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ORIGINAL PAPER

Sincere versus sophisticated voting when legislators vote sequentially

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Abstract Elsewhere (Groseclose and Milyo 2010), we examine a game where each legislator has preferences over (i) the resulting policy and (ii) how he or she votes. The latter preferences are especially important when the legislator is not pivotal. We show that when the game follows the normal rules of legislatures—most important, that legislators can change their vote after seeing how their fellow legislators have voted—then the only possible equilibrium is one where all legislators ignore their policy preferences. That is, each legislator votes as if he or she is not pivotal. The result, consistent with empirical studies of Congress, suggests that legislators should tend to vote sincerely, rather than sophisticatedly. In this paper we examine how outcomes change if we change the rules for voting. Namely, instead of a simultaneous game, we consider a game where legislators vote sequentially in a pre-determined order. We show that, opposite to the simultaneous game, an alternative wins if and only if a majority of legislators' *policy* preferences favor that alternative. Our results suggest that if Congress adopted this change in rules, then sophisticated voting would become frequent instead of rare.

1 Introduction

The rational-choice literature on Congress identifies two types of voting behavior, sincere and sophisticated. "Sophisticated voting" essentially means that legislators vote

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rationally, based on their preferences for policy. Thus, faced with a complex agenda involving a bill, amendments, a substitute bill, substitute amendments and the like, a sophisticated voter looks down the game tree and employs backward induction to inform each vote cast in the legislative process. In contrast, a "sincere voter" treats each roll call as if it were an isolated one-shot game, regardless of the subsequent implications that this choice may have for the final outcome of the legislative process. This behavioral assumption is typically justified as embodying the constraint that unsophisticated constituents impose on a re-election maximizing legislator; in other words, naive constituents induce legislators to act on "position-taking" preferences that may conflict with their "outcome preferences."

Put this way, sophisticated voting is consistent with forward-looking and rational behavior among all political actors and so, not surprisingly, has been the favored approach to modeling legislative behavior among rational choice theorists. However, Groseclose and Milyo (2010) conduct an extensive review of the empirical literature on Congressional voting and identify only a handful of isolated roll-call votes that plausibly indicate instances of sophisticated voting. Meanwhile, more systematic tests (Ladha 1994; Poole and Rosenthal 1997; Wilkerson 1999) decidedly conclude that sophisticated voting is very rare.

Groseclose and Milyo (2010) propose a solution to this apparent puzzle by making note of a previously ignored institutional feature of roll call voting in Congress: the prohibition against "quick gavels." The common practice in both the U.S. House and Senate is that roll call votes end only when no legislator desires to change his or her vote. [1] The rule thus requires that every roll-call vote must be part of a pure-strategy Nash Equilibrium. Given this, Groseclose and Milyo demonstrate that the only possible equilibrium is for each legislator to vote sincerely.

In this paper we show, however, that if the rules of the game are altered slightly, then outcomes will change greatly. Namely, instead of voting simultaneously, suppose that legislators vote sequentially in a pre-determined order. We show that this causes sophisticated voting to be common.

2 Model

Let $N = \{1, 2, \ldots, n\}$, n odd and $n \geq 3$, be a set of legislators, who must choose between a bill b and an amendment a by majority rule. Assume that legislator n votes first, then legislator $n-1$, and so on. Assume that each legislator is perfectly informed about how previous legislators have voted and completely informed about the preferences of the other legislators. The equilibrium concept that we adopt is subgame-perfect Nash.

We interpret the vote between a and b as the first round of a two-round voting game. Although we do not model the second round, we assume that if a wins the first round, then it will lose in the second round to a status quo q, and all legislators know

[1] The rules of each chamber establish only a minimum time that must be permitted for a roll call vote, not a maximum. The norm of "no quick gavels" is so strong that we find only four instances of quick gavels in the entire history of Congressional voting, each of which was controversial.

this. Accordingly, if a legislator prefers a to b, yet prefers b to q, then she has an opportunity to vote sophisticatedly—that is, to vote for b even though she prefers a. Meanwhile, we assume that if b wins in the first round, then it will also win in the second round, and all legislators know this. Thus, a is a potential killer amendment.

Let $U_i(x, y)$ be legislator i's payoff when x is the winning alternative and y is the alternative for which she votes. We assume that utility is additively separable. That is, there exist two functions, $o_i()$ and $p_i()$, such that

$$U_i(x, y) = o_i(x) + p_i(y).$$

We say that $o_i()$ represents i's *outcome* preferences and $p_i()$ represents i's *position-taking* preferences.

Often, when an opportunity for sophisticated voting arises, a legislator's outcome and position-taking preferences differ. For instance, suppose the "true" policy preferences of legislator i and all her constituents are a over b and b over q. Thus, if the legislator or her constituents could unilaterally determine policy, then they would choose a over b. We interpret position-taking preferences as reflecting those preferences i.e., $p_i(a) > p_i(b)$. A consequence of position-taking preferences is that if constituents do not understand the voting agenda, then they might think that the legislator best represents them if she votes for a instead of b, even though this could cause the eventual policy outcome to be q, the least-favored choice of the constituents. Accordingly, if the legislator is not pivotal, she prefers to vote according to her position-taking preferences, i.e., for a over b.

