 must vote their bias. Moreover, from this it follows that if $i \in \mathcal{A}_0$ is not voting informatively, she must be voting her bias, for otherwise, letting k denote the number of liberals voting informatively, $\tau_{s_0}(t_0; \sigma_0) = t_0 + n_0^Q + n_0^A - k$, and thus $\tau_{s_0}(\theta_0 - 1; \sigma_0) \leq \rho_A - 2 \Leftrightarrow \theta_0 \leq k - n_0 - (1 - \rho_A) < r_0$. EMR voting equilibria for $\mathcal{A}_1 \in W(C_1)$ can then be characterized, provided they exist, by pairs (k,$\theta_0(k)$) such that *(i)* $\sigma_i(s, \mathbf{v}_0) = -1$ $(= 1)$ $\forall i \in C_1$, $\forall \mathbf{v}_0 = \sigma_0(\mathbf{s}_0)$ such that $t(\mathbf{v}_0) \leq \theta_0 - 1$ $(\geq \theta_0 + 1)$, *(ii)* $\sigma_i(s, \emptyset) = -1 \; \forall \; i \in \mathcal{Q}_0$, and *(iii)*

$$\sigma_i(s, \emptyset) = s \;\; \forall i \in \mathcal{A}_0^I(k) \equiv \{i \in C_0 : b_i = 1, i \leq k\}$$

$$\sigma_i(s, \emptyset) = 1 \;\; \forall i \in \mathcal{A}_0^N(k) \equiv \{i \in C_0 : b_i = 1, i > k\}$$

Note then that $t(\sigma(s_0)) = -n_0^Q + (n_0^A - k) + \sum_{i \in A_0^I(k)} s_i$, so that $\tau_{s_0}(t_0; \sigma_0) = t_0 + n_0^Q - (n_0^A - k)$, and similarly $\tau_{s_{0,-i}}(t_{0,-i}; \sigma_{0,-i}) = t_{0,-i} + n_0^Q - (n_0^A - k)$. Since $\lambda_i^{\mathcal{SP}}(s_i; r_1) = \beta(\tau_{s_{0,-i}}(\theta_0, \sigma_{0,-i}^*) + s_i)$, for incentive compatibility we need either $\tau_{s_{0,-i}}(\theta_0; \sigma_{0,-i}) = \rho_A$ or $\tau_{s_{0,-i}}(\theta_0; \sigma_{0,-i}) = \rho_A - 1$. Together with $\tau_{s_0}(\theta_0 - 1, \sigma_0^*) \leq \rho_A - 2$, this implies that

$$\theta_0(k) = (n_0^A - k) - n_0^Q - (1 - \rho_A) \tag{6}$$

Since we need $\theta_0(k) \geq r_0 - 1$, then $k \leq (n_0^A - n_0^Q) - [(1 - \rho_A) + (r_0 - 1)]$ (which implies $n_0^A \geq R_0$). Since on the equilibrium path $n_0^A - n_0^Q - 2k \leq t_0 \leq n_0^A - n_0^Q$, and thus we need $n_0^A - n_0^Q - 2k + 1 \leq \theta_0(k) \leq n_0^A - n_0^Q - 1$, then $k \geq 1 + (1-\rho_A)$. There exists a k satisfying these two inequalities if and only if $(1-\rho_A) \leq \frac{n_0^A - n_0^Q - r_0}{2}$. To show that σ^* is a voting equilibrium for $k : 1 + (1-\rho_A) \leq k \leq (n_0^A - n_0^Q) - [(1-\rho_A) + (r_0 - 1)]$ and $\theta_0(k) = (n_0^A - k) - n_0^Q - (1-\rho_A)$ it only remains to show that members of the originating committee that don't vote informatively do not have profitable deviations. Note that these deviations produce histories that have zero probability. Suppose then that members of the receiving committee treat these deviations as informative: if $i \in \mathcal{A}_0^N$ votes against the proposal then $j \in C_1$ believes $s_i = -1$, similarly for $i \in \mathcal{Q}_0$. Note that σ_1^* is consistent with these beliefs. Note that if $i \in \mathcal{A}_0^I$, and $j \in \mathcal{A}_0^N$, then $\tau_{s_{0,-j}}(t;\sigma_{0,-j}) = \tau_{s_{0,-i}}(t;\sigma_{0,-i}) + 1$, and if $\ell \in \mathcal{Q}_0$, then $\tau_{s_{0,-\ell}}(t;\sigma_{0,-j}) = \tau_{s_{0,-i}}(t;\sigma_{0,-i}) - 1$. It follows from these and the fact that $i \in A_0^I$ doesn't have a profitable deviation, that no player wants to deviate. ■

Lemma 2 *If $\mathcal{Q}_1 \in B(C_1)$, there exists an EMR voting equilibrium with k informative votes ($1 + \rho_Q \leq k \leq n_0^Q$) if and only if $-(n_0 - r_0 - k) \leq 1 + \rho_Q \leq n_0^Q$. If all individuals voting uninformatively in C_0 vote their bias then there exists an EMR voting equilibrium with k informative votes ($1 + \rho_Q \leq k \leq n_0^Q$) if and only if $n_0^Q \geq 1 + \rho_Q$ and $n_0^A \geq (r_0 - 1) - \rho_Q$.*

