

# Legislative Bargaining Experiments

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## 1 Introduction

In this chapter we survey the experimental literature on legislative bargaining in committees. Legislative committees are typically comprised of three or more members, each representing her own group of constituencies, and are charged with making decisions using a pre-specified set of rules and procedures dictated by institutions in place. The focus of our survey will be on understanding the effects of these rules on policies chosen by committees and bargaining process per se. We will not cover the papers that deal with two-person bargaining games or unstructured bargaining.<sup>1</sup>

From a methodological point of view, we focus on the incentivized controlled laboratory experiments, which fall into the economics tradition. The chapter starts with a short description of the methodology used in laboratory experiments. The remainder of the chapter looks at the two main types of committees: ad hoc or temporary committees (one-time decisions) and standing committees (repeated decisions by the same committee). Rather than summarizing every experimental paper on this topic, the chapter will attempt to identify the main insights about the effects of institutional rules on the bargaining process and bargaining outcomes.

## 2 Methodology of laboratory experiments

Laboratory experiments in Political Science follow the principles of Experimental Economics developed by Vernon Smith in the early 1970s, and further advanced by Charles Plott, who was one of the first to study the effects of political institutions and rules on policy outcomes in non-market settings such as committees, elections, and juries.<sup>2,3</sup> The approach pioneered by Smith and Plott is the marriage of theory and experimental designs (Plott and Smith (1978)).

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<sup>1</sup>See Roth (1995) and Palfrey (2015) for excellent surveys of two-person bargaining experiments and unstructured bargaining.

<sup>2</sup>See, for instance, the influential paper by Fiorina and Plott (1978) who experimentally test the basic theory of the core in small committees and examines its robustness with respect to the fine details of committee rules.

<sup>3</sup>For the survey of the early history of Experimental Economics see Roth (1993).

At the heart of theory-based experiments is the creation of simple yet real economic environments, in which we observe real subjects making decisions with real economic consequences. While the settings studied in these experiments are usually very complex, the objective of the experiments is to provide clean tests of core theories of human behavior; theories that are often hard to test using field data due to the scarcity of such data, unobservability of counterfactuals, endogeneity problems, and other confounding factors that prevent identification of causal effects. If theoretical predictions fail in the simplest and most transparent version of the model, i.e., in the laboratory experiment, that casts serious doubt on the usefulness of the theory as applied to complex settings.

The key features of the laboratory experiments are control, incentives, and replicability. Participants in the experiments operate under a controlled and carefully designed set of institutional rules and are provided monetary incentives that are linked to their behavior and reflect trade-offs captured by theory. These incentives are crucial, as hypothetical behavior may diverge from how participants behave when their decisions have real consequences measured in monetary terms. Finally, most of the experiments frame the task in a neutral way avoiding labels that may influence participants' decisions. The advantages of context-free designs include the ease of replicability and general inferences that one can make about effects of institutions on behavior absent any specific context. For the literature discussing the methodology of controlled laboratory experiments see Davis and Holt (1993), Roth (1988) and Smith (1976 and 1989).

### 3 Ad hoc committees

Experimental literature on legislative multilateral bargaining originated with studies of ad hoc committees that distribute fixed budgets among members with conflicting interests, i.e., the divide-the-dollar game. The conflict of interest between members represents the classical economic problem of scarcity of resources since each member would like to deliver a higher share to her constituencies. The workhorse model in this literature is Baron and Ferejohn (1989). It provides a natural and parsimonious formulation of the bargaining protocol, which lends itself easily to incorporation of various institutional features present in real committees. As a result, it serves as a theoretical benchmark for many experimental papers that investigate the effects of institutional rules on implemented policies.

#### 3.1 Overview of Baron and Ferejohn (1989) model

A committee of size  $n$  decides how to allocate a unit of resources among its members; i.e., this is the divide-the-dollar game. Each committee member is a legislator representing constituencies in her district. The game has an infinite-horizon with common discount factor  $\delta \in (0, 1]$  applied between bargaining stages. The discounting captures the cost of delay in reaching the agreement. Each member cares about the share allocated to her district only; i.e., the utility of member  $i$  when proposal  $x$  with share  $x_i$  allocated for member  $i$  is implemented in stage  $t$  is  $U_i = \delta^{t-1}x_i$ . The bargaining protocol is an extension of the two-person bargaining protocol of Rubinstein (1982) to a multi-person bargaining situation. Specifically, the recognition rule specifies the probability that each member

is selected to be the proposer in a bargaining stage, and the voting rule specifies the number of votes required to pass the proposal. At the beginning of each bargaining stage, based on the recognition rule, one member is selected to be the proposer. The proposer submits a budget allocation  $x = (x_1, x_2, \dots, x_n)$  where  $\sum_{i=1}^n x_i \leq 1$  and  $x_i \geq 0$  for all  $i$ . Committee members observe the allocation vector  $x$  and vote either to support or to reject it. If the proposal receives the required number of positive votes, then the allocation is implemented and the game is over. If, however, the proposal fails, then the committee moves on to the next bargaining stage, in which again one of the members is selected to serve as the proposer based on the recognition rule and she proposes an allocation, which is then put to a vote. The process repeats itself until one of the proposals obtains the required number of votes; otherwise, all members receive zero payoffs.

This game admits a plethora of subgame-perfect equilibria: for sufficiently high  $\delta$  and  $n$  any allocation can be maintained as part of a subgame perfect equilibrium. To increase the predictive power of this model, the literature has focused on the stationary equilibria (SSPE), which restrict attention to memoryless strategies.<sup>4</sup> The unique symmetric SSPE in the case of a uniformly random recognition rule prescribes the proposer to allocate positive shares to a minimum winning coalition and appropriate the remainder of resources. Specifically, if  $q \leq n$  votes are required to pass the proposal, then  $q - 1$  randomly selected members are invited into a coalition and receive  $x^{\text{Coalition}} = \frac{\delta}{n}$ , while the proposer gets a larger share of  $x^{\text{AS}} = 1 - (q - 1)\frac{\delta}{n}$ ; the remaining members get nothing. The coalition partners vote in favor of the proposal, which guarantees that agreement occurs immediately without any delay.

In the remainder of this section, we survey experimental papers that address many variants of this basic game focusing on games with an infinite horizon. Palfrey (2015) surveys the finite-horizon lab implementations of the Baron-Ferejohn model.

## 3.2 Bargaining protocol

The first laboratory experiment to investigate the infinite-horizon model of Baron-Ferejohn is Frechette, Kagel, and Lehrer (2003).<sup>5</sup> The experiment compares two types of amendment rules: the closed one, in which submitted proposals are immediately put to a vote, and the open one, in which submitted proposals are subject to possible amendment by a randomly selected committee member. The theory predicts that the equilibrium in the game with the open amendment rule might feature delays in agreements, larger the minimum winning coalitions, and smaller proposers' shares compared with the game with the closed amendment rule.

Frechette et al. (2003) test these predictions using five-member committees and observe that the main theoretical predictions regarding the effects of amendment rules are borne out in the data. Specifically, the closed rule produces no delays, while there is a

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<sup>4</sup>See Baron and Kalai (1993) who argue that a stationary subgame-perfect equilibrium is the simplest and therefore most likely subgame-perfect equilibrium.

<sup>5</sup>For the very first test of Baron-Ferejohn model see McKelvey (1991) who implements the finite-horizon version of the game.

considerable delay in the open rule committees. Proposers enjoy higher shares than any other committee members in both rules, with the closed rule featuring higher proposers' shares than the open rule. However, in both treatments, proposers appropriate a much smaller fraction of resources than the theory predicts even after subjects play the game many times. Finally, despite the fact that parameters of the game were chosen so that only minimum winning coalitions should arise in both treatments, larger than minimum winning coalitions are frequent in the open rule committees, while the most common coalition size is minimum winning in the closed rule committees.

