"One Bite at the Apple": Legislative Bargaining Without Replacement[*]

Duk Gyoo Kim[†]

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Abstract

To better understand the motivations behind the multilateral bargaining behaviors observed in the laboratory, I consider a modified many-player divide-the-dollar game in which players cannot propose again if they were randomly selected in one of the previous rounds but failed to provide an accepted proposal. This finite-horizon bargaining model without replacement captures the legislative process in which each legislator has only one opportunity to propose while the order of proposers is unknown. The unique symmetric subgame perfect equilibrium has several features that allow the transparent interpretation of experimental data. I find that proposers do not fully extract their rent, but the concern about inequity aversion is not a driving factor even in a myopic sense. Out-of-equilibrium observations suggest that retaliation and the fear thereof may be driving factors.

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[†]Department of Economics, Sungkyunkwan University, South Korea. *kim.dukgyoo@skku.edu*

What happened last November, when we lost the majority, we got ourselves in a position where we figured, gosh, we will have only one bite at the apple*, only one opportunity to allow the majority of the House to come together and address these issues.*

- Mr. Dreier, 1st session of the 110th Congress[1]

1 Introduction

Multilateral bargaining is a ubiquitous political process in which many agents with conflicting preferences attempt to divide an economic surplus ("pie") under a specified voting rule. The essential features of multilateral bargaining are captured by a many-player "divide-the-dollar" game, where one randomly selected player proposes a division of a surplus (normalized to a dollar), and the proposal is put up to a vote until a pre-specified number of players accepts it. The standard economic theory (i.e., the Baron–Ferejohn (BF) legislative bargaining model (Baron and Ferejohn, 1989)) and many extensions thereof predict that a proposer should enjoy the proposer advantage by offering the continuation value of the minimum winning coalition (MWC) members and taking the remainder. However, experimental studies on many-player divide-the-dollar games have consistently found that proposers do not take full advantage of being proposers when subjects are not allowed to communicate;[2] I refer to proposers' behavior of taking smaller payoffs than theoretical predictions as *partial rent extraction*.

The primary purpose of this study is to better understand partial rent extraction, using a modified form of finite many-person bargaining, in which random recognition *without* replacement is adopted as the proposer selection process. The idea of random recognition without replacement is closely related to the so-called "one bite at the apple" principle that is often explicitly considered in legislative and judiciary processes. This principle implies that each politician/agent/party has only one chance to take advantage of an opportunity.[3] As being a proposer is a means of taking advantage of an opportunity, the random recognition process without replacement precisely captures the "one bite at the apple" principle: Members who are recognized as proposers (i.e., members who have already taken a "bite at the apple") cannot be proposers again (i.e., they cannot take

[1]Congressional Record—House, April 19, 2007, page H3571. [online]

[2]See, for example, Fréchette et al. (2003), Diermeier and Morton (2005), Fréchette et al. (2005a,b,c), Kagel et al. (2010), Miller and Vanberg (2013), Agranov and Tergiman (2014), and Gantner et al. (2016). Baranski and Morton (2022) provide meta-analysis results on the Baron–Ferejohn majoritarian bargaining experiments.

[3]For example, in a speech on the Senate floor on August 1, 2001, Mr. Bond said, "Under current law, you only get one incentive period, one bite at the apple. That's it" [online, page S8598].

another bite).

The theoretical model has already been developed and solved elsewhere (Sutton, 1986; Kim, 2019); herein, I exploit theoretical predictions as a benchmark for the experiment. Perhaps the most distinctive prediction is that under unanimity, the proposer's equilibrium share is *smaller* than that of the other players when the discount factor is sufficiently large. This *proposer disadvantage* serves as a useful tool for investigating the role of inequity aversion in explaining partial rent extraction. Suppose, for example, that partial rent extraction is the optimal decision of an inequity-averse proposer and that it should fall between the equilibrium share and the equal split. When the equilibrium share is smaller than the equal split, the proposer's share should be less than the equal split. To the best of my knowledge, no multilateral bargaining protocols that have been considered in prior studies have predicted the proposer disadvantage.

The proposer selection protocol, that is, random selection without replacement, facilitates my investigation into the effect of retaliation and the fear thereof. The way the proposer is selected in the second round[4] is distinctive in that the second proposer can rationally regard the previous proposer as a "cheaper" member for an MWC or behaviorally regard the previous proposer as the one being retaliated against. Thus, the model can provide a straightforward design for interpreting the extent to which retaliation and the fear thereof drive bargaining behavior.

I conducted four main treatments and one supplementary treatment of modified many-person divide-the-dollar experiments. The four main treatments differed in two dimensions: the voting rule used to pass the proposal (majority or unanimity) and the size of the legislature (3 or 7). In each bargaining period, one randomly selected player proposes the division of a given surplus, which is immediately voted on. Unless the proposal receives the required votes for approval, bargaining proceeds to the next round, where the budget shrinks proportionally, and another proposer is randomly selected among those who have not yet proposed. This process is repeated until either a proposal is passed or everyone has proposed. The supplementary treatment mimics the second and third rounds of the three-person majority-rule treatment: One of the members is excluded from the potential pool of proposers from the beginning. The only difference is that the randomly selected member who does not make a proposal during the period is not the one who failed to pass a proposal beforehand but the one randomly excluded.

The experimental evidence can be summarized as follows: First, I found that concern about fairness[5] is not at all the primary factor leading to partial rent extraction. Sec-

[4]In equilibrium, the first-round proposal should be accepted; thus, the behavior of the "second" proposer is an out-of-equilibrium observation.

[5]By fairness concerns, I mean inequity aversion throughout the context. Admittedly, there are other forms of other-regarding preferences, such as (impure) altruism and (intention-based) reciprocity (Salazar

ond, the proposers from previous rounds within a bargaining session were more likely to be excluded from the winning coalition. Retaliation explains a significant proportion of this exclusion. In the supplementary sessions where one member was randomly excluded from the pool of potential proposers, the excluded member was more likely to be included as a winning coalition. Third, after observing the rejection of a reasonable split among coalition members and experiencing the exclusion of previous proposers from the winning coalition in later rounds of bargaining, the subjects tended to propose a more egalitarian allocation. These three results suggest that the existence of a few subjects who rejected reasonable proposals might have driven the entire process toward an equal split of the economic surplus among the members of a coalition. Similar to the results of other experimental studies, most of the first proposals in my experimental treatments were accepted, and the most frequently observed type of proposal involves the formation of an MWC.

The remainder of this paper is organized as follows. The following subsection discusses the related literature. Section 2 describes the n-round legislative bargaining process and the symmetric subgame perfect equilibrium. Section 3 presents the experimental design and procedures, and Section 4 summarizes the experimental results. Section 5 discusses the possible sources of partial rent extraction and proposes other explanations for the voting preferences exhibited in my experimental conditions. Section 6 concludes. The proofs are provided in Appendix A.

1.1 Related literature

Random recognition without replacement leads to a specific form of state dependency in bargaining because the previous bargaining outcome affects the bargaining environment in the following round. In this sense, multilateral bargaining studies that depart from the i.i.d. random recognition process of the BF model are closely related. State dependency may occur when the previous period's allocation becomes the reversion point[6] of the rejected proposal (Kalandrakis, 2004), when no individual can be recognized twice in succession (Bernheim et al., 2006), and when the current agenda setter enjoys a persistent position unless a proposal is rejected (Diermeier and Fong, 2011; Jeon and Hwang, 2022). Regarding the proposer recognition order, Breitmoser (2011) considers a model allowing for priority recognition of some committee members, and Ali et al. (2019) assume that some players can be ruled out as the next proposer. It is worth comparing the current study with Ali et al. (2019). In the case of the unanimity rule with no penalty for delay, my model predicts that the first proposer receives no economic surplus in equilib-

et al., 2022), so negating inequity aversion does not necessarily mean complete ignorance of others' payoffs.

[6]For empirical analysis on the reference dependent choices, see Chernulich (2021).

rium, which is the opposite of the prediction of another extreme case addressed by Ali et al. (2019), where the first proposer, in equilibrium, takes the entire economic surplus if the recognition procedure permits legislators to rule out some players' possibility of being a proposer in the next round. My study shares a concern with Ali et al. (2019) regarding the random recognition rule adopted in the BF model. Both studies illustrate that the proposer recognition procedure significantly affects equilibrium outcomes. I view their study as being complementary to mine.[7] I consider a recognition rule in which no one is allowed to be the proposer in more than one round, whereas they consider a recognition rule in which there are d players that are not allowed to be the next proposer. In the former case, the current proposer needs to win over the non-proposers who have a higher continuation value than she does. In the latter case, the current proposer exploits those who have a "cheaper" vote.

As this study investigates the finite-horizon version of the legislative bargaining model, Norman (2002) and Diermeier and Morton (2005) are closely related theoretical and experimental work, respectively. Norman (2002) shows the existence of a continuum of asymmetric subgame perfect equilibria with three or more finite rounds when players coincidentally believe in a particular asymmetric coalition formation pattern. By contrast, the current study focuses on the symmetric subgame perfect equilibrium. I claim that asymmetric equilibria due to particular asymmetric coalition formation patterns cannot be a proper ground for an experiment in which subjects are randomly re-matched in every round, and the identification codes are reassigned. Diermeier and Morton (2005) study a three-player divide-the-dollar game in which the subjects earn nothing if no proposal is accepted in five rounds of the proposal voting process. The key difference between the current study and theirs is the theoretical predictions due to the different proposer selection protocols. In my study, the theoretical benchmark can predict proposer *disadvantage*, whereas in Diermeier and Morton (2005), the proposer always enjoys the advantage of being a proposer regardless of the voting rule. I claim that this proposer disadvantage can help disentangle the concern for fairness from other factors, including retaliation.

The current study investigates the potential sources of proposer's partial rent extraction. It is worth mentioning that the main finding of Agranov and Tergiman (2014) and Baranski and Kagel (2015) is that casual chatting over a computer interface significantly increases the proposer's rent. Although chatting does not serve as a commitment device,

[7] For a similar reason, I view the model in Breitmoser (2011) and the example considered in Sutton (1986) as complementary. Suppose a chairperson has already considered a randomly ordered list of proposers. Then, the only difference in game structure is whether the order is disclosed sequentially (in my model) or ex-ante (in theirs). The information about the predetermined order of proposers leads to a stark difference in the first proposer's advantage. Their models yield a disproportionate payoff share for the proposer relative to the BF model.

it decreases the uncertainty in coalition members' willingness to accept and facilitates to decrease the non-proposers' willingness to accept. However, even in the last bargaining period under the chatting treatment, the median proposer's share is still below that predicted by the theory, and it is unknown whether the gap is due to other factors that have not been accounted for. As I do not allow communication in every treatment condition, I nonetheless acknowledge that there are important factors, including uncertainty about the voter's acceptance threshold, other than fairness concerns and retaliation that affect proposer power.

This study provides a supporting argument that concern about fairness does not play an essential role in multilateral bargaining, but such an argument is not new. Montero (2007) claims that inequity aversion cannot explain attenuated proposer power and shows that the legislative bargaining game with rational players who have (non-myopic) Fehr–Schmidt preferences will lead to an even *greater* proposer advantage and hence greater inequity. In other words, if our goal is to investigate the primary factor driving the proposer's partial rent-seeking, the non-myopic version of the Fehr–Schmidt preference can already be ruled out. In this study, I consider "myopic" inequity aversion, where the inequity-averse proposer merely cares for her own utility without considering other players' inequity aversion. There is mixed evidence on whether players in multilateral bargaining care about the distributional fairness of the proposed allocation. Some studies report that the players care only about their own share (Fréchette et al., 2003, 2005a,b; Fréchette and Vespa, 2017), while others find that the proposer's share also matters (Miller and Vanberg, 2013; Fréchette et al., 2005c). The findings of this study support the former argument. More supporting evidence is found in Curry et al. (2019), who investigate how people in 60 societies perceive cooperative behaviors in different contexts as moral and report that people tend to regard pursuing property rights (e.g., rent-seeking when available) as moral behavior, and fair bargaining as not generally moral.

Regarding retaliation and the fear thereof, Bradfield and Kagel (2015) report that in multilateral bargaining with teams, team members discuss retaliation and act on it. Baranski and Morton (2022) find that retaliation plays a role in treatments without communication. The experiment considered in the current study has a methodological contribution because retaliation against the previous proposer (i.e., not including the previous proposer as a coalition member) is distinctively different from rational behavior (i.e., including the previous proposer as a coalition member cheaply).

2 The Model

Consider a legislature consisting of n members indexed by $i \in \{1, 2, \ldots, n\} \equiv N$, where n is an odd number greater than or equal to 3. The legislature decides how to allocate a fixed economic surplus (normalized to 1) among themselves. In round 1, one member is randomly selected with an equal probability to make a proposal. The proposal is immediately voted on under the q-quota voting rule. On the one hand, if the proposal is supported by at least q members, then the game ends, and payoffs accrue according to the proposal. Legislator i's utility from approved proposal p is $U^i(p) = p_i$. On the other hand, if the proposal is not supported by q members, the process is repeated in round 2, but the new proposer is randomly selected from all members except the first proposer. A delay is costly: In each round, the utility is discounted by a common factor $\delta \in [0, 1]$. Formally, in round t, where $t = 1, 2, \ldots, n$, a randomly recognized player makes a proposal p^t, where p^t is a distribution plan $(p_1^t, \ldots, p_n^t)$ such that $\sum_{i=1}^{n} p_i^t = 1$ and $p_i^t \geq 0$ for all $i \in N$. Thus, if the proposal is supported by at least q members in round t, then the game ends and player i receives $\delta^{t-1} U^i(p^t)$, where $U^i(p^t)$ is player i's undiscounted utility from the approved proposal p^t. Players are assumed to be risk-neutral and self-interested; therefore, $U^i(p^t) = p_i^t$. If the proposal is not approved and $t < n$, then the proposer is excluded thereafter from the pool of potential proposers, and the game continues to round $t+1$. This process continues until a proposal is eventually supported by a majority or there is no further member available to propose. Payoffs are 0 if no proposal wins by the end of round n.[8]

The solution concept for this n-round game is a symmetric subgame perfect equilibrium. Backward induction is applied. Player i's pure symmetric strategy is described by the distribution plan $p^t = (p_1^t, \ldots, p_n^t)$ which she will propose if selected in round t and the cut-off x^t such that player i will vote to accept any proposal that gives her more than x^t. As is typical in the literature, I assume that a player votes for a proposal when she is indifferent between voting for it and voting against it.

To characterize a symmetric equilibrium, consider the problem of the player selected to be the proposer at the beginning of round t. She wants to get her proposal passed in a way that gives her district the largest share of the budget. She, thus, needs to form an MWC consisting of herself and $q-1$ other players. One immediate prediction is that under a q-quota rule, if the game moves to round q or later, the proposer in such a round can keep the entire share of resources. This is because the previous proposers who failed to get $q-1$ votes for approval and will never get another chance to propose have zero continuation value in the game.

[8]Any q-quota voting rule in infinite-horizon multilateral bargaining without replacement is considered in Kim (2019).

For terminological clarity, I divide the set of players other than the current proposer into two groups. The previous proposers comprise the *trivial coalition pool* because they would accept any offer. The *nontrivial coalition pool* consists of players who have not yet been selected as proposers. During and after round q, the trivial coalition pool (plus the proposer) constitutes an MWC.

Another important implication of the trivial coalition pool is that whenever the committee moves to the second round (although this will not happen in equilibrium), the second-round proposer should include the previous proposer as a coalition member. In practice, if the proposer should offer a coalition member slightly more than the continuation value, we would observe a rational second-round proposer offering an epsilon amount to the first-round proposer rather than offering a substantial amount to the other members who have not yet proposed. This prediction serves one of the key hypotheses of the experimental treatments in this study.

Backward induction process from round $t = q-1$ leads to the following proposition.

Proposition 1. *Consider n-round legislative bargaining without replacement under a q-quota rule. Each player's equilibrium strategy is* $\{x^k, \max\{\frac{n-1}{2} - k, 0\}\}_{k=1}^{n}$ *in which the randomly recognized proposer for round k offers* $x^k = \frac{\delta}{n-k}$ *to* $\max\{q-k, 0\}$ *players randomly selected from those who have not proposed yet. In round k, previous proposers accept any offer, and the* $n-k$ *players who have not proposed yet accept offers of at least* x^k*. Therefore, the randomly selected first proposer offers* $\frac{\delta}{n-1}$ *to* $q-1$ *players, and she gets* $1 - \frac{\delta}{n-1}(q-1)$.

Proof: See Appendix A.

The two special q-quota rules, namely, majority ($q = \frac{n+1}{2}$) and unanimity ($q = n$), have several notable properties. Although out-of-equilibrium strategies are described as a function of the number of players and the number of previous proposers, in the symmetric equilibrium, the initial proposer always claims a constant share, $1 - \frac{\delta}{2}$ under majority and $1 - \delta$ under unanimity, *regardless of n*.[9] I claim that this result renders a pertinent null hypothesis for laboratory experiments because it implies no treatment effects on group size.

Under unanimity, the first proposer gets $1 - \delta$ in equilibrium. If $\delta > \frac{n-1}{n}$, then the proposer's share is *strictly smaller* than that of the non-proposers. When $\delta = 1$, she gets *nothing*. This "proposer disadvantage" is not observed in the BF model, where under unanimity, the first proposer gets $1 - \frac{n-1}{n}\delta$. In the BF model, the proposer always gets a strictly larger share than the non-proposers if $\delta \in [0, 1)$ and an equal share if $\delta = 1$.

[9] Under a majority, the BF model predicts that a randomly selected proposer (with replacement) will claim $1 - \frac{n-1}{2n}\delta$. As n goes to infinity, this converges to $1 - \frac{\delta}{2}$. Thus, legislative bargaining without replacement attains the smallest possible proposer advantage in the BF model.

The theoretical prediction of the n-round unanimity no-discount bargaining game (i.e., that the first proposer gets nothing) is somewhat unintuitive, but this is the only subgame perfect equilibrium. To verify this claim, consider $n = 3$ and $\delta = 1$. For notational simplicity, a proposal is rearranged such that the kth proposer's share is the value of the kth entity. In the third (last) round, the proposer offers (0,0,1). All previous proposers accept this proposal because it is the final round. Knowing that the player who will be the proposer in the third round will reject any offer less than 1, the second-round proposer offers (0,0,1), which is approved by all players. The first-round proposer, who knows that one of the players (the one who will *not* be selected as the proposer in the second round) will get the entire dollar, offers (0, 1/2, 1/2) so that the non-proposers' continuation value is the same as the amount being offered. Simply put, this setting grants the proposer zero negotiation power while the non-proposers share negotiating power because if they reject the current proposal, they benefit from not only a higher chance of being a proposer in a later round but also the larger number of players in the trivial coalition pool in that later round.

Table 1 presents the theoretical predictions of two n-round models when different recognition processes are applied.

Table 1: Theoretical Predictions of the Distribution When $\delta = 0.8$

Voting Rule	**Protocol**	**Proposer's Share**	**Coalition Partner's Share**	**Proposer Advantage**†
Majority, $n = 3$	BF	0.7333	0.2667	0.4
	1-Cycle	0.6	0.4	0.2667
Majority, $n = 7$	BF	0.6571	0.1143	0.5142
	1-Cycle	0.6	0.1333	0.4571
Unanimity, $n = 3$	BF	0.4667	0.2667	0.1333
	1-Cycle	0.2	0.4	−0.1333
Unanimity, $n = 7$	BF	0.3143	0.1143	0.1714
	1-Cycle	0.2	0.1333	0.0571

This table juxtaposes the theoretical predictions when the common discount factor, δ, is 0.8 (i.e., a penalty of 20% per delay) and the size of the legislature, n, is either 3 or 7. Under the majority and unanimity rules, one-cycle bargaining without replacement predicts a smaller share for the proposer than the BF model, and such share is constant in the legislature size. Under unanimity, a notable feature arises when the proposer selection protocol is random selection without replacement: When δ is sufficiently large, the proposer's share can be smaller than that of the non-proposers.
†: Proposer advantage is the proposer's share in equilibrium minus the ex-ante expected share.

3 Experimental Design and Procedures

I designed laboratory experiments not only to test the theoretical predictions of my model but also to address the gaps in previous theoretical and experimental studies. Previous experimental studies have consistently reported that the proposer advantage predicted by theory is less significant. As one of the fundamental purposes of conducting laboratory experiments is to infer individuals' underlying reasoning from their observed behavior, the discrepancy between the theoretical predictions and experimental evidence has not successfully advanced our understanding. This is because the uncertainty in the other subjects' type and willingness to accept an offer, the concern about distributional fairness, or both could explain the partial rent extraction of proposers. Furthermore, apart from other factors that affect individuals' decisions, the observed allocation of resources can be entirely explained by another equilibrium.

To address these factors, I conducted a set of modified many-person divide-the-dollar experiments. The three-player majority-rule divide-the-dollar game proceeds as follows: In each bargaining period, one randomly selected player proposes a division of a dollar, which is immediately voted on. If the proposal receives two votes, the bargaining period ends, and every player gets paid according to the proposal. Otherwise, bargaining proceeds to the second round, where the budget shrinks proportionally, a new proposer is randomly selected, and the new proposal is voted on. Previous proposers are not eligible to become proposers in later rounds. This process is repeated until a proposal is passed or until everyone has proposed. The other n-player q-quota divide-the-dollar games also proceed analogously. The proposer selection process is the only crucial difference between the game herein and the typical BF divide-the-dollar game used in previous studies, where previous proposers are allowed an equal chance to be proposers again. In my experimental treatments, only those who have not yet proposed are potential proposers in later rounds.

3.1 Experimental Procedures

All experiments were conducted at the Experimental Social Science Laboratory at University of California Irvine (UCI) in 2016. The subjects were recruited from the general undergraduate population of UCI, and none of the subjects participated in more than one experimental session. The treatment conditions were randomly ordered, and the subjects participated in a session without knowing which treatment they would face. All interactions between participants took place via computer terminals using Python and its Pygame application.[10] After reading the instructions, which were printed and

[10] The software used in the experiments is available upon request.

displayed on the screen, the subjects answered six multiple-choice questions to check their understanding of the instructions. They repeated the quiz until they got all the answers correct. The experimenter offered help as needed. Those who passed the quiz played a demo version of the experiment with computer players to familiarize themselves with the interface. In the demo game, it was made clear that: (1) they were playing with computer players who were making random proposals and casting random votes, and (2) the actions of the computer players were irrelevant to what actual subjects would do in the experiment.

Four main treatments and one supplementary treatment were implemented. The four main treatments differed in two dimensions: the voting rule used to pass the proposal (majority or unanimity) and the size of the legislature (3 or 7). The four sessions that adopted a simple majority rule, two with $n = 3$ and the other two with $n = 7$, are collectively called the Majority treatment. The Unanimity treatment is defined similarly. When a distinction in group size is necessary, the four treatments are abbreviated as M3 (Majority treatment with $n = 3$), M7 (Majority treatment with $n = 7$), U3 (Unanimity treatment with $n = 3$), and U7 (Unanimity treatment with $n = 7$). A similar number of subjects (54 for M3, 48 for U3, and 56 each for M7 and U7) participated in each treatment.

All four treatments shared the same structure: For each of the 15 bargaining periods, subjects are randomly divided into groups of $n \in \{3, 7\}$ members and assigned ID numbers from 1 to n. At the beginning of each period, every member proposes how to divide $50 * n$ tokens.[11] After everyone submits their proposal, one proposal is randomly chosen with equal probability. All members vote after observing the proposal and the proposer's ID. If the proposal receives q or more votes, then it passes, players earn the number of tokens prescribed by the proposal, and the bargaining period ends. Under majority and unanimity, q is $\frac{n+1}{2}$ and n, respectively. If the proposal fails, then the budget shrinks by 20%, and bargaining continues with random selection but excluding the first proposer. That is, in the second round of the bargaining period, every member repeats the first-round procedure with the shrunk $50 * n * 0.8$ tokens. If the second-round proposal within a bargaining period fails and the game proceeds to the third round, then the bargaining involves dividing $50 * n * 0.8^2$ tokens, and so on. This process is repeated for a maximum of n rounds. If no proposal wins within n rounds, the game ends, and no one earns anything. After each bargaining period, the subjects are shuffled to form new groups. As

[11] To maximize the number of observations from the experiment, I used the strategy method (Fréchette et al., 2003) to elicit budget proposals from all group members. The main difference between the strategy method and the bargaining protocol considered in the model is the timing at which the proposer is selected. No qualitative difference in outcomes in terms of the timing of the choice of the proposer has been reported (Agranov and Tergiman, 2014).

a new group is formed and new IDs are assigned per period, the subjects cannot identify their group members. At the end of the experimental session, the tokens earned are converted to US dollars at $0.02/token.

