Public Good Bargaining under Mandatory and Discretionary Rules: Experimental Evidence*

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Abstract

We experimentally test a model of public good bargaining due to Bowen et al. (2014) and compare two institutions governing bargaining over public good allocations. The setup involves two parties negotiating the distribution of a fixed endowment between a public good and each party's individual account. Parties attach either high or low weight to the public good and the difference in these weights reflects the degree of polarization. Under discretionary bargaining rules, the status quo default allocation to the group account (in the event of disagreement) is zero while under the mandatory bargaining rule it is equal to the level last agreed upon. The mandatory rule thus creates a dynamic relationship between current decisions and future payoffs, and our experiment tests the theoretical prediction that the efficient level of public good is provided under the mandatory rule while the level of public good funding is at a sub-optimal level under the discretionary rule. Consistent with the theory, we find that proposers (particularly those attaching high weight to the public good) propose significantly greater allocations to the public good under mandatory rules than under discretionary rules and this result is strengthened with an increase in polarization. Still, public good allocations under mandatory rules fall short of steady state predictions, primarily due to fairness concerns that prevent proposers from exercising full proposer power.

JEL Codes: C78, C92, E62, H41, H61
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1 Introduction

Expenditures on public goods are often the result of a bargaining process between legislative parties that differ in terms of their bargaining power and in the utility they derive from public good expenditures. In addition, there is often a dynamic element to such negotiations in that a considerable fraction of public expenditures are often *mandated* by law, and are not subject to discretionary, renegotiation from one period to the next. For example, in the U.S., mandatory expenditures (e.g., on Social Security, Medicare, Medicaid, Veteran's Benefits and other sources of "Income Security" - the latter including Disability Assistance, Food and Nutrition Assistance, Supplemental Security Income, Earned Income Tax Credits, Child Tax Credits, Unemployment Insurance, Student Loans, and Deposit insurance) accounted for over two thirds of total federal government spending in FY 2020, while discretionary spending that is subject to renegotiation each year (e.g., on military and non-defense cabinet offices) accounted for about one quarter of FY 2020 spending – see Figure 1 (The remaining amount is interest on government debt which is not included in the figure).

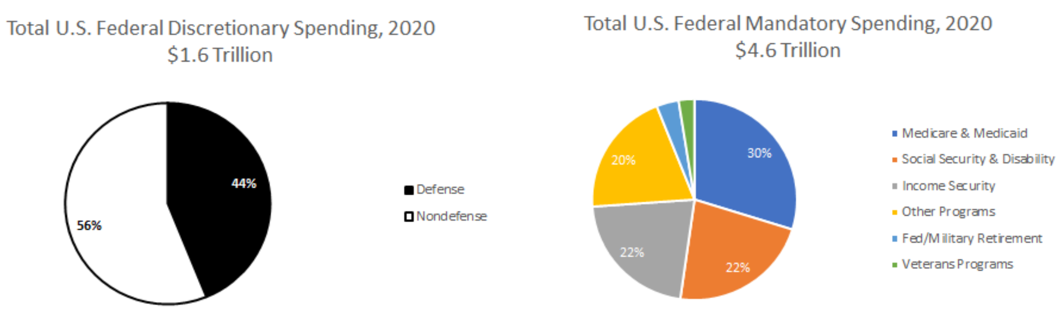


Figure 1: Breakdown of U.S. Federal Government Spending in 2020, Source: Congressional Budget Office Data

According to the Congressional Budget Office[1] U.S. federal mandatory spending has steadily increased over time from an average of 12.7 percent of GDP over the years 2010-2019 to more than 20% of GDP during the pandemic years of 2020-21 and are projected to be 15.2 percent of GDP by 2030. By contrast, discretionary outlays have steadily declined from 7 percent of GDP in 2013 to 6.4 percent 2020 and are projected to be 5.6 percent of GDP in 2030.

In this paper we explore the process by which two parties bargain over public good expenditures under two distinct budgeting rules. Specifically, we experimentally test a model of this bargaining process due to Bowen et al. (2014), henceforth "BCE". Under a purely discretionary bargaining rule, BCE assume that the status quo allocation to the public good in the event of a bargaining disagreement is always zero. However, under mandatory bargaining rules, the status quo default public good expenditure in the event that there is no bargaining agreement is assumed to be equal to the level of public good expenditure that was last agreed upon by the two parties. BCE show that under this mandatory bargaining

[1]CBO, The Budget and Economic Outlook: 2022 to 2032, May 2022, https://www.cbo.gov/publication/57950

rule, allocations to the public good are higher and can Pareto dominate allocations under the discretionary rule under certain conditions. BCE thus provide a simple dynamic mechanism that enables efficient provision of public goods to be attained and rationalizes the steady growth of mandatory spending in the historical U.S. federal budget. Our aim in this paper is to experimentally test the predictions of the BCE model in a laboratory experiment with paid human subjects. We implement a version of their model in the laboratory and we find strong, though imperfect support for the model predictions in our experimental data.

Our paper is most closely related to the experimental literature on coalitional and legislative bargaining; see, e.g. Palfrey (2015) and Baranski and Morton (2022) for surveys. John Kagel has made many pioneering contributions to this literature including Fréchette et al. (2003), Fréchette et al. (2005a,b,c),Fréchette et al. (2012) and Baranski and Kagel (2015). Of these papers, the one that is most closely related to this paper is Fréchette et al. (2012) They consider a version of the Baron and Ferejohn (1989) model of majoritarian coalitional bargaining where 5 players must make and vote on allocations to both private (particularistic) and public goods as in our study. The difference between their paper and ours is that we consider dynamic budgeting rules that depend on the status quo level of previously agreed upon public good expenditures and we have only 2 players who make or agree to proposed allocations, so that our decision rule amounts to unanimity. Further, in our setting, following BCE, the public good yields a nonlinear payoff (implying an interior optimum for the public good amount) that varies with the player type – the high (low) type gets a higher (lower) utility from the public good.

Our paper is also related to the recent literature on dynamic bargaining experiments, possibly with an endogenous status quo, in legislative and/or multilateral settings (e.g., Battaglini et al. (2012) and Battaglini and Palfrey (2012). Those papers allow for an endogenous status quo, but focus either on purely distributive politics without a public good element or on the provision of durable public goods under different voting rules (majority/unanimity).

The main question we address in this paper is whether dynamic, mandatory budgeting rules matter for the achievement of the efficient level of the public good relative to discretionary budgeting rules when the public good allocation is the result of a bargaining process by two parties with different interests.

Our experimental data clearly show that Pareto improvements in public good allocations are possible under dynamic, mandatory budget rules, as opposed to discretionary rules. These improvements result from private negotiations between interested parties and occur in the absence of transaction costs. In this sense, the dynamic public good bargaining game provides a mechanism to obtain efficient public good provision in line with the Coase Theorem. To preview our results, we find that in the discretionary treatment, participants tend to allocate more to the public good than what is anticipated based on the static equilibrium. However, in the mandatory treatments, participants allocate even more to the public good, and come very close to achieving the Pareto efficient outcome in public good provision. However, they fall just short of that level, and we attribute this failure to fairness concerns. In order to convince responders to accept proposals, proposers are not able to exercise full proposer power. Instead, proposers must award responders with some private points, despite the equilibrium prediction that proposers allocate zero private points to responders in most cases unless the responders have a strong outside option. These private points awarded to responders reduce both the public good allocation and the proposer's own private allocations in the mandatory treatments, and that is why the Pareto optimum is not quite achieved.

Our results provide some support for the key insight of BCE that the endogenous status quo level of public good provision works as an outