

Predictability and Power in Legislative Bargaining

S. NAGEEB ALI

Pennsylvania State University

B. DOUGLAS BERNHEIM

Stanford University

and

XIAOCHEN FAN

New York University

First version received August 2014; Editorial decision January 2018; Accepted January 2018 (Eds.)

The rules and procedures of legislatures often provide legislators with information bearing on the identities of upcoming proposers. For a broad class of legislative bargaining games, we establish that Markovian equilibria necessarily deliver all economic surplus to the first proposer whenever the information structure permits the legislators to rule out some minimum number of proposers one round in advance. This result holds regardless of the recognition process and even if players vary in patience and risk aversion. It raises the possibility that procedures adopted in the interest of transparency may contribute to the imbalance of political power.

Key words: Bargaining power, Concentration of power, Predictability, Transparency.

JEL Codes: D72, C78

1. INTRODUCTION

A central objective of democracy is to distribute political power equally among citizens. Participatory and representative institutions of government are usually designed with that end in mind. For example, in *Reynolds v. Sims* (1964), the Supreme Court construed the Equal Protection Clause of the U.S. Constitution as requiring representation in state legislatures based on districts with roughly equal populations, according to the principle of “one person, one vote”. And yet an important theme of both academic and popular discourse concerns the persistent and pronounced imbalance of power that prevails in modern democracies (*e.g.* [Acemoglu and Robinson, 2005, 2012](#)). Indeed, recent populist movements in the U.S., Western Europe, and Latin America involve struggles between average citizens and privileged elites who wield disproportionate power. Political influence remains surprisingly concentrated even in settings that appear reasonably egalitarian on paper.

The literature has explored a variety of factors that contribute to the concentration of political power. Some, such as financial inducement and activism, concern the mechanisms through which

The editor in charge of this paper was Botond Koszegi.

citizens influence their elected representatives; see, for instance Grossman and Helpman (2002). Others concern the procedures that representatives use to make laws. For example, power can flow from control over the legislative agenda, which may in turn result from seniority rules or committee structures (Berry and Fowler, 2016, 2018).

An important branch of the literature suggests that unequal political power may be an intrinsic feature of multilateral bargaining, one that the various mechanisms mentioned in the previous paragraph may exploit and amplify. The reason is that, at any given point in time, only one person has the power to suggest a course of collective action. The significance of this “proposal power” is evident from the seminal work of Baron and Ferejohn (1989), which has been widely applied and extended.¹ In their framework, a legislator is chosen at random to make a proposal concerning the division of a fixed payoff. If the proposal receives sufficient support, it is implemented and deliberation ends. Otherwise, the process repeats until some proposal is accepted or a fixed time limit is reached (if one exists). Focusing on stationary equilibria, Baron and Ferejohn demonstrate that the fraction of surplus received by the first proposer depends on the legislators’ discount factors, but always exceeds one-half.² From an ex ante perspective (*i.e.*, prior to the resolution of the proposer’s identity), expected payoffs are distributed equally, but the realized distribution is sharply skewed.

In this article, we examine how knowledge about the allocation of future proposal power affects the concentration of political influence. In the basic Baron–Ferejohn framework, legislators lack such knowledge: the identities of future proposers are entirely unpredictable. While one can defend that assumption as a stylized attempt to capture the arguably inscrutable nature of legislative protocols, for many applications it is plainly unrealistic, for two reasons. First, uncertainty concerning the sequencing of proposers may resolve itself, either partially or completely, earlier than the Baron–Ferejohn framework envisions. As an example, the regular publication of a legislative calendar or agenda can reveal the identities of upcoming proposers. Likewise, when the Chair has some discretion regarding the selection of proposers, and when each potential Chair has known alliances or affiliations, resolution of uncertainty concerning the Chair’s identity can narrow down the set of likely proposer sequences, at least for the near term. Second, the recognition process itself may be less random than the Baron–Ferejohn framework envisions. The rules of a legislature may restrict possible selections, for example by requiring alternation between members of opposing coalitions, or by giving priority to senior legislators, high-ranking members of particular committees, or those who have not been recognized recently. All of these features are found in actual legislative institutions. For example, the U.S. House of Representatives uses legislative calendars (as detailed in Chapter 9 of Brown, Johnson and Sullivan’s “House Practice: A Guide to the Rules, Precedents, and Procedures of the House”), affords the Chair with discretionary power (as detailed in Chapter 46.2), and has rules governing recognition priority (as detailed in Chapter 46.4–46.9).

We modify the Baron–Ferejohn framework to allow for information structures and selection mechanisms that render upcoming proposers predictable to varying degrees. The main lesson of our analysis is that, even with a modest degree of predictability, *the first proposer receives the entire surplus, irrespective of legislators’ discount factors*. More specifically, if the voting

1. For examples of papers that investigate, enrich, and/or apply the Baron–Ferejohn framework, see Austen-Smith and Banks (1988), Baron (1991, 1996), Baron and Kalai (1993), Banks and Duggan (2000), Diermeier *et al.* (2003), Merlo (1997), McCarty (2000), Eraslan (2002), Eraslan and Merlo (2002), Kalandrakis (2004a,b, 2006), and Battaglini and Coate (2007, 2008).

2. Specifically, the first proposer keeps the fraction $1 - \frac{\delta(n-1)}{2n}$ of the total payoff while $\frac{n-1}{2}$ randomly selected legislators (other than the proposer) each receive a payoff of $\frac{\delta}{n}$, where n is the (odd) number of legislators and δ is their common discount factor.

rule requires at least q favourable votes (out of n) for a proposal to pass, this conclusion holds for Markovian equilibria as long as each participant always has enough information to rule out at least q legislators as the next proposer. For example, a process that randomly selects proposers as in Baron–Ferejohn but publishes a calendar that preannounces them one round in advance satisfies this condition. Thus, information about the distribution of future proposal power dramatically amplifies the forces that generate concentrated political power within the Baron–Ferejohn framework. Notably, [Berry and Fowler \(2018\)](#) conclude that the conditions for our results “appear to be met in congressional committees”.

Why does modest predictability of the upcoming proposers have this effect? To formulate a successful proposal, a legislator must recruit $q - 1$ supporters by offering to share surplus. The minimum cost of recruiting any given supporter depends inversely on the amount of power that individual expects to have in the next round. Thus, any ability to identify those who are unlikely to make proposals in the next round, and who therefore expect to have relatively little power, augments the proposer’s ability to extract surplus. To gauge the magnitude of this effect, consider the case in which bargaining continues indefinitely until a majority consents to a proposal ($q = \frac{n+1}{2}$, where n is the number of legislators), and assume for simplicity that the information structure enables legislators to rule out at least $\frac{n+1}{2}$ of their members as the next proposer one round in advance. For the purpose of this illustration, also assume this process is symmetric and stationary, and that each player’s discount factor is $\delta < 1$.³ Symmetry and stationarity imply that the smallest fraction of surplus retained by any given proposer in any equilibrium, call it λ , is the same for all proposers and in all rounds. Now consider the first proposer. Given our assumptions, he can identify $\frac{n-1}{2}$ legislators other than himself who collectively expect to receive at most $1 - \lambda$ in the next round. Consequently, he can recruit them as supporters by offering them no more than $\delta(1 - \lambda)$ in total, leaving at least $1 - \delta + \delta\lambda$ for himself. By definition, this lower bound on his equilibrium payoffs cannot exceed λ . But we can have $1 - \delta + \delta\lambda \leq \lambda$ only if $\lambda = 1$. The core of our analysis formalizes and generalizes this simple reasoning.

We also explore the magnitude of proposer power when the degree of “one-period predictability”, d (defined as the number of legislators who can be ruled out as the next proposer one period in advance), falls short of the critical threshold (in other words $d < q$). As long as it is always possible to rule out q legislators as the next proposer with high probability (though not necessarily with certainty), proposers capture nearly all of the surplus. The same is true if there is some small chance that the recognition process will become unpredictable in the future. In cases where each legislator’s odds of being the next proposer are either 0 or $\frac{1}{n-d}$, the first proposer’s power increases monotonically in d , and in large legislatures depends only on $\frac{d}{q}$.

The logic of our main result applies across a range of environments beyond the Baron–Ferejohn framework. It extends to environments with general coalition structures (allowing for weighted voting rules), non-transferable utility, and mechanisms through which legislators can influence the selection of the current and future proposers. In all of these settings, when the identity of the next proposer is sufficiently predictable, the first proposer’s share of total surplus is unaffected by heterogeneity in discount factors, recognition probabilities, voting weights, risk-aversion, and the costs of influencing the recognition process. Somewhat weaker but qualitatively similar results emerge in settings with an efficient default option (rather than a highly inefficient one as in Baron–Ferejohn), private information about selection probabilities, and inequality-averse legislators.

3. For example, the following process is stationary: for each round, a proposer and $\frac{n+1}{2}$ non-proposers are selected randomly one round in advance, all with equal probabilities, and the $\frac{n+1}{2}$ non-proposers are revealed.

Moreover, the equilibrium identified in our main result depicts an extremely simple norm and does not presuppose a high level of sophistication. The equilibrium norm is that proposers demand the entire surplus and a minimal winning coalition votes in favour. With an expectation that this norm will prevail in the following period (for which the proposer is known), there is plainly nothing to be gained by departing from the norm in the current period. Strikingly, this pure-strategy equilibrium is highly robust with respect to the details of the bargaining environment: the behaviour remains completely unchanged even with a finite deadline, or when players differ with respect to their prospects for future recognition, voting weights, patience, and/or risk preferences. In contrast, the standard SSPE studied by [Baron and Ferejohn \(1989\)](#) is in mixed strategies and it requires careful calibration of randomizations to account for heterogeneity in players' power and preferences. Furthermore, for generic parameters, the SSPE of the infinite horizon game is not the limit of equilibria of long finite games ([Norman, 2002](#)), and is thus fragile to players learning about a deadline for reaching agreements. Thus, the equilibrium norm we identify is simple, "detail-free", and places minimal cognitive demands on the legislators.

Is it possible to achieve a more equal distribution of political power by modifying the protocols of negotiation? [Baron and Ferejohn \(1989\)](#) also examine an "open-rule process" in which legislators can propose amendments to a proposal before they put it to a vote. They demonstrate that this alternative procedure moderates the power of proposers and generates more egalitarian distributions of resources. In contrast, we show that when the degree of one-period predictability is less than q , an open-rule amendment process only induces proposers to share surplus with the first potential amender. We also point out that [Baron and Ferejohn \(1989\)](#) restrict attention to a setting in which amendments are unrestricted: a legislator can, in effect, move to amend a proposal by replacing it with an entirely unrelated proposal. In practice, most legislative bodies have germaneness rules that limit the degree to which an amendment can deviate from the proposal it seeks to modify. As we explain, such rules can severely limit the extent to which the proposer shares surplus even with the first potential amender.

We also investigate whether an alternative amendment procedure can limit the proposer's power more effectively than the standard open-rule process. We devise a procedure wherein the legislature brings a proposal to a vote only after a designated set of legislators all move the question sequentially. With unrestricted amendments and patient negotiators, this novel procedure can achieve a high degree of egalitarianism even when upcoming proposers and amenders are revealed in advance. However, germaneness rules can sharply limit its effectiveness, leaving the initial proposer with near-dictatorial power.

Our analysis has significant positive, normative, and methodological implications. From a positive perspective, it provides a possible contributory explanation for the high concentration of political power in collective decision-making, and points to features of bargaining protocols that may help to determine the degree of concentration. For example, in line with the prediction of our amplification results, [Berry and Fowler \(2016, 2018\)](#) find that committee chairs enjoy significantly more power and influence than most committee members, and suggest that "... power in Congress is concentrated among a small set of committee chairs" Obviously, we do not mean to suggest that proposer power is absolute in practice. Real legislatures are much more complicated than our simple models, and many additional considerations presumably come into play. Even so, the forces we identify may still be at work, influencing outcomes directionally by amplifying the power of a temporary agenda-setter.