Another experimental session was conducted with 24 participants to provide supplementary evidence. This treatment is abbreviated as M3R2 because its structure is identical to that of M3 starting in the second round. Specifically, at the beginning of each period, all group members are informed that one randomly selected member will be unable to propose during the period, and the selected member's ID is disclosed. The other two members propose to divide 150 tokens. After two members submit their proposals, one proposal is randomly chosen with an equal probability. All three group members then vote on the chosen proposal. If the proposal is accepted, the members earn tokens according to the proposal and move to the next period. If the proposal is rejected, they move to the second round of the period. In the second round, the member whose proposal was not chosen in the first round makes another proposal. The number of tokens to be divided is be reduced to 120. If the proposal is rejected in the second round, all three group members earn nothing during that period. Thus, the first round in M3R2 is structurally identical to the second round in M3. The only difference is that the randomly selected member who does not make a proposal during the period is not the one who failed to pass a proposal. More details regarding the M3R2 treatment are provided in Section 5. Including the 24 subjects in the M3R2 treatment, a total of 238 subjects participated in one of the experimental treatments.

The experimental details are summarized in Table 2.

Table 2: Experimental Design

Treatment	**Group Size**	**#Bargaining Periods**	**Total Subjects**	**Each Period Ends in**	**Voting Rule**	**%Female**
M3	3	15	54 (27+27)	3 rounds	Majority	57.14
M7	7	15	56 (28+28)	7 rounds	Majority	58.18
U3	3	15	48 (21+27)	3 rounds	Unanimity	54.17
U7	7	15	56 (21+35)	7 rounds	Unanimity	55.36
M3R2	3	15	24	2 rounds	Majority	50.00

Except for M3R2, each treatment was conducted in two sessions. Each session consisted of 21–35 subjects.

Theoretical predictions serve as null hypotheses, which are as follows:

Hypothesis 1. *For any treatment, the first proposal is approved. For the Majority treatments, the proposer forms an MWC.*

Hypothesis 2. *In all treatments, the proposer's share is constant with the group size.*

Hypothesis 3. *Compared with the non-proposers, the proposer keeps a smaller share in U3 and a larger share in U7.*

Hypothesis 4. *When the bargaining period reaches the second round or later, the previous proposers are included as winning coalitions.*

Hypothesis 5. *The second-round observations of M3 are the same as the first-round observations of M3R2.*

As the model associated with these treatments has a unique symmetric subgame perfect equilibrium, it directly tests whether the subjects behaved in a strategically correct way. If all the theoretical predictions are supported, we can assert that players behaved rationally and that a simple modification of the recognition process could reduce the variance of the difference between ex-ante expected earnings and ex-post earnings. If experimental evidence from legislative bargaining without replacement is similar to that with replacement, it may imply that the subjects did not strategically respond to changes in the proposer recognition process.[12] If the observed behaviors are inconsistent with theoretical predictions, we may check the validity of behavioral assumptions, including some forms of other-regarding preferences. In particular, the proposer disadvantage in U3 should be observed if the partial rent extraction from previous studies is due to a myopic concern about fairness.

4 Results

Each session, including the tutorials at the beginning and the post-experiment survey, took less than 70 minutes. Including a show-up payment of $7, the subjects earned $20.98 on average, and the aggregated earnings distribution was unimodal around a mode of $20.92. Each treatment except M3R2 was repeated twice. I pooled two sessions by treatment as the two-sample Kolmogorov–Smirnov test results do not reject the null hypothesis that the two earning distributions are from the same distribution.[13] Each earnings distribution per treatment was also unimodal, and the Shapiro–Wilk W test results do not reject the null hypothesis that the data are normally distributed. In sum, the earnings have no noticeable features.

The results of the experiments are reported in the order corresponding to the null hypotheses.

[12] However, this does not necessarily mean that subjects did not respond strategically. I found evidence that some subjects strategically considered the proportion of subjects with bounded rationality (Section 5).

[13] In the first session of U3, one subject consistently rejected all proposals he did not propose. As a result, he had the lowest earnings of $16.3 among all the subjects. The two-sample Kolmogorov–Smirnov test for two sessions in U3 was performed after excluding this subject and subtracting the mean of each session.

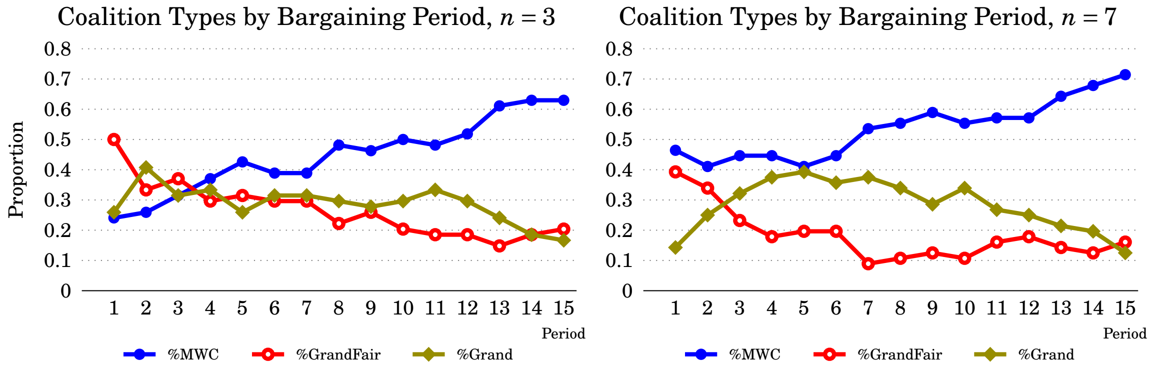

Figure 1: Coalition Types in Majority Treatments
Blue lines with filled dots: the proportion of MWC-type proposals for each bargaining period. Red lines with empty dots: the proportion of proposals that divide the tokens evenly among all the members. Green lines with diamonds: the proportion of proposals that cannot be classified as either of the other two types, mostly allocating positive shares to all members unequally.

First, the MWC was the most frequently observed coalition type.[14] As in previous studies, the "grand fair" (equal split) and "grand coalition" (everyone offered 10 or more tokens) were also observed, but their proportions generally decreased over 15 periods (Figure 1).

The subjects agreed on the chosen proposal without delay for 86.67% of the periods in the Majority treatments (Figure 2). In the Unanimity treatments, more than 63.33% of the proposals were passed without delay (71.67% in U3 and 63.33% in U7). A total of 10 out of 240 groups in U3 and 1 out of 120 groups in U7 could not reach an agreement by the final round and earned no tokens for that bargaining period. Under unanimity, a small number of subjects accounted for nearly one third of all the delays.[15] Thus, it is naturally difficult to reach an agreement when the acceptance of more individuals is required. This loss of efficiency under unanimity is also observed in Kagel et al. (2010) and Miller and Vanberg (2013, 2015). Unless otherwise mentioned, I focus on the first-round proposals and responses for the remaining analysis.

Result 1. *For all treatments, most bargaining is done in the first round. For the Majority treatments, the MWC is the most frequently observed.*

Next, the proposer's share is inconsistent with the theoretical prediction for legislative bargaining without replacement, thus rejecting Hypothesis 2. Figure 3 illustrates the average proposer's share over periods. For every treatment, the null hypothesis that

[14]As in previous studies, I use a "soft boundary" to determine whether a member is included as a coalition partner. If a proposer offered another member less than 10 tokens, I assume that the member was not considered a coalition partner. For example, I code a proposal (80,62,8) as an MWC type.

[15]In U7, 44 groups moved to the second round of bargaining. Only 2 subjects out of 56 accounted for 14 delays out of the 44. In U3, 4 subjects out of 49 led to 21 delays out of 68.