Proof of Lemma 2. Proceeding exactly as in the proof of Lemma 1 we can establish that in a EMR voting equilibrium *(i)* $\tau_{s_0}(\theta_0 + 1, \sigma_0^*) \geq \rho_Q + 1$, *(ii)* $i \in \mathcal{A}_0$ doesn't vote informatively, and *(iii)* there exists $i \in \mathcal{Q}_0$ who votes informatively. Equilibrium does not pin down from this the behavior of liberals or conservatives voting uninformatively in C_0, and as a result for equilibrium purposes we are only concerned in C_0 with the incentive compatibility constraints of individuals voting informatively.[23] Now denote the net tally of liberals in C_0 by t_0^A, and the net tally of conservatives voting uninformatively in C_0 when σ_0 contains k informative votes by $t_0^{QN}(k)$. Then $\tau_{s_0}(t_0, \sigma_0^*) = t_0 - t_0^A - t_0^{QN}(k)$, and therefore *(i)* above implies $\theta_0 \geq t_0^A + t_0^{QN} + \rho_Q$. Incentive compatibility of σ for $i \in \mathcal{Q}_0$ requires $\beta(\tau_{s_{0,-i}}(\theta_0;\sigma_{0,-i}^*) - 1) \leq \pi_Q \leq \beta(\tau_{s_{0,-i}}(\theta_0;\sigma_{0,-i}^*) + 1)$, and therefore either $\tau_{s_{0,-i}}(\theta_0;\sigma_{0,-i}) = \rho_Q$ or $\tau_{s_{0,-i}}(\theta_0;\sigma_{0,-i}) = \rho_Q - 1$, which together with the previous inequality imply $\theta_0 = t_0^A + t_0^{QN} + \rho_Q$. For feasibility we need $r_0 - 1 \leq \theta_0 \leq n_0 - 1$ and $t_0^A + t_0^{QN}(k) - k + 1 \leq \theta_0 \leq t_0^A + t_0^{QN}(k) + k - 1$, or equivalently $\max\{r_0 - 1 - t_0^A - t_0^{QN}(k), 1 - k\} \leq \rho_Q \leq k - 1$. This results in two relevant inequalities: $k \geq 1 + \rho_Q$ (which implies the necessary condition

[23] The deviations of individuals voting uninformatively are (when they are supposed to vote against their bias) or can be made to be (when they are supposed to vote for their bias) uninformative, and as a result only matter in the event that $t_{0-i} = r_0 - 1$, but then never, since independently of their vote here the outcome is Q for sure.

$n_0^Q \geq 1 + \rho_Q$) and

$$\rho_Q \geq r_0 - 1 - t_0^A - t_0^{QN}(k) \tag{7}$$

Note that the right hand side of (7) is minimized when all individuals voting uninformatively in C_0 vote for A, in which case this becomes $\rho_Q \geq r_0 - 1 - n_0 + k$, so the maximum number of individuals voting informative is $(k \leq)\ \rho_Q + n_0 - (r_0 - 1)$. Note that if instead conservatives in C_0 voting uninformative vote their bias, (7) becomes $k \geq n_0^Q - n_0^A + (r_0 - 1) - \rho_Q$. That is, in this case we need $k \geq \max\{1 + \rho_Q, n_0^Q - n_0^A + (r_0 - 1) - \rho_Q\}$, and therefore the necessary and sufficient conditions for the existence of a EMR voting equilibrium with any number $1 + \rho_Q \leq k \leq n_0^Q$ of conservatives voting informatively and the remaining conservatives voting their bias uninformatively is that $n_0^Q \geq 1 + \rho_Q$ and $n_0^A \geq (r_0 - 1) - \rho_Q$. ■

Lemma 3 *All voting equilibria with relevant informative voting only in the originating committee must be EMR voting equilibria.*

Proof of Lemma 3. Suppose not. Then there are at least two cutpoints in the receiving committee. If all of these are below the cutpoint of the EMR voting equilibrium, the IC of members of the originating committee voting informatively would be violated. The same would occur if all the cutpoints are above the cutpoint of the EMR voting equilibrium. Then at least one cutpoint must be below and one above θ_ℓ. But then the IC of members of the relevant majority in the receiving committee must be violated in some continuation. ■

To state Lemma 4 formally, we need to develop some terminology. We say that σ produces an optimal policy for individuals with bias b given a realization of signals $\mathbf{s}$, and denote this by $O_b^\sigma(\mathbf{s}) = 1$, if $t(\sigma_0) \geq r_0$ and $t_1(\sigma_1(\mathbf{s}_1, \sigma_0)) \geq r_1 \Leftrightarrow t(\mathbf{s}) \geq \rho_b$. Otherwise we let $O_b(\mathbf{s}; \sigma) = 0$. That is, we define the mapping $O_b(\cdot; \sigma) : S \to \{0, 1\}$ by $O_b(\mathbf{s}; \sigma) = 1$ if $t(\sigma_0) \geq r_0$ and $t_1(\sigma_1(\mathbf{s}_1, \sigma_0)) \geq r_1 \Leftrightarrow t(\mathbf{s}) \geq \rho_b$, and $O_b(\mathbf{s}; \sigma) = 0$ otherwise. Let $\overline{O}_b(\sigma) \equiv \sum_{\mathbf{s}: O_b(\mathbf{s};\sigma)=1} Pr(\mathbf{s})$ denote the probability that σ produces an optimal policy for individuals with bias b. Given a committee C', let $\Sigma_{C'}$ denote the set of uninformative and EMR voting equilibria, and let $\overline{\sigma}_{C'}$ denote the most informative equilibrium in $\Sigma_{C'}$. Let $C(k) \equiv \{n_0^Q(k), n_0^A(k), n_1^Q(k), n_1^A(k)\}$. We say that a sequence of committees $\{C(k)\}_k$ is increasing if $n_j^b(k+1) > n_j^b(k)\ \forall k$, $j = 0, u$ and $b = Q, A$. We say that a sequence of committees is liberal (conservative) if $\mathcal{A}_1(k) \in W(C_1(k))$ $(\mathcal{Q}_1(k) \in B(C_1(k)))\ \forall k$. Then