From a normative perspective, our analysis has implications for the design of institutions that govern multilateral negotiations. As noted above, it identifies a potential drawback of germaneness rules that limit the scope of amendments, and thus favours the types of procedures used in the U.S. Senate over those employed by the House of Representatives. Even more directly, it suggests that a reduction in the predictability of a recognition process can lead to more equitable outcomes.

There are two ways to reduce predictability: either explicitly introduce randomness, or increase inscrutability. Common wisdom holds that opaque and inscrutable institutions are vulnerable to corruption that undermines fairness. Our analysis points to a countervailing consideration: an increase in the transparency (and thus predictability) of decisions governing recognition can lead to unintended increases in the concentration of political power.

From a methodological perspective, our analysis provides new insights concerning a class of models that have played a central role in the analysis of political institutions. Ours is not the first study to examine multilateral bargaining protocols with recognition orders that are, to some degree, predictable. However, it is to our knowledge the first to distill this feature and explicitly explore how it amplifies the concentration of political power.

The article proceeds as follows. Section 2 provides a detailed account of related work in the literature and clarifies the nature of our contribution. Section 3 elaborates on the intuition for our results through some simple examples. We present our framework in Section 4 and our core results in Section 5, along with some comparative statics. Section 6 concerns various extensions, and Section 7 analyses open-rule negotiations. Section 8 concludes. All omitted proofs appear in an online [Supplementary Appendix](#).

2. RELATED LITERATURE

Our analysis illustrates how the combination of a non-unanimous voting rule (excludability), and information structures and selection mechanisms that render upcoming proposers predictable, confers extreme power to those with short-term control over agenda-setting. Perhaps surprisingly, neither predictability nor excludability, in isolation, engenders such inequality. [Rubinstein \(1982\)](#) models an alternating-offer protocol in which future bargaining power is perfectly predictable but requires a unanimity voting rule; in both bilateral and multilateral settings, stationary equilibria yield approximately equal division as $\delta \rightarrow 1$ ([Osborne and Rubinstein, 1990](#)). [Baron and Ferejohn \(1989\)](#) model excludability, insofar as the proposer need not include all players in her minimal winning coalition, but assume that future bargaining power is completely unpredictable; as a result, the proposer shares roughly half the surplus with the winning coalition. Combining these two features generates a starkly different prediction, and illustrates how predictability can amplify the concentration of power hinted at by these previous studies.

An important feature of our analysis is that it distinguishes between the characteristics of the proposer recognition process and the characteristics of the information structure attached to that process. To our knowledge, we are the first to explicitly model information about future bargaining power, and disentangle its effects from that of the recognition process. Of course, some recognition processes are by their nature predictable. Examples include settings in which the same legislator makes the proposal in every period, or the opportunity to propose rotates through legislators in a fixed sequence. However, *all* recognition processes, including the symmetric random recognition rule of [Baron and Ferejohn \(1989\)](#), *become* predictable to varying degrees when coupled with certain types of information structures. Most obviously, a legislative calendar that always lists the next proposer confers one-period predictability of degree $n - 1$ upon *any* recognition process.

Because the existing literature has not modelled information about future bargaining power, prior results that speak to the role of predictability in determining proposer power do so by focusing exclusively on recognition processes that inherently manifest a degree of predictability (*e.g.* [Baron and Ferejohn, 1989](#); [Kalandrakis, 2006](#)). Such analyses confound the role of predictability with other considerations. To take a stark example, suppose the same legislator is expected to be the proposer in every period. In that case, she certainly has the power to extract all of the surplus. However, that power could in principle derive from her status as a dictator and not from the predictability of the recognition process.

Our analysis demonstrates, in essence, that near-term predictability is, in fact, the main source of proposer power in these settings. It gives rise to high concentrations of power even when the confounding consideration of durable recognition priority is not present. The current proposer derives her power not from her high likelihood of proposing in subsequent periods, but rather from the fact that uncertainty concerning the identity of the next proposer—whoever it may be—is low. As long as the information structure permits legislators to rule out q members as the next proposer, the current proposer will appropriate the entire surplus even when her priority status is fleeting, and not merely when it is persistent.

Other papers likewise study recognition processes that are inherently predictable, and hence cannot illuminate the separate roles of the processes themselves and the information structures appended to them. One strand of work in this vein directly extends Rubinstein (1982) to multilateral negotiations requiring unanimous consent, by assuming that bargaining power deterministically rotates through the group.⁴ While this process is entirely predictable, the requirement of unanimity neutralizes the forces that drive our results. Another strand studies Markov recognition processes, wherein the recognition probabilities in period $t+1$ depend only on the identity of the period- t proposer.⁵ We consider a much broader class of recognition processes that allow for arbitrary forms of history dependence.⁶ A simple corollary of our main result establishes that, within this broad class, the addition of a limited legislative calendar specifying the upcoming proposer one round in advance renders the features of the recognition process (upon which previous results focus) entirely irrelevant, in that the first proposer always extracts all of the surplus.⁷

In extending our analysis to environments in which a legislator's recognition priority results from the choices of a chair with known preferences or from strategic political maneuvering, we introduce considerations studied in the literature on endogenous bargaining power (Yildirim, 2007; Ali, 2015; Diermeier *et al.*, 2016). We show that as long as legislators can predict the outcome of their strategic interaction, the first proposer captures the entire surplus. A related result appears in the subliteration on “rejector-friendliness” (Chatterjee *et al.*, 1993), which considers processes wherein the first voter to reject a proposal (according to some established order) experiences either an elevated or depressed recognition probability in the next period. Ray (2007) shows that the first proposer can capture the entire surplus when that probability is zero, even with the requirement of unanimous consent.⁸ Our results are complementary and apply to different settings: in our model, bargaining power is potentially non-stationary and independent of prior votes, rather than the other way around, and we focus on the role of information structures, which has no counterpart in this subliteration.

Our results also speak to the importance of commitment: if the second proposer could commit to an equitable distribution of surplus, others would reject any exploitative offer made by the first proposer, and so instead he too would propose a more equitable outcome.⁹ Relatedly,

4. See Herrero (1985), Binmore (1986), Asheim (1992), and Kultti and Vartiainen (2010).

5. Kalandrakis (2004a) provides an existence theorem for this class of environments. Britz *et al.* (2010) characterize outcomes based on the characteristics of the Markov processes, but require irreducibility thereby excluding processes that exhibit one-period predictability of degree q .

6. We are not the first to examine a canonical class of recognition processes; see Merlo and Wilson (1995), Yildiz (2003, 2004), and Cho and Duggan (2009). However, those papers focus on other issues.

7. Because the previous literature does not model information structures explicitly, players learn about future bargaining power only by observing who is recognized beforehand. Bargaining power becomes “more predictable” in period $t+1$ only if one varies the actual primitive recognition process in period $t+1$ so as to concentrate that power (conditional on the history of recognition). In contrast, our analysis shows that proposers can exploit information about future bargaining power even when the underlying process itself remains highly symmetric along all realized paths.

8. See Kawamori (2013) and Britz *et al.* (2014) for extensions to this result.

9. As an illustration, suppose that the proposer at $t=1$, p^1 , can commit to an offer to be made at $t=1$ before the proposer at $t=0$, p^0 , makes an offer. The legislator p^1 has an incentive to ensure that she is the most expensive member

Bernheim *et al.* (2006) prove that in negotiations with an evolving status quo, a mildly predictable recognition process can provide the *last* proposer with dictatorial power. Note also the contrast between the implications of our paper and that of Diermeier and Fong (2011), in which a single agenda-setter's inability to commit to future proposals limits the surplus she can extract; in our case, it is the inability of future agenda-setters to commit that permits the current agenda-setter to extract surplus.

3. EXAMPLES

Because we aim for generality, our formal analysis involves a high level of abstraction. To aid interpretation, we describe three illustrative bargaining protocols that fit into our framework.¹⁰ Readers may find it useful to keep these concrete examples in mind throughout the rest of the article.

Each example shares the following common features: n legislators negotiate over the division of a fixed payoff, normalized to unity, in a (potentially infinite) sequence of rounds; in each round, one legislator makes a proposal; if the proposal receives at least q favourable votes (where $q < n$), it passes and the negotiation ends; if the proposal receives fewer than q favourable votes, the process proceeds to the next round; permanent disagreement results in zero payoffs. Our examples differ with respect to the mechanics of the proposer selection process and the nature of the associated information structure.

Example 1: A simple legislative calendar. Suppose each legislator becomes the period- t proposer with probability $\frac{1}{n}$, independently of the past. If the period- t proposer is revealed after all period- $(t-1)$ decisions, we have the Baron–Ferejohn model. Here we append a different information structure to the same recognition process: the period- t uncertainty is resolved at the outset of period $t-k$ and the realization is announced immediately. In effect, each period begins with the publication of a “calendar” listing the current proposer along with the next k upcoming proposers, in order. We say that this process is characterized by k -period predictability of degree $n-1$, inasmuch as the period- t calendar permits participants to rule out $n-1$ legislators as the period- t' proposer for each t' from $t+1$ to $t+k$.

To build intuition, consider the case of $k=1$, and imagine for the moment that negotiations end after two periods, with a default option that yields a payoff of zero for all participants. The unique sub-game perfect equilibrium (henceforth SPE) outcome emerges from backward induction, as follows. If an agreement is not reached in the first period, the second-period proposer will extract all of the surplus. Because the calendar shows everyone who the second-period proposer will be, the first-round proposer can secure $1-\epsilon$ for all $\epsilon > 0$ by offering to divide ϵ among $q-1$ voters other than himself and the second-period proposer. Thus, the first proposer extracts all of the surplus.

The same reasoning plainly extends to all finite horizon settings. With an infinite horizon, it is easy to see that there exists an SPE in which the first proposer receives the entire prize: in every period, the selected legislator proposes to keep the prize for himself, and all legislators (except the next proposer, whose identity is known) vote in favour. Given the continuation equilibrium,

of a minimal winning coalition at $t=0$. She can do at least as well as committing to an offer providing 0 to $q-1$ players (including the first proposer), $\frac{1}{n-q}-\epsilon$ to herself, and equal shares for the remaining $n-q-1$ players. The legislator p^0 then chooses a policy in which he obtains $q-2$ players for free and proposer p^1 at a cost of $\frac{\delta}{n-q}-\delta\epsilon$. It is unclear as to what would emerge as an equilibrium outcome, or whether commitment leads to an indeterminacy problem when the entire sequence of potential proposers can commit to their proposals ahead of time (Roessler *et al.*, 2016).

10. See Section 4 for a formal demonstration of the claim that our framework subsumes these examples.

rejecting the proposal would simply shift the prize from the current proposer to the next one, which is of no benefit to other legislators. Thus, an equilibrium prevails. Indeed, given the symmetric and stationary nature of this example, a straightforward generalization of the argument given in the introduction (for the case of majority rule) proves that this is the only stationary subgame-perfect equilibrium.

Example 2: (Somewhat) predictable chairs. Suppose each legislator becomes the period- t chair with probability $\frac{1}{n}$, and that realizations are independent across periods. The chair then selects the period- t proposer. Each legislator i has a known group of political allies, A_i , and as chair would recognize j with probability p_{ij} , where $\sum_{j \in A_i} p_{ij} = 1$. The uncertainty concerning the chair's choice is meant to capture high-frequency events that make particular political relationships either more or less valuable.¹¹

If the period- t chair is announced after all period- $(t-1)$ decisions, then we have a Baron-Ferejohn model with possibly unequal recognition possibilities. Here we append a different information structure to the same recognition process: uncertainty concerning the identity of the period- t chair is resolved at the outset of period $t-1$ and announced immediately. In other words, we make the reasonable assumption that newly appointed chairs do not assume their duties instantly. Notice that this process is characterized by 1-period predictability of degree $n - \max_i |A_i|$, inasmuch as the appointment of the period- t chair in period $t-1$ permits participants to rule out at least $n - \max_i |A_i|$ legislators as the period- t proposer. Our analysis implies that, as long as no legislator has too many allies ($n - \max_i |A_i| \geq q$), the first proposer captures all the surplus.

In the interest of greater realism, one might elaborate on this simple framework in a variety of ways. For example, one could explicitly treat the chair's recognition of proposers as a strategic choice (guided by preferences over allies), modify the payoff structure to allow for common objectives among allies, allow for the possibility that chairs serve for multiple periods, and/or model the political process governing the chair's selection. As we demonstrate, our main result generalizes along each of these dimensions.

Example 3: A rotating recognition requirement. Now consider a recognition rule that perpetually cycles through the set of legislators in a fixed order. This is the generalization of the classic two-person alternating-offer bargaining protocol to settings requiring unanimous consent among three or more parties (Osborne and Rubinstein, 1990). Notice that this recognition process inherently guarantees maximal predictability (technically, infinite-period predictability of degree $n-1$), and consequently our results apply.

Rotating recognition orders feature prominently in the formation of new governments within parliamentary systems (Austen-Smith and Banks, 1988). However, opportunities to make proposals cycle through parties (ordered by the number of votes received), rather than through legislators. Using n_{\max} to denote the size of the largest party, we see that this process inherently guarantees infinite-period predictability of degree $n - n_{\max}$, which means our results continue to apply, permitting the proposer to capture the entire surplus if $n - n_{\max}$ exceeds q . A more realistic treatment of political parties would allow for common objectives. As we demonstrate, our main result generalizes to accommodate this modification.

11. One can justify this model by assuming that i evaluates a distribution (x_1, \dots, x_n) made in period t according to the objective function $x_i + \sum_{j \in A_i} w_{ij}^t x_j$, where the welfare weights w_{ij}^t are independent random variables realized at the outset of period t and revealed only to the legislator i . To avoid complications arising from the treatment of ties, one can assume for the sake of simplicity that the distribution of welfare weights is non-atomic.

The contrast between the third example and the previous two is noteworthy. In examples 1 and 2, predictability is entirely determined by the properties of the information structure, and not by the properties of the recognition process. However, when the recognition process cycles through legislators, the set of possible information structures is degenerate, so the choice of information structures plays no role. With respect to modeling, our main departure from the current literature is to separate recognition processes from information structures as in Examples 1 and 2, and examine comparative statics with respect to the features of the information structure for fixed recognition processes. Our key insight is that the features of the recognition process become irrelevant once the information structure ensures a small amount of predictability, because in that case the first proposer necessarily captures all of the surplus.

4. THE MODEL

4.1. *Environment*

Consider a group of players, $\mathcal{N} \equiv \{1, \dots, n\}$, who are bargaining over the division of a fixed payoff: the policy space is $\mathcal{X} \equiv \{x \in [0, 1]^n : \sum_{i \in \mathcal{N}} x_i = 1\}$. Proposals are made at discrete points of time in $\mathcal{T} \equiv \{t \in \mathbb{N} : t \leq \bar{t}\}$, where $\bar{t} \leq \infty$ is the deadline for bargaining. In each period t , a player p^t in \mathcal{N} is recognized to propose a policy in \mathcal{X} . If the group approves the proposal according to the voting rules described below, the game ends and the policy is implemented. If the group rejects the proposal, play proceeds to the next period unless $t = \bar{t}$, in which case the game ends and each player obtains a payoff of 0.

Within period t , events unfold as follows. First, information concerning the identity of current and future proposers is revealed, and the proposer for period t , p^t , is determined. Second, that proposer makes a proposal in \mathcal{X} . Third, all legislators vote on the proposal. We describe these stages in further detail below.

Stage 1: Recognition and Information. The selection of proposer in period t may depend on random events and institutional rules that constrain the possible sequences of proposers, and players may obtain public information about the selection of future proposers. Formally, consider a complete and separable state space \mathcal{S} ,¹² and a time-homogeneous Markov Process $(\theta^t)_{t \in \mathcal{T}}$ that realizes values in \mathcal{S} and is (Borel-)measurable.¹³ We denote by s a generic element of \mathcal{S} , and by $\mu(\cdot|s)$, the Markov kernel that governs the transition between states. Let $\tilde{\mu}$ be the distribution of the state selected in period 0. Nature's move in period t is perfectly observed in period t and all subsequent periods, and s^t denotes the state chosen in period t . The recognition rule is a measurable function $P: \mathcal{S} \rightarrow \mathcal{N}$, where $P(s^t)$ is the proposer in period t when the state is s^t . Since the state space is arbitrary, and could in principle encode the full history of prior proposers, as well as other signals, this formulation is “canonical” in that it embeds every deterministic and stochastic recognition protocol that is independent of players' actions, along with every possible information structure that is likewise action-invariant.

This compact formulation embeds information about future recognition through the Markov kernel: in state s^t in period t , players ascribe probability $\int_{\mathcal{S}} \mathbf{1}_{\{P(s')=i\}} d\mu(s'|s^t)$ to player i being the proposer in period $t+1$, and analogously, iterations of this Markov kernel determine beliefs about recognition at future dates. Notably, two states s^t and \tilde{s}^t may coincide with respect to the history of proposers up to and including period t , but nevertheless induce different (common) beliefs about

12. A space is separable if it contains a countable dense set.

13. Time-homogeneity does not preclude non-stationarity because one can define the state to include aspects of the history.

recognition in future periods due to the arrival of different signals. The framework encompasses the extreme possibilities that the recognition order is known in advance, and that no information concerning the period- t proposer is revealed prior to period t . Between these extremes, we place no restrictions on the correlation structure governing the selection of proposers and the generation of signals.

While our compact notation does not separately identify recognition processes and information structures,¹⁴ it nevertheless flexibly accommodates arbitrary combinations of the two. To illustrate this point, we return to the Baron–Ferejohn model and the various examples discussed in Section 3.

- *The Baron–Ferejohn process:* Let $\mathcal{S} = \mathcal{N}$, $P(s) = s$, and $\mu(s'|s) = \frac{1}{n}$ for every s and s' .
- *A simple legislative calendar:* Let $\mathcal{S} = \mathcal{N}^{k+1}$, $P(s) = s_1$, and $\mu(s'|s)$ equals $\frac{1}{n}$ if $s'_j = s_{j+1}$ for $j = 1, \dots, k-1$, and equals 0 otherwise.
- *A (somewhat) predictable chair:* Suppose that each player is selected to be chair with probability $\frac{1}{n}$ and when player i is chair today, she chooses tomorrow's proposer according to a vector of probabilities $p_i = (p_{i1}, \dots, p_{in})$. We represent this process as follows: let $\mathcal{S} = \mathcal{N}^2$, where the first coordinate, s_1 , denotes the proposer today and the second coordinate, s_2 , denotes the identity of the chair who selects the proposer tomorrow. Accordingly, $P(s) = s_1$ and $\mu(s'|s) = \frac{1}{n} p_{s_2 s'_1}$.
- *A rotating recognition requirement:* Let $\mathcal{S} = \mathcal{N}$, $P(s) = s$, and $\mu(s'|s) = 1$ if $s' = s \bmod n + 1$, and 0 otherwise.

As a further illustration, we also consider the Markov selection process described by Kalandrakis (2004a), in which selection probabilities depend on the identity of the most recent proposer. In the absence of a legislative calendar, we represent this process as follows: $\mathcal{S} = \mathcal{N}$, $P(s) = s$, and for every s and s' , let $\mu(s'|s) = \gamma_{s,s'}$, where γ is a right stochastic $n \times n$ matrix. With a one-period legislative calendar, the representation becomes $\mathcal{S} = \mathcal{N}^2$, $P(s) = s_1$, $\mu(s'|s) = \gamma_{s_2, s'_2}$ if $s_2 = s'_1$, and 0 otherwise.

Stage 2: Voting. Players vote on the proposal in a fixed sequential order. A proposal is implemented if and only if at least q players (including the proposer) vote in favour. A voting rule is *non-unanimous* if $q < n$.

Payoffs: Players evaluate payoffs according to conventional exponential discounting. If proposal x is implemented at time t , player i 's payoff is $u_i(x, t) \equiv \delta_i^t x_i$ where δ_i is player i 's discount factor. No player is perfectly patient and $\hat{\delta} \equiv \max_{i \in \mathcal{N}} \delta_i < 1$ denotes the highest discount factor. If proposals at every period t in \mathcal{T} are rejected, each player obtains a payoff of 0.

4.2. Solution concept

It is well-known that when five or more players bargain, every division may be supported as the outcome of a subgame perfect equilibrium in the infinite horizon (Baron and Ferejohn, 1989; Osborne and Rubinstein, 1990) if players are sufficiently patient. The literature evades this

14. One can also proceed by describing recognition processes and information structures explicitly. For instance, one can posit that nature moves only once at the outset of the game, choosing some state ω from Ω , and then write the period- t proposer and public signal, $P^t(\omega)$ and $\sigma^t(\omega)$, as functions of the state. Restricting attention to Perfect Bayesian equilibria in which player's off-path beliefs about ω are unrelated to proposals and voting decisions (so that "one cannot signal what one does not know"), the same results would emerge.

“folk theorem” by restricting attention to outcomes of a stationary sub-game perfect equilibrium (henceforth SSPE), where players’ equilibrium strategies are identical at all nodes associated with the same state (*i.e.* those at which the same information pertinent to the selection of subsequent proposers has been revealed), and thus, behaviour in period t is not influenced by past proposals or voting decisions. We adopt the same solution-concept here in this setting. As explained below, our framework allows for the possibility that states are date-specific. Consequently, it does not rule out processes with non-stationary structures.

Formally, at the proposal stage of period t , the *structural state* corresponds to s^t . For the voting stage of period t , the state consists of (s^t, x^t) , where x^t is the period- t proposal.¹⁵ Let \mathcal{S}_i be the set of all $s \in \mathcal{S}$ consistent with player i being the proposer in state s . An SSPE is an SPE in which we can write each player’s equilibrium strategy as a pair of functions (ξ_P^i, ξ_V^i) such that $\xi_P^i: \mathcal{S}_i \rightarrow \Delta \mathcal{X}$ is player i ’s randomization over proposals when recognized in state s , and $\xi_V^i: \mathcal{S} \times \mathcal{X} \rightarrow \Delta \{\text{yes, no}\}$ is player i ’s randomization over whether to vote for or against a policy $x \in \mathcal{X}$ proposed in state s .

Because the state s^t may encode information not only about the identity of future proposers but also about the identity of past proposers and temporal sequencing, an SSPE may condition on these variables. Thus, strictly speaking, a stationary equilibrium may involve time-dependent play. However, the state s^t (and thus, the selection of proposers) is unaffected by past offers or voting decisions, and so the focus on SSPE rules out behaviour that depends on past proposals and votes, inasmuch as those actions have no direct structural implications for the continuation game. Our restriction is on equilibria, and not strategies directly: players may consider non-stationary deviations and an SSPE must be immune to such deviations.

We have two motivations for studying this class of equilibria. First, adopting the same solution concept that is widely used in the literature facilitates transparent comparisons with existing results and highlights the implications of predictability. Second, SSPE strategies are the simplest possible form of behaviour consistent with equilibrium rationality.¹⁶ Every equilibrium must condition choices on variables that alter structural features of the continuation game, and non-stationary equilibria are more complex because choices *also* depend on variables (offers and votes) that have no structural implications for the continuation game. Because non-stationary equilibria require legislators to follow different continuation strategies in structurally identical circumstances, sustaining any such equilibrium presumably requires more coordination. Yet, because every stationary equilibrium ends in immediate agreement (as we show in Lemma 1), there is no efficiency motive for selecting a more complex equilibrium. Thus, the complex coordination required for a non-stationary equilibrium is never in the legislators’ mutual interests.