What determines bargaining power of players in multilateral bargaining games? Frechette et al. (2005a, 2005b) design a series of experiments to separate out two natural suspects: the voting power, i.e., the number of votes controlled by each member and the recognition power, i.e., the likelihood of being selected to serve as a proposer. The authors conduct experiments, in which they vary voting and recognition powers one at a time and contrast predictions of the Baron-Ferejohn model with the Gamson Law, which is the popular competing model of coalition formation in Political Science. According to the Gamson Law, coalition members receive shares of resources proportional to the voting power that they bring to the coalition. The experimental data shows that the Baron-Ferejohn model organizes results better than the Gamson Law; however the fit of the Baron-Ferejohn model is not perfect.<sup>6</sup>

Does bargaining protocol per se have an effect on what transpires during bargaining sessions and which outcomes are implemented? This is the question studied by Frechette et al. (2005c) who compare two bargaining protocols: the Baron-Ferejohn protocol and the alternative model of bargaining developed by Morelli (1999) called the demand bargaining model. According to the demand bargaining model, committee members are randomly ordered and make sequential demands until a subset of feasible demands emerges that holds a majority share of votes. If there is no feasible winning coalition when all members have had their turn to speak, then the process starts all over again with discounted payoffs. Theoretically, the demand bargaining model predicts allocations which are proportional to voting weights and no first mover advantage.<sup>7</sup> The experiment considers five-member committees without discounting, two bargaining protocols and two sets of parameters: one, in which all voters have equal voting weights, and another, in which one member has three times the voting weight as other members. The data shows that in demand bargaining sessions, proposals are more likely to pass in the first bargaining stage as compared with Baron-Ferejohn sessions. Most of the implemented allocations are minimum winning in both bargaining protocols. In the treatment with equal voting weights, the first-mover appropriates a higher share of resources compared with other coalition members in both protocols; this advantage is stronger in the Baron-Ferejohn sessions.

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<sup>6</sup>See also Maaser et al. (2019) who compare three nominally different representations of majority rule in a Baron-Ferejohn game with five players and find that while inexperienced players respond to the framing of the voting rule, effects are weak for experienced players.

<sup>7</sup>Breitmoser and Tan (2013) study experimentally a simultaneous version of the demand bargaining game with three players, in which two non-proposers submit demands to the proposer, who proposes an allocation after observing these demands. If at least one demand is satisfied by this allocation, then it is implemented and the game ends. Otherwise, the next bargaining round begins.

However, in the treatment with unequal voting weights, proposers who control higher numbers of votes appropriate shares comparable to those of other coalition partners, and overall, the outcomes are much more similar between the two bargaining protocols than the theory predicts.

### 3.3 Voting rules and continuation values

The effects of voting rules are explored in Miller and Vanberg (2013, 2015). Miller and Vanberg (2013) compare three-person committees that use majority and unanimity voting rules focusing on delay in bargaining. The theory predicts immediate agreement irrespective of the number of votes required to pass the proposal. In fact, the only differences between the two voting rule treatments should be the number of non-agenda setter players that are included in the coalition and the proposer's share. Consistent with the theory, experimental results show that majority committees feature mostly minimum winning coalitions, while the unanimity committees feature all inclusive coalitions. However, contrary to the theory, unanimity committees take longer to reach agreements and, moreover, while proposers appropriate higher shares of resources than any other committee member, these shares are below those predicted by the theory. These results speak to the work of Buchanan and Tullock (1962) who argue in favor of approximate unanimity rules given that less inclusive voting rules involve higher external costs of collective decisions defined as the cost associated with the coercion of the minority. In a follow-up paper Miller and Vanberg (2015) consider the effect of group size (three-person versus seven-person committees) on the frequency of delay in bargaining under both voting rules. Under the unanimity rule, the delays occur equally often in both large and small committees, while under the majority rule, the delays are more frequent in large than in small committees.

Frechette and Vespa (2017) zoom in on the voting behavior of non-proposers. The authors vary subjects' discount factors to generate substantial variation in their continuation values and uncover the determinants of voting in favor of the proposal. The results show that about 90% of all voting choices are consistent with the equilibrium prediction of voting in favor of a proposal whenever one's own share is higher or equal to the continuation value. This suggests that the equilibrium voting rule formulated based on the continuation value principle organizes data better than alternative behavioral rules which do not take continuation values into account.