However, since "a vote for a is really a vote for q," and since the legislator prefers b over q, she prefers that b defeat a in the first round. We let outcome preferences reflect this ranking i.e., $o_i(b) > o_i(a)$.

We say that a legislator votes *sophisticatedly* if her outcome and position-taking preferences rank a and b differently, and she votes according to her outcome preferences. We say that a legislator votes *sincerely* if her vote is consistent with her position-taking preferences.

For simplicity, we assume that no legislator is ever indifferent over how she votes, whether she is pivotal or not. That is, for all $i \in N$, $p_i(a) \neq p_i(b)$ and $o_i(a)+p_i(a) \neq o_i(b) + p_i(b)$.

Define a *dominant-a legislator* as one who prefers to vote for a, regardless of whether she is pivotal—i.e., regardless of whether she changes the winning alternative with her vote. Formally, i is a *dominant-a legislator* if and only if

$$p_i(a) > p_i(b) \quad \text{and} \quad o_i(a) + p_i(a) > o_i(b) + p_i(b).$$

We define a *dominant-b legislator* in a similar manner.

Define a *contingent-a legislator* as one who prefers to vote for a if she changes the winning alternative with her vote, otherwise she prefers to vote for b. Formally, i is a *contingent-a legislator* if and only if

$$o_i(a) + p_i(a) > o_i(b) + p_i(b) \quad \& \quad p_i(b) > p_i(a).$$

We define a *contingent-b legislator* in a similar manner.

3 Result

Define $s(j)$ as the *strength* of alternative a when it is legislator j's turn to vote. (Recall that legislator n votes first, $n-1$ votes second, and so on.) It equals the margin by which a wins if every remaining legislator votes as if he or she is pivotal. Formally,

$$\begin{aligned} s(j) = &\text{ Total votes for } a \text{ after legislator } j+1 \text{ votes} \\ &-\text{Total votes for } b \text{ after legislator } j+1 \text{ votes} \\ &+\text{Remaining dominant-}a \text{ legislators after legislator } j+1 \text{ votes} \\ &-\text{Remaining dominant-}b \text{ legislators after legislator } j+1 \text{ votes} \\ &+\text{Remaining contingent-}a \text{ legislators after legislator } j+1 \text{ votes} \\ &-\text{Remaining contingent-}b \text{ legislators after legislator } j+1 \text{ votes} \end{aligned}$$

Some properties of $s(j)$ follow directly from its definition:

- (I) $s(0)$ equals a's margin of victory after the final round of voting.
- (II) Since n is odd, $s(j)$ is odd, for all j.
- (III) If a contingent-a or dominant-a legislator votes for a, the strength of a does not change—that is $s(j-1)$ has the same value as $s(j)$. The strength of a changes only if one of these legislators votes for b (in which case it decreases) or if a contingent-b or dominant-b legislator votes for a (in which case it increases).
- (IV) For all $j < n$, either (i) $s(j) = s(j+1) + 2$, (ii) $s(j) = s(j+1)$, or (iii) $s(j) = s(j+1) - 2$.

The following proposition shows that a wins if and only if the strength of a is positive before the first round of voting. That is, a wins if and only if the dominant-a and contingent-a legislators outnumber the dominant-b and contingent-b legislators. As our earlier paper discusses, this contrasts starkly with the simultaneous game, where a wins if and only if the dominant-a and contingent-b legislators outnumber the dominant-b and contingent-a legislators.

Proposition *Alternative a wins if and only if* $s(n) > 0$.

To prove the proposition it is first useful to prove the following lemma.

Lemma 0 *If* $s(1) \geq 1$, *then a wins. If* $s(1) \leq -1$, *then b wins.*

Proof First, note that if $s(1) > 1$ (hence, by II, $s(1) \geq 3$), then, by the definition of $s()$, no matter how legislator 1 votes, $s(0) \geq 1$. By property (I), this means a wins.

Now suppose $s(1) = 1$. If legislator 1 is dominant-a or contingent-a, then he prefers to vote for a, which makes $s(0) = 1$; hence a wins. If legislator 1 is dominant-b or contingent-b, then by definition of $s()$, after legislator 2 votes, then the "Total votes for a" minus the "Total votes for b" is 2. Consequently, no matter how legislator 1 votes, $s(0) \geq 1$; hence a wins. A similar proof shows that if $s(1) \leq -1$, then b wins. □

To prove the proposition, it is also useful to define the statement Q_j, which roughly means that in round j and in subsequent rounds, all legislators vote rationally. Most important, this means that if a legislator is contingent (i.e. contingent-a or contingent-b), then she votes optimally. That is, she votes her policy preferences if an only if she sees that her vote will be pivotal. Further, she assumes that all future-voting legislators will behave the same way.

Formally, let Q_j be the statement: "For all $i \in [1, j]$, if legislator i is a contingent-a legislator, then she votes for a if and only if $s(i) = 1$; and if legislator i is a contingent-b legislator, then he or she votes for b if and only if $s(i) = -1$."