5. BARGAINING WITH A CLOSED RULE

5.1. Predictability

In each period, players forecast the distribution of future bargaining power based on all information accumulated up to the present. Suppose that in stage 1 of period t , the state is s^t . We denote the probability that player i is recognized at time $t+1$ by $r_i(s^t) \equiv \int_{\mathcal{S}} \mathbf{1}_{\{P(s')=i\}} d\mu(s'|s^t)$. The *losers*

15. As is conventional, we ignore the voting history at stage 2 of period t up to the time that player i votes. Although an equilibrium must specify behaviour for every voting history, it is well-known that sequential rationality combined with voting in a sequential order implies that for every equilibrium, there exists an outcome-equivalent equilibrium in which each player eliminates weakly dominated strategies at the voting stage and “votes as if pivotal”.

16. In the canonical legislative bargaining environment, Baron and Kalai (1993) prove that the Markovian equilibrium is the simplest equilibrium based on an automaton notion of complexity.

are those players who have 0 probability of being the proposer at $t + 1$ conditional on all that is known at the proposal stage in period t :

$$L(s^t) \equiv \{i \in \mathcal{N} : r_i(s^t) = 0\}.$$

We use the cardinality of this set to measure the degree of predictability.

Definition 1. *The bargaining process exhibits one-period predictability of degree d if $|L(s)| \geq d$ for all s in \mathcal{S} .*

One-period predictability of degree d means that by the time the proposer is selected in period t , at least d players have been ruled out as the proposer for period $t + 1$. Plainly, one-period predictability of degree d implies one-period predictability for any degree $d' < d$. We can classify the examples from Section 3 as follows: the Baron–Ferejohn process does not exhibit one-period predictability of degree d for any $d > 0$, Examples 1 and 3 exhibit one-period predictability of degree $n - 1$, and Example 2 exhibits one-period predictability of degree $n - \max_i |A_i|$. Note that one-period predictability of degree d has no implications for two-period predictability (defined in an analogous way). For example, though Example 1 exhibits one-period predictability of degree $n - 1$, it does not exhibit two-period predictability of degree d for any $d > 0$. The degree of predictability for a given bargaining process depends on both the underlying recognition process and the information structure. Different information structures for the same recognition process can lead to different levels of predictability, as we see in comparing the Baron–Ferejohn process with and without the use of legislative calendars. Our results for this class of models do not require an ability to predict bargaining power in any period but the next.

5.2. Main result

In this section, we state and prove our main result.

Theorem 1. *Suppose the voting rule is non-unanimous, requiring $q < n$ votes for a proposal to pass. If the bargaining process exhibits one-period predictability of degree q , the proposer selected at $t = 0$ captures the entire surplus in every SSPE of the infinite horizon and every SPE of the finite horizon.*

This result describes the implications of combining predictability of the bargaining process with a non-unanimous voting rule: the current proposer extracts all of the surplus by forming a winning coalition with those who definitely will not make a proposal in the next period. Her coalition partners may expect to have bargaining power two periods hence, but in equilibrium, their votes are bought cheaply since they expect to obtain no surplus in the next period. Thus, one-period predictability of degree q confers complete power.

Constructing an SSPE that delivers this division of surplus is straightforward. Suppose that in each state s , the proposer $P(s)$ offers to share nothing, each player in $L(s)$ accepts all offers, and any other player accepts an offer if and only if his share exceeds his discounted continuation value. No player has a strict incentive to deviate from this strategy profile.

Our theorem makes the stronger claim that all SSPE generate this outcome. The proof makes use of two properties of SSPE, stated formally (and proven) below as Lemmas 1 and 2: all such equilibria end in immediate agreement, and the proposer never offers strictly positive surplus to more than $q - 1$ other players (the smallest group needed to achieve a winning coalition). Once these preliminary steps are established, the proof of our main result is reasonably straightforward.

The following is an intuitive sketch of the main argument, a formal version of which appears below. Suppose towards a contradiction that the first (period 0) proposer, player i , does not capture the entire surplus. Let player j be a member of player i 's minimal winning coalition to whom i offers (weakly) more than she does to anyone else, and let x_j^0 denote this share. Because she chooses to exclude the other $(n - q)$ players and include player j in her minimal winning coalition, each of the excluded players must be more expensive to buy out; *i.e.*, each has an expected discounted continuation value that weakly exceeds x_j^0 . Thus, at least $(n - (q - 1))$ players have expected discounted continuation values no less than x_j^0 . If the bargaining process exhibits one-period predictability of degree q , then at least one of those persons (call her player k) has no chance of being recognized in the next period. Player k necessarily derives all of her continuation value from the payoff she expects to receive when someone else serves as the proposer in period 1. Thus, in some structural state in period 1, the period-1 proposer must offer player k a payoff of at least $x_j^0 / \hat{\delta}$, where $\hat{\delta}$ (defined earlier) is the discount factor of the most patient player.

The same logic, of course, holds for the aforementioned state in period 1. So by induction, there is some period-2 state in which the proposer offers some player a payoff of at least $x_j^0 / \hat{\delta}^2$. Iterating this argument, we see that, for every t , there exists a structural state in which the proposer offers another player a share of at least $x_j^0 / \hat{\delta}^t$. Because $\hat{\delta} < 1$, at least one player eventually obtains a share that exceeds the maximal feasible payoff, which is an obvious contradiction.

Necessity: The preceding logic shows that one-period predictability of degree q suffices for the first proposer to capture the entire surplus. Is this condition also necessary? We describe a setting in Section 5.3 where the first proposer cannot capture the entire surplus if the degree of one-period predictability is strictly less than q . Nevertheless, for that setting, greater predictability confers greater power: the first proposer's share is strictly increasing in the degree of predictability until $d = q$, at which point he captures the entire surplus.

However, as a general matter, one-period predictability of degree q is not the tightest possible condition for ensuring that the first proposer receives the entire surplus. One way to weaken this condition is to employ a "proposer-specific" notion of predictability. Suppose in particular that, in each structural state s^t , one can rule out $q - 1$ players *other* than the current proposer, p^t , as the proposer for $t + 1$. Then the current proposer captures the entire surplus even if the degree of one-period predictability is less than q . We return to this possibility in Section 6.2.

Proof of the Main Result: We relegate the proof for the finite horizon to the [Supplementary Appendix](#). For the infinite horizon, we first establish that every pure or mixed SSPE must yield an immediate agreement, and that every equilibrium proposal is directed towards securing the support of a cheapest minimal winning coalition. To prove these claims, we introduce notation for players' continuation values in an SSPE. Let $V_i(s)$ denote the expected continuation value of player i after the rejection of the current offer in state s . For a coalition $C \subseteq \mathcal{N}$, let $W_C(s) \equiv \sum_{i \in C} \delta_i V_i(s)$ represent the sum of discounted continuation values for the coalition. Denote the lowest cost of a coalition of size $q - 1$ as

$$\underline{W}(s) \equiv \min_{\substack{C \subseteq \mathcal{N} \setminus \{P(s)\}, \\ |C|=q-1}} W_C(s),$$

the associated set of coalitions that achieve the minimum cost by

$$\mathbb{C}(s) \equiv \{C \subseteq \mathcal{N} \setminus \{P(s)\} : |C| = q - 1 \text{ and } W_C(s) = \underline{W}(s)\},$$

and the cheapest policies required to secure the support of such coalitions as

$$\mathcal{X}(s) \equiv \{x \in \mathcal{X} : \exists C \in \mathbb{C}(s) \text{ such that } x_i = \delta_i V_i(s) \forall i \in C \text{ and } x_{P(s)} = 1 - \underline{W}(s)\}.$$

The set $\mathbb{C}(s)$ is the set of all cheapest minimal winning coalitions for the proposer $P(s)$: every coalition C in $\mathbb{C}(s)$ includes $q - 1$ players (other than the proposer) with the weakly lowest discounted continuation value. The set of policies $\mathcal{X}(s)$ are those that offer discounted continuation values to a cheapest minimal winning coalition, 0 to others, and the rest to the proposer $P(s)$. Observe that the maximum offered to any player other than $P(s)$ is the same for all proposals in $\mathcal{X}(s)$: *i.e.*, there exists $\bar{x}(s)$ such that for every offer $x \in \mathcal{X}(s)$, $\bar{x}(s) = \max_{i \neq P(s)} x_i$.

Lemma 1. (Immediate Agreement). *Every SSPE proposal offered with strictly positive probability in state s is accepted with probability 1 in state s .*

Proof. Suppose there is a state s in \mathcal{S} such that an equilibrium proposal offered with strictly positive probability in that state, x' , is rejected with strictly positive probability. Select some $x \in \mathcal{X}(s)$ and let C in $\mathbb{C}(s)$ be an associated minimal winning coalition (excluding the proposer). Define a proposal x^ϵ for small $\epsilon \geq 0$ in which $x_i^\epsilon = x_i + \epsilon$ for every $i \in C$, $x_i^\epsilon = 0$ for every $i \notin C \cup \{P(s)\}$, and the proposer keeps the remainder. In equilibrium, the proposal x^ϵ is accepted by all members of C with probability 1 if $\epsilon > 0$. Observe that because $\sum_{j \in \mathcal{N}} V_j(s) \leq 1$, and $\hat{\delta} < 1$,

$$\sum_{i \in C} \delta_i V_i(s) + \delta_{P(s)} V_{P(s)}(s) \leq \hat{\delta} \sum_{j \in \mathcal{N}} V_j(s) < 1. \tag{1}$$

Therefore, for sufficiently small ϵ , the proposer's share of $1 - \sum_{i \in C} \delta_i V_i(s) - (q - 1)\epsilon$ exceeds her discounted continuation value of $\delta_{P(s)} V_{P(s)}(s)$. Conditional on the equilibrium proposal x' being rejected, the proposer is strictly better off deviating to x^ϵ for sufficiently small $\epsilon > 0$. Conditional on the equilibrium proposal x' being accepted, the proposer's share can be no greater than that she obtains when offering x (otherwise a winning coalition would not support it). Since proposal x' is rejected with strictly positive probability, she is strictly better off offering x^ϵ for sufficiently small $\epsilon > 0$. Therefore, no equilibrium offer is rejected with strictly positive probability. \parallel

Lemma 2. (Minimal Winning Coalition). *For every state s , every SSPE proposal offered with positive probability provides positive payoffs only to members of the cheapest minimal winning coalition: $x \in \mathcal{X}$ is an SSPE proposal in s only if $x \in \mathcal{X}(s)$.*

Proof. Any proposal in which the proposer shares less than $\underline{W}(s)$ with others is rejected with probability 1, and so Lemma 1 rules out such SSPE proposals. If the proposer shares strictly more than $\underline{W}(s)$ with others, deviating to the proposal x^ϵ defined in the proof of Lemma 1 is strictly profitable for sufficiently small $\epsilon > 0$. \parallel

Proof of Theorem 1. In an equilibrium, let $\bar{x}(s)$ be the highest equilibrium share that the proposer $P(s)$ offers to any player other than herself with strictly positive probability. Let the structural state in Stage 1 of period 0 be s^0 . Suppose towards a contradiction that $\bar{x}(s^0) > 0$. By Lemmas 1–2, we know that every SSPE offer is made to a minimal winning coalition and accepted. Consider

the set of players whose support cannot be secured for shares less than $\bar{x}(s^0)$:

$$H(s^0) \equiv \left\{ i \in \mathcal{N} \setminus \{P(s^0)\} : \delta_i V_i(s^0) \geq \bar{x}(s^0) \right\}.$$

$H(s^0)$ must have a cardinality of at least $n - (q - 1)$, because otherwise proposer $P(s^0)$ could form a cheaper coalition without having to offer $\bar{x}(s^0)$ to any player. Since the bargaining process exhibits one-period predictability of degree q , $H(s^0) \cap L(s^0)$ is non-empty. Consider a generic player i in $H(s^0) \cap L(s^0)$: player i definitely will not be the proposer in the next period, and his continuation value must therefore reflect an offer he receives. So there exists some state s^1 that occurs in period 1 such that the associated proposer offers player i at least $\frac{\bar{x}(s^0)}{\delta_i} \geq \frac{\bar{x}(s^0)}{\delta}$ with strictly positive probability. Therefore, the highest share offered by that proposer to another player, $\bar{x}(s^1)$, is no less than $\frac{\bar{x}(s^0)}{\delta}$.