Lemma 4 *(i) For any* $\varepsilon > 0$ *and increasing sequence of conservative committees* $\{C(k)\}_k$*, there exists a* $\overline{k}$ *such that if* $k \geq \overline{k}$*,* $|O_b(\overline{\sigma}_{C^k}) - 1| < \varepsilon$*. However, (ii) there exists an* $\varepsilon > 0$ *and an increasing sequence of liberal committees* $\{C(k)\}_k$ *such that* $|O_b(\overline{\sigma}_{C^k}) - 1| > \varepsilon \; \forall k$*.*

Proof of Lemma 4. For *(ii)*, it is enough to note that if along a sequence $n_0^Q(k) \geq n_0^A(k)$, the most informative voting equilibrium is the non-informative equilibrium. The result follows, since we can always find an increasing sequence of committees with this property. For *(i)*, note first that there is always a k^+ such that the strategy profile σ^* in part *(i)* of Theorem 1 is a voting equilibrium. Therefore for $k \geq k^+$, $\sigma^*_{C'}$ is the most informative equilibrium in $\Sigma_{C'}$. Now $\sum_{i=1}^n s_i \geq \rho_Q \Leftrightarrow \sum_{i=1}^n s_i^+ \geq \frac{n+\rho_Q}{2} \Leftrightarrow \frac{1}{n}\sum_{i=1}^n s_i^+ \geq \frac{1}{2} + \frac{\rho_Q}{2n}$. So suppose that $\omega = \omega_A$. Conditional on ω_A, signals are i.i.d. Bernoulli(q) random variables. The strong law of large numbers then implies that $\Pr(\lim_{n\to\infty} \frac{1}{n}\sum_{i=1}^n s_i^+ = q) = 1$, and therefore (since $q > 1/2$) that $\Pr(\lim_{n\to\infty} \left[\frac{1}{n}\sum_{i=1}^n s_i^+ - \left(\frac{1}{2} + \frac{\rho_Q}{2n}\right)\right] \geq 0) = 1$. However, it also implies that $\Pr(\lim_{n_0^Q\to\infty} \left[\frac{1}{n_0^Q}\sum_{i\in Q_0} s_i^+ - \left(\frac{1}{2} + \frac{\rho_Q}{2n}\right)\right] \geq 0) = 1$. Therefore for large committees, conditional on $\omega = \omega_A$, both optimality for conservatives and the most informative equilibrium in $\Sigma_{C'}$ choose A with probability 1. A similar argument can be made with $\omega = \omega_Q$. This completes the proof. ■

Proof of Theorem 2. We begin with *(2.ii)*; i.e., we show that if $\rho'_Q(\mathbf{v}_0, \sigma_0^k) > R_1^Q$ for some vote outcome $\mathbf{v}_0$ such that $t(\mathbf{v}_0) \geq r_0 - 1$, and also $\rho'_Q(\mathbf{v}_0, \sigma_0^{n_0^Q}) \geq r_1^Q$ for all $\mathbf{v}_0$ such that $t(\mathbf{v}_0) \geq r_0 - 1$ then there exists a TSI voting equilibrium in which all conservatives in the originating committee vote informatively that is robust to sequential voting within each committee.

(2.ii.a) First note that if all conservatives vote informatively in the originating committee, then the conditions in the hypothesis boil down to (4) as discussed in the text. By Proposition 4, we know that if a TSI voting equilibrium σ exists, then it must be that there exist $\underline{\theta}_0$, θ_0 and $\overline{\theta}_0$ ($r_0 - 1 \leq \underline{\theta}_0 \leq \theta_0 \leq \overline{\theta}_0 \leq n_0 + 1$), and $\tilde{k}^0(t_0)$, $\tilde{k}^1(t_0)$ such that for all $\mathbf{v}_0 : \underline{\theta}_0 + 1 \leq t(\mathbf{v}_0) \leq \theta_0 - 1$, $\tilde{k}^0(t(\mathbf{v}_0))$ conservatives vote informatively and all other committee members vote their bias, and for all $\mathbf{v}_0 : \theta_0 + 1 \leq t(\mathbf{v}_0) \leq \overline{\theta}_0 - 1$, $\tilde{k}^1(t(\mathbf{v}_0))$ conservatives vote informatively and all other committee members vote in favor of the proposal. By Proposition 3, these strategy profiles are equilibria in $\Gamma(\mathbf{v}_0)$ for all $\mathbf{v}_0 : \underline{\theta}_0 + 1 \leq t(\mathbf{v}_0) \leq \theta_0 - 1$ if and only if $\tilde{k}^0(t_0) = r_1 + n_1^Q - n_1^A - \rho_Q + (t_0 - n_0^A)$ and (from feasibility and relevant informative voting)

$$\rho_Q + n_0^A - \frac{(n_1^Q - n_1^A + r_1)}{2} \leq \underline{\theta}_0 + 1 \leq \theta_0 - 1 \leq n_1^A + \rho_Q + n_0^A - r_1 \qquad (8)$$