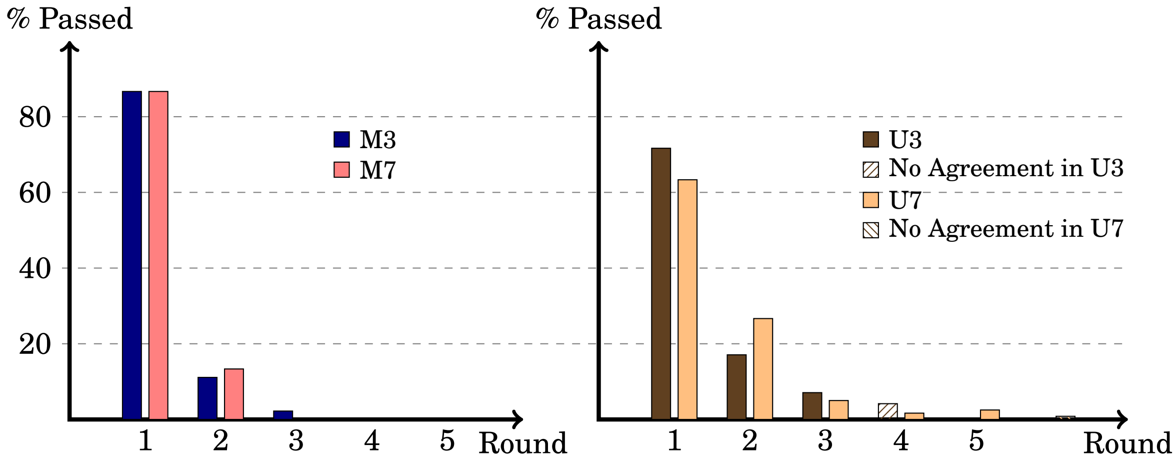

Figure 2: % Proposals Passed by Round

These bar charts illustrate the proportion of proposals accepted in each proposal round. In the Majority treatments, 86.67% of the chosen proposals were accepted without delay. In the Unanimity treatments, smaller proportions of the chosen proposals were accepted in round 1. In U3, nine groups could not reach an agreement by the final round, while in U7, one group could not reach an agreement.

Table 3: Proposer's Share, Majority

Dependent variable: Proposer's share−equilibrium share

	All		MWC only	
	Whole	Last 5	Whole	Last 5
$M7$	-0.1881^{***}	-0.1908^{***}	-0.2074^{***}	-0.2044^{***}
	(0.0125)	(0.0151)	(0.0135)	(0.0157)
cons.	-0.1641^{***}	-0.1427^{***}	-0.0982^{***}	-0.0873^{***}
	(0.0096)	(0.0116)	(0.0117)	(0.0130)
R^2	0.4941	0.5138	0.5826	0.6265
Obs.	1,600	529	786	321

The dependent variable is the difference between the observed proposer's share and the equilibrium share so that the constant terms can directly show the test results on the null hypothesis that the average proposer's share is equal to the proposer's equilibrium share. First-round proposals that were rejected are excluded. $M7$ is a binary variable indicating whether the treatment of the session was M7. The standard errors clustered at the individual level are in parentheses. *, **, and *** indicate statistical significance at the 5%, 1%, and 0.1% levels, respectively.

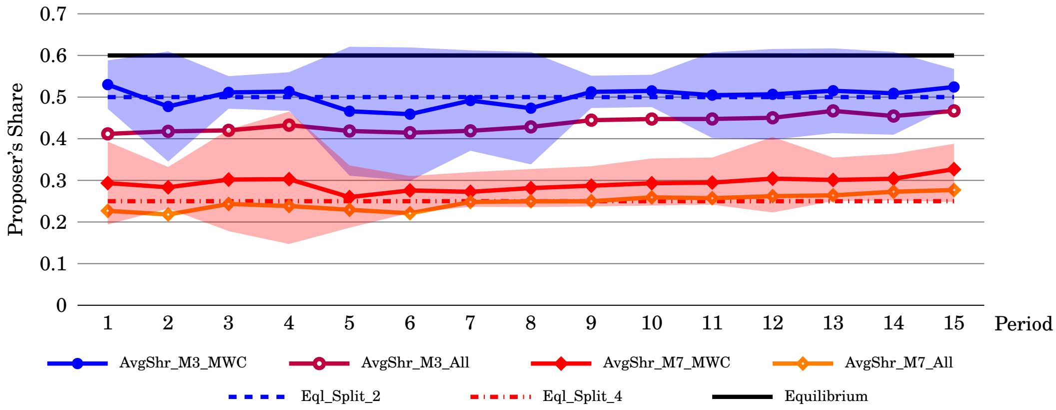

Figure 3: Average Proposer Share by Bargaining Period, Majority

First-round proposals that were rejected are excluded. The line with filled dots and the line with filled diamonds show the average proposer's share from the proposals that allocated resources only to an MWC. The line with open dots and the line with open diamonds show the average proposer's share from all the proposals, respectively. The dashed line and the dash-dot line are for the hypothetical proposals in which there would be an equal split within an MWC. The areas shaded in blue and red depict the standard error around the average proposer's share of MWC-type proposals in M3 and M7, respectively.

the average proposer's share equals the proposer's equilibrium share is rejected at the 1% significance level (Table 3). In the Majority treatments, given the average proposer's share of the MWC-type proposals in M3 for the last five periods, which is closest to the theoretical prediction, the average proposer's share is 8.73 percentage points smaller than the equilibrium share. An equal split within the MWC, known as Gamson's law, seems to describe the subjects' behavior, at least in the Majority treatments. However, observations in the Unanimity treatment do not support Gamson's law; the average proposer's share is statistically different from the equilibrium and equal-split shares at the 1% level (Table 4). Altogether with the high frequency of MWC-type proposals, high efficiency, and partial rent extraction, this evidence is consistent with that in past experimental studies that examined legislative bargaining with replacement. In addition, this evidence confirms that some important factors have not been accounted for in the model. This topic is investigated further in the following subsection.

Result 2. *The proposer's share decreases with the group size.*

Another interesting observation is that even when the proposer disadvantage was expected in U3, the subjects proposed to keep *more* than an equal-split share for themselves, on average, across all 15 periods; thus, Hypothesis 3 is rejected. This observation implies that concern about fairness, even in a myopic sense, is not the main driving force behind their behavior. This argument is further explained in Section 5, but the intuition is straightforward. Suppose the proposer's partial rent extraction, consistently observed

Table 4: Proposer's Share, Unanimity

Dep.Var.	Proposer's share −equilibrium share		Proposer's share −equal split	
	Whole	Last 5	Whole	Last 5
$U3$	0.1960***	0.1935***	0.0055	0.0030
	(0.0054)	(0.0151)	(0.0054)	(0.0058)
cons.	−0.0427***	−0.0431***	0.0144***	0.0141***
	(0.0026)	(0.0038)	(0.0026)	(0.0038)
R^2	0.8352	0.7872	0.0040	0.0009
Obs.	1,452	487	1,452	487

The dependent variable for the first two columns is the difference between the observed proposer's share and the equilibrium share so that the constant terms can directly show the test results on the null hypothesis that the average proposer's share is equal to the proposer's equilibrium share. The dependent variable for the last two columns is the difference between the observed proposer's share and an equal-split share so that the constant terms can directly show the test results on another hypothesis that the average proposer's share is equal to an equal-split share. The first-round proposals that were rejected are excluded. $U7$ is a binary variable indicating whether the treatment of the session was U7. The standard errors clustered at the individual level are in parentheses. *, **, and *** indicate statistical significance at the 5%, 1%, and 0.1% levels, respectively.

in previous and current studies, stems from a mixture of self-interest and a myopic concern about fairness, which could be captured by inequity aversion (Fehr and Schmidt, 1999). In this case, the proposer's share should be between the theoretical prediction and an equal-split share. This implies that in U3, where the equilibrium proposer share is smaller than an equal-split share, the observed proposer's share must be *smaller* than an equal-split share but larger than the proposer's equilibrium share. In U3, however, only 5.44% of all proposals (48 out of 882) involved the proposer receiving a strictly smaller share than the equal-split share. Excluding a few observations that are highly likely to be due to misunderstandings or mistakes, the proportion of proposals indicating the proposer disadvantage is much lower.[16] Therefore, although the average proposer share seems close to the equal-split share, the proposers' rent-seeking behavior is apparent.

