Bargaining in Legislatures with Overlapping Generations of Politicians*

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October 2002

Abstract
We extend the existing formal literature on bargaining in legislatures by analyzing the strategic incentives of reelection-minded politicians in overlapping-generations institutions (like the staggered-term arrangement in the United States Senate). Politicians bargain over the division of distributive benefits session after session after each of which some portion of them face reelection and the retrospective evaluation of constituents. We write down a formal model of this repeat-play, divide-the-dollar game, describe some of its qualitative implications, and identify and analyze a focal equilibrium.

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“The first four years are for God and country. The last two are for the folks back home.”
-- Hubert Humphrey

Introduction

In July 1991 the U.S. Senate, after many years of failure, passed a bill banning honoraria and increasing Senate pay dramatically. This was one of those bills that most members wanted to pass but were not eager to support. (Positive pay raise votes had proven very unpopular with voters in the past, and thus grist for a potential opponent’s campaign.) It took the prodigious entrepreneurial efforts of Majority Leader Robert Byrd (D-W.Va.) to organize the winning coalition. Evidencing both the popularity of the bill and the nervousness associated with supporting it, Congressional Quarterly Weekly Report (July 20, 1991, p. 1961) reports the reaction after the vote:

On the floor, members were ecstatic, slapping each other on the back and shaking hands all around. J. Bennett Johnston, D.-La., waved his arms with joy. Senators crowded around Byrd to congratulate him, including several who had voted against him. (emphasis added)

An interesting feature of the vote was the way in which the “pain” was shared. The bill passed 54-46. (Byrd had wanted to be certain the bill passed by more than a one-vote margin so that no senator could later be accused by an opponent of having cast the decisive vote.) There was some partisan difference – the Democrats supported it 29-28 whereas the Republicans did so 25-18 – but this was not the big difference. It was electoral timing that made a considerable impact. Of those senators up for reelection in 1992, the vote was 8-26 against, whereas those not up for
reelection that next November supported the bill 46-20. As Byrd himself observed, “I urged [the others] to vote for this so I wouldn’t have to count on senators that would have to run next year.” CQ went on to state that “though Byrd approached many of the 34 members expected to run for re-election in 1992, they all got a pass without too much pressure.”

The present paper seeks to analyze the implications of staggered terms, an important feature of some legislative bodies like the U.S. Senate. This electoral feature produces in any cross-section a legislative body consisting of overlapping generations of legislators. Our approach to legislative politics, one that fits squarely into existing rational choice and game-theoretic traditions emphasizing the distribution of benefits and burdens, the structure of rules, and the sequence in which behavior unfolds, extends this body of work to institutions in which legislators are distinguished both by preference parameters and by temporal characteristics, particularly the timing of their (re)elections.

Legislative bodies are long-lived institutions, but the legislators themselves have a more fleeting existence as they come and go over time. Not only that, in staggered-term assemblies, their comings and goings are not synchronized. These two facts require us to acknowledge that

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1 The partisan difference was at least partly a reflection of the fact that the Democrats had more members up for reelection in 1992.

2 Our thanks to Professor Timothy Groseclose for bringing this example to our attention.

3 See Shepsle (1979) and Baron and Ferejohn (1989) on distribution and sequence, respectively. These approaches are sometimes referred to under the rubric of “distributive politics.” See Krehbiel (1991) for an alternative view emphasizing information and uncertainty, and Shepsle and Weingast (1995) for a comparative assessment of these “positive theories of congressional institutions.”

4 This fact makes certain game-theoretic equilibria problematical, a point to which we return in our analysis below. In an important observation Baron and Ferejohn (1989, p. 1181) note that many of the equilibria in legislative bargaining that exist (as a consequence of the Folk Theorem) require complex punishment arrangements that are likely to be undermined by legislative turnover – the frequent comings and goings of legislators owing to retirement, death, and defeat.
legislative careers are finite in length and overlapping. In contrast, other analyses typically treat legislators either as infinite-lived or as finite-lived but serving coterminous terms.

On one interpretation (one that we shall not pursue in the current paper) we may think, loosely, of generations of legislative politicians:

- freshmen and -women who, if they play their cards well, have long careers ahead of them;
- mid-careerists coming into their own both in terms of power in the legislature and familiarity (if not adulation) in their constituencies; and
- veterans who are currently powerful but closer to the end than to the beginning of their legislative careers.

Most legislative bodies may be thought of in these cross-sectional terms, which Fenno (1978) has described as the expansionist and protectionist phases of a legislative career.

There is a second interpretation, a longitudinal one we explore further here, that characterizes legislatures as repeat-play games orchestrated by the electoral cycle. Legislators at time $t$ play a legislative game – a pork-barrel, divide-the-dollar game in our formulation. When the legislative session concludes, there is an election. Survivors and replacements repeat the game in the next legislative session. This sequence repeats indefinitely. As just noted, we formalize this as the repeated play of the Baron-Ferejohn, divide-the-dollar version of distributive politics. Indeed, such a model captures much of the reality of legislative life in institutions like the U.S. House of Representatives where there is a new dollar each session to divide among a cast

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5 As Congress scholars know, a session is a well-defined unit in congressional life, with two (or sometimes three) sandwiched between elections. We do not use this term in so precise a manner, referring instead to a session as the entire inter-election period. To keep the accounting simple, then, there is effectively one session per Congress.
of characters, one from each district, some of whom were incumbents last time and some of whom are newly elected members.

This formulation, however, does not capture something distinctive about legislative bodies like the U.S. Senate. That there is a dollar to divide each legislative session among incumbent and new legislators seems as reasonable there as in the House. That each legislator faces an election at the end of each session does not. The U.S. Constitution (Article I, Section 3) specifies three classes of senator that translates into an institution comprised of overlapping generations. A third of the body is up for reelection at the end of one session; another third has two such sessions before it must face election; and the final third, having just been elected, has three such sessions. House and Senate members, therefore, are distinguished not only by the length of their respective terms, but also by the fact that election is synchronized for House members but not for senators.

We begin by reviewing the Baron-Ferejohn formulation and its extension to repeat play. Then we set up a more general overlapping-generations supergame that takes into account how the preferences of legislators in a staggered-term legislature depend on their place in the electoral cycle. Next we identify a focal allocation in which all lawmakers receive bargaining gains only in their final legislative session – the one immediately prior to their re-election contest – deferring to others in sessions when they are not about to face the voters. We analyze the overlapping-generations game to see if this “focal” allocation can be sustained as a non-cooperative equilibrium. We find that legislators are indeed more attractive coalition partners when they are nearer to election or when they have not accrued distributive benefits in earlier bargaining sessions. Both dynamics favor the focal allocation, but are insufficient to guarantee the legislature will achieve it. In light of this result, the next section identifies a simple punishment regime and proves that it can sustain the focal allocation as an equilibrium. The paper concludes

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6 So, we may take a session in the present context to be a two-year period. One session constitutes a term of office for a House member. Three sessions constitute a senatorial term.
with a discussion of how our findings inform theoretical and empirical work on staggered term legislatures and bicameralism generally, and the United States Senate and Congress in particular.

The theoretical analysis is of interest in its own right. But its real payoff, we believe, lies in the novel empirical insights it generates about both a staggered-term legislative body like the Senate and the tensions induced in a bicameral system in which the other chamber does not possess a staggered-term arrangement. In effect, the different temporal characteristics governing House and Senate election cycles generate patterns of inter-chamber conflict and cooperation over and above those ordinarily attributed in the literature to differences in constituency and term length.\(^7\)

**Divide the Dollar (Once)**

Baron and Ferejohn (1989) develop a divide-the-dollar game – based on the alternating-offers bargaining model of Rubinstein (1982) – that allows them to analyze the effects of legislative structure and rules. They demonstrate that commonly encountered legislative structures and procedures allow a legislature to settle on equilibrium distributions of the dollar despite the social choice problems inherent in constant-sum distributive politics. They analyze the distributional effects of open and closed legislative rules, focusing on how identically situated legislators bargain over the dollar. Below we extend the most basic form of their model to a

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\(^7\) Let us be clear that our analysis is of a staggered-term legislature like the Senate, and not of a fully bicameral system containing two chambers with different term structures as in the US Congress. Thus, we produce an analysis of how the staggered-term feature induces distinctive preferences among legislative politicians, differing from those in a chamber with simultaneous election. Because the US system mixes both in a bicameral setting, it sets into motion tensions that have not been fully anticipated by students of bicameralism. A natural extension of the present paper is to model a fully bicameral setting in which the two chambers are not, in effect, mirror images of each other but rather display the distinctive distributional preferences of their respective chambers induced by their different term structures.
setting in which legislators are not identical; they are differentiated by the fact of their staggered
terms.\footnote{Baron and Ferejohn do consider a legislature in which members have asymmetric probabilities
of recognition. However, this asymmetry is of a different sort than the one we wish to model.} To introduce notation and terms, we first review the two-round closed-rule example they present.

The basic model of Baron and Ferejohn considers an $N$-member legislature that divides a
dollar by majority rule. There is a single legislative session in which there are as many as two
attempts (rounds) to do this. Legislator i’s share of the dollar is $x^i$. The strategies of a player i
consist of what division of a dollar to propose if recognized and how to vote on each possible
proposal:

- **Proposal.** $p^i : m \rightarrow \Delta$, where $m$ is the round and $\Delta$ is the $N$-1 dimensional
  simplex, i.e., a proposal is an element of the set $\Delta = \{(x^1, \ldots, x^N) : x^j \geq 0 \ \forall j$
  and $\Sigma_j x^j = 1\}$.

- **Vote.** $v^i : p \times m \rightarrow \{0, 1\}$, where $p$ signifies the particular proposal under
  consideration, $v^i = 1$ signifies a “yes” vote for player i, and $v^i = 0$
  signifies a “no” vote for player i.

The utility function of member i is $u^i(p,m) = \delta^{m-1} x^i$, where $m$ is again the round in which the
legislature adopts the distribution $p$, $x^i$ is i’s share of the dollar, and $\delta$ is the (between-round)
discount factor common to all legislators.

The tree diagram below illustrates how the two-round game proceeds in a three-person
legislature. At recognition node $R^*$ a randomizing device determines which of the legislators is
recognized. The legislature operates under a random recognition rule with each legislator
recognized with probability $1/N$. Once recognized, a legislator proposes some $p$, a vector of
offers to individual legislators, $(x^1, \ldots, x^N)$. At node $V$ the proposal is then subjected to an
immediate up-or-down vote. Since proceedings are governed by a closed rule, no legislator is able to seek recognition to offer an amended proposal. Legislator $j$ votes yes if $x_j^t$ is at least as large as the discounted expected value of her allocation in the next round, referred to as her continuation value and denoted as $\delta E(x_{t+1}^i)$. If at least $(N+1)/2$ legislators vote yes then the proposal is adopted, the distribution of the dollar is made, and the session concludes. Otherwise the game moves to the next round of the session and legislators devalue the dollar by the common discount factor $\delta \in (0,1]$. This round begins with another recognition node at which a legislator is

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9 We employ a time subscript on payoffs when required for clarity. The superscript on payoffs identifies its recipient. Occasionally, p will be super-scripted to indicate the identity of its proposer.
selected to make a proposal \( p' \). The legislature immediately moves to a vote on \( p' \). If fewer than \((N+1)/2\) legislators vote for the proposal then everyone receives zero.\(^{10}\)

Baron and Ferejohn establish the following features of the strategy configuration in a subgame-perfect equilibrium:

- If recognized in the first round, a member makes a proposal to distribute \( \delta/N \) to \((N-1)/2\) other members and to keep \( 1-\delta(N-1)/2N \). If recognized in the second round, a member proposes to keep the entire dollar.

- Each member votes for any first-round proposal in which he or she receives at least \( \delta/N \), and votes for any second-round proposal.

- The first proposal is accepted and the legislature adjourns after the first round.

This follows from backward induction. In the second round legislators will unanimously vote for any proposal. This follows from the assumption about indifference (see footnote 10) and the fact that to defeat a bill in the second round is to terminate the game with each legislator receiving zero. Therefore, a legislator recognized in the second round can propose to take all of the dollar. It follows that the continuation value for a legislator in the first round, \( \delta E(x^j_2) \), is \( \delta/N \), the discounted value of the entire dollar \( (\delta) \) multiplied by the probability that the legislator will be recognized \( (1/N) \). Therefore, the legislator recognized in the first round must offer at least this much to \((N-1)/2\) other legislators in order for her proposal to receive a majority of votes. This allows the recognized legislator to keep \( 1-\delta(N-1)/2N \) for herself. She will always make such a proposal if recognized because \( 1-\delta(N-1)/2N > \delta/N \).

Baron and Ferejohn assume that all of the legislators are risk neutral, i.e. they are indifferent between an offer with a certain payoff and a lottery with an identical expected payoff.

\(^{10}\) We assume throughout that when a legislator is indifferent between a motion on the floor and
Harrington (1989) considers a similar model with players that have different risk preferences. In a model where players are more and less risk averse, he finds that the most risk-averse player has the highest expectation of receiving *some* share of the dollar. The intuition is that as players become more risk averse their certainty-equivalent for the lottery – to be the proposer in the next round according to the recognition probability and capture the entire dollar for themselves – is lower. This makes the attractiveness of players as coalition partners in the first round monotonically increasing in risk aversion.\(^{11}\)

**Divide the Dollar (Repeatedly)**

New issues come to light when the divide-the-dollar game is repeated (Muthoo, 1999, chap. 10). In particular, the electoral process, which lurks in the background of the Baron-Ferejohn analysis, but never is explicitly fleshed out, can be more naturally investigated within a repeat-play framework. Baron and Ferejohn model legislators whose objective is to maximize their share of the dollar – presumably for electoral gain as opposed to personal advantage – but the source of legislator preferences remains ambiguous in their work. This is because the legislators in the Baron and Ferejohn model never actually face reelection. In a repeat-play setting, in which each stage game represents a single legislative session, we can incorporate elections by assuming that the probability with which a legislator is reelected is a function of the bargaining gains he has achieved during his term of office. This allows us to separate the “benefits of office,” whatever they might be, which induce the legislator to serve and to seek power, from the slice of the budgetary pie that the legislator is able to win while dividing the the continuation value from its defeat, he or she votes *for* the motion.

\(^{11}\) Harrington also shows that while attractiveness as a coalition partner may be monotonic in risk aversion, additional conditions must be satisfied for this to mean that expected winnings are also monotonic in risk aversion.
dollar. In other words, the legislator cares about his winnings at each stage of the game only to the extent that these serve as a means to reelection.

In an overlapping-generations institution such as the U.S. Senate, a further complication exists: members have staggered terms of office. As such, in any given session, some legislators will be going directly to the voters once that session’s bargaining has been completed, while others will have one or more additional sessions in which to win a budget share for their constituents. Potentially interesting strategic behavior arises within overlapping-generations legislatures, as does the possibility of endogenous cooperative institutions. First, if the divide-the-dollar game is modeled as stochastic (as in the Baron and Ferejohn model, where the rule governing the recognition of proposal makers is probabilistic), then depending on the form of the probability-of-reelection function, some legislators may manage to ensure their safety quite early in their terms, while others may be in desperate shape going into the last session of their terms in office. This will affect strategic calculation and the prospects for cooperation and coalition formation. Second, some empirical evidence suggests that voters exhibit a recency bias, discounting their representatives’ performance retrospectively. That is to say, they cast their votes in a manner giving greater weight to more proximate events (Fiorina, 1981). If this is the case – or if politicians believe it to be the case – then institutions might well evolve in which those who are just beginning their terms in office defer to those who face re-election imminently, in expectation that this favor will be returned when their date with electoral destiny draws near. The key distinction that arises in the staggered-term context is that legislators are no longer identical. This and the other issues just discussed are examined next.

**Divide the Dollar (OLG): Initial Considerations**

Overlapping generations of legislators. Here we examine the divide-the-dollar logic in a repeat-play, overlapping-generations setting. There are N senators, each of whom is serving a
term of three sessions. At the end of each session, N/3 senators face reelection.\footnote{12} We refer to the senators up for reelection at the end of the present session as class \( t \); those who will face reelection at the end of the next session as class \( t-1 \); and those who will face reelection in two sessions as class \( t-2 \). In each session a dollar is divided by a majority-rule process to be described below. We assume that all senators seek reelection; i.e., we exclude the possibility of retirement, and we assume that defeated senators are unable to run again in the future.\footnote{13} First we will discuss the stage game that takes place once per session. Then we will move on to the supergame which, for each senator, consists of three plays of the stage game leading up to that senator’s reelection bid.

Stage game. The divide-the-dollar stage game is essentially the example we recounted from Baron and Ferejohn. We maintain the same notation as before. Each play of the stage game will be referred to as a session that consists of no more than two bargaining rounds. The game each session involves a majority-rule decision on partitioning an exogenously provided dollar among legislators. The difference between our stage game and the example given by Baron and Ferejohn is that senators do not discount between the two rounds of the same session.

A randomizing device determines which senator will be allowed to make a proposal. We take each senator to have an equal probability \( 1/N \) of being selected.\footnote{14} The recognized senator, \( j \),

\footnote{12} For convenience we will assume \( N \) is divisible by three, avoiding the slight unevenness in cohort size of the real U. S. Senate.

\footnote{13} The continuation value from running for reelection may be inferior to that of “retirement,” if the probability of reelection is sufficiently low or the value of post-senatorial opportunities sufficiently high. We have not explored this possibility in the present paper. A political-economy model of legislative careers is found in Diermeier, Keane, and Merlo (2002).

\footnote{14} We follow the convention of Baron and Ferejohn in assuming that all legislators seek recognition because, as they note, “recognition is valuable in equilibrium.” In repeat-play contexts, however, even though recognition is valuable in equilibrium in the stage game, certain
proposes some $p^j \in \Delta$. This proposal is voted on immediately. Let $V \leq N$ be the number of senators for whom $v^i(p^j) = 1$. If $V \geq (N+1)/2$, then the proposal is adopted, the distribution of the dollar is made, and the session concludes. If $V < (N+1)/2$ then the recognition phase is repeated, with a senator (possibly the same senator) selected by the random recognition rule to make a proposal $p' \in \Delta$. This is put to an immediate vote, but this time if $V < (N+1)/2$ then the dollar is not allocated and everyone receives zero. This constitutes a play of the stage game – at most two motions are entertained.\footnote{One such play of the stage game occurs each session, followed by an election in which a designated portion of the senators must face the judgment of their respective constituents.}

Office benefits. Each senator is treated as a purely Downsian politician in the sense that he or she seeks office solely for the associated benefits or ego-rents. It is assumed that each politician acts so as to maximize the probability of being reelected in his or her next campaign. Thus, in contrast to the Baron-Ferejohn argument, the dollar over which politicians bargain each session is only indirectly valuable to them. As we develop below, shares of the dollar contribute to the expected utility of politicians through their probability-of-reelection function.

Reelection. We treat reelection as a stochastic process in which each legislator’s probability of reelection depends endogenously upon his level of success in “bringing home the bacon” to his or her constituents over the course of a full term in office. We denote as $x_m$ the portion of the dollar obtained by the legislator in session $m$ (with a superscript on the payoff when it is necessary to identify its recipient). We will refer to the various realizations, $x$, achieved by any given senator as that senator’s legislative record, where $x$ is a vector. A senator

\footnote{Alternative models could allow for this possibility.}
who has completed all three bargaining sessions will be said to have a complete record; one who is at an earlier point in his term will be said to have an incomplete record. Thus, a complete record is a vector with three elements \((x_t, x_{t-1}, x_{t-2})\) whereas an incomplete record contains one or more missing values; for example \((\bullet, \bullet, x_{t-2})\) represents that of a senator who has completed only one of his three sessions. A given legislative record will be said to be more complete than another if it contains fewer missing values.

With \((x_t, x_{t-1}, x_{t-2})\) representing the (complete) record of some legislator of type \(t\), we take \(\Pi = \Pi(x_t, x_{t-1}, x_{t-2})\) to be this legislator’s probability of reelection.\(^{16}\) We assume that \(\Pi\) possesses positive first derivatives in all its arguments. That is to say, a legislator’s probability of reelection increases as his level of success in any of the bargaining sessions increases, holding constant his level of success in other bargaining sessions. We also take \(\Pi\) to be concave, so that the incremental returns to bargaining gains are diminishing. Defining \(\lambda_j = \partial\Pi/\partial x_j\) as the marginal effect of an increase in a legislator’s payoff in session \(j\) on his or her probability of reelection, and \(\lambda_{jj}\) as the change in this marginal effect, we summarize this as the

**Wealth Assumption.** (i) \(\lambda_j > 0\). (ii) \(\lambda_{jj} < 0\). A legislator’s probability of reelection is increasing in his or her payoff in any bargaining session, but at a decreasing rate.

If \(\lambda_j > \lambda_{j-1} > 0\) (for \(j = t, t-1\)), as evaluated at any fixed, complete legislative record, then constituents are said to observe a retrospective voting rule (Fiorina, 1981) that we call the WHYDFML Principle (“What have you done for me lately?”).\(^{17}\) This means that legislators

\(^{16}\) Notice that a politician’s reputation is based only on his or her record during the most recent term of incumbency. Upon reelection, the slate is wiped clean.

\(^{17}\) That is, for a given complete legislative record, \(x^*\), if changes in \(\Pi(x^*)\) are more sensitive to changes in the legislative record closer to election than farther from it – if changing \(x_{j}^*\) by an
prefer an additional increment of pork closer to their reelection contest to one at an earlier date. This is given as the

**WHYDFML Principle.** \( \lambda_j > \lambda_{j-1} > 0 \) (for \( j = t, t-1 \)). Given any complete legislative record, the impact of a further incremental increase in payoff on the probability of reelection is larger for later sessions than for earlier ones.\(^{18}\)

**Strategies in the Supergame.** An individual strategy in the supergame must specify what proposals an individual would offer and what offers an individual would accept at any node on the game tree. We provide for the possibility that individuals can condition their actions on the results of past play of the game. Actions can be conditioned directly on past actions, for example in a punishment regime, or they can be conditioned on the outcomes of prior play that define present conditions. We denote by \( h \) the past history of play, which includes the proposals and votes of all senators, as well as information about which is the present session.

amount \( \varepsilon \) has a bigger effect on \( \Pi(x^*) \) than changing \( x_{j-1}^* \) – then the WHYDFML Principle applies.

\(^{18}\) Before proceeding to the equilibrium analysis we make one last technical observation. Our formulation has voters assessing candidates at the time of election by taking the entirety of an incumbent’s record over his or her term in office into account, but placing less weight on achievements that came earlier in the term. This captures the idea that voters do not bother to evaluate legislator actions as they occur – they do not engage in continuous assessment – waiting instead until attention is focused on the election, information is spoon-fed to them by the press and campaigns, and they must cast a vote. An alternative formulation, suggested to us by Sven Feldmann, assumes that voters evaluate incumbents periodically, or even continuously, throughout their terms in office, arriving at a summary judgment at election time as a convex combination of these earlier evaluations (giving greater weight to more recent evaluations). We have adopted our view because it demands less of voters, allowing for short attention spans, little interest in politics, and faulty memories. The alternative view, however, has some interesting and perhaps advantageous modeling implications, perhaps providing legislators with greater
• **Proposal.** $p^i : h \rightarrow \Delta$, where $\Delta$ is the N-1 dimensional simplex, i.e., $\Delta = \{(x_1, \ldots, x_N): x^j \geq 0 \ \forall j \text{ and } \Sigma_j x^j = 1\}$. 

• **Vote.** $v^i : p \times h \rightarrow \{0, 1\}$, where $p$ signifies the particular proposal under consideration, $v^i = 1$ signifies a “yes” vote for player $i$, and $v^i = 0$ signifies a “no” vote for player $i$.

The next section examines whether senators can sustain an inter-temporal norm as a stationary equilibrium – that is, as the result of history-independent play. After having analyzed this possibility, we examine equilibrium play conditioned on history.

**A Focal Equilibrium**

We take up a focal candidate for equilibrium in which the dollar is shared only among the senators about to face reelection. The intuition for focusing on this distributional arrangement flows from two salient features of this overlapping-generations legislature. First, only one third of the senators face reelection at the end of each session. Second, retrospective voter assessments exhibit a recency bias with greater weight placed on accomplishments occurring nearer to election time. If legislators could choose a distributional arrangement behind a veil of ignorance, before play of the game begins and before legislators know how they are situated, they would choose to back-load expected benefits into their final session, because this distribution maximizes the expected value of the game for each legislator.\(^{19}\)

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\(^{19}\)There are many equilibria in this supergame, and it is possible that a staggered-term legislature would arrange itself according to an equilibrium norm associated with any one of them. We do not possess a model of equilibrium selection, but, as is conventional in developments like this in the literature, we claim that the one we examine is *focal* because it Pareto dominates any other.
Proposition 1. The legislative record \((x_t, x_{t-1}, x_{t-2}) = (1,0,0)\) is ex ante optimal among all allocations in which each legislator receives his or her expected value.

Proof.\(^{20}\) This follows directly from the WHYDFML Principle. If, in each session, the legislator closest to election receives the entire dollar, then all legislators will eventually have a complete legislative record, \((1,0,0)\). How does such a record compare with other records, \((z_t, z_{t-1}, z_{t-2})\), for which the legislator receives his or her expected value, i.e., for which \(\sum_j z_j = 1\)? Note first that \(\lambda_{t-1} > \lambda_{t-2}\) implies \(\Pi(z_t, z_{t-1}+\varepsilon_1, z_{t-2}-\varepsilon_1) \geq \Pi(z_t, z_{t-1}, z_{t-2})\) for arbitrarily small values of \(\varepsilon_1\). Note also that \(\lambda_t > \lambda_{t-1}\) implies \(\Pi(z_t+\varepsilon_2, z_{t-1}-\varepsilon_2, z_{t-2}) \geq \Pi(z_t, z_{t-1}, z_{t-2})\) for arbitrarily small values of \(\varepsilon_2 \leq \varepsilon_1\). These facts together imply that \(\Pi(z_t+\varepsilon_2, z_{t-1}+\varepsilon_1-\varepsilon_2, z_{t-2}-\varepsilon_1) \geq \Pi(z_t, z_{t-1}, z_{t-2})\). Repeated application of this inequality yields \(\Pi(1,0,0) \geq \Pi(z_t, z_{t-1}, z_{t-2})\) for all allocations in which each legislator receives his or her expected value. As such, each senator prefers to back-load the entire expected payoff into the period just before election. ♦

This optimum distributional arrangement is produced by strategies in which any senator, when recognized, offers the proposal giving the last-session senator the entire dollar. Each senator then votes in favor of this distribution.

That this outcome is good for senators is the content of Proposition 1. Behind the veil of ignorance, senators in our three-person example expect to receive one-third of the pork allocated over the three sessions of their incumbency – in total, one dollar. They would prefer to receive this expected amount entirely in the session directly preceding their election, as opposed to equal shares in each session (a universalism norm) or any other conceivable distribution across their term. That this outcome can be the result of divide-the-dollar politics is demonstrated by the

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\(^{20}\)To make things as transparent as possible in what follows, we develop our argument in a three-person setting. Our results are easily generalized, as we demonstrate in subsequent discussion at the end of the paper.
strategies outlined above. That this outcome is an *equilibrium* of these politics is still to be demonstrated.

We prove shortly that the proposal and voting pattern described above is sustainable as an equilibrium with an appropriate punishment regime. In this equilibrium, legislators must be prepared to punish off-the-equilibrium-path behavior. Sometimes this is “self-executing,” as when the punishing legislators get to do things they actually like to do but are deterred from doing along the equilibrium path – like acquiring additional shares of the dollar in sessions in the electoral cycle other than their last. In other situations, forbearance is required. For example, in punishing someone who offers a \( p' \neq p \), if, after the non-proposers (properly) reject \( p' \), the deviating party is (randomly) recognized in a second round and offers some share of the dollar to one of the prospective punishers, then the latter must vote against this (thus refusing a positive share) or risk being punished herself in the next session. In still other situations, the punishment must be carried out by the *replacements* of senators against whom the original deviation took place – this will occur when a “victimized” senator is subsequently defeated for reelection so that his replacement must, at the appropriate time, carry out a punishment. The punishment regime, that is, must provide for punishments extending across sessions and sometimes involving new players. In short, some fairly subtle and delicate features of the punishment regime must hold. As Baron and Ferejohn discuss, expectations about precisely this sort of thing are susceptible to disruption from noise, legislative turnover, and other distractions (see footnote 4 above).

Further complications arise once we extend consideration beyond the simple illustration in which there is only one senator of each type. For instance, with more than one type \( t \) senator, there are now multiple potential recipients, alternative allocations, and thus conflicts-of-interest among them. What this all amounts to is that we have identified an equilibrium that may require considerable coordination on proposing, voting, and punishing.
Below we first explore the prospects for sustaining this equilibrium when coordination on punishment is absent. In effect, we ask whether the Wealth Assumption and the WHYDFML Principle naturally lead legislators to behave in ways that support the ex ante optimal distribution identified above. In doing this we are able to identify the effects of these two features of the problem. We conclude, however, that \( p = (1,0,0) \) cannot always be sustained as a stationary, i.e., history-independent, equilibrium (Proposition 2). We then describe a simple punishment regime on which basis \( p = (1,0,0) \) can be sustained as a (non-stationary) equilibrium – one in which individual strategies are conditioned on past bargaining behavior entailing the credible punishment of off-the-equilibrium-path behavior. Finally, we explore the robustness of our result to one natural extension – namely, to allowing more than one senator of each type.

We do not focus on any systematic data in the present paper. As an empirical matter, however, if the WHYDFML Principle captures the behavior of voters, and senators are able to coordinate in ways that allow them to exploit WHYDFML and thereby back-load expected benefits, we should observe traces of a temporal pattern in distributive politics in bodies like the U.S. Senate. Senators up for reelection should disproportionately seek pork, on the one hand, and, as in the pay-raise example with which we began this paper, they should be spared burdens like embarrassing votes, on the other. An empirical hypothesis suggested by the equilibrium pattern just described is that a state should enjoy two “prosperous” pork-barrel Congresses and one “impoverished” one out of every three, all other things equal, since in four out of every six years there is a senator from the state in his or her last Congress.\(^2\)

As a normative matter, it is worth noting that while this equilibrium is ex ante optimal for senators, their constituents may tend to find the boom-or-bust, feast-or-famine nature of their

\(^2\) It should be strongly emphasized that these are expected tendencies deriving exclusively from equilibrium norms in the Senate \textit{taken in isolation}. We comment on their effects in a richer bicameral setting in the concluding discussion section below.
pork flow unattractive, instead preferring a smoother inter-temporal pattern of distribution. This serves as a reminder that we are not thinking of the WHYDFML Principle as optimal behavior by voters, but rather are treating it as an exogenous feature of the limited disposition and capacity of mass electorates to monitor their elected officials.\(^\text{22}\)

**(Partial) Equilibrium Effects of Retrospective Voting and Wealth**

This section abstracts from our supergame and considers how the previous bargaining gains of senators (or *Wealth Effect*) and their position in the electoral cycle (or *WHYDFML Effect*) influence bargaining in the stage game. For now we ignore the potential implications for future stage games of bargains struck in the current stage game in order to help isolate the effects of wealth and WHYDFML. In an isolated stage game the recognized senator makes a proposal p, seeking as allies those who are the “cheapest,” which as we explain later may not necessarily be the case in the supergame. Because of the overlapping-generations feature, the N-1 other senators are, unlike in the Baron-Ferejohn setting, *not* identical as prospective coalition partners. Thus, the senator recognized will make alliance with the senators that have the (N-1)/2 smallest continuation values. Who are these “cheap dates”? We show in the next few paragraphs that, *ceteris paribus*, seniors further along in the election cycle whose constituents place relatively more weight on their recent accomplishments (WHYDFML Effect), on the one hand, and those who have not secured much pork in previous sessions (Wealth Effect), on the other, are less expensive coalition partners.

Suppose, in the three-legislator case, that senator t is recognized and makes a proposal p = (x^t, x^{t-1}, x^{t-2}) ∈ Δ. The proposal must satisfy the “participation constraint” of one other ally, i.e.,

\(^\text{22}\) There are contexts in which a retrospective rule like the WHYDFML Principle *is* optimal, even for otherwise non-myopic voters. Rogoff and Silbert (1988) and Rogoff (1990), for example, develop this argument when voters are imperfectly informed about the competence of their representative so that agent performance serves as a signal of this competence.
either $x^{t-1}$ or $x^{t-2}$ must exceed the continuation value for senator $t-1$ or $t-2$, respectively, in the
subgame that would follow the defeat of $p$. If $p$ loses, then each senator has a 1/3 probability of
being recognized and, if so, will propose a $p'$ in which the proposer takes the entire dollar (a
proposal that passes unanimously). If, counterfactually, senators cared directly for the dollar
available to be divided and were risk neutral, as in the Baron-Ferejohn model, then either (2/3, 0,
1/3) or (2/3, 1/3, 0) would do the trick as a proposal from senator $t$, satisfying the participation
constraint of exactly one ally and allowing the proposer to claim the residual. However, our
senators do not derive utility directly from consumption; the dollar is desired by them for its
impact on $\Pi$, the probability of reelection. Thus, senator $t$ seeks the smallest amount $x_{t-i}^*$ for
which either

$$\Pi(\bullet, x_{t-i}^*, x_{t-2}) = \left[\frac{1}{3}\Pi(\bullet, 1, x_{t-2}) + \frac{2}{3}\Pi(\bullet, 0, x_{t-2})\right]$$

or

$$\Pi(\bullet, \bullet, x_{t-2}^*) = \left[\frac{1}{3}\Pi(\bullet, \bullet, 1) + \frac{2}{3}\Pi(\bullet, \bullet, 0)\right].$$

Here $x_{t-i}^*$ is the amount that makes senator $t-i$ indifferent between accepting senator $t$’s
offer or rejecting it in favor of another recognition round. It is the certainty equivalent of the
lottery that will occur if the game progresses to the next recognition round. Because $\Pi$ is concave
the dollar value of the certainty equivalent will always be smaller than the dollar value of the
expected gains from the lottery. For example, with three legislators the lottery offers a 1/3 chance
of getting one dollar and a 2/3 chance of getting nothing, which is worth less than receiving 1/3 of
the dollar for certain because of the decreasing returns in $\Pi$.

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23 Notice that we use *subscripts* to the arguments in these expressions, since $\Pi$ is a function of a
senator’s legislative record and time is consistently written as a subscript in our development.
Earlier in the paragraph we spoke of a proposal, $p$, offered at a *specific* time (hence no subscript)
but describing a distribution across legislators (hence *superscripts*) giving their respective names.
Moving between time and identities – subscripts and superscripts – is an annoyance for the reader
but is necessary to keep things straight.
Moreover, the certainty equivalent of the lottery will vary depending on the interval of $\Pi$ over which the lottery is conducted. If senator $t-1$ received some positive allocation ($x_{t-2}$) in the previous session, then the wealth of senators $t-1$ and $t-2$ differs as they enter the bargaining round. This means that the present second-round lottery will be associated with different certainty equivalents for the two senators.

The certainty equivalents of the lotteries facing $t-1$ and $t-2$ also depend on the amount that constituents discount the value of pork gained in the current session. Recall that $\lambda_j = \partial \Pi / \partial x_j$ for $j \in \{t, t-1, t-2\}$ and $\lambda_t > \lambda_{t-1} > \lambda_{t-2} > 0$ from the WHYDFML Principle. We can think of this as indicating the rates at which constituents discount pork acquired, for example, in the first and second sessions of a legislator’s term: since $\lambda_{t-2}$ is smaller than $\lambda_{t-1}$, constituents discount pork from session $t-2$ more heavily than pork from session $t-1$. Thus, the “effective” gains to legislator $t-1$, whose constituents discount the current-session gains less, will be larger than would comparable gains to legislator $t-2$. This provides a second reason for different certainty equivalents for the two legislators. In short, the certainty equivalent, and hence the basis for an offer from a proposer, is affected by both the legislator’s past track record and the retrospective assessments of his or her constituents.

Without more precise information about $\Pi$, it is difficult to draw general conclusions about the relative size of $x_{t-i}^*$. Nevertheless, a simple graphical analysis allows us to determine some “cheap date” principles. In the remainder of this section, we offer a graphical analysis of the effects of wealth and WHYDFML on the certainty equivalent of the lottery legislators face if the game continues to the second round. This illustrates that legislators who discount the dollar less are cheaper coalition partners.

To understand the principles at work we join a single-session, three-player game (i.e. an isolated stage game from our supergame) after one legislator has already been recognized as a first-round proposer. We focus on the two remaining legislators who are potential coalition
partners for the proposer, and ask which will be a cheaper date. For this example, we select an arbitrary concave function $\Pi$ that maps bargaining gains onto the probability of reelection. To examine the effect of WHYDFML we consider a bargaining session in which the constituents of Legislator 1 ($L_1$) discount the dollar by $\frac{1}{2}$ while those of Legislator 2 ($L_2$) do not discount the dollar at all. Although we are outside of the overlapping-generations, repeat-play structure of our game, this is analogous to a situation where $L_1$ is one session away from reelection and $L_2$ faces reelection at the end of this session, leading $L_2$’s constituents to weigh her current session gains more heavily than those of $L_1$. Figure 1 displays both legislators on a single graph. The x-axis measures discounted value, not the actual amount of the distribution. For example, if $L_1$ receives $\frac{1}{2}$ of the dollar, then it is plotted as the discounted value $\frac{1}{4} \times \frac{1}{2}$ on the x-axis. On the other hand if $L_2$, whose constituents will not discount benefits in this current session, receives $\frac{1}{2}$ unit, then it is plotted as $\frac{1}{2}$ on the x-axis. The important point is that while the value of these offers is different for the legislators who receive them, the cost of the offers to the proposer is identical. The y-axis represents the value of benefits to a legislator as determined by the probability of reelection function, $\Pi$.

**Figure 1 here**

Along the x-axis we have plotted the benefits that each legislator will receive if he or she rejects an offer in the first session and is recognized in the second session. For $L_1$ this is $\frac{1}{2}$, because although he can keep the entire dollar, it will be discounted by $\frac{1}{2}$. For $L_2$ this is 1, because she can also keep the entire dollar but it is not discounted. We have plotted the probability of election associated with these distributions, $\Pi(1/2)$ and $\Pi(1)$, respectively, on the y-axis. Next we determined the utility of the lotteries that each legislator faces if the game continues into the second round, where each has a $1/3$ probability of recognition. For $L_1$ this is $1/3\Pi(1/2) + 2/3\Pi(0)$; for $L_2$ this is $1/3\Pi(1) + 2/3\Pi(0)$. Finally, we plot the certainty equivalent of the lotteries along the x-axis, $c^*$ for $L_1$ and $c^{**}$ for $L_2$. These certainty equivalents make
legislators indifferent between accepting a first-round offer or continuing to the second round and facing the lottery.

To see that \( L_2 \) is the cheaper coalition partner we need to consider whether it costs the proposer more to offer \( c^* \) to \( L_1 \) or \( c^{**} \) to \( L_2 \). A first glance is deceptive. It appears that \( L_1 \) is cheaper than \( L_2 \) because \( c^* \) is less than \( c^{**} \). However, this does not take into account the fact that the x-axis represents the discounted value of the benefits. Remember that \( L_1 \) discounts by \( \frac{1}{2} \), meaning that to enjoy \( c^* \) worth of benefits, she must be offered \( 2c^* \) in the distribution. Thus, the proposer has a choice between offering \( 2c^* \) to \( L_1 \) or \( c^{**} \) to \( L_2 \). In Figure 1 it is clear that \( c^{**} < 2c^* \), meaning that \( L_2 \), who does not discount, is the cheaper coalition partner. More generally, we have the

**WHYDFML Effect.** The minimum offer from a proposer acceptable to a prospective coalition partner in the first round of a session is monotonically increasing in the number of sessions until the prospective partner’s next election.

All other things equal, those more distant from an election will be more expensive as coalition partners, because of the concavity of \( \Pi \) and the fact that whatever they receive is discounted more steeply than by someone closer to an election. Politically older colleagues – those closer to the next election – are more attractive coalition partners. The **WHYDFML Principle** privileges electoral-cycle “age.”

The *ceteris paribus* qualification, however, means some features that may be *correlated* with electoral-cycle age need to be taken into account. One of these is the endowment a legislator brings to a current play of the game – a legislator’s “wealth” – and this is our next consideration.

\(^{24}\) Notice that the more expensive prospective partner cannot lower her “price” to make herself more attractive. Her higher price reflects a higher continuation value, a consequence of the greater interval until the end of her term.
We want to determine the effect of these ex ante endowments on the attractiveness of legislators as coalition partners. We show that those who have higher pre-existing endowments – that is, those who have been relatively successful in previous divide-the-dollar sessions of their incumbency – are more expensive than those without such previous good fortune. Put colloquially, legislators start a current round of bargaining with different probability-of-reelection prospects based on differences in their (incomplete) legislative records; given the concavity of \( \Pi \), the same offer of a portion of a dollar will affect their subsequent electoral prospects differently.

To sharpen intuition about this effect, we again join the first round of an isolated three-player stage game at the point when one legislator has been recognized to make a proposal and must determine which other legislator is a cheaper coalition partner. Legislator 1 (L₁) does not have any previous benefit successes, whereas Legislator 2 (L₂) has one unit of endowment from previous sessions. In order to isolate the effect of this wealth in the present example, displayed in Figure 2, we assume the electorates do not discount so that legislators are simply bargaining over the distribution of a single dollar. Along the horizontal axis of Figure 2 is the aggregate amount of benefits each legislator will receive if recognized in the second round – gains from this session plus previous successes. The associated probability of reelection, \( \Pi \), is given along the vertical axis.\(^{25}\) Thus, if the bargaining in this session should go to the second round and L₁ is recognized, he will capture the entire benefit leaving him with one unit of benefits in total at the end of the session. If he is not recognized he will receive no benefits in the current session and will take no benefits home at the end of the session (since he had no endowment). Thus, were this his last session before an election, he would face the lottery \( 1/3 \Pi(1) + 2/3 \Pi(0) \) if the legislature continued into the second round of the session. If L₂ is recognized for the second round of the session, he would capture the entire benefit. When this is combined with his previous success, he

\(^{25}\) For this example we treat the probability of reelection as depending on the sum of pork, i.e., \( \Pi(x_t, x_{t-1}, x_{t-2}) = \Pi(\Sigma x_i) \).
will have a total of two units at the end of the session. On the other hand if he is not recognized he will still be left with one unit from his previous success. Thus he would face as a reelection prospect the lottery $1/3\Pi(2) + 2/3\Pi(1)$.

**Figure 2 here**

We have translated the lotteries into certainty equivalents ($c^*$ for $L_1$ and $c^{**}$ for $L_2$) on the horizontal axis. To determine how much a proposal must offer to secure the vote of a legislator, we subtract the pre-existing endowment of the legislator from the certainty equivalent of the lottery she faces if she rejects an offer; this is the increment the current proposal must provide. From the graph it is clear that $c^*- 0 < c^{**}- 1$, meaning that the legislator without an ex ante endowment is cheaper than the legislator with the endowment. From the concavity of $\Pi$, this will hold whenever there is a prior endowment disparity. More generally, we have

**Wealth Effect.** The minimum offer from a proposer acceptable to a prospective coalition partner in the first round of a session is monotonically increasing in the endowment of previous successes enjoyed by that prospective partner.

The effects of wealth and WHYDFML on the attractiveness of a legislator as a coalition partner in the isolated stage game suggest the possibility of interesting and complicated strategic dynamics in the supergame. Young legislators, who may be disadvantaged because of the WHYDFML Principle, might think ahead, seeking to keep their endowments low enough that, if not recognized later as a proposer, they may nevertheless be an attractive coalition partner. Alternatively, consider the incentives of a proposer in an early session of his term precisely when present accomplishments will subsequently be heavily discounted. The benefits that this proposer could derive from his proposal may not be sufficient to make up for the fact that he has become wealthier, and thus a less attractive coalition partner in the later rounds that really matter. As a result, he might wish to give away a substantial portion of the dollar in order to increase his own relative attractiveness in a subsequent session.
In particular, consider two legislators, each of whom is in the second session of her three-session term. Imagine that \( L_1 \) has a slightly smaller endowment than \( L_2 \), and that the proposal maker includes \( L_1 \) but not \( L_2 \) in her minimal winning coalition. In our previous one-shot analysis, \( L_1 \) would of course support the proposal, so long as it at least matched her continuation value into the following round of the legislative session. Now, however, \( L_1 \) might reason as follows. If she accepts the proposal, then her endowment will increase by a certain amount. However, if this means that \( L_1 \)’s endowment now exceeds \( L_2 \)’s, all things being equal, this will make it less likely that \( L_1 \) will be selected to join a winning coalition in the final session of her term. If, on the other hand, she opposes the proposal, and as a result does not receive the bargaining benefits it contains, her endowment remains at a lower level than \( L_2 \)’s, and she thereby remains ahead of \( L_2 \) as an attractive coalition partner in the third session. Since we have assumed that the bargaining gains of later legislative sessions have a higher marginal value for legislators (according to the WHYDFML Principle), it is easy to imagine circumstances in which maintaining the upper hand in later bargaining rounds is worth foregoing benefits in earlier rounds.

The WHYDFML and Wealth Effects, that is, encourage an incumbent optimizing over her entire term to forego early benefits in order to position herself to score big when it really matters. The intuition here is that individual optimizing behavior pushes legislators toward supporting an outcome that looks very much like the focal equilibrium we identified earlier, one in which the back-loading of benefits is prominent.

However, we should reiterate that we have arrived at these intuitions by considering the incentives that legislators face in the isolated stage game. It remains to be seen under what conditions and to what extent these effects play out in the equilibria of the supergame. What is clear, however, is that the correct way to analyze the supergame is to consider the legislator’s continuation value for the remainder of her entire term in office, not just the remainder of the present legislative session. We proceed with this discussion in the following section.
Divide the Dollar (OLG): Equilibrium Analysis

The stage-game analysis just concluded hints at pressures toward back-loading of benefits. Perhaps the focal candidate for dividing the dollar, the one that is ex ante optimal for legislators (Proposition 1), can be supported by stationary strategies as an equilibrium of the overlapping-generations version of the repeat-play, divide-the-dollar game. That is, perhaps the pressures of the Wealth Effect and the WHYDFML Effect are sufficient inducements to produce the back-loading result. Unfortunately, this will not always be the case, as demonstrated in the following Proposition.

**Proposition 2.** The ex ante optimal outcome, \((x_t, x_{t-1}, x_{t-2}) = (1,0,0)\), is not in general sustainable as a stationary equilibrium.

The proof is found in the Appendix. The idea is this. If a legislator other than the oldest is recognized, he or she need not have an incentive to propose the ex ante optimal proposal. The payoff-relevant consequences suggested by the Wealth Effect and the WHYDFML Effect may not be sufficient to deter this behavior for some forms of \(\Pi\). That is, there are probability-of-reelection functions, concave and monotonic in each of their arguments and reflecting retrospective evaluations, that nevertheless do not deter proposals that fail to give the entire dollar to the legislator closest to her reelection. So we must conclude that the ex ante optimal distribution cannot always be sustained as a stationary equilibrium.

We have shown that the ex ante optimal distribution, \((1,0,0)\), cannot always be sustained by the incentive effects of wealth and WHYDFML – by the sheer inclination of each legislator to burnish a reputation for being an inexpensive coalition partner at precisely the point in his or her electoral cycle when payoffs from a share of the dollar would have the greatest impact on the probability of reelection. Non-stationary strategies involving history-dependent punishment to discourage proposal and voting behavior inconsistent with back-loading is sometimes required. As alluded to earlier, this may prove problematical in more general models because of imperfect
information and changing personnel. Nevertheless, especially simple punishment regimes are not as vulnerable to these problems. We propose the following:

**Simple Punishment Regime.** (i) If i proposes any distribution other than (1,0,0), then i is “zeroed out” when i is old. (ii) If j ≠ i,3 supports an “off-the-path” proposal, then i’s punishment is canceled and j is “zeroed out” when j is old.

We call it the “simple” punishment regime because it truly is simple, and is quite plausible even in environments like those of real-world legislatures. This punishment arrangement yields the following

**Proposition 3.** With the simple punishment regime, (1,0,0) is sustainable as a (non-stationary) equilibrium.

The proof is found in the Appendix. We show there that no deviation can be profitable for a prospective deviator because the punishment is both effective and credible.

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26 It will be necessary to *identify* deviations from the equilibrium path, something made problematical by such practices as a secret ballot or a voice vote, for example; that is, deviations must be *observable*. It will also be necessary to know *why* the nominal deviation has taken place – is it a deviation or a punishment for a prior transgression? Noise and other sources of information imperfection will complicate matters. Finally, as noted earlier, changing personnel, particularly those that did not directly experience a deviation, will be especially dependent on *verifiable* deviations.

27 Legislative scholars recount James Buckley’s (I-NY) flouting of Senate norms through his effort in the early 1970s to reduce pork-barrel spending. In Senate action during the 93rd Congress, only projects from New York State were struck from the omnibus public works bill, leading the *New York Times* to complain that New York apparently had only one senator! See Richard Reeves, “Isn’t It Time We Had a Senator?” *New York Times*, February 25, 1974, p. 38 (cited in Mayhew, 1974, pp. 91-92.) This captures the spirit of, and is actually a close approximation to, the simple punishment regime we have in mind.
Discussion

**Robustness.** We have presented our results on bargaining among overlapping generations of politicians in the very simplest of cases – one in which there is a single senator of each type – in order for the intuition to come through clearly. But many of our intuitions hold more generally. Suppose that there now are \( k \geq 1 \) senators of each type, and thus \( 3k \) senators in all.

It is easy to see that the intuition contained in Proposition 1, that back-loading of bargaining gains is desirable for politicians, is unchanged in this new context. When there are \( k \) senators of each type, the expected value to be received by a given senator during the course of his term is \( 1/k \), rather than 1 as in the three-senator special case, because a dollar is to be divided among the \( 3k \) senators in each of three sessions. Although the magnitude of the gains differ between the two cases, this difference does not affect the logic of the proof given for Proposition 1 – identical analysis establishes that \( \Pi(1/k, 0, 0) \geq \Pi(z_t, z_{t-1}, z_{t-2}) \) for any distribution satisfying \( \Sigma_j z_j = 1/k \). Specifically, the WHYDFML Principle justifies the repeated application of a marginal shift of benefits from an earlier session to a later one for any arbitrary \((z_t, z_{t-1}, z_{t-2})\). As such, the optimal inter-temporal allocation is the same regardless of the size of the legislative body.

It is also possible to construct an analogue to Proposition 3 for values of \( k \geq 1 \) – that is, to demonstrate that this optimal distribution can be maintained in a non-stationary equilibrium via an analogous punishment regime in which a deviator is zeroed-out in his or her last session. Extending the intuitions of Proposition 2 to settings in which \( k > 1 \) is more difficult, although it seems intuitively plausible that a modified version would hold for larger values of \( k \). At the same time, an extension of Proposition 2 is unnecessary to convey the message that our focal equilibrium remains focal, and an equilibrium, outside of the special case \( k=1 \).

**Substantive Significance.** Were the U.S. Senate a unicameral legislature, then our focal equilibrium would suggest an empirical pattern in which states enjoy four boom years of
government largesse followed by two bust years. The reason? In two out of every three Congresses, there is a senator from the state whose term ends and whose state thus enjoys the benefits of the “back-loaded” equilibrium on which we have focused. Needless to say, this claim abstracts from lots of other issues – marginal versus safe seats, retirement and open seats, partisan distinctions, small versus large states (Lee and Oppenheimer, 1999), entitlement and other “uncontrollable” spending – for which a fully specified empirical analysis would want to control. And, of course, the very premise is false, so that we would want to take on board the consequences of bicameral interactions as well (to be addressed below). Nevertheless, the simple theoretical argument developed in this paper suggests, minimally, that *traces of an electoral pork-barrel cycle induced by the staggered-term arrangement in the Senate should be in evidence.*

Additional empirical expectations are implied by the logic developed here. It would come as no surprise that reelection-oriented senators engage in credit-claiming, blame ducking, and advertising – the burnishing of a reputation with voters that Mayhew (1974) emphasized more than twenty-five years ago. And, as dictated by the WHYDFML Principle, this reputation-burnishing behavior is likely to be especially intense and animated just before elections (as the head-note quotation from the late Senator Hubert Humphrey suggests). But even with the effects of WHYDFML, it is the sort of activity in which a senator would engage almost continuously throughout his or her term. The same would hold for casework, private-member bills, and other forms of constituency service. True, the voters may only dimly recall something for which a senator claimed credit early in the electoral cycle. But a reputation-burnishing senator will take enhancements to his or her status wherever (and whenever) they are to be found. What the reputation-burnishing hypothesis cannot explain, but which our argument addresses, is why, early in his or her electoral cycle, a senator would *forego* credit-claiming, would be prepared to fall on

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28 In a companion research project we are replicating the empirical study of federal outlays by Levitt and Snyder (1995) to see if a staggered-term effect emerges.
his or her sword by casting a vote unpopular with voters to help his or her party, or take a position or make a speech at odds with constituent opinion to support his or her party’s president (or oppose a president from the opposition party). Taking “hits” to reputation, making sacrifices, casting embarrassing votes, and passing up opportunities for gain (as in the pay raise example in the introduction to the present paper) remain unexplained in most models of reelection-oriented politicians, or are accommodated in an ad hoc (“statesmanship”) or static (part of a contemporaneous logroll) fashion. The claim of this paper is that these acts are part of an inter-temporal deal. They are instances of an institutional norm; they constitute equilibrium behavior of repeat play; they are made possible by the fact that the U.S. Senate is a continuing body of staggered-term legislators. As such, we would expect not only the feast-or-famine pattern of public expenditures mentioned earlier, but also disparities in the degree to which a senator supports (opposes, resp.) the president with whom he shares (does not share, resp.) a partisan label, defends his own party when its position is not popular with a state’s voters, votes for issues (like the pay raise) that are hard to explain to the folks back home – behavioral disparities that are correlated with the temporal rhythms of the electoral cycle.

Our emphasis on the temporal distinction among senators induced by staggered terms also sheds light on the “pooling” problem for credit-claiming in multi-member districts, MMDs (see Bueno de Mesquita, 2002). Taking a state to be an MMD, the politicians that represent it in the Senate compete with each other in claiming responsibility credibly for projects and policies beneficial to constituencies there. At least one way in which senators from the same state ameliorate their difficulty in distinguishing their respective efforts on behalf of constituents follows from the fact that a state is an unusual MMD – its senators do not run for re-election at the same time. So, as a result of the WHYDFML Principle, it will be possible for a state’s senators to engage in temporal coordination in credit-claiming.
There are other empirical implications of the perspective offered by the results of this paper. Especially interesting are those related to the bicameral tensions between the Senate and the House. A state delegation in the House will be composed of happy campers in years when, if our propositions are accurate, a state benefits from back-loading. But in one Congress out of three, senators and their respective state delegations in the House will be in conflict. Both senators are prepared to forego benefits this one time out of three, but House members need something to take home to the voters every election. Thus, while representatives love it when they are beneficiaries of back-loading, they cannot face their voters under such propitious circumstances every election. The literature on bicameral conflict tends to pit one entire chamber against the other. The arguments in this paper suggest a more nuanced set of bicameral tensions between state delegations in the respective chambers, tensions orchestrated by the temporal rhythms of the election cycle.

This perspective provides an interpretation on bicameralism that probably eluded the Founding Fathers. But a focus on the inter-temporal deal described in Propositions 1-3 allows us to recognize additional (non-obvious) features of bicameralism. Senate amendments to

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29 We searched the relevant passages of The Founders’ Constitution on the parts of the U.S. Constitution dealing with the senatorial election cycle (Kurland and Lerner, 1987, vol. 2, pp. 182-239). This is a multi-volume set consisting of original documents – contributions from The Federalist Papers, records of the Federal Convention, letters from Madison, Pinckney, Jefferson, and other notables, deliberations in various state constitutional conventions, editorials, pamphlets, and newspaper op-ed columns – addressing (and organized according to) the various sections of the Constitution. The pages cited at the beginning of this note deal with the issue of Senate terms (Article I, section 3, clauses 1 and 2). While many contemporaries in 1787 appreciated the tensions inherent in bicameralism – this was at least partly the point of the arrangement – nowhere in this collection of their writings is there any sense of the temporal overlay to these tensions induced by the staggered-term arrangement in the Senate that we have identified.

30 In identifying the phenomenon of backloading as a focal equilibrium of our game, we should allow for the fact that once embedded in a much richer empirical setting, with many other things
House bills, successful ones at least, should disproportionately favor those states with senators in the last period of their electoral cycle. Likewise, Senate treatment of House amendments should depend upon whether last-period senators stand to benefit. And conference delegations from the Senate should be united on this dimension and should stand firmly for the protection of their colleagues up for reelection.31

We hope to have demonstrated in this section that there is an agenda to be prosecuted extending the theoretical argument and examining the robustness of the conclusions as well as a set of substantive expectations to be explored empirically.

To conclude, we believe our model of distributive politics, a repeat-play divide-the-dollar game among overlapping generations of politicians, provides a plausible argument for an electorally induced pork-barrel cycle. Staggered terms and overlapping generations in the Senate, seemingly arcane attributes of this legislative body, may not be the only explanations for the distinctive forms of pork barreling, credit-claiming, and blame-ducking observed in the politics of distribution and in the “third-rail” politics of hot-button issues like the pay-raise example. But these institutional features are rich in theoretical possibilities and potentially useful in understanding aspects of the empirical world.

affecting the politics of distribution, this focal equilibrium surely will not explain everything. Nevertheless, it does suggest that traces of this staggered-term effect should emerge in the data.

31 More generally, it appears that the effect of the inter-temporal norm we identify in the Senate as a consequence of its staggered-term arrangement is to qualify the long-term perspective the Founders intended for the upper chamber. While a member’s concern for his or her own electoral fortunes will be as intended (viz., dampened throughout his or her term until just before election), there will nevertheless be an on-going short-term concern by all for those who are up for election. Our thanks to Guido Tabellini for this observation.
Appendix

Proof of Proposition 2.

In order to demonstrate that the ex ante optimal outcome \((x_t, x_{t-1}, x_{t-2}) = (1,0,0)\) is not generally sustainable as a stationary equilibrium, it is sufficient to show that optimal play given a history compatible with \((x_t, x_{t-1}, x_{t-2}) = (1,0,0)\) does not involve the passage of a proposal in which the type \(t\) legislator gets the whole dollar. First consider the incentives of the type \(t\) legislator himself, with incomplete record \((\bullet, 0, 0)\) – a record compatible with a history of play in which the ex ante optimal outcome repeatedly occurs. Suppose that a second bargaining round in \(t\)’s last session were to take place. Then clearly the type \(t\) legislator, who in seeking to maximize his probability of reelection must maximize his bargaining gains in the present round, will support any allocation in which he receives a positive amount. Knowing this, a type \(t\) legislator in a first bargaining round will, by backward induction, accept any offer exceeding \(z^*\), where \(\Pi(z^*,0,0) = (1/3) \Pi(1,0,0) + (2/3) \Pi(0,0,0)\). Since \(\Pi\) is concave and monotone increasing, it must be that \(0 < z^* < 1/3\).

The strategic calculations of the type \(t\) legislator have implications for the offers that will be made by legislators in the first bargaining round. In particular, consider the incentives facing a type \(t-1\) legislator, with incomplete record \((\bullet, \bullet, 0)\) – a record that, again, is compatible with a past history of play in which the ex ante optimal outcome is universal. If this type \(t-1\) legislator proposes a continuation of the ex ante optimal outcome, his record becomes \((\bullet, 0, 0)\). If there is available to this legislator an alternative proposal which will lead, in expectation, to a higher ultimate probability of reelection, then it will not constitute a stationary equilibrium for him to propose a continuation of the ex ante optimal outcome. Consider the case in which he proposes to offer \(z^*\) to the type \(t\) legislator and to keep \(1-z^*\) for himself. This proposal will pass with the
support of the type t legislator, and the legislator of type t-1 will have a new legislative record (•, 1-z*, 0) as he becomes a legislator of type t.

It remains to compare the ultimate probabilities of reelection that might result from the two incomplete legislative records (•, 0, 0) and (•, 1-z*, 0). In particular, if for some \( \Pi \) the ultimate probability of reelection corresponding to the deviating proposal exceeds that corresponding to the ex ante optimal proposal, then the proposition is proven, since the type t-1 legislator would not propose to give the whole dollar to the type t legislator in stationary equilibrium. A lower bound to the ultimate probability of reelection for the case in which t-1’s proposal deviates from the ex ante optimal offer is \( (1/9) \Pi(1,1-z*,0) + (8/9) \Pi(0,1-z*,0) \). This is so because when t-1 becomes the newly-minted type t legislator, he will have proposal power throughout his final session with probability 1/9. In this event, if a second round takes place, he will gain the whole dollar; if a second round does not take place, his proposal power in the first round means that nonetheless he will do no worse than having a 1/3 chance of gaining the whole dollar in a potential second round. With remaining probability 8/9, the probability of reelection can of course be no worse than \( \Pi(0,1-z*,0) \) in which he gets nothing in his final session. We must compare this lower bound for the “deviating case” to an upper bound on the probability of reelection for the case in which t-1 does not deviate – in which a proposal consistent with maintaining the ex ante optimal outcome is made. This would be \( \Pi(1,0,0) \).

The only restrictions on \( \Pi \) are that it is monotone in its arguments, is separately concave in each of its arguments, and that, from any fixed allocation, additional resources are most profitably funneled into later periods. But clearly it is possible to specify a form of \( \Pi \) satisfying these criteria and for which \( (1/9) \Pi(1,1-z*,0) + (8/9) \Pi(0,1-z*,0) > \Pi(1,0,0) \) – i.e., in which a deviation is profitable. Note that \( (1/9) \Pi(1,1-z*,0) + (8/9) \Pi(0,1-z*,0) = \Pi(y*,1-z*,0) \), where, from the concavity of \( \Pi \), \( y^* \) is the certainty equivalent satisfying \( 0 < y^* < 1/9 \). Because there are no
conditions on cross partials, we are free to choose a $\Pi$ that is very concave for $\Pi(\bullet,0,0)$ – with corresponding $z^*$ very small – but which is much less concave for $\Pi(\bullet,1-z^*,0)$ – meaning that $y^*$ is near $1/9$. As such, $\Pi$ can be selected such that $1+y^*-z^* > 1$ – and therefore it is possible to choose a $\Pi$ such that $\Pi(y^*,1-z^*,0) > \Pi(1,0,0)$ while simultaneously satisfying the WHYDFML principle.

As such, $\Pi$ can be chosen in such a way that legislator $t-1$ will make a proposal that deviates from a continuation of the ex ante optimal outcome – and that this deviating proposal will be accepted by legislator $t$ – from a history that reflects a prior ongoing play of the ex ante optimal outcome. Thus, the ex ante optimal outcome is not stable – in the sense that players who begin on its path will deviate from it under at least one chosen proposer for some forms of $\Pi$. This establishes the Proposition.

Proof of Proposition 3.

The punishment, if administered, yields a deviator (say $i=1$) an amount $x^i$ in a period before its last. But to obtain this, it must elicit the vote of another whose punishment will supercede the initial deviator’s (according to (ii) of the simple punishment regime). So, to deter this departure it must be the case that a supporter of a deviating proposal must not profit. The maximal profit occurs if $i=1$ deviates by proposing to give the whole dollar to $j=2$. But this means that 2 will run on the legislative record $(0,1,0)$ according to the punishment, whereas on the equilibrium path 2’s record would be $(1,0,0)$. Since $\Pi(0,1,0) < \Pi(1,0,0)$ by the WHYDFML Principle, 2 does worse by getting the whole dollar in the second session but not getting it in the last session; thus, 2’s punishment for supporting an off-the-equilibrium path proposal prevents 2 from profiting. If 2 will not support the deviation, then 1 will be deterred from deviating in the first place.

It remains to show that it is rational for others to implement the punishment as specified. Suppose 2 does support the off-the-equilibrium-path proposal of the previous paragraph. In the
next session, 2 is now oldest. Consider, first, the case in which 2 is recognized (in either round of this session). If it makes any proposal giving itself a non-zero payoff, the others must vote against (or be exposed to punishment). By the WHYDFML Principle, there is no payoff to either of the non-proposers from which it can profit. Consider, second, the case in which one of the younger legislators is recognized. It can propose \((0, x, 1-x)\) for any \(x\), since all such proposals are consistent with the simple punishment regime. This means that the other young legislator must support this proposal which, by rationality, implies that the proposer will take the entire dollar and punishment takes the form of \((0,0,1)\) or \((0,1,0)\) depending on which young legislator is recognized. In either of these cases, it is rational to support the punishment. ♦

References


Figure 1. The Effect of WHYDFML on Certainty Equivalents

\[ c^* \text{ Certainty Equivalent of } \frac{1}{3} \Pi (1/2) + \frac{2}{3} \Pi (0) \]

\[ c^{**} \text{ Certainty Equivalent of } \frac{1}{3} \Pi (1) + \frac{2}{3} \Pi (0) \]
Figure 2. The Effect of Wealth Endowments on Certainty Equivalents

\[ c^* = \frac{1}{3} \pi(1) + \frac{2}{3} \pi(0) \]

\[ c^{**} = \frac{1}{3} \pi(2) + \frac{2}{3} \pi(1) \]