, and are equilibria in $\Gamma(\mathbf{v}_0)$ for all $\mathbf{v}_0 : \theta_0 + 1 \leq t(\mathbf{v}_0) \leq \overline{\theta}_0 - 1$ if and only if $\tilde{k}^1(t_0) = \rho_Q + n_1 - (r_1 - 1) - (t_0 - n_0^A)$ and (from feasibility and relevant informative voting)

$$n_1^A + \rho_Q + n_0^A - r_1 + 1 \leq \theta_0 + 1 \leq \overline{\theta}_0 - 1 \leq \rho_Q + n_0^A + \frac{n_1 - r_1}{2} \tag{9}$$

We want to show that there exist $r_0 - 1 \leq \underline{\theta}_0 \leq \theta_0 \leq \overline{\theta}_0 \leq n_0 + 1$ satisfying (8) and (9) when relevant such that $\beta(\rho_Q - 1 + s_i) \leq \lambda_i^{\mathcal{SP}}(s_i; r_1) \leq \beta(\rho_Q + s_i)$, eliminating profitable deviations for $i \in \mathcal{Q}_0$, where $\lambda_i^{\mathcal{SP}}(s_i; r_1)$ is given by (2) with $K(\sigma) = \{k : \underline{\theta}_0 \leq k \leq \overline{\theta}_0\}$; i.e.,

$$\lambda_i^{\mathcal{SP}}(s_i; r_1) = \sum_{k=\underline{\theta}_0}^{\overline{\theta}_0} \lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, k)) f(s_i, k) \tag{10}$$

(2.ii.b) Let $\underline{\theta}_0 = \rho_Q + n_0^A - \frac{(n_1^Q - n_1^A + r_1)}{2} - 1$, and let $\theta_0 = \overline{\theta}_0 = n_0 + 1$. Let $\sigma_i(\mathbf{v}_0, s_i) = -1$ for all s_i, for all $i \in C_1$ for all $\mathbf{v}_0 : t(\mathbf{v}_0) \leq \underline{\theta}_0 - 1$. The conditions $n_0^A \geq \frac{n_1^Q - n_1^A + r_1}{2} + (r_0 - \rho_Q)$ and $n_0^Q - \rho_Q \geq 0$ imply, respectively, that $\underline{\theta}_0 \geq r_0 - 1$, and $\underline{\theta}_0 \leq n_0 - 1$. By Lemma 5, $\lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, \underline{\theta}_0)) = \beta(\rho_Q - 1 + s_i^0)$. By Lemma 6, $\beta(\rho_Q - 1 + s_i^0) \leq \lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, \hat{t}_0)) \leq \beta(\rho_Q + s_i^0)$ for all $\mathbf{v}_{0,-i} : t(\mathbf{v}_{0,-i}) = \hat{t}_0$, with $\underline{\theta}_0 + 2 \leq \hat{t}_0 \leq \theta_0 - 2$. But then we are done, since $n_0^Q - \rho_Q \leq n_1^A - r_1$ implies - noting that $\tilde{k}^0([n_1^A + n_0^A + \rho_Q - (r_1 - 1)] - 1) = n_1^Q$ - that for all tallies on the equilibrium path $t(\sigma_0(s_0)$ (and in fact for all feasible tallies), $t(\sigma_0(\mathbf{s}_0)) \leq \theta_0 - 1$.

(2.ii.c) That this voting equilibrium is robust to sequential voting within each committee follows since by Lemma 5 and Lemma 6 members of the originating committee have no incentives to deviate even ex post, i.e., for any realization of votes of members of the receiving commitee. Thus the argument in Dekel and Piccione (2000) for single-committees works equally well here. Part *(1)* now also follows immediately after noting that if instead of all conservatives voting informatively in C_0 as in *(2.ii)* now $n_0^Q - k_0$ conservatives in C_0 vote uninformatively in favor of the proposal, the previous analysis applies with the relabeling $n_0'^A = n_0^A + (n_0^Q - k_0)$ and $n_0'^Q = k_0$ since in this case conservatives voting uninformatively for the proposal in C_0 have no profitable deviations.

(2.i) As for *(2.ii)* above, first note that if all conservatives vote informatively in the originating committee, then the conditions in the hypothesis boil down to (5) as discussed in the text. Repeat now step *(2.ii.a)* above. Next let $\sigma_i(\mathbf{v}_0, s_i) = -1$ (=1) for all s_i, for all $i \in C_1$ for all $\mathbf{v}_0 : t(\mathbf{v}_0) \leq \underline{\theta}_0 - 1$ ($\geq \overline{\theta}_0 + 1$). Let $\underline{\theta}_0 = \rho_Q + n_0^A - \frac{(n_1^Q - n_1^A + r_1)}{2} - 1$. As before, the conditions $n_0^A \geq \frac{n_1^Q - n_1^A + r_1}{2} + (r_0 - \rho_Q)$ and $n_0^Q - \rho_Q \geq 0$ imply, respectively, that $\underline{\theta}_0 \geq r_0 - 1$, and $\underline{\theta}_0 \leq n_0 - 1$. By Lemma 5, $\lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, \underline{\theta}_0)) = \beta(\rho_Q - 1 + s_i^0)$. Now if $n_0^Q -$

$\rho_Q \leq n_1^A - r_1$, we know that the result holds by part *(2.ii)*. Therefore assume to the contrary that $n_1^A - r_1 + 2 \leq n_0^Q - \rho_Q$, so that $\max_{s_0} t(\sigma_0(\mathbf{s}_0)) \geq \theta_0 + 1$ for all θ_0 satisfying (8). Let $\theta_0 = n_1^A + n_0^A + \rho_Q - (r_1 - 1)$. By Lemma 6, $\beta(\rho_Q - 1 + s_i^0) \leq \lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, \hat{t}_0)) \leq \beta(\rho_Q + s_i^0)$ for all $\mathbf{v}_{0,-i} : t(\mathbf{v}_{0,-i}) = \hat{t}_0$, with $\underline{\theta}_0 + 2 \leq \hat{t}_0 \leq \theta_0 - 2$. We now show that there exists a $\overline{\theta}_0 \geq \theta_0$ satisfying (9) such that $\beta(\rho_Q - 1 + s_i) \leq \lambda_i^{\mathcal{SP}}(s_i; r_1) \leq \beta(\rho_Q + s_i)$, eliminating deviations for $i \in \mathcal{Q}_0$. In what follows we will make explicit the dependency of $\lambda_i^{\mathcal{SP}}(s_i; r_1)$ on $\overline{\theta}_0$ in σ^* by writing $\lambda_i^{\mathcal{SP}}(s_i; r_1, \overline{\theta}_0)$ (here we fix $\underline{\theta}_0$ and θ_0 at the values specified above).

First note that if $\overline{\theta}_0 = \theta_0 = n_1^A + n_0^A + \rho_Q - (r_1 - 1)$, then $\lambda_i^{\mathcal{SP}}(s_i; r_1; \overline{\theta}_0) \leq \beta(\rho_Q + s_i)$. To see this note that since Q loses against A independently of $\mathbf{s}_1$ in $\Gamma(\mathbf{v}_{0,-i}^+)$, $L(\mathcal{SP}_i(r_1, \overline{\theta}_0)) = L(t(\mathbf{v}_1 | \mathbf{v}_{0,-i}^-) \leq r_1 - 2) = L(\sum_{j=1}^{n_1^Q} s_j \leq r_1 - 2 - n_1^A) \geq \left(\frac{1-q}{q}\right)^{\left(r_1 - 2 - n_1^A\right)}$ by Lemma 7. Since also $\tau_{s_{0,-i}}(\overline{\theta}_0, \sigma_{0,-i}^*) = n_1^A + \rho_Q - (r_1 - 1)$, and thus $L(\mathbf{v}_{0,-i} : t(\mathbf{v}_{0,-i}) = \overline{\theta}_0) = \left(\frac{1-q}{q}\right)^{n_1^A + \rho_Q - (r_1 - 1)}$, we have $\lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, \hat{t}_0)) \leq \beta(\rho_Q + s_i - 1)$.

If also $\lambda_i^{\mathcal{SP}}(s_i; r_1; \overline{\theta}_0) \geq \beta(\rho_Q + s_i - 1)$, then we are done. So suppose not. Then in equilibrium $\overline{\theta}_0 \geq \theta_0 + 2$. Since $\tilde{k}^0(\theta_0 - 1) = n_1^Q$ and $\tilde{k}^1(\theta_0 + 1) = n_1^Q - 1$, $t(\sigma_1^*(\mathbf{s}_1, \mathbf{v}_{0,-i}^-)) \leq r_1 - 2$ and $t(\sigma_1^*(\mathbf{s}_1, \mathbf{v}_{0,-i}^+)) \geq r_1$ only if $\sum_{i=1}^{n_1^Q} s_i = r_1 - 2 - n_1^A$. Then $L(\mathcal{SP}_i(r_1, \theta_0)) = \left(\frac{1-q}{q}\right)^{r_1 - 2 - n_1^A}$, which with $L(\mathbf{v}_{0,-i} : t(\mathbf{v}_{0,-i}) = \theta_0) = \left(\frac{1-q}{q}\right)^{n_1^A + \rho_Q - r_1 + 1}$ gives $\lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, \theta_0)) = \beta(\rho_Q - 1 + s_i^0)$.

Now, by Lemma 6, *(a)* for all $\mathbf{v}_{0,-i} : t(\mathbf{v}_{0,-i}) = \hat{t}_0$ such that $\theta_0 + 2 \leq \hat{t}_0 \leq \overline{\theta}_0 - 2$, we have $\beta(\rho_Q + s_i^0) \leq \lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, \hat{t}_0)) \leq \beta(\rho_Q + 1 + s_i^0)$, but *(b)* for all $\mathbf{v}_{0,-i} : t(\mathbf{v}_{0,-i}) = \hat{t}_0$ such that $\underline{\theta}_0 + 2 \leq \hat{t}_0 \leq \theta_0 - 2$ instead $\beta(\rho_Q - 1 + s_i^0) \leq \lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, \hat{t}_0)) \leq \beta(\rho_Q + s_i^0)$. Together with the fact that (by Lemma 7) $\lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, \overline{\theta}_0))$ is also increasing in $\overline{\theta}_0$, this implies that $\lambda_i^{\mathcal{SP}}(s_i; r_1; \overline{\theta}_0)$ is strictly increasing in $\overline{\theta}_0$ for $\overline{\theta}_0 \geq \theta_0 + 2$. Finally, note that if we choose

$$\overline{\theta}_0 = \rho_Q + n_0^A + 1 + \left(\frac{n_1 - r_1}{2}\right) \tag{11}$$

and this is feasible, in the sense that $\overline{\theta}_0 = \rho_Q + n_0^A + \left(\frac{n_1 + 1}{2}\right) \leq n_0 + 1$ (which is assumed true in the hypothesis), then $\lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, \overline{\theta}_0)) = \beta(\rho_Q + s_i)$. This follows since $L(\mathcal{SP}_i(r_1, \overline{\theta}_0)) = L(t(\mathbf{v}_1 | \mathbf{v}_{0,-i}^-) \leq r_1 - 2)$, and according to σ^*, $t(\sigma_1^*(\mathbf{s}_1, \mathbf{v}_{0,-i}^-)) = n_1^A + [n_1^Q - \tilde{k}^1(\overline{\theta}_0 - 1)] + \sum_{j=1}^{\tilde{k}^1(\overline{\theta}_0 - 1)} s_j \leq r_1 - 2 \Leftrightarrow \sum_{j=1}^{\tilde{k}^1(\overline{\theta}_0 - 1)} s_j \leq \rho_Q + n_0^A - \overline{\theta}_0$, but