Result 3. *In U3 and U7, the proposer keeps, on average, a larger share than the non-proposers.*

One distinctive observation from the out-of-equilibrium paths is that the subjects

[16] A few subjects occasionally proposed to keep $1/3-x$ for themselves, offer one member $1/3-x$, and offer the other member $1/3+2x$, where $x \in (0,1/3)$. Except for one or two "mistakes," those subjects consistently proposed to keep $1/3+2x$ for themselves. One subject seemed to have consistently confused the number of the desk at which he sat with the ID numbers assigned to each of the bargaining periods in the experiment. Excluding all those actual or possible mistakes, only 16 proposals from two subjects consistently offered a smaller share to the proposer.

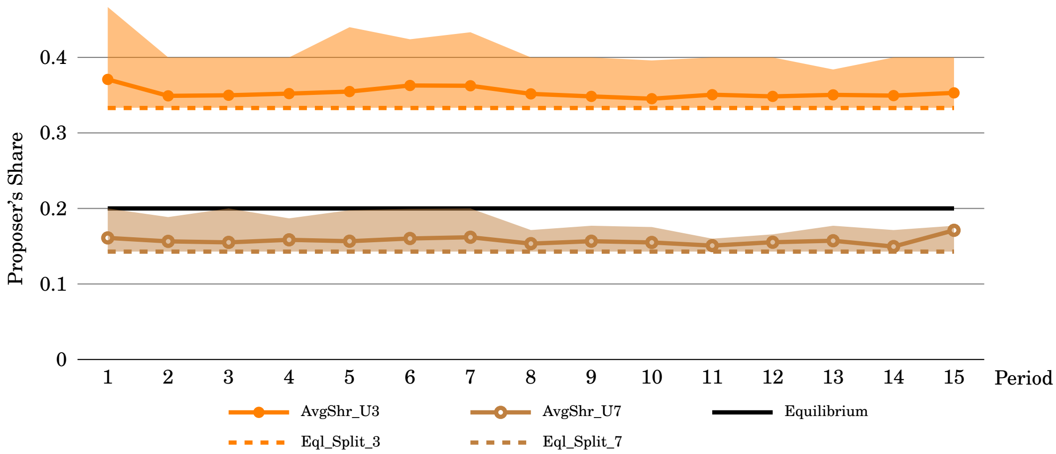

Figure 4: Average Proposer Share by Bargaining Period, Unanimity

The first-round proposals that were rejected are excluded. The dashed lines are for hypothetical proposals in which there would be an equal split. Shaded areas in orange and brown depict the 10%–90% percentile proposer's share in U3 and U7, respectively. In U3, few proposals involve the proposer disadvantage.

seemed to "retaliate" against previous proposers. The first-round proposer was more likely to be excluded when forming an MWC in the second round. In M3, 30 of the 36 (83.33%) second-round proposals, which offered one member almost near-zero tokens,[17] involved splitting the remaining tokens with a non-proposer from the first round. Furthermore, the second-round proposers allocated almost no tokens to the first-round proposer when they were not treated badly[18] (19 out of the 30) or were even favored[19] (12 out of the 19). As the previous proposer had lost her bargaining power, that is, the previous proposer was "cheaper," it is rational to include the previous proposer in the MWC. The choice of the winning coalition member is more distinctive in M3 than in any other treatment. With the tie-breaking assumption that members will vote for a proposal when indifferent between accepting and rejecting it, the second-round proposer may want to propose keeping all the resources for herself because the first proposer (who will earn nothing regardless of whether she accepts the offer or when the game moves on to the third round) will accept the second-round proposer's offer of 0. Even if the assumption of tie-breaking is relaxed, choosing the previous proposer as a coalition partner is still an ideal way to obtain the largest share of resources. Formally, consider three-person bargaining with a majority rule, and suppose that a non-proposer accepts an offer of x only when $x \geq v + \varepsilon$, where v is a continuation value and ε is the "tiny-more" term that captures

[17] The equilibrium proposal is for the second-round proposer to keep everything (Lemma 1), but no such second-round proposals were observed.

[18] For notational simplicity, denote three members of the group as the first-round proposer, member i, and member j. Member i is not treated badly by the first-round proposer if $p_i^1 \geq p_j^1$.

[19] Member i is favored by the first-round proposer if $p_i^1 > p_j^1$.

any general tie-breaking rule. In the final round, the proposer will keep $1-\varepsilon$ and offer one randomly selected member ε because the non-proposer's continuation value is 0. In the second round, the continuation value of the previous proposer is $\delta\frac{\varepsilon}{2}$, whereas that of the other member who has not yet proposed is $\delta(1-\varepsilon)$. When $\varepsilon < \frac{2}{3}$, $1-\varepsilon$ is greater than $\frac{\varepsilon}{2}$. Thus, although it is rational to include previous proposers as winning coalition members under all reasonable circumstances, the finding is the opposite; hence, Hypothesis 4 is rejected.

Result 4. *In M3, the first-round proposer is not included as a coalition member.*

We cannot hastily conclude that members' actions can be viewed as retaliation against the previous proposer because it is rational to offer the previous proposer few tokens or nothing in theory. The question that naturally follows within this interpretation is why the second-round proposer, who knows that the previous proposer will accept an offer of a few tokens, allocates a significant number of tokens to the other member. One possible explanation is that the second-round proposer may want to hedge the possibility of being rejected by the previous proposer: Since the previous proposer's ε term is unknown, it is possible that the offered number of tokens can be less than $\delta\frac{\varepsilon}{2}+\varepsilon$, and she may want to make a hedge by winning over the other member for her proposal to be accepted.

The additional experimental sessions of the M3R2 treatment help to examine whether the second-round proposer retaliates against the first-round proposer by offering no or few tokens or whether the second-round proposer, who is unsure about the previous proposer's decision rule, wins over the other member. The structure of M3R2 is identical to that of the subgame starting from the second round of M3. The only difference is how the member who ultimately lost her bargaining power within the period, that is, the "cheaper" member, is determined. In M3R2, the cheaper member is randomly selected while in M3, the cheaper member is the first-round proposer. If the proportion of MWC-type proposals that exclude the cheaper member in M3R2 is similar to that in M3, we can conclude that retaliation is not the driving factor. If all MWC-type proposals in M3R2 include the cheaper member, we can conclude that retaliation is the only driving factor.

The result shown in Figure 5 supports the claim that the second-round proposers' actions can be partly understood as retaliation against the previous proposer.[20] In M3R2, 44.44% of the first-round MWC-type proposals (56 out of the 126) excluded the cheaper member. In M3, the proportion of second-round MWC-type proposals was 82.86% (29 of

[20] Admittedly, it would be ideal if the number of observations would have been larger. Since the proportion of the rejected first-round proposals in M3 was 13.33%, only 36 groups in M3 moved to the second round, implying that 72 second-round proposals were observed. There were 240 comparable observations in M3R2.

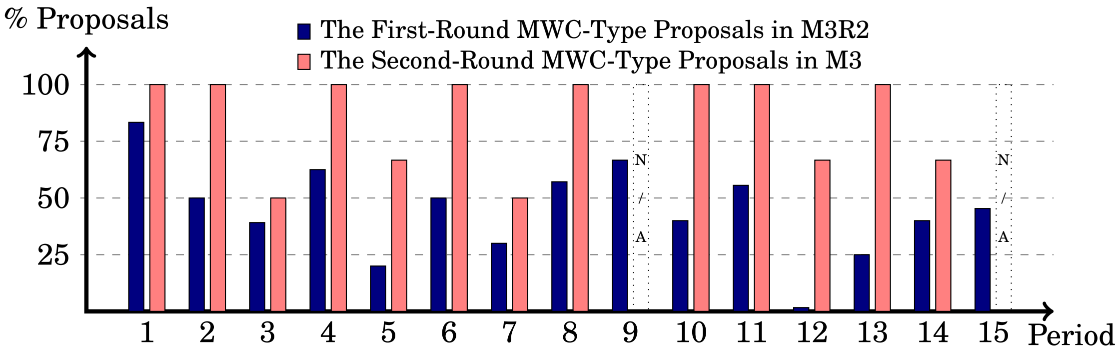

Figure 5: Retaliation Against the Previous Proposer

This bar chart illustrates the proportion of MWC-type proposals that excluded the "cheaper" member. The cheaper member is the first-round proposer in the second round of M3 and is randomly selected in the first round of M3R2. In periods 9 and 15 of M3, every group agreed on the first proposal; thus, no data for the second round were available. A more substantial proportion of the proposals excluded the cheaper member in M3 than in M3R2.

the 35.) In the last five periods, when the MWC-type proposals were more frequently observed, the proportion of such proposals in M2R2 decreased to 35.56% while that in M3 stayed at 83.33%.