Breitmoser and Tan (2017) compare a standard infinite-horizon Baron-Ferejohn game with discount factor  $\delta = 0.95$  with a one-period game, in which players are paid their continuation payoffs from the first game if they do not reach agreement in the first period of the game. While the two games are strategically equivalent for payoff-maximizing players, the experimental results show substantial differences, which are best explained by the reference dependent altruism model, according to which a player's degree of altruism is low if her payoff is below the reference point and high otherwise.

### 3.4 Voting power

Kagel, Sung and Winter (2010) study the effect of granting some members the veto power which can inefficiently prolong the process of reaching the agreement and award its holder

excessive power. The authors study the three-member committees with and without a veto player and vary costs of delay. While, in theory, no delay should be observed in either treatment, there are more delays in committees with a veto player especially when the cost of delay is low. Most of the difference comes from the inability of non-veto proposers to pass their proposed allocations right away. Results show that veto players obtain significantly higher shares when serving as proposers than both other non-veto proposers and proposers in the control treatment with no veto power; however, these shares of the veto proposers are still below the theoretically predicted ones. Consistent with the theory, the increase in the costs of delay increases the willingness of players without veto power to accept lower shares. Finally, the authors conduct an additional treatment in which they disentangle the proposer power and the veto power and find that veto power trumps proposer power.

Drouvelis, Montero, and Sefton (2010) study changes in voting power driven by adding new committee members holding fixed the budget and the voting rule. The authors find that the addition of a new member has differential effects on the bargaining power of the original members depending on whether the original members had veto power or not.<sup>8</sup>

### 3.5 Communication

Several recent papers have analyzed the effects of cheap-talk communication that precedes formal bargaining. Theoretically, it is not clear why communication should have any effect in the Baron-Ferejohn game, since this is the game with complete information, in which one should be able to compute players' continuation values without talking to each other. Consistent with this intuition, SSPE predictions in the Baron-Ferejohn game do not change when bargainers have access to communication channels.

Agranov and Tergiman (2014) study five-member committees that use the majority voting rule and allow members to send any free-form messages to any subset of the committee before the proposer submits the allocation for the vote. The results show that the introduction of communication moves outcomes closer to those predicted by SSPE: delays almost never happen, the vast majority of passed allocations feature minimum winning coalitions, and, most importantly, proposers appropriate significantly *higher* shares when negotiations are allowed. The mechanism that drives these results resembles the auction for a place in the coalition, which occurs between the non-proposers. Given that a simple majority is enough to pass a proposal, non-proposers compete with each other for a place in the coalition by announcing their reservation prices. The proposer exploits this competition and invites into the coalition the 'cheapest' members and appropriates the remaining resources. Baranski and Kagel (2015) confirm these results and the mechanism underlying them with the committees of three members.

The introduction of communication in unanimity committees leads to very different outcomes. Agranov and Tergiman (2019) show that in unanimity committees communication leads to *more* egalitarian outcomes and significantly reduces delay in reaching

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<sup>8</sup>For the investigation of a vote of confidence procedure, which links the survival of a winning coalition to the successful passage of a bill in a finite-horizon Baron-Ferejohn game see Tergiman (2015).

agreements as documented by Miller and Vanberg (2013) in experiments without communication. The differential effect of communication in unanimity versus majority committees comes from different uses of communication channels in the two voting rules. In the majority committees, most communication is private and contains conversations about amounts non-proposers are willing to support in the voting stage, while in the unanimity committees, most communication is public and contains conversations about fairness, equality and social concerns. These conversations despite being the cheap-talk affect the behavior of proposers, especially in the unanimity treatment, in which each member de facto has a veto power.

Merkel and Vanberg (2020) introduce explicit costs to communication: every second of communication increases the probability that the game is terminated before a proposal can be made, in which case each player receives an exogenously fixed value with the sum of values being smaller than the budget size. The results show that the unanimity rule leads to longer communication delays and more frequent breakdowns especially when disagreement values are asymmetric.