The same logic applies in state s^1 . So by induction, there exists a sequence of states $\{s^t\}_{t=0,1,2,\dots}$ such that $\bar{x}(s^t) \geq \frac{\bar{x}(s^0)}{\delta^t}$. Because $\delta < 1$, $\bar{x}(s)$ eventually exceeds 1, yielding a contradiction. \parallel

5.3. Comparative statics with respect to one-period predictability

Our main result shows that a proposer captures the entire surplus when the degree of one-period predictability, d , exceeds the critical threshold, q . What happens when d falls below q ? We address this question using a tractable subclass of our model. We show that our qualitative insights are preserved in the following sense: the first proposer's share is strictly increasing in d for $d < q$, and changes "continuously" as d passes through q .

The class of environments we consider has two distinguishing features. First, each legislator becomes the period- t proposer with probability $\frac{1}{n}$. Second, legislators receive a signal in period $t - 1$ indicating "priority ranks" for period t , where a given rank implies a fixed probability of selection regardless of the period. Accordingly, we can use this structure to bridge from [Baron and Ferejohn \(1989\)](#), in which there is no one-period predictability, to the setting of [Theorem 1](#), in which there is one-period predictability of degree q .

Formally, fix a vector of probabilities $\bar{\lambda} = (\bar{\lambda}_1, \dots, \bar{\lambda}_n)$ such that $\bar{\lambda}_1 \leq \bar{\lambda}_2 \leq \dots \leq \bar{\lambda}_n$. Let Λ be the set of all $n!$ permutations of $\bar{\lambda}$, and enumerate this set so that $\lambda^{(k)}$ is the k^{th} permutation. Construct a state space $S \equiv \mathcal{N} \times \Lambda$, with generic element $(i, \lambda^{(k)})$ where i denotes the identity of the current proposer and $\lambda^{(k)}$ denotes the signal about tomorrow's proposer. The initial state s^0 is drawn with uniform probability, and for $s^t = (i, \lambda^{(k)})$ and $s^{t+1} = (i', \lambda^{(k')})$, the transition probability $\mu(s^{t+1} | s^t)$ is $\frac{\lambda_{i'}^{(k')}}{n!}$ (so that each potential signal occurs with probability $\frac{1}{n!}$). This transition probability ensures that in state $s^t = (i, \lambda^{(k)})$, the probability that player i' is the period- $(t+1)$ proposer is $\lambda_{i'}^{(k')}$, and the probability that player i'' is the period- $(t+2)$ proposer is $\frac{1}{n}$.

This subclass accommodates a number of relevant cases through the selection of $\bar{\lambda}$: [Baron and Ferejohn \(1989\)](#) assume $\bar{\lambda}_1 = \dots = \bar{\lambda}_n = \frac{1}{n}$ (exhibiting one-period predictability of degree 0) and [Example 1](#) in [Section 3](#) (a simple legislative calendar) assumes $0 = \bar{\lambda}_1 = \dots = \bar{\lambda}_{n-1} < \bar{\lambda}_n = 1$ (implying one-period predictability of degree $n - 1$). Generally, any process with $\bar{\lambda}_1 = \dots = \bar{\lambda}_d = 0$ has one-period predictability of degree d .

An SSPE takes a simple form. Suppose the realized state in period t is $(i', \lambda^{(k')})$. Each player i anticipates being the period- $(t+1)$ proposer with probability $\lambda_i^{(k')}$. Furthermore, each permutation of $\bar{\lambda}$, corresponding to the signal received in period $t+1$ about the identity of the period- $(t+2)$

proposer, is equally likely. If λ_ℓ is the probability in state $(i', \lambda^{(k)})$ that player i becomes the proposer in the following period, then player i 's SSPE continuation value, w^ℓ is given by the following formula:¹⁷

$$w^\ell = \bar{\lambda}_\ell \left(\frac{n-q+1}{n} \left(1 - \delta \sum_{j=1}^{q-1} w^j \right) + \frac{1}{n} \sum_{k=1}^{q-1} (1 - \delta \sum_{j=1, j \neq k}^q w^j) \right) + (1 - \bar{\lambda}_\ell) \delta \left(\sum_{j=1}^{q-1} \frac{w^j}{n} + \frac{(q-1)w^q}{n(n-1)} \right).$$

This recursive formulation generates a linear system with n equations and n unknowns, and has a unique solution. We illustrate this approach using a three player game.

Example 1. *Suppose there are three players who make decisions based on simple majority rule. As $\delta \rightarrow 1$, the expected share to the first proposer (evaluated prior to the realization of the first signal) converges to*

$$\frac{2}{3}(1-w^1) + \frac{1}{3}(1-w^2) = \frac{2\bar{\lambda}_1 + \bar{\lambda}_2 + 3}{6\bar{\lambda}_1 + 3\bar{\lambda}_2 + 3}.$$

Recall that $\bar{\lambda}_1 \leq \bar{\lambda}_2 \leq \bar{\lambda}_3$, and that these parameters reflect the information players learn today about the identity of tomorrow's proposer. The above term is decreasing in both $\bar{\lambda}_1$ and $\bar{\lambda}_2$ so less predictability monotonically decreases the first proposer's share. The proposer's ability to capture rents also depends on the relative power of the other players. Holding fixed $\bar{\lambda}_3$, the first proposer's share increases with the disparity of power between the other two players. Indeed, the first proposer's share can be re-written as $\frac{9-3\bar{\lambda}_3-(\bar{\lambda}_2-\bar{\lambda}_1)}{15-9\bar{\lambda}_3-3(\bar{\lambda}_2-\bar{\lambda}_1)}$, which is increasing in both $\bar{\lambda}_3$ and $\bar{\lambda}_2 - \bar{\lambda}_1$. Greater inequality in predicted bargaining power decreases the cost of buying the vote of the weakest coalition partner, that is the legislator assigned $\bar{\lambda}_1$.

We use this approach to investigate the implications of varying one-period predictability of degree d for $d < q$. We consider the special case where d players learn one period in advance that they definitely will not be the next proposer, while the remaining $n - d$ players learn that they are equally likely to be the next proposer; formally, $\bar{\lambda}_1 = \dots = \bar{\lambda}_d = 0$ and $\bar{\lambda}_{d+1} = \dots = \bar{\lambda}_n = \frac{1}{n-d}$. We write continuation values as \underline{w} for those who are losers and \bar{w} for the other players. We solve for these values by computing \underline{w} recursively and use the fact that all continuation values must sum to 1 (since there is no delay). Relegating the algebra to the [Supplementary Appendix](#), we find that

$$\bar{w} = \frac{(n-1)(n-\delta d)}{n((n-1)(n-d) - \delta d(n-q))}, \text{ and } \underline{w} = \frac{\delta(n(q-(d+1))+d)}{n((n-1)(n-d) - \delta d(n-q))}. \tag{2}$$

The above terms are strictly positive for non-unanimous rules ($q < n$) when the degree of predictability d is strictly less than q . The first proposer's expected share is $1 - \delta + \delta(n-q)\bar{w} + \delta/n$. Using this solution, we determine the effect of d , the number of players who definitely will not make the next offer, on the proposer's payoff for the case of $d \leq q$:

17. The continuation value specifies, given all that is known in period t , what players expect as payoffs in period $t+1$ if they disagree in period t . In the equation for w^ℓ , the first term in the above expression is her expected payoff from being the period- $(t+1)$ proposer: either she is among the $n-q+1$ players most likely to be recognized in period $t+2$, in which case she will purchase the cheapest $q-1$ votes (*i.e.* those of the players least likely to be recognized), or she is among the $q-1$ players least likely to be recognized, in which case she will purchase the $q-1$ cheapest votes other than her own. The second term is her expected payoff from another player being the next proposer: she is included in the minimal winning coalition if in period $t+1$, (1) she is assigned a recognition probability $\bar{\lambda}^j$ for period $t+2$ where $j < q$, or (2) she is assigned the recognition probability $\bar{\lambda}_q$ and the period- $(t+1)$ proposer is assigned a weakly lower probability in period $t+2$.

Theorem 2. *Suppose the voting rule is non-unanimous, and the bargaining process exhibits one-period predictability of degree $d \leq q$. For every $\delta > 0$, the share obtained by the first proposer is strictly increasing in d .*

Thus, we see that the broader message of our main result, Theorem 1, generalizes to the case of $d \leq q$: greater one-period predictability (measured according to the degree d) implies greater power to the first proposer. Because we are fixing the recognition process, this result elucidates how greater transparency about future bargaining power amplifies inequities of negotiations today. Better information about tomorrow's proposer helps today's proposer form her minimal winning coalition with weaker partners whom she exploits to obtain a larger share of the surplus.

Our second result characterizes the proposer's (approximate) share in large finite legislatures. Consider a sequence of games $(G_n)_{n=3,4,\dots}$ such that game G_n has n players, requires q_n votes for approval of a proposal, and exhibits one-period predictability of degree d_n . We say that the sequence is *convergent* if there exist α_v and α_p such that $q_n/n \rightarrow \alpha_v$ and $d_n/n \rightarrow \alpha_p$. Our next result identifies the proposer's limiting share in a convergent sequence of games.

Theorem 3. *Consider a convergent sequence of games $(G_n)_{n=3}^\infty$ in which α_v is the limiting proportional voting rule and α_p is the limiting proportional degree of one-period predictability. For every $\epsilon > 0$, there exists \bar{n} such that if $n > \bar{n}$, the share of the surplus captured by the first proposer is within ϵ of $1 - \frac{\delta(\alpha_v - \alpha_p)}{1 - \alpha_p(1 + \delta(1 - \alpha_v))}$ if $\alpha_p \leq \alpha_v$, and is 1 otherwise.*

This expression shows how one-period predictability of a less-than-decisive degree influences the first proposer's share in the limit. For $\alpha_p = 0$, the proposer's share corresponds to that found by [Baron and Ferejohn \(1989\)](#). Increases in the limiting degree of one-period predictability (as measured by α_p) improve the outcome for the first proposer, consistent with the conceptual message of Theorem 2. Moreover, for $\alpha_p < \alpha_v$, the proposer's share is a convex function of α_p .¹⁸ Finally, note that the first proposer's share converges to unity as α_p approaches α_v , consistent with Theorem 1.

Two additional implications of Theorem 3 merit emphasis. First, even if the votes required for passage (q_n) exceeds the degree of one-period predictability (d_n), the proposer's share converges to unity as the legislature becomes arbitrarily large provided that the difference $q_n - d_n$ grows less than linearly. Second, as the voting rule converges to unanimity ($\alpha_v \rightarrow 1$), the first proposer's limiting share converges to $1 - \delta$ irrespective of the limiting degree of one-period predictability. Thus, the ability to form a winning coalition without having to include all voters is necessary for predictability to play a role.