$\sum_{j=1}^{\tilde{k}^1(\overline{\theta}_0-1)} s_j \geq -\tilde{k}^1(\overline{\theta}_0-1) = -\rho_Q - n_1 - n_0^A + \overline{\theta}_0 + r_1 - 2$. Therefore with $\overline{\theta}_0$ as in (11), we have $L(\mathcal{SP}_i(r_1, \overline{\theta}_0)) = \left(\frac{1-q}{q}\right)^{\rho_Q + n_0^A - \overline{\theta}_0}$, and hence $\lim_{\alpha\to 0} Pr^{(\sigma,\alpha)}(\omega_A|s_i, \mathcal{SP}_i(r_1, \overline{\theta}_0)) = \beta(\rho_Q + s_i)$. Therefore $\beta(\rho_Q - 1 + s_i) \leq \lambda_i^{\mathcal{SP}}(s_i; r_1; \overline{\theta}_0) \leq \beta(\rho_Q + 1 + s_i)$. But then there exists a $\overline{\theta}_0$: $n_1^A + n_0^A + \rho_Q - (r_1 - 1) \leq \overline{\theta}_0 \leq \rho_Q + n_0^A + \left(\frac{n_1+1}{2}\right)$ such that $\beta(\rho_Q - 1 + s_i) \leq \lambda_i^{\mathcal{SP}}(s_i; r_1; \overline{\theta}_0) \leq \beta(\rho_Q + s_i)$. ■

Lemma 5 *Let $\mathcal{Q}_1 \in B(C_1)$. Suppose that σ is a TSI voting equilibrium and that $i \in C_0$ votes informatively. Let $\underline{\theta}_0 = \rho_Q + n_0^A - \frac{(n_1^Q - n_1^A + r_1)}{2} - 1$. Then*

$$\lim_{\alpha\to 0} Pr^{(\sigma,\alpha)}(\omega_A|s_i, \mathcal{SP}_i(r_1, \underline{\theta}_0) = \beta(\rho_Q - 1 + s_i^0)$$

Proof of Lemma 5. Fix $\mathbf{v}_{0,-i} : t(\mathbf{v}_{0,-i}) = \underline{\theta}_0$. First note that since $t(\mathbf{v}_{0,-i}^-) = \theta_0 - 1$, then $t(\sigma_1^*(\mathbf{s}_1, \mathbf{v}_{0,-i}^-)) \leq r_1 - 2 \ \forall \ \mathbf{s}_1$, and as a result, $L(t(\mathbf{v}_1|\mathbf{v}_{0,-i}^-) \leq r_1 - 2, t(\mathbf{v}_1|\mathbf{v}_{0,-i}^+) \geq r_1) = L(t(\mathbf{v}_1|\mathbf{v}_{0,-i}^+) \geq r_1)$. Now according to σ^*, this is $t(\sigma_1^*(\mathbf{s}_1, \mathbf{v}_{0,-i}^+)) = n_1^A - [n_1^Q - \tilde{k}^0(\underline{\theta}_0 + 1)] + \sum_{j=1}^{\tilde{k}^0(\underline{\theta}_0+1)} s_j \geq r_1$, or equivalently, $\sum_{j=1}^{\tilde{k}^0(\underline{\theta}_0+1)} s_j \geq (n_1^Q - n_1^A + r_1) - \tilde{k}^0(\underline{\theta}_0 + 1)$. But $\sum_{j=1}^{\tilde{k}^0(\underline{\theta}_0+1)} s_j \leq \tilde{k}^0(\underline{\theta}_0 + 1)$. We now choose $\underline{\theta}_0 + 1$ so that $z = A$ following $\underline{\theta}_0 + 1$ is only consistent, according to σ^*, with $\tilde{k}^0(\underline{\theta}_0 + 1) = \frac{(n_1^Q - n_1^A + r_1)}{2}$ positive signals:

$$\underline{\theta}_0 = \rho_Q + n_0^A - \frac{(n_1^Q - n_1^A + r_1)}{2} - 1 \tag{12}$$

As a result, $t(\sigma_1^*(\mathbf{s}_1, \mathbf{v}_{0,-i}^+)) \geq r_1 \Leftrightarrow \mathbf{s}_1 \in \left\{\mathbf{s}_1 : t(\mathbf{s}_1) = \left(\frac{n_1^Q - n_1^A + r_1}{2}\right)\right\}$, and therefore we have $L(t(\mathbf{v}_1|\mathbf{v}_{0,-i}^+) \geq 1) = \left(\frac{1-q}{q}\right)^{\left(\frac{n_1^Q - n_1^A + r_1}{2}\right)}$. Next, note that $\tau_{s_{0,-i}}(t, \sigma_{0,-i}^*) = t - n_0^A$, so that $\tau_{s_{0,-i}}(\underline{\theta}_0, \sigma_{0,-i}^*) = \rho_Q - \left(\frac{n_1^Q - n_1^A + r_1}{2}\right) - 1$, and therefore $L(\mathbf{v}_{0,-i} : t(\mathbf{v}_{0,-i}) = \underline{\theta}_0) = \left(\frac{1-q}{q}\right)^{\rho_Q - \left(\frac{n_1^Q - n_1^A + 1}{2}\right) - 1}$. Putting these observations together we obtain the result. ■