### 3.6 Bargaining with public goods and public policy

Frechette, Kagel and Morelli (2012) study the modification of the Baron-Ferejohn game, in which a budget can be allocated to both public good and private transfers to individual members of the legislature. Members value both public good and private transfers and the experiment varies parameter  $\alpha$ , which governs the relative weight members attach to private goods in their payoff function. This experiment is based on the theoretical paper by Volden and Wiseman (2007), which predicts full investment in the public good for low values of  $\alpha$  and no investment in the public good for high  $\alpha$ . For the intermediate values of  $\alpha$ , we should observe both public and private goods, with a somewhat counterintuitive prediction that the investment in the public good increases with  $\alpha$ , which results in a non-monotonic relationship between  $\alpha$  and the proposer's private share.<sup>9</sup> The experimental results are at odds with this last prediction for the intermediate values of  $\alpha$ , but track theory closely for low and high values of  $\alpha$ . Other characteristics of bargaining outcomes are similar to those observed in previous Baron-Ferejohn games: delays are rare, proposers' shares tend to be higher than those of other coalition partners but lower than predicted and minimum winning coalitions are frequent (in the appropriate region). Overall, consistent with the experimental literature on the voluntary provision of public goods, public good provision is substantially higher than predicted (see the survey of voluntary public good games by Ledyard (1995)).

Christiansen et al. (2014) consider a related but different setting in which a three-person legislature bargains over the public policy with or without the availability of private goods. The experiment is based on the model of Jackson and Moselle (2002). In all treatments, members have a single-peaked preferences over public policy with different ideal policies. In addition, in a treatment with private goods, there is a fixed budget available to be distributed between committee members. The bargaining protocol is standard with an

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<sup>9</sup>This prediction is driven by the linearity in preferences and does not hold for more general types of preferences.

equal recognition rule and no discounting. Theoretically, in games without private goods the median preferred policy should emerge. Under the parameterization used in the experiments, in games with private goods, we expect to see the shift in average implemented policy (towards one of the extreme legislators) and positive probability of coalitions that exclude the median legislator and instead consist of two extremists. Experimental results show the shift in location of public policy when private transfers are introduced, which is in line with the theoretical prediction. First stage proposals are much more likely to pass in games with private transfers than in games without private transfers consistent with the “greasing the wheels” interpretation of private transfers. Total welfare of the committees is generally higher when private transfers are available.<sup>10</sup> All this evidence highlights the positive role of private transfers in bargaining in ad hoc committees.

### 3.7 Bargaining over endogenous budgets

Several recent papers investigate the Baron-Ferejohn bargaining game augmented by the production stage in which surplus to be divided through bargaining is created. Baranski (2016 and 2018) compares the two versions of such a game: the redistributive game, in which the production stage precedes the bargaining stage, and the pre-distribution game, in which the production stage occurs after the bargaining stage. The production of a joint surplus resembles the public good game, i.e., players allocate their endowment between private consumption and investment in the joint project; the sum of contributions into the joint project is scaled up by a factor of two to produce the joint budget. The bargaining stage follows the standard Baron-Ferejohn protocol with equal recognition probabilities, majority voting rule and no discounting. Theoretically, the production stage in the redistribution game is similar to the standard public good game, since shares allocated to subjects in the bargaining stage are independent of their contributions. Thus, the theory predicts no individual investments in the production stage. In the pre-distribution game, the proposer is expected to appropriate the whole budget, and, thus, he is the only one expected to contribute his whole endowment to the joint production. In the experiment, individual contributions in the two games are different but not consistent with the theory predictions. In the redistribution game, investments rise with experience towards an efficient rather than an equilibrium outcome. In the pre-distribution game, subjects’ contributions decline over time and joint budgets converge to zero. Contrary to the theory, many coalitions are all-inclusive rather than minimum winning, which drives down proposers’ shares. Finally, in the redistribution game players obtain shares proportional to their individual contributions, while in the pre-distribution game, players free-ride in the production stage, which results in unravelling towards no contributions.

Merkel and Vanberg (2019) compare how claims based on contributions to production affect bargaining behavior under the majority and unanimity rule in a redistribution game, in which the budget to be divided is produced by an individual real effort task. Under both voting rules, observed outcomes constitute a convex combination of equal-splits

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<sup>10</sup>Christiansen et al. (2018) study how framing of the bargaining problem affects bargaining outcomes in a similar environment.



and splits proportional to relative contributions.<sup>11</sup> Taken together, these studies suggest that distribution of endogenously created budgets are quite different from exogenous ones despite the fact that the same bargaining protocol is used to govern the bargaining process.

### 3.8 Effect of Malapportionment

Vespa (2016) explores legislative committees which consist of members who represent communities of different sizes. He studies two commonly used institutions that introduce malapportionment in voting power in legislative committees, which are meant to protect the rights of minority groups. The two institutions are bicameralism and weighted voting. The bicameralism system requires the approval of a proposal from two chambers, House and Senate, and implements proportional representation in the House and a fixed number of senators in the Senate. Weighted voting has a unicameral committee with higher representation of more populated states. The experiment is concerned with understanding how implemented allocations change in response to the two institutions described above and to changes in the recognition probability of members representing groups of constituencies of different sizes, i.e., states. Several treatments are conducted with variation in the institution used to pass the proposals as well as the recognition probability of members. All treatments use a variant of the Baron-Ferejohn bargaining protocol with a closed amendment rule and no discounting. The results show support for qualitative prediction of the theory, which suggests that proposal power can be used to equalize per-capita allocations under bicameralism, but not under weighted voting. Under bicameralism, final allocations feature no difference across members representing states of different sizes if all members have the same probability of being recognized as the proposer. On the contrary, members representing small states appropriate a higher per-capita share of resources under weighted voting and in case recognition probabilities are malapportioned under bicameralism.

## 4 Standing committees

Many bargaining situations involve repeated interactions. This is certainly true in legislatures which operate by standing committees that interact repeatedly year after year and bargain over the allocation of scarce resources over the sequence of budget cycles rather than just once. The experimental literature on dynamic bargaining, which we survey below, is still in its infancy and has been developing rapidly over the past few years.

### 4.1 Dynamic bargaining with endogenous status quo

The first studies of dynamic bargaining introduced dynamics by linking decisions of the committee over several budget cycles via endogenous status quo determined by previously implemented outcomes. The game was introduced theoretically by Kaladrakis (2004) and

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<sup>11</sup>Gantner et al. (2016) compare different bargaining procedures, all of which require unanimous consent to reach agreement, and also find that fairness judgments reflect individual contributions.

studied experimentally by Battaglini and Palfrey (2012). In the game, the committee with  $n$  members must decide in each of an infinite number of periods how to allocate a fixed budget among its members using the majority voting rule. The agenda setter is selected randomly in every period. If the allocation proposed by the agenda setter receives a majority of votes, then this allocation is implemented, the current cycle ends, the committee moves on to the next bargaining cycle and the implemented allocation becomes the status quo for the next cycle. However, if the current proposal fails to achieve the support of the majority, then the status quo policy is implemented. Theoretically, there exists a Markov perfect equilibrium in undominated strategies, in which regardless of the initial status quo, the trajectory of implemented allocations converges to a rotating dictatorship with the current proposer appropriating the whole budget and such allocations passing without any delay.

Experiments conducted by Battaglini and Palfrey (2012) consider several versions of this game with three-member committees and discount factor  $\delta < 1$ . In two of the three treatments, the set of possible allocations was limited, while in the third treatment proposals could be any three-way split of the budget with fine grid. The allocations in the first two treatments were chosen in such a way that the three-way equal split is the Condorcet winner and the absorbing state in the first treatment and a Condorcet loser in the second treatment. The experimental results were quite mixed with the second treatment showing patterns most closely tracked by theoretical predictions. The unconstrained third treatment shows a lot of egalitarian outcomes, which are not predicted by the theory. The authors show that concavity of utility (instead of linearity assumed in the theory) is able to decrease the gap between theoretical predictions and observed outcomes.