Finally, the analysis of this section speaks to an alternative interpretation of the distribution of bargaining power. Thus far, we have assessed the distribution of bargaining power in period t based on expected payoffs once period- t information concerning the recognition order becomes available. As an alternative, one could follow [Simsek and Yildiz \(2016\)](#) in evaluating that distribution prior to the release of period- t information. From this perspective, bargaining power is distributed equally among all players throughout the game in the Baron–Ferejohn model ($d = 0$). In settings with $d > 0$, it is divided equally among the potentially changing set of $n - d$ individuals who may be recognized in the current period, as well as among the d individuals who definitely

18. The second derivative of the proposer's share with respect to α_p is $\frac{2\delta(1-\alpha_v)(1-\delta\alpha_v)(1+\delta(1-\alpha_v))}{(1-\alpha_p(1+\delta(1-\alpha_v)))^3} > 0$. The direct effect of increasing α_p is that today's proposer can include more losers in her coalition. The indirect effect is that each of those losers is weakened by tomorrow's proposer being able to do the same, and thus demands less from today's proposer. Convexity derives from the combination of these two effects.

will not, with members of the former group enjoying more bargaining power than members of the latter. The gap between $\bar{w} - \underline{w}$ (defined on p. 515) captures the difference in bargaining power between these two groups, according to this definition.¹⁹

6. ROBUSTNESS

In this section, we describe several extensions of our framework, pointing out that (1) the proposer captures nearly all of the surplus if he can “almost” rule out q other players, and even if the predictability of the process is not expected to persist indefinitely; (2) our analysis generalizes to arbitrary coalitional structures and payoff functions; (3) qualitatively similar results apply when players have access to an efficient default option; and (4) the logic of our results also extends to settings in which players are inequity-averse. All formal proofs for these extensions appear in the [Supplementary Appendix](#). Additionally, the [Supplementary Appendix](#) includes generalizations to settings in which legislators can influence the recognition processes through political manoeuvring, as well as to environments in which players learn about bargaining power privately.

6.1. Almost-persistent virtual predictability

For our main theorem to apply, legislators must be certain that q individuals will not be the next proposer, and they must also be certain that this same statement will hold in all future periods. We have already seen in the previous section that one can relax the first of these certainty requirements. What about the second? Suppose the bargaining process starts out in a regime for which signals “almost” rule out at least q individuals as the next proposer. As we show in this section, if the likelihood of transitioning out of this regime in any given period is sufficiently low, the first proposer captures nearly all of the surplus. Notably, our analysis subsumes cases in which it is essentially guaranteed that future proposers will eventually become entirely unpredictable.

For every $\epsilon \in [0, 1)$, let the set of *almost losers* be $L_\epsilon(s) \equiv \{i \in \mathcal{N} : r_i(s) \leq \epsilon\}$: based on all information available at the proposal stage today, the probability that any player in $L_\epsilon(s)$ will be recognized as the proposer tomorrow is no more than ϵ . Let $\mathcal{P}_{d,\epsilon} \equiv \{s \in \mathcal{S} : |L_\epsilon(s)| \geq d\}$ be those states in which at least d players are ϵ -virtually excluded from being the proposer tomorrow.

Definition 2. *The bargaining process exhibits $(1 - \rho)$ -persistent one-period ϵ -predictability of degree d if $\mathcal{S}^0 \subseteq \mathcal{P}_{d,\epsilon}$ and $\mu(\mathcal{P}_{d,\epsilon} | s) \geq 1 - \rho$ for all $s \in \mathcal{P}_{d,\epsilon}$.*

The preceding definition weakens one-period predictability of degree d not only at each moment in time, but also over time. For $\rho = 0$ and $\epsilon = 0$, the definition collapses to one-period predictability of degree d (modulo probability-0 events). For $\epsilon > 0$, it states that even if every player has some chance of being selected as tomorrow’s proposer, at least d players are ϵ -virtually excluded. Setting both $\epsilon > 0$ and $\rho > 0$ implies that at $t = 0$, players can ϵ -virtually exclude d players from being the proposer at $t = 1$, and in every period $t \geq 1$, the process transitions out of this regime with probability no greater than ρ . This notion permits us to evaluate whether our results extend to settings in which predictability is not perfectly persistent.²⁰ Notice that $(1 - \rho)$ -persistent

19. We thank a referee for pointing this interpretation out to us. For the special case we have modelled in Section 5.3, the set of players who have bargaining power in period t is drawn independently from the past. Bargaining power is therefore transient in this model and evolves discontinuously in the continuous-time limit of the game where offers are made frequently. We show in the [Supplementary Appendix](#) that transience works against our result, and making bargaining power durable (in the spirit of [Simsek and Yildiz, 2016](#)) only amplifies the gap between those who have bargaining power and those who do not.

20. We know of no precedents for this form of robustness analysis in the literature on dynamic games.

one-period ϵ -predictability of degree d allows for the possibility that the process eventually becomes unpredictable with near-certainty.²¹

Theorem 4. *If the bargaining process exhibits $(1 - \rho)$ -persistent one-period ϵ -predictability of degree q , then in every SSPE, the proposer selected at $t=0$ does not offer more than $\frac{\hat{\delta}(\epsilon + \rho)}{1 - \hat{\delta}(1 - \epsilon - \rho)}$ to any other player, which converges to 0 as $\epsilon, \rho \rightarrow 0$.²²*

Theorem 4 demonstrates that holding fixed payoff parameters (such as δ), our main result is continuous with respect to both predictability being *imperfect*, meaning that q players may be almost but not entirely ruled out from being the proposer tomorrow, and *impermanent*, meaning that the bargaining process may cease to be predictable in the future. The proof of Theorem 4 resembles that of Theorem 1: we show that if the proposer at $t=0$ offers any player a share that exceeds the bound in this theorem, then there must exist some future state in which the proposer offers at least one player more than the entire surplus.²³ Although we cannot construct an SSPE for this general setting, existence follows from Duggan (2017) for the case in which \mathcal{S} is countable.

For Theorem 4, we consider a limiting case in which ρ and ϵ both approach zero while the highest discount factor of any player, $\hat{\delta}$, remains bounded away from 1. As an alternative, one may wish to capture the possibility that the environment evolves at a constant rate, in which case smaller values of ρ and ϵ correspond implicitly to reductions in the length of the period, which should drive $\hat{\delta}$ to 1. In the [Supplementary Appendix](#), we consider a family of bargaining games where if the period length is Δ , the discount factor of each player is $e^{-r\Delta}$ and the bargaining process exhibits $e^{-\gamma\Delta}$ -persistent one-period $(1 - e^{-\Psi\Delta})$ -predictability of degree q . We treat $r > 0$, $\gamma > 0$, and $\Psi > 0$ as fixed rates corresponding to patience,²⁴ imperfectness of predictability, and impermanence of predictability, respectively, and study limiting behaviour as the period length, Δ , approaches 0. This frequent-offers limit approximates a continuous-time setting in which (1) the bargaining process ceases to be predictable if there is one type of a Poisson shock, which occurs at rate γ , and (2) a loser is recognized at time t if there is another type of Poisson shock, which occurs at rate Ψ (independently from the first Poisson process). This limiting case delivers $\epsilon, \rho \rightarrow 0$ and $\delta \rightarrow 1$, as desired. We show that in this frequent-offers limit, the proposer selected at $t=0$ does not offer more than $\frac{\psi + \gamma}{r + \psi + \gamma}$ to any other player. One can interpret this expression using the language of Simsek and Yildiz (2016): substituting $D \equiv \frac{r}{\psi + \gamma}$, we obtain a bound of $\frac{1}{1 + D}$. The term D measures the “effective durability rate of predictability”. A high value of D , which would generate a stringent bound on the amounts the proposer offers others in her coalition, represents a setting where the bargaining process is expected to remain predictable for a span of time that is “long” when assessed at discount rate r . In contrast, a low value of D , which would generate a loose bound for the amounts the proposer offers others, represents a setting where the bargaining process is not expected to remain predictable for very long, again assessed according

21. For example, the process may start in a regime with one-period predictability of degree q , but at each subsequent date, transitions permanently with probability ρ to a regime with one-period predictability of degree 0. In that case, the probability that the process retains a positive degree of predictability decays exponentially with time, eventually becoming entirely unpredictable in virtually all states.

22. Assuming $\epsilon, \rho \approx 0$, we have $0 < 1 - \epsilon - \rho < 1$. Recall that $\hat{\delta} \equiv \max_{i=1, \dots, n} \delta_i$ is the highest discount factor of any player.

23. In contrast to the proof of Theorem 1, the maximum amount offered to a weak player does not increase geometrically; however, when initialized at a level exceeding $\frac{\hat{\delta}(\epsilon + \rho)}{1 - \hat{\delta}(1 - \epsilon - \rho)}$, it grows according to an “expansive” mapping that upon repeated iteration escapes $[0, 1]$.

24. For simplicity, we assume a common degree of patience.

to the discount rate r . In that case, the proposer has to offer larger amounts to secure agreement from others because they are more willing to wait for the process to cease being predictable.

6.2. General coalitional structures and payoff functions

Our main result applies to settings with general coalitional structures and concave utility functions. Suppose that player i 's stage payoff from policy x is $u_i(x_i)$ where, for each i , $u_i(\cdot)$ is strictly increasing, continuous, and concave, with $u_i(0) = 0$, and perpetual disagreement yields a payoff of 0. A coalition of players is *decisive* if approval of an offer by all members of the coalition results in its implementation. Let \mathcal{D} be the set of all *decisive coalitions*. As is conventional, we assume that \mathcal{D} satisfies *monotonicity*: if D is decisive and $D \subseteq D'$, then D' is decisive. The coalitional structure here encompasses settings in which players have unequal voting weights and may have individual or coalitional veto power. Note that one can interpret a legislator with an inflated voting weight as a coalition of legislators whose interests are aligned. One-period predictability generalizes as follows:

Definition 3. *The bargaining process exhibits one-period decisive predictability if for all s in S , there exists a decisive coalition D in \mathcal{D} such that:*

- (a) D includes the proposer $P(s)$, and
- (b) every other player in D definitely will not be the next proposer, i.e., $D \setminus \{P(s)\} \subseteq L(s)$.

For the special class of anonymous aggregation rules—i.e. D is in \mathcal{D} if and only if $|D| \geq q$ —one-period decisive predictability actually *weakens* one-period predictability of degree q , insofar as it requires only that $q - 1$ players *other than the current proposer* definitely will not be the next proposer. The vital implication of predictability is that the current proposer can form a decisive coalition with players who definitely will not be recognized in the next period.

Theorem 5. *If the bargaining process exhibits one-period decisive predictability, the proposer selected at $t = 0$, player i , obtains a payoff of $u_i(1)$ in every SSPE.*

Observe that Theorem 5 implies Theorem 1, and its greater generality requires a more subtle argument that considers the cost of forming each coalition, filtered through each proposer's utility function. We establish that coalitions formed with players who definitely will not be the next proposer must have zero cost; otherwise, there is some state in which a future proposer offers more than is feasible. Because at least one such coalition is decisive, the proposer captures the entire surplus.

Two implications follow from extending our analysis to permit curvature of utility functions and hence risk-aversion. First, heterogeneity in risk-aversion, as captured by the concavity of $u_i(\cdot)$, is unrelated to bargaining power in our setting. This finding is of interest because it contrasts sharply with the conclusions that obtain with a unanimity rule (Roth, 1985; Binmore *et al.*, 1986). Second, players may be worse off with predictable protocols. If all utility functions are identical and strictly concave, egalitarianism increases aggregate *ex ante* welfare, but with decisive predictability, extreme inequality prevails. Players are worse off *ex ante*, and would Pareto prefer an unpredictable protocol. Thus, when players are risk-averse, early resolution of procedural uncertainty can adversely impact the efficiency of bargaining.

The generality of this setting permits us to revisit an important question in political economy: how much do legislators benefit from veto power?²⁵ Because a decisive coalition must include

25. Winter (1996) and McCarty (2000) explore the implications of veto power in the Baron–Ferejohn framework.

all veto players, the existence of veto players makes one-period decisive predictability difficult to satisfy.²⁶ When it is not satisfied, the first proposer must share surplus with each veto player, because otherwise that player would delay agreement until she became the proposer. Even so, as long as proposals require at least q total votes to pass (including those of the veto players), our original condition—one-period predictability of degree q —ensures that the proposer shares no surplus with non-veto players.

Theorem 6. *Suppose that the passage of a proposal requires the support of players $1, \dots, k$ and at least $q - k$ of the remaining $n - k$ players, where $k \leq q < n$. If the bargaining process exhibits one-period predictability of degree q , then in every SSPE, the proposer selected at $t = 0$ offers 0 to every player without veto power.*

6.3. Other Default Options

So far, we have assumed that in the event of perpetual disagreement, each player obtains a payoff of 0. While this assumption features in much of the literature on multilateral bargaining, it may appear to play a particularly important role in our analysis (at least in finite horizon bargaining problems, which transparently permit the final-round proposer to extract all of the surplus). We show that a qualitatively similar result applies even if the default option selected in the event of disagreement is efficient.

This extension is important for two distinct reasons. First, in many negotiations, the most recent agreement serves as the default option for the next round of bargaining, so there is reason to believe that disagreements may not destroy surplus.²⁷ Second, this extension permits us to address settings in which the bargaining process changes arbitrarily at some known point in time, by incorporating continuation values into a terminal default option.

We restrict attention to simple-majority rule with an odd number of players, assume that there is perfect one-period predictability, and take $\delta \rightarrow 1$. We begin with the finite horizon: suppose that if the players do not accept a proposal by period $\bar{t} \in \{2, 3, \dots\}$, then a default option x^D is implemented. Order players by their share of the default option so that $x_1^D \leq x_2^D \leq \dots \leq x_n^D$. We make two assumptions about the default options:

- **Genericity:** For each pair of distinct players i and j , $x_i^D \neq x_j^D$.
- **Majority Improvements:** For every minimal winning coalition C , $\sum_{i \in C} x_i^D < 1$.

Genericity rules out the knife-edge case in which two distinct players receive an identical default option. Majority improvements ensures that for every minimal winning coalition, there is a distribution of surplus that improves upon the default option. Note that we allow for the possibility that all agreements are utilitarian inefficient, since we do not impose $\sum_{i \in \mathcal{N}} x_i^D \leq 1$.

Theorem 7. *If there are at least 7 players and 3 periods, the first proposer captures the entire surplus in every SPE, and every other player obtains 0.*

26. For one-period decisive predictability to hold despite the existence of veto players, it must be the case that (1) veto players who are not the first proposer are never recognized, and (2) if the first proposer is a veto player, there is no realization in which she is recognized in non-consecutive periods (e.g. periods 1, 2, and 5).

27. Motivated by this possibility, a burgeoning literature (e.g. Baron, 1996; Kalandrakis, 2004b; Bernheim et al., 2006; Diermeier and Fong, 2011; Anesi and Seidmann, 2015) has studied bargaining dynamics with an endogenous status quo.

Thus, even when the default option provides every legislator with a strictly positive share, strategic forces lead a majority to capitulate to a proposal that offers them nothing. The proof, which appears in the [Supplementary Appendix](#), proceeds by sequentially excluding players with high default options from winning coalitions near the end of the game, which makes default options virtually irrelevant to continuation payoffs earlier in the game. We also show in the [Supplementary Appendix](#) that our results do not hinge on backward induction from a fixed deadline known at $t=0$, and apply even if that deadline is uncertain.

6.4. *Inequity aversion*

The starkness of the extreme inequality implied by our main result may lead one to question whether players who dislike inequality might behave differently. Following [Fehr and Schmidt \(1999\)](#), suppose player i 's payoff from policy x is $x_i - \frac{\alpha}{n-1} \sum_{j \neq i} \max\{x_j - x_i, 0\} - \frac{\beta}{n-1} \sum_{j \neq i} \max\{x_i - x_j, 0\}$, where $\alpha > \beta > 0$, and $\beta < \frac{1}{n-1}$. We show in the [Supplementary Appendix](#) that in the ‘‘Simple Legislative Calendar’’ example described in Section 3, the unique MPE of the infinite horizon game involves the first proposer capturing the entire surplus as players become infinitely patient ($\delta \rightarrow 1$). We offer the following intuition for this result. When considering whether to accept an offer, a coalition partner dislikes disadvantageous inequality today; however, rejecting the proposal introduces the prospect that one may be excluded from the winning coalition tomorrow, which generates even greater disutility from disadvantageous inequality. As $\delta \rightarrow 1$, this second effect dominates the first, even as each proposer demands the entire surplus. Each player's *ex ante* payoff (prior to recognition at $t=0$) converges to $\frac{1}{n}(1 - \alpha - \beta)$ as $\delta \rightarrow 1$. As a result, if $\alpha + \beta > 1$, the players unanimously prefer the default option (0 for everyone) to the equilibrium payoffs. An inability to commit to perpetual disagreement leaves all players strictly worse off.

7. DO AMENDMENT PROCEDURES COUNTER PREDICTABILITY?

Many legislatures employ ‘‘open rule’’ procedures that allow for amendments and require a motion to bring any (possibly amended) proposal to a vote. Legislative bodies differ according to whether they entertain all conceivable amendments, as in the U.S. Senate, or restrict amendments to ‘‘germane’’ modifications, as in the U.S. House of Representatives and three-quarters of U.S. state legislatures.²⁸ Broadly, germaneness rules limit the differences between the original and amended bills. In the House, an amendment violates the germaneness requirement if it introduces a new subject, changes the fundamental purpose of the bill, falls outside the jurisdiction of the committees to which the bill was referred, seeks to accomplish the same result as the original bill by a different method, seeks to replace an initiative of limited scope with one of a more general nature (even when the two are closely related), or aims to make a temporary provision permanent ([Brown et al., 2011](#)).

[Baron and Ferejohn \(1989\)](#) and others examine open-rule procedures that place no restrictions on amendments. They find that such rules substantially attenuate the power of the first proposer and lead to more egalitarian outcomes. Here we address three related questions. First, focusing on legislatures that permit unrestricted amendments, does a high degree of one-period predictability re-establish a high degree of inequality? We find that it does. Second, could a legislature achieve egalitarian outcomes more robustly through some alternative and novel amendment procedure? We show that it can and exhibit such a procedure. Third, how does the imposition of a restrictive

28. See <http://www.ncsl.org/research/about-state-legislatures/germaneness-requirements.aspx>.

germaneness restriction affect the answers to these questions? We show that it robustly restores the power of the first proposer.

Formally, we consider an open-rule bargaining process that generalizes the amendment procedure studied by [Baron and Ferejohn \(1989\)](#), allows for predictability, and incorporates arbitrary restrictions on allowable amendments. We take the number of legislators, n , to be odd, and assume that all discount payoffs according to a common discount factor $\delta < 1$.

At the beginning of period 0, the first proposer p^0 names a policy x^0 in \mathcal{X} . A slate of k distinct evaluators, $A^0(p^0) = (a_1^0, \dots, a_k^0)$ is then drawn at random (with equal probabilities) from $\mathcal{N} \setminus \{p^0\}$. The proposal does not come up for a vote unless *all* evaluators move the question. (In the standard open-rule process, the slate comprises a single evaluator, and the proposal comes up for a vote if and only if she moves the question.) First a_1^0 chooses to either move the proposal or to offer an amendment within some potentially restricted set, $\mathcal{A}(x^0)$. If she moves the proposal, a_2^0 is recognized and must likewise either move the proposal or offer an amendment. The process unfolds differently according to whether all evaluators join the motion, or some evaluator offers an amendment.

Imagine first that every evaluator joins the motion. In that case, the policy x^0 is put to a vote. Should a strict majority vote in favour, the policy is implemented; otherwise, period 0 ends and the entire process is reinitialized at the outset of period 1 with the random selection of a new proposer p^1 , as well as a new slate of evaluators, $A^0(p^1)$.

Now imagine that, instead of moving the question, some evaluator offers an amendment, x' . In that case, legislators immediately vote between x^0 and x' . Period 0 ends and period 1 begins, with the winning policy serving as the proposal on the table. A new slate of evaluators, $A^1(p)$, is selected (where p is the period 1 evaluator if the amendment passed and p^0 otherwise). Regardless of whether the proposal on the table is x^0 or x' , the set of allowable amendments remains $\mathcal{A}(x^0)$. This feature of our model reflects the notion that the original proposal establishes the subject, scope, and method of the initiative.

A particular case of this amendment procedure is that of a single evaluator ($k = 1$) and a fully flexible amendment process ($\mathcal{A}(x) = \mathcal{X}$). This is the setting proposed by [Baron and Ferejohn \(1989\)](#) and studied in the subsequent literature. Our framework generalizes this by allowing for the novel possibility that several legislators must move the proposal before it comes up for a vote ($k > 1$), and by introducing germaneness considerations.

Due to the comparatively complex structure of this process, our notion of one-period predictability requires some adjustment. We assume that, throughout period t , legislators know who the next slate of evaluators will be if the current proposal is successfully amended, and who the next set of proposer and evaluators will be if the current proposal is moved and eventually rejected.

We obtain the following result in the case of a fully flexible amendment process:

Theorem 8. *When amendments are fully flexible, the unique SSPE reaches the following agreement without delay: the first proposer offers $\frac{\delta}{1+\delta k}$ to each amender and 0 to every other player, keeping $\frac{1}{1+\delta k}$ for herself.*

For the standard amendment process ($k = 1$), Theorem 8 implies that the first proposer splits the surplus with the first potential evaluator, but all other legislators receive nothing. Notably, the outcome coincides with [Rubinstein's](#) solution of the two-person bargaining problem with equal discounting: the proposer's share is $\frac{1}{1+\delta}$ and the first evaluator's share is $\frac{\delta}{1+\delta}$. Accordingly, with one-period predictability, the standard open-rule protocol with a single evaluator does not do much to limit the concentration of political power.

Theorem 8 applies to a larger class of amendment processes including those in which a proposal passes only if $k > 1$ legislators sequentially turn down opportunities to offer amendments, and instead join the motion that brings the proposal to a vote. These novel processes are more successful at limiting the concentration of political power: in the extreme case where $k = n - 1$, the proposer keeps $\frac{1}{1-\delta+\delta n}$ and shares $\frac{\delta}{1-\delta+\delta n}$ with every other legislator. As the negotiators become arbitrarily patient ($\delta \rightarrow 1$), these payoffs converge to equal shares.

Unfortunately, these egalitarian equilibria disappear once germaneness restrictions are introduced. We model a germaneness restriction of size ϵ by assuming that, for all x and some $\epsilon > 0$, $\mathcal{A}(x) = \{x \in \mathcal{X} : \sum_{i=1}^n |x'_i - x_i| \leq \epsilon\}$. In other words, germaneness restricts amendments to be close to the original proposal in payoff space (using the ℓ_∞ norm to measure distance). In effect, we are assuming that payoffs cannot drift too far from those associated with the initial proposal unless implicitly, at some point, the subject, scope, or method of the proposal changes discretely. To illustrate how germaneness restrictions may be inimical to equity, we focus on the amendment procedure from the class considered above that is most conducive to equity, namely $k = n - 1$. Under the same predictability condition assumed in Theorem 8, the following result illustrates the impact of germaneness restrictions.