Lemma 6 *Let $\mathcal{Q}_1 \in B(C_1)$. Suppose that σ is TSI voting equilibrium, and that $i \in C_0$ votes informatively.*

(i) Let $\mathbf{v}_{0,-i}$ be a voting outcome in $C_{0,-i}$ such that $\underline{\theta}_0 + 2 \leq t(\mathbf{v}_{0,-i}) \leq \theta_0 - 2$. Then

$$\beta(\rho_Q - 1 + s_i) \leq \lim_{\alpha\to 0} Pr^{(\sigma,\alpha)}(\omega_A|s_i, \mathcal{SP}_i(r_1, t(\mathbf{v}_{0,-i}))) \leq \beta(\rho_Q + s_i)$$

(ii) Let $\mathbf{v}_{0,-i}$ *be a voting outcome in* $C_{0,-i}$ *such that* $\theta_0 + 2 \leq t(v_{0,-i}) \leq \overline{\theta}_0 - 2$. *Then*

$$\beta(\rho_Q + s_i) \leq \lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, t(\mathbf{v}_{0,-i}))) \leq \beta(\rho_Q + 1 + s_i)$$

Proof of Lemma 6. Consider part *(i)*. Fix $\mathbf{v}_{0,-i} : t(\mathbf{v}_{0,-i}) = \hat{t}_0$ for $\underline{\theta}_0 + 2 \leq \hat{t}_0 \leq \theta_0 - 2$. We know already that $\tau_{s_{0-i}}(t, \sigma^*_{0,-i}) = t - n_0^A$, so that $L(\mathbf{v}_{0,-i} : t(\mathbf{v}_{0,-i}) = \hat{t}_0) = \left(\frac{1-q}{q}\right)^{\hat{t}_0 - n_0^A}$. Next note that according to σ^*, i's vote is influential only if $t(\sigma_1^*(\mathbf{s}_1, \mathbf{v}_{0,-i}^-)) \leq r - 2$ and $t(\sigma_1^*(\mathbf{s}_1, \mathbf{v}_{0,-i}^+)) \geq r$. But $t(\sigma_1^*(\mathbf{s}_1, \mathbf{v}_{0,-i}^-)) = n_1^A - (n_1^Q - \tilde{k}^0(\hat{t}_0 - 1)) + \sum_{i=1}^{\tilde{k}^0(\hat{t}_0-1)} s_i \leq r - 2$, or if and only if for some labeling of the individuals voting informatively

$$\sum_{i=1}^{\tilde{k}^0(\hat{t}_0-1)} s_i \leq \rho_Q + n_0^A - \hat{t}_0 - 1 \tag{13}$$

Similarly $t(\sigma_1^*(\mathbf{s}_1, \mathbf{v}_{0,-i}^+)) \geq r$ if and only if

$$\sum_{i=1}^{\tilde{k}^0(\hat{t}_0+1)} s_i = \sum_{i=1}^{\tilde{k}^0(\hat{t}_0-1)} s_i + \sum_{i=\tilde{k}^0(\hat{t}_0-1)+1}^{\tilde{k}^0(\hat{t}_0+1)} s_i \geq \rho_Q + n_0^A - \hat{t}_0 - 1 \tag{14}$$

Since $\sum_{i=\tilde{k}^0(\hat{t}_0-1)+1}^{\tilde{k}^0(\hat{t}_0+1)} s_i \leq 2$, this implies that to the knowledge that $\sum_{i=1}^{n_0^Q} s_i = \hat{t}_0 - n_0^A$ in C_0, we must add $\sum_{i=1}^{\tilde{k}^0(\hat{t}_0-1)-1} s_i = \rho_Q + n_0^A - \hat{t}_0 - 2$, $s_{\tilde{k}^0(\hat{t}_0+1)} = 1$ and $(s_{\tilde{k}^0(\hat{t}_0-1)}, s_{\tilde{k}^0(\hat{t}_0-1)+1}) \in \{(-1,1);(1,-1);(1,1)\}$ (or permutations thereof). Denoting this latter event by Z, we have $\frac{\Pr(Z|\omega_Q)}{\Pr(Z|\omega_A)} = \frac{2q(1-q)+(1-q)^2}{2q(1-q)+q^2} > \frac{1-q}{q}$, and therefore $\frac{\Pr(Z|\omega_Q)}{\Pr(Z|\omega_A)} = \mu \frac{1-q}{q}$ for some $\mu > 1$. Thus

$$\lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, \hat{t}_0)) = \frac{1}{1 + \mu \left(\frac{1-q}{q}\right)^{\rho_Q + s_i}} = \frac{1}{1 + \left(\frac{1-q}{q}\right)^{\rho_Q + s_i - x}}$$

for some $x \in (0,1)$. Equivalently, $\lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, \hat{t}_0)) = \beta(\rho_Q + s_i - x)$ for some $x \in (0,1)$, which implies the claim. Part *(ii)* follows from the same argument, noting that inequalities (13) and (14) become $\sum_{i=1}^{\tilde{k}^1(\hat{t}_0-1)} s_i \leq \rho_Q + n_0^A - \hat{t}_0$ and $\sum_{i=1}^{\tilde{k}^1(\hat{t}_0+1)} s_i \geq \rho_Q + n_0^A - \hat{t}_0$. ■

Lemma 7 *(i)* $Pr(\omega_A | \sum_{i=1}^k s_i \leq k - A)$ *is decreasing in* k *and* A*, and (ii)* $Pr(\omega_A | \sum_{i=1}^k s_i \leq k - A) < Pr(\omega_A | \sum_{i=1}^k s_i = k - A)$

Proof of Lemma 7. For *(i)*, it is enough to show that $\frac{Pr(\sum_{i=1}^{k} s_i \leq k-A|\omega_Q)}{Pr(\sum_{i=1}^{k} s_i \leq k-A|\omega_A)}$ is increasing in k and A. But this follows since

$$\frac{Pr(\sum_{i=1}^{k} s_i \leq k-A|\omega_Q)}{Pr(\sum_{i=1}^{k} s_i \leq k-A|\omega_A)} = \frac{Pr(|s^-| \geq \frac{A}{2}|\omega_Q)}{Pr(|s^-| \geq \frac{A}{2}|\omega_A)} = \frac{Pr(|s^+| \geq \frac{A}{2}|\omega_A)}{Pr(|s^+| \geq \frac{A}{2}|\omega_Q)} = \frac{\sum_{t=A/2}^{k} F(t;\omega_A)}{\sum_{t=A/2}^{k} F(t;\omega_Q)}$$

where $F(t;\omega_A) \equiv \begin{pmatrix} k \\ t \end{pmatrix} q^t(1-q)^{k-t}$ and $F(t;\omega_Q) \equiv \begin{pmatrix} k \\ t \end{pmatrix} (1-q)^t q^{k-t}$, and $\frac{F(k+1;\omega_A)/F(k+1;\omega_Q)}{F(k;\omega_A)/F(k;\omega_Q)} = \left(\frac{q}{1-q}\right)^2 > 1$, so that $\frac{F(k+1;\omega_A)}{F(k+1;\omega_Q)} > \frac{F(k;\omega_A)}{F(k;\omega_Q)}$. This also implies *(ii)*. ∎

Proof of Proposition 5. We sketch the argument, the details can be filled using the steps in previous results. First, proceeding as in Lemma 6, we can show that if $\mathcal{A}_1 \in W(C_1)$, σ is a MR voting equilibrium with relevant two-sided informative voting, and $i \in C_0$ votes informatively, then for any $\mathbf{v}_{0,-i}$ such that $\underline{\theta}_0 + 2 \leq t(\mathbf{v}_{0,-i}) \leq \theta_0 - 2$.

$$\beta(\rho_A - 2 + s_i) \leq \lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, t(\mathbf{v}_{0,-i}))) \leq \beta(\rho_A - 1 + s_i)$$

, while for any $\mathbf{v}_{0,-i}$ such that $\theta_0 + 2 \leq t(\mathbf{v}_{0,-i}) \leq \overline{\theta}_0 - 2$

$$\beta(\rho_A - 1 + s_i) \leq \lim_{\alpha \to 0} Pr^{(\sigma,\alpha)}(\omega_A | s_i, \mathcal{SP}_i(r_1, t(\mathbf{v}_{0,-i}))) \leq \beta(\rho_A + s_i)$$

From this it follows immediately that if σ is robust to sequential voting within each committee, then only liberals in C_0 can vote informatively. But then (by the same argument as in Lemma 1, conservatives in C_0 must be voting their bias, and hence if conservatives are a blocking coalition in C_0 there can't be relevant informative voting in C_0. So suppose next that liberals are a winning coalition in C_0, and that in equilibrium k liberals vote informatively and all other members of the originating committee vote their bias. Note that if $k \leq \frac{n_0^A - (n_0^Q + r_0)}{2}$, then $t(\sigma_0) = -n_0^Q + (n_0^A - k) + \sum_{i=1}^{k} s_i \geq r_0$ for all $\mathbf{s}_0$. So assume in fact that $1 \leq k \leq \frac{n_0^A - (n_0^Q + r_0)}{2}$ (this is possible since $\mathcal{A}_0 \in W(C_0)$). Then $\tau_{s_0}(t_0, \sigma_0) \geq -k \geq -\frac{n_0^A - (n_0^Q + r_0)}{2}$ for any $\mathbf{s}_0$, and thus by the assumption in the hypothesis $(1 - \rho_A) + \tau_{s_0}(t_0, \sigma_0) \geq -(n_1^Q + r_1)$ for any $\mathbf{s}_0$ (note that for $k = 1$ this condition is always satisfied). But this, together with Proposition 3, implies that if there is relevant informative voting in $\Gamma(\mathbf{v}_0)$ then liberals voting uninformatively vote in favor of the proposal, or equivalently that for any such $\mathbf{v}_{0,-i} = \sigma_{0,-i}(\mathbf{s}_{0,-i})$, $\theta_0 + 2 \leq t(\mathbf{v}_{0,-i}) \leq \overline{\theta}_0 - 2$ (i.e., that in equilibrium $\underline{\theta}_0 = \theta_0$). If $\tau_{s_0}(t_0, \sigma_0) + 1 - \rho_A < \frac{n_1^A - n_1^Q - r_1}{2}$, then we are done. Otherwise, set $\overline{\theta}_0$ so that $\tau_{s_0}(\overline{\theta}_0 - 1, \sigma_0) + 1 - \rho_A = \frac{n_1^A - n_1^Q - r_1}{2}$. ∎

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