## 4.2 The effects of communication

Baron, Bowen and Nunnari (2016) extend the unrestricted treatment of Battaglini and Palfrey (2012) by allowing the committee members to communicate with each other either through a public chat or privately and study the effects of communication on bargaining outcomes and the coalition formation process. Similar to the results obtained by Battaglini and Palfrey (2012), when communication channels are not available, dictatorial outcomes are almost never observed, most outcomes feature all inclusive coalitions, and less than a third are minimum winning coalitions. Private communication decreases the fraction of all inclusive coalitions and boosts the number of minimum winning coalitions to nearly half of all outcomes. In contrast, public communication increases the number of all inclusive coalitions and essentially eliminates minimum winning coalitions. Durable coalitions emerge more frequently and last longer when communication is allowed. The contents of communication logs show patterns similar to the ones observed in the static bargaining games with communication (see Agranov and Tergiman (2014)). In particular, public communication by non-proposers is correlated with all inclusive three-way allocations. Moreover, advocating for fairness increases the fraction of an all inclusive allocation, while advocating for minimal winning coalitions and one's own allocation decreases this fraction.

### 4.3 Veto power

The introduction of the veto players in the dynamic bargaining may lead to status quo inertia and even larger leverage of the veto players as compared with the static bargaining games with veto players. Nunnari (2019) investigates experimentally these concerns by studying a dynamic bargaining game with three players and an endogenous status quo. The experiment manipulates the strength of dynamic incentives captured by a variation in the players' degree of patience (discounting) and the presence of a veto player. The empirical investigation of this setting is particularly warranted since even when one focuses on the Markov Perfect Equilibria, theoretical predictions depend strongly on the assumptions about the space of feasible allocations, initial status quo, and discount factors (see Diermeier et al. (2017) and Nunnari (2018)). Experimental results show that in games with a veto player most outcomes allocate a positive share to the veto player and to at most one non-veto player, and allocations which give most resources to the veto player are stable and absorbing state with share of the veto player gradually increasing over time. Further, the frequency of dictatorial and all-inclusive three-way coalitions does not depend on players' patience, and allocations that give a substantial amount of resources to both non-veto players are more likely to survive when committee members are more patient.

### 4.4 Public good accumulation

Several papers have considered the ability of legislatures to provide public goods in dynamic settings. These papers consider a legislature with  $n$  members which divides a fixed budget between durable public good and private transfers to individual members over a sequence of periods. Members value both public good and private transfers. The bargaining protocol is the Baron-Ferejohn protocol with a randomly chosen proposer in every period. The passage of a proposal requires obtaining the support of  $q$  members. If the proposal fails, then the status-quo policy with no public good investment is implemented.

The first paper of this kind is Battaglini, Nunnari and Palfrey (2012) who study an infinite-horizon model. Theoretically, Markov Perfect Equilibria feature a monotonic relation between the steady-state provision of public goods and the voting rule: higher  $q$  implies higher provision of public goods.<sup>12</sup> Battaglini et al. (2012) test theory predictions with five-member committees members, no depreciation, and three different voting treatments: unanimity rule ( $q = 5$ ), majority rule ( $q = 3$ ) and dictatorship rule ( $q = 1$ ). Experimental results confirm the main comparative static predictions of Markov perfect equilibria: a higher  $q$  leads to higher investment in the public good. However, similar to the static voluntary provision public good experiments and the public good provision in static legislatures described above, the authors observe significant over-investment in the public good in the early rounds of play for all three voting rules. This over-investment is mainly compensated by disinvestments in the later rounds in all three treatments. Within

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<sup>12</sup>There are two effects at play. First, similar to the static environment, a higher  $q$  forces the agenda setter to internalize a larger share of the public good. Second, a higher  $q$  reduces the worry about the future proposers' incentives to appropriate the current public good investments, which is only present in dynamic settings.

each bargaining round, most of the proposals pass without invoking the status-quo and most feature allocation of private transfers to minimum winning coalitions.

Agranov et al. (2016) design an experiment to empirically estimate relative magnitudes of static and dynamic distortions in a dynamic bargaining game. The experiment utilizes variation in depreciation rates across treatments in order to identify the importance of dynamic linkage between periods, and decomposes dynamic distortions into two types of distortions: crowding-out effect and durability effect. Experimental results show that dynamic inefficiencies can be large and increase with a dynamic link across periods. Among the two types of dynamic distortions, the durability effect is large in magnitude, while the crowding-out effect is less pronounced. The analysis of individual strategies shows that many subjects choose high public good investments in the first periods of the game and then shift towards minimum winning coalitions, excluding members who do not invest enough in the public good in early periods and rewarding those who do by including them in their coalitions.