Theorem 9. *If the amendment process involves $n - 1$ evaluators and a germaneness restriction of size ϵ , then there exists an SSPE in which agreements are delayed by one period, and the first proposer captures $1 - \frac{\epsilon}{2}$ of the surplus.*

Theorem 9 illustrates how an apparently reasonable restriction on amendment procedures can undermine some of the benefits of permitting amendments: the initial proposer can once more capture a large fraction of the surplus. Accordingly, our analysis favours the amendment procedures used in the U.S. Senate, where no such germaneness restrictions are imposed, over those used in the U.S. House of Representatives. Of course, we have formulated germaneness restrictions in a particular way. Whether alternative formulations have similar implications concerning the concentration of political power is an important topic for future research.

8. CONCLUSION

Our research is motivated by a central question in political economy: what forces lead to the persistent imbalance and concentration of political power? Previous studies of legislative bargaining have emphasized two forces. The first—“proposal power”—is the ability to suggest a course of collective action. The second is the ability to implement a course of action without unanimous consent, and consequently to withhold benefits from those excluded from winning coalitions. Our analysis shows that the strength of these forces depends critically on the information structures attached to proposer recognition processes. Dramatic increases in the concentration of political power result when the information structure renders near-term proposers even modestly predictable. These observations are empirically relevant because the rules and procedures of real legislatures render proposer selection predictable, at least to some degree. Pertinent provisions include legislative calendars and agendas, rules governing the election and discretion of chairs, and procedural restrictions on recognition. Our theory yields implications that are testable, and is potentially useful for understanding why certain groups divide resources less equally than others.

We find that predictability need not be perfect to influence negotiations. On the contrary, a modest degree of predictability ensures that the first proposer receives the entire surplus. Below that threshold, greater predictability implies a larger share for the proposer. Predictability of future power is a critical source of current power, one that can dominate the effects of

heterogeneity in patience, risk-aversion, or voting weights. Relative to the Baron–Ferejohn framework, predictability implies a greater difference in power between veto and non-veto players. Finally, the implications of predictability are robust with respect to the inclusion of efficient default options and inequity-averse negotiators.

We view these results as offering normative insights into institutional design. For example, they explain how transparency can generate inequality and inefficiency in certain contexts. With modest predictability, amendment processes also become much less effective at limiting the concentration of political power. We have exhibited a class of novel amendment processes that more effectively promote egalitarianism, but even those can fail to produce meaningful improvements when amendments are subject to germaneness restrictions of the type used in the U.S. House of Representatives and many state legislatures.

High concentrations of political power may also be traceable to corruption, particularly when institutions are opaque and inscrutable. Transparency is often viewed as an antidote to corruption. While greater transparency of political processes has many virtues, our analysis demonstrates that some intuitively appealing measures to promote it may exacerbate rather than mitigate the concentration of political power.

Acknowledgments. We thank the Editor (Botond Koszegi) and three anonymous referees for their helpful and constructive comments. We also thank Attila Ambrus, David Baron, Renee Bowen, Tiberiu Dragu, Simone Galperti, Ben Golub, Johannes Horner, Matt Jackson, Ehud Kalai, Navin Kartik, Alessandro Lizzeri, George Mailath, Peter Norman, Tom Palfrey, Romans Pancs, Debraj Ray, Joel Sobel, Leeat Yariv, Huseyin Yildirim, Muhamet Yildiz, and various seminar and conference audiences for their feedback and comments. Alex Bloedel, Erik Lillethun, and Garima Singal provided expert research assistance. Nageeb Ali gratefully acknowledges Microsoft Research for their financial support and hospitality, and financial support from the NSF (SES-1127643 and SES-1530639). B.D.B. gratefully acknowledges financial support from the NSF (SES-0137129 and SES-1530639).

Supplementary Data

Supplementary data are available at *Review of Economic Studies* online.

REFERENCES

- ACEMOGLU, D. and ROBINSON, J. A. (2005), *Economic Origins of Dictatorship and Democracy* (New York: Cambridge University Press).
- (2012), *Why Nations Fail: The Origins of Power, Prosperity, and Poverty* (Bungay, Suffolk: Crown Business).
- ALI, S. N. (2015), “Recognition for Sale”, *Journal of Economic Theory*, **155**, 16–29.
- ANESI, V. and SEIDMANN, D. J. (2015), “Bargaining in Standing Committees with an Endogenous Default”, *Review of Economic Studies*, **82**, 825–867.
- ASHEIM, G. B. (1992), “A Unique Solution to n-Person Sequential Bargaining”, *Games and Economic Behavior*, **4**, 169–181.
- AUSTEN-SMITH, D. and BANKS, J. (1988), “Elections, Coalitions, and Legislative Outcomes”, *American Political Science Review*, **82**, 405–422.
- BANKS, J. S. and DUGGAN, J. (2000), “A Bargaining Model of Collective Choice”, *American Political Science Review*, **94**, 73–88.
- BARON, D. P. (1991), “Majoritarian Incentives, Pork Barrel Programs, and Procedural Control”, *American Journal of Political Science*, **35**, 57–90.
- (1996), “A Dynamic Theory of Collective Goods Programs”, *American Political Science Review*, **90**, 316–330.
- BARON, D. P. and KALAI, E. (1993), “The Simplest Equilibrium of a Majority-rule Division Game”, *Journal of Economic Theory*, **61**, 290–301.
- BARON, D. P. and FERREJOHN, J. A. (1989), “Bargaining in Legislatures”, *American Political Science Review*, **83**, 1181–1206.
- BATTAGLINI, M. and COATE, S. (2007), “Inefficiency in Legislative Policymaking: A Dynamic Analysis”, *American Economic Review*, **97**, 118–149.
- (2008), “A Dynamic Theory of Public Spending, Taxation, and Debt”, *American Economic Review*, **98**, 201–236.
- BERNHEIM, B. D., ANTONIO, R. and RAYO, L. (2006), “The Power of the Last Word in Legislative Policy Making”, *Econometrica*, **74**, 1161–1190.
- BERRY, C. R. and FOWLER, A. (2016), “Cardinals or Clerics? Congressional Committees and the Distribution of Pork”, *American Journal of Political Science*, **60**, 692–708.

- (2018), “Congressional Committees, Legislative Influence, and the Hegemony of Chairs”, *Journal of Public Economics*, **158**, 1–11.
- BINMORE, K. G. (1986), “Bargaining and Coalitions”, in Alvin Roth, (ed.), *Game Theoretic Models of Bargaining* (Cambridge, UK: Cambridge University Press).
- BINMORE, K. G., ARIEL, R. and WOLINSKY, A. (1986), “The Nash Bargaining Solution in Economic Modelling”, *RAND Journal of Economics*, **17**, 176–188.
- BRITZ, V., HERINGS, P. J.-J. and PREDTETCHINSKI, A. (2010), “Non-cooperative Support for the Asymmetric Nash Bargaining Solution”, *Journal of Economic Theory*, **145**, 1951–1967.
- (2014), “On the Convergence to the Nash Bargaining Solution for Action-dependent Bargaining Protocols”, *Games and Economic Behavior*, **86**, 178–183.
- BROWN, W. H., CHARLES, W. J. and SULLIVAN, J. V. (2011), *House Practice: A Guide to the Rules, Precedents, and Procedures of the House* (Washington, DC: United States Government Printing Office).
- CHATTERJEE, K., BHASKAR, D., DEBRAJ, R., et al. (1993), “A Noncooperative Theory of Coalitional Bargaining”, *Review of Economic Studies*, **60**, 463–477.
- CHO, S.-j. and DUGGAN, J. (2009), “Bargaining Foundations of the Median Voter Theorem”, *Journal of Economic Theory*, **144**, 851–868.
- DIERMEIER, D. and FONG, P. (2011), “Legislative Bargaining with Reconsideration”, *Quarterly Journal of Economics*, **126**, 947–985.
- DIERMEIER, D., CARLO, P. and VLAICU, R. (2016), “A Bargaining Model of Endogenous Procedures”, *Social Choice and Welfare*, **47**, 985–1012.
- DIERMEIER, D., HÜLYA, E. and MERLO, A. (2003), “A Structural Model of Government Formation”, *Econometrica*, **71**, 27–70.
- DUGGAN, J. (2017), “Existence of Stationary Bargaining Equilibria”, *Games and Economic Behavior*, **102**, 111–126.
- ERASLAN, H. (2002), “Uniqueness of Stationary Equilibrium Payoffs in the Baron–Ferejohn Model”, *Journal of Economic Theory*, **103**, 11–30.
- ERASLAN, H. and MERLO, A. (2002), “Majority Rule in a Stochastic Model of Bargaining”, *Journal of Economic Theory*, **103**, 31–48.
- FEHR, E. and SCHMIDT, K. M. (1999), “A Theory of Fairness, Competition, and Cooperation”, *Quarterly Journal of Economics*, **114**, 817–868.
- GROSSMAN, G. M. and HELPMAN, E. (2002), *Special Interest Politics* (Cambridge, MA: MIT Press).
- HERRERO, M. (1985), “A Strategic Theory of Market Institutions”.
- KALANDRAKIS, T. (2004), “Equilibria in Sequential Bargaining Games as Solutions to Systems of Equations”, *Economics Letters*, **84**, 407–411.
- (2004), “A Three-Player Dynamic Majoritarian Bargaining Game”, *Journal of Economic Theory*, **116**, 294–322.
- (2006), “Proposal Rights and Political Power”, *American Journal of Political Science*, **50**, 441–448.
- KAWAMORI, T. (2013), “Rejecter-Proposer Legislative Bargaining with Heterogeneous Time and Risk Preferences”, *Social Choice and Welfare*, **40**, 27–40.
- KULTTI, K. and VARTIAINEN, H. (2010), “Multilateral Non-cooperative Bargaining in a General Utility Space”, *International Journal of Game Theory*, **39**, 677–689.
- MCCARTY, N. M. (2000), “Presidential Pork: Executive Veto Power and Distributive Politics”, *American Political Science Review*, **94**, 117–129.
- MERLO, A. (1997), “Bargaining Over Governments in a Stochastic Environment”, *Journal of Political Economy*, **105**, 101–131.
- MERLO, A. and WILSON, C. (1995), “A Stochastic Model of Sequential Bargaining with Complete Information”, *Econometrica*, **63**, 371–399.
- NORMAN, P. (2002), “Legislative Bargaining and Coalition Formation”, *Journal of Economic Theory*, **102**, 322–353.
- OSBORNE, M. J. and RUBINSTEIN, A. (1990), *Bargaining and Markets*, Vol. 34 (San Diego, CA: Academic Press, Inc.)
- RAY, D. (2007), *A Game-Theoretic Perspective on Coalition Formation* (New York: Oxford University Press).
- ROESSLER, C., SANDRO, S. and STRULOVICI, B. (2016), “Collective Commitment”, *Journal of Political Economy*, Forthcoming.
- ROTH, A. E. (1985), “A Note on Risk Aversion in a Perfect Equilibrium Model of Bargaining”, *Econometrica*, **53**, 207–211.
- RUBINSTEIN, A. (1982), “Perfect Equilibrium in a Bargaining Model”, *Econometrica*, **50**, 97–109.
- SIMSEK, A. and YILDIZ, M. (2016), “Durability, Deadline, and Election Effects in Bargaining” (Cambridge, MA: MIT Economics).
- WINTER, E. (1996), “Voting and Vetoing”, *American Political Science Review*, **90**, 813–823.
- YILDIRIM, H. (2007), “Proposal Power and Majority Rule in Multilateral Bargaining with Costly Recognition”, *Journal of Economic Theory*, **136**, 167–196.
- YILDIZ, M. (2003), “Bargaining without a Common Prior: An Immediate Agreement Theorem”, *Econometrica*, **71**, 793–811.
- (2004), “Waiting to Persuade”, *Quarterly Journal of Economics*, **119**, 223–248.