To prove the proposition, we prove three additional lemmas.

Lemma 1 *Suppose Q_j is true, and $s(j) \geq 1$. Then $\forall k \in [1, j]$, it must be that $s(k) \geq 1$.*

Proof Assume Q_j is true, and $s(j) \geq 1$. Now suppose that the claim of the lemma is false. Then, using property (IV), there must exist $k_0 \in [1, j]$ such that $s(k_0) = 1$ and $s(k_0 - 1) = -1$. That is, the strength of a becomes less than zero after legislator k_0 votes.

By definition of $s()$, the only way that the strength of a can decrease is if a contingent-a or a dominant-a legislator votes for b. Since a dominant-a legislator always prefers to vote for a, this means that k_0 must be a contingent-a legislator, and she votes for b.

However, recall that $s(k_0) = 1$. By Q_j (and since $k_0 \in [1, j]$), k_0 votes for a, a contradiction. It follows that $\forall k \in [1, j]$, $s(k) \geq 1$. □

Lemma 2 *Suppose Q_j is true, and $s(j) \leq -1$. Then $\forall k \in [1, j]$, $s(k) \leq -1$.*

(The proof follows the same logic as the proof for Lemma 1.)

Lemma 3 *Suppose $1 \leq j < n$. If Q_j is true, then Q_{j+1} is true.*

Proof Assume Q_j is true. To show Q_{j+1}, we must show that legislator $j + 1$ votes "optimally." That is, if she is contingent-a, then she votes for a if and only if $s(j+1) = 1$. And if she is contingent-b, then she votes for b if and only if $s(j + 1) = -1$.

To do this, first suppose that $j + 1$ is a contingent-a legislator. We must show that she votes for a if and only if $s(j + 1) = 1$. To do this we consider three cases: (i) $s(j + 1) \geq 3$, (ii) $s(j + 1) = 1$, and (iii) $s(j + 1) \leq -1$.

(i) If $s(j + 1) \geq 3$, then regardless of how $j + 1$ votes, $s(j) \geq 1$. That is, in the next round, the strength of a will remain at least 1. By Lemma 1 and Q_j, this means that $s(1) \geq 1$, which, by Lemma 0, implies that a wins. Thus, a wins no matter how $j + 1$ votes. Thus, $j + 1$ is not pivotal, which means she prefers to vote for b.

(ii) Now suppose $s(j+1) = 1$. If $j+1$ votes for b, then $s(j) = -1$. By Q_j, Lemma 2 and Lemma 0, this means that b will win. On the other hand, if $j+1$ votes for a, then $s(j) = 1$. By Q_j, Lemma 1 and Lemma 0, a will win. Thus, a wins if and only if $j+1$ votes for a. Hence, $j+1$ is pivotal. Since she is a contingent-a legislator, she votes for a.

(iii) Now supose $s(j+1) \leq -1$. Since $j+1$ is a contingent-a legislator, by the definition of $s()$, the strength of a falls if she votes for b, and it remains the same if she votes for a. Thus, no matter how she votes, the strength of a cannot increase. Thus, $s(j) \leq -1$, which by Q_j, Lemma 2, and Lemma 0, implies that b wins. Most important, no matter how $j+1$ votes, b wins. Thus $j+1$ is not pivotal. Since she is a contingent-a legislator, this means that she votes for b.

It thus follows that $j+1$ votes for a if and only if $s(j+1) = 1$. A similar argument shows that if $j+1$ is a contingent-b legislator, then she votes for b if and only if $s(j+1) = -1$. These two statements, along with our assumption that Q_j is true, imply that Q_{j+1} is true. □

Proof of the Proposition By the definition of $s()$, it trivially follows that Q_1 is true. This, Lemma 3, and the law of induction, imply that Q_n is true.

Now suppose that $s(n) > 0$. By the properties of $s(n)$ (specifically, that it must be odd), this means that $s(n) \geq 1$. This, Q_n, and Lemma 1 imply that $s(1) \geq 1$, which, by Lemma 0, implies that a wins.

Now suppose that $s(n) \leq 0$. By the properties of $s(n)$, this means that $s(n) \leq -1$. This, Q_n, and Lemma 2 imply $s(1) \leq -1$, which, by Lemma 0, implies that b wins. It follows that a wins if and only if $s(n) > 0$. □

4 Conclusion

Lemma 3 characterizes the voting strategies of contingent legislators. Namely, contingent- a legislators vote for a if and only if the strength of a is 1 when it is their turn to vote. Contingent-b legislators vote for b if and only if the strength of a is -1 when it is their turn to vote. Further, these are the *unique* strategies of these legislators for any subgame perfect equilibrium.

The Proposition provides a simple method to determine which alternative is the winning outcome: We simply count how each legislator would vote if he or she were pivotal. This gives a stark contrast to the simultaneous game, where instead the winner is determined by counting how legislators would vote if they were *not* pivotal. Thus, loosely speaking, while sophisticated preferences are irrelevant in the simultaneous game, in the sequential game they are all important.

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