In addition, the subjects in M3R2 clearly understood that the cheaper member, known to be unable to propose, had a lower continuation value than the other member who could be the ultimatum proposer in the second (final) round. On average, when choosing the cheaper member as their coalition partner, the subjects offered a significantly smaller number of tokens (60.58) than what they offered to the other member (66.36) on average (t-statistics: 3.4042, $n_1 = 71$, $n_2 = 56$). These pieces of evidence reject Hypothesis 5 and indicate that in M3, the subjects tried to retaliate against the first-round proposer for offering them unacceptable tokens.

Result 5. *The second-round proposer behavior in M3 differs from the first-round proposer behavior in M3R2.*

5 Discussion

This section further examines the proposer's partial rent extraction. As the two theoretical predictions (no treatment effect on group size and proposer disadvantage in U3) are inconsistent with the experimental evidence, I provide some behavioral explanations and argue how I support/reject such explanations.

5.1 A Model with Inequity Aversion of Myopic Agents

One of the robust observations of previous experimental studies on multilateral bargaining is the proposer's partial rent extraction, which is also observed in my experiment. This section claims that inequity aversion, either in a fully rational[21] or myopic sense, is not a driving factor behind partial rent extraction. To this end, I formulate a new hypothesis drawn from a theoretical prediction with inequity aversion and show how the observations reject the hypothesis.

In a situation where every player has inequity aversion and is rational enough to internalize the fact that other players are also inequity-averse, Montero (2007) shows that inequity aversion works in the opposite direction in explaining the attenuated proposer advantage; that is, the proposer's equilibrium share is *larger* than that without the assumption of inequity aversion. The intuition behind this result is that from the coalition partner's perspective, the proposer's rent-seeking behavior involves attenuated inequity between her and non-coalition members;[22] thus, her continuation value becomes smaller than that in the situation with selfish members. This intuition similarly applies to finite-horizon bargaining without replacement. Therefore, I rule out fully-rational inequity aversion as a potential candidate to explain partial rent extraction.

I consider a myopic form of inequity aversion as a supplementary approach to Montero (2007). Myopic inequity-averse proposers care about distributional fairness but do not consider non-proposers' inequity aversion.[23] Under the assumption of myopic agents, I postulate that inequity-averse proposers would find the optimal proposal after calculating the equilibrium allocation with self-interested utility. Following Fehr and Schmidt (1999), suppose that player i's payoff from accepting proposal p is

$$p_i - \alpha \frac{\sum_{j\neq i} \max\{p_j - p_i, 0\}}{n-1} - \beta \frac{\sum_{j\neq i} \max\{p_i - p_j, 0\}}{n-1},$$

where $\alpha > \beta > 0$ and $\beta < \frac{n-1}{n}$.

With this utility function in mind, I first derive the range of parameters consistent

[21] Full rationality is not meant to be narrowly defined as completeness and transitivity. Fully rational inequity aversion implies that the inequity-averse player can exploit the fact that other players are also inequity-averse to maximize her utility. In contrast, myopic inequity aversion implies that the inequity-averse player does not consider other players' inequity aversion.

[22] In addition, it exacerbates inequity between her and the proposer, which, in turn, lowers her continuation value. Her expected utility is also affected by the chance of being a proposer.

[23] In the sense that I focus on the proposer's decisions, this is a complementary approach to studies investigating voting behaviors. Some studies, including Fréchette et al. (2003), Fréchette et al. (2005a), and Fréchette et al. (2005b), report that the voter's share is the only significant dependent variable explaining the probability of accepting the offer. However, Fréchette et al. (2005c) and Miller and Vanberg (2013) report that voters also care for the proposer's share when casting a vote. Such mixed evidence does not give us a clear clue whether the proposal by itself is the result of the myopic inequity aversion.

with the typical observations in M3. Note that in M3, most proposers form an MWC, keep about half of the entire budget, and give (most of) the remainder to one of the other members. I postulate that in M3, the first proposer solves the following maximization problem:

$$\max_{x\in[0,0.1]}(0.6-x)-\alpha\frac{((0.6-x)-(0.4+x))+(0.6-x)}{2}=(1-\alpha)(0.6-x)+\alpha\frac{0.4+x}{2},$$

where 0.6 is the proposer's equilibrium share, the first term captures the proposer's selfish payoff, the first term of the numerator captures the disutility from advantageous inequity between the proposer and the coalition member, and the second term captures the disutility from advantageous inequity between the proposer and the other member who is offered zero. The discount factor, δ, is set to 0.8; thus, the proposer's equilibrium share is 0.6 ($= 1-0.8/2$). The amount that the proposer is willing to give others to relieve disutility from advantageous inequity, x, would be chosen in $[0,0.1]$ because for $x>0.1$, the proposer would get a smaller share than the coalition member, which is never observed.[24] As the objective function is linear, it has corner solutions. Solving for x, we find that $x=0.1$ if $\alpha>\frac{2}{3}$. Thus, $\alpha>\frac{2}{3}$ is the range of parameters that admits the experimental evidence from M3.

Next, I derive the range of parameters consistent with the typical observations in U3. Note that in U3, the proposer keeps more than the equal-split share. The first proposer in U3 solves the following maximization problem:

$$\max_{x\in[-1/5,4/5]}(1/5+x)-\alpha\left(1/5+x-\left(2/5-\frac{x}{2}\right)\right)\mathbb{1}_{x\geq 2/15}-\beta\left(2/5-\frac{x}{2}-(1/5+x)\right)\mathbb{1}_{x<2/15},$$

where 1/5 is the proposer's equilibrium share, x is the additional share the proposer wants to take, and $\mathbb{1}$ is the indicator function. We first check whether $x<2/15$—keeping a smaller share than other members—could be a solution to the problem. If the proposer tries to keep a smaller share than the other two members, the disadvantageous inequity term plays a role. The first-order condition, $1+\beta+\beta/2$, is always positive; therefore, the corner solution is $x=4/5$. However, this contradicts the supposition of $x<2/15$. Now consider $x\geq 2/15$. The first-order condition is $1-\alpha-\alpha/2$. Thus, $x>2/15$ (i.e., an equal-split share or more) is the optimal choice when $1-\alpha-\alpha/2>0$, or $\alpha<\frac{2}{3}$.

In sum, to explain the M3 observations using inequity aversion, α should be greater than 2/3. However, for U3 observations, α should be smaller than 2/3. This contrast leads to the following result.

[24]Even if we allow that x could be larger than 0.1, it can be shown that $x>0.1$ can never be optimal when β, which is the parameter capturing the degree of disadvantageous inequity, is smaller than α as commonly assumed.

Result 6. *No set of parameters jointly admits the proposer behaviors in M3 and U3.*

Another interpretation of this result is as follows: If the proposer's "partial rent extraction" in M3 were to be explained by the concern about inequity aversion, the proposer's "partial disadvantage transfer" would have been observed in U3. The experimental findings (Result 3) contradict this prediction.

5.2 Behavioral Experimentation

Retaliating behavior is interesting because retaliation has no monetary benefit for the current period[25] and for future periods in which subjects are shuffled to form new groups. Even if the first-round proposer in the previous period is included in the current group, there is no way to identify her because new ID numbers are assigned. However, the subjects being retaliated against in previous periods are more likely to propose an equal split within an MWC. This observation provides a hint to examine the subjects' behavioral experimentation.

As each subject does not know the voting thresholds of the other subjects, it is natural for subjects to experiment to get a sense of the rationality of the other players by observing the voting results. If a reasonable proposal that could have been accepted if every member had acted rationally is rejected, subjects seemed to update their beliefs about the type of population and then modify their proposals accordingly.

The following illustration clarifies how a rational subject might decide to stick with an equal split within an MWC or an even more egalitarian split. Suppose that in M3, three subjects (A, B, and C) each submit a proposal (s_A^j, s_B^j, s_C^j), where s_i^j is the number of tokens allocated to subject $i \in \{A,B,C\}$ according to the proposal submitted by subject $j \in \{A,B,C\}$. Suppose that in the first round, subject A submits the equilibrium proposal (90,60,0), and subject B, who proposes (0,75,75), is the recognized proposer. Although subject A, who was offered no tokens, votes against the proposal, she expects that subject C will accept the offer because 75 is strictly greater than 60, the number of tokens that subject A would have accepted if she had been offered. If subject B's proposal is rejected, subject A learns that subject C is not as rational as expected. Then, in the second round, the reaction of subject A is based on the relative weights she assigns to two pieces of new information from the first round: (1) subject B wants an equal split within an MWC, and (2) subject C does not want an equal split within an MWC, even if she is included as a coalition partner. If subject A focuses more on (1), then she might propose (60,60,0) in the hope that subject B will accept the same type of offer that he proposed in the

[25] Retaliation has no monetary benefit for a current period because the previous proposer is "cheaper" to form an MWC. Here I focus on how the experience of retaliation affects future bargaining behavior.

previous round. Subject A might propose (40,40,40) if she is more concerned about (2) and interprets subject C's voting decision as a signal that he prefers an equal split. At the very least, subject A would know that a proposal of (60,0,60) will not be accepted by subject C because if subject C would accept (60,0,60) in the second round, she should have accepted (0,75,75) in the first round. Even when the bargaining period ends and all subjects are shuffled to form new groups, subject A would realize that (i) at least one subject wants an equal split within a winning coalition, (ii) another subject may want a more egalitarian split, and (iii) those two subjects might be assigned to the same group in a later period within the session. This type of experimentation helps subjects update the type distribution of the subject pool, and their proposals in later periods will reflect their related beliefs.[26]

Table 5: Before and After Observing an Irrational Rejection

Dep. Var.	Max−Med	Med
$After$	−4.6667	0.0000
	(2.4563)	(2.9795)
cons.	8.7333	64.1333
	(2.8793)	(2.8560)
R^2	0.0579	-
Obs.	30	30

The dependent variables are the difference between the maximum and the median of the proposed offers and the median. The standard errors clustered at the individual level are in parentheses.

I examine how the proposals change before and after observing an "irrational" rejection in M3.[27] In this work, an irrational rejection is a negative voting result led by an irrational voter's decision. In the example above, from the perspective of subjects A and C, rejecting (0,75,75) is irrational because subject B, who was offered more than the continuation value, rejected it. Table 5 summarizes how the subjects who did not make the irrational rejection but experienced it, that is, subjects A and C in the example, changed their proposals. I focus on the difference between the maximum and median of the proposed offers, which captures the extent to which the proposer takes more than the coalition member.

As most first-round proposals were accepted, there were only 15 irrational rejections. Although the statistical significance is weak, the regression result confirms how the subjects responded to the irrational rejection. After observing the irrational rejection, the

[26]This narrative is in line with the main argument in Fréchette (2009).

[27]Although I could conduct similar analyses for the other treatments, M3 is best suited for defining irrational rejections and summarizing the changes in the proposals.

subjects tended to decrease the amount of what they claimed for themselves. On average, the subjects did not change the amount of an offer to the winning coalition.

Result 7. *Observing "irrational" rejections leads to more egalitarian proposals.*

6 Concluding Remarks

This study examines how we can investigate the proposer's partial rent extraction typically observed in the laboratory by modifying the proposer selection rule. In the existing legislative bargaining literature, random recognition allows the current proposer to be recognized again in the following rounds. The model considered here prohibits the recognition of any player as the proposer in more than one round, capturing the idea of the "one bite at the apple" principle.

Two unique features are as follows: (1) Proposer disadvantage is expected in some situations, and (2) on the out-of-equilibrium path, the previous proposers can be cheaply included in a coalition. These features enable us to examine the role of inequity aversion and the motivation of retaliation.

Although distributional fairness may have been considered a crucial factor resulting in partial rent extraction, it does not affect subjects' decisions even when considering myopic agents who only care for their own inequity aversion. The players in U3 propose (and get accepted) to take more than the equal-split share when the equilibrium proposer share is half the share of other members, which cannot be explained by inequity aversion.

Out-of-equilibrium observations suggest that retaliation (and the fear thereof) is an important driving factor. By comparing the second-round proposals in M3 with the first-round proposals in M3R2, I found that the second-round proposers unnecessarily spent more resources to retaliate against the previous proposer at their expense. This finding needs to be investigated further because retaliatory behavior does not help subjects increase their earnings, especially when they are randomly rematched at the beginning of each bargaining period. A theoretical investigation of type variation or the learning of types may also be worthwhile. In addition, although the sessions were well balanced, the small number of sessions for the experiment could be a potential weakness, so replicating the experiment and collecting more data may help validate the findings.

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A Appendix: Omitted Proofs

Proof of Proposition 1: We build upon the following two lemmas.

Lemma 1. *In the symmetric subgame perfect equilibrium, the randomly selected proposer, player i, will proposer $p_i^t = 1$ and $p_j^t = 0$ for all $j \neq i$ and all $t \geq q$.*

Proof: The fact that a game has reached round q implies that there are $q-1$ previous proposers, who cannot be the proposer again and thus have lost their bargaining power. If the game reaches the last round, all the previous proposers will be offered zero and it will be accepted. In the second to the last round, the proposer (who knows that the previous $n-2$ proposers' continuation value is zero) will offer them zero. Thus there are at least $q-1$ legislators who will vote for a payoff of 0 in round q or later. □

Lemma 2. *When the $(q-l)$th proposer is randomly recognized, $l = 0, 1, \ldots, q-1$, in equilibrium she offers $\frac{\delta}{n-(q-l)}$ to l randomly selected players from the nontrivial coalition pool.*

Proof: Let's first consider trivial cases. When $l = 0$ for any n, that is, when qth round is reached, the proposer will keep the entire budget by Lemma 1. Since the equilibrium strategy is not stationary, backward induction has to be adopted. First, let's check if the $(q-l)$th proposer offers $\frac{\delta}{n-q+l}$ to one player when $l = 1$. By the fact that there are $q-2$ previous proposers in the trivial coalition, she wants to offer some nonnegative payoff, x, to only one additional player to form a MWC. The player received an offer x would accept it only when his continuation value is not as great as accepting x. If he rejects the offer, he would have 1 in the next round with probability $\frac{1}{n-(q-1)}$ being a proposer, and zero otherwise by Lemma 1. His expected payoff in the next round, $\frac{1}{n-(q-1)}$ is discounted by

δ, so he will accept x if it is greater or equal to $\frac{\delta}{n-(q-1)}$. Now suppose the claim holds for some $l = 1,\dots,q-2$. That is, the $(q-l)$th proposer offers $\frac{\delta}{n-q+l}$ to l randomly selected players from the nontrivial coalition pool. I want to show this will also hold for $l = q-1$. The $(q-l)$th proposer, or the first proposer, needs to offer some nonnegative payoff, x, to l players from the nontrivial coalition pool. Each of players who received the offer x would accept if it is greater than the continuation value. When one offered player rejects the offer, he would expect to earn $1-(q-2)\frac{\delta}{n-2}$ with probability $\frac{1}{n-1}$ being a proposer, and earn $\frac{\delta}{n-2}$ with probability $\frac{q-2}{n-1}$ being in a nontrivial MWC. Thus the expected payoff in the next round is $\frac{1}{n-1}\left(1-\frac{q-2}{n-2}\delta\right)+\frac{q-2}{n-1}\frac{\delta}{n-2}=\frac{1}{n-1}$. Since the continuation value for the next round is discounted by δ, the non-proposers will accept if $x=\frac{\delta}{n-1}$. □

By Lemma 1, when $\frac{n-1}{2}-t<0$, that is, in round $\frac{n+1}{2}$ or after, any proposer in round t will get the entire budget. When $\frac{n-1}{2}-t>0$, that is, in round $\frac{n-1}{2}$ or before, Lemma 2 can be directly applied. The round t is equivalent to round $k-l$, where $k=\frac{n-1}{2}$ and $l=0,1,\dots,k-1$. The round t proposer will offer $\frac{\delta}{n-(k-l)}=\frac{\delta}{n-t}$ to $l+1=\frac{n-1}{2}-t+1$ randomly selected players. □

B Appendix: Supplementary material

Supplementary data associated with this article and the sample instructions used for this experiment are available online at osf.io/vyjnz/.