Finally, Battaglini et al. (2019) modify this game by introducing the possibility of borrowing and lending between periods and uncertainty about the future value of the public good. The theory predicts that the proposer issues too much debt and uses these funds for private transfers to get the support of members of the minimum winning coalition. The amount of debt is decreasing in the size of the required majority and converges to an efficient level for the unanimity rule. For a fixed voting rule, the equilibrium level of debt is decreasing in the probability that the public good has a high value in the future. The treatments vary the voting rules, the distribution of the future public good value, and the presence of commitment. The experimental results show many patterns consistent with the theory. Public policies are inefficient, and efficiency is increasing in the number of votes required to pass the proposals,  $q$ . Observed levels of debt are lower when the probability of future negative shocks is higher. When proposers can commit to a policy in early periods, the dynamic distortions are essentially eliminated. However, contrary to the theory, most of the time subjects choose allocations which are budget-balanced in each period of the game, which leads to lower distortions than predicted. In addition, consistent with the insights of the static bargaining experiments, higher  $q$  leads to more delays in reaching the agreements.

## 4.5 Agenda setting rules

Agranov, Cotton and Tergiman (2020) consider the dynamic bargaining settings without the status-quo structure, and, instead, focus on the agenda-setting rules. The paper studies both theoretically and experimentally two versions of the infinitely repeated multilateral divide-the-dollar game: the Endogenous Power game and the Random Power game. In the Endogenous Power game, the proposer can hold onto power across bargaining rounds as long as she maintain the support of a majority of other members. In the Random Power game, the proposer is chosen randomly in every bargaining round. Under the standard stationarity refinement, the two games are outcome equivalent, since stationarity rules out the ability of the proposer to reward those who supported her in the past. This eliminates any incentives that players have to keep a proposer in power, and results in high turn-over of proposers and outcome-equivalence in both games. Contrary

to the theory, the experimental analysis shows substantial differences in behavior and outcomes across the games. In the Endogenous Power game, proposers use institutional rules to their advantage and remain in power for long stretches of time. This, coupled with the fact that proposers obtain on average higher shares than other members creates a high level of inequality in the long-run payoffs between committee members. Slightly over half of observed coalitions are minimum winning, while the remaining are all inclusive coalitions. In general, the evolution of coalitions across cycles features stability across several dimensions: coalition size, identity of coalition partners and their shares. On the contrary, when rotation in proposers' power is institutionalized as in the Random Power game, persistence of power is not possible by design, which reduces the inequality in members' long-run payoffs. This also affects which types of coalitions are formed and passed within each round. Most outcomes in the Random Power game feature all inclusive coalitions with equal splits among all members. Overall, the experimental data clearly show that in both games, subjects use strategies that involve punishments, reciprocity and history dependence - all properties that contradict the stationarity refinement. This casts serious doubts on the ability of the stationary refinement to organize the data for the dynamic bargaining games despite its very good fit in the one-shot bargaining games.

## 5 Future Directions

As apparent from this short survey, we have accumulated a much more nuanced understanding of how institutional details of the bargaining process affect bargaining dynamics and outcomes in the ad hoc committees that are dissolved after reaching the agreement. Much less is known about the functioning of standing committees which interact repeatedly. Existing studies of dynamic bargaining paint a clear picture which prevents a simple extrapolation of results from one-shot bargaining environments to the dynamic ones. This makes future studies of dynamic bargaining environments both exciting and complex due to the many forms that dynamic interactions take in legislatures. The progress in this literature will crucially depend on the dialog between two dimensions: (a) the development of appropriate theoretical refinements that can narrow down the set of possible outcomes and bargaining trajectories one can expect to emerge in dynamic environments, and (b) the collection of richer data sets which will be used to evaluate theoretical predictions and inform the theory of missing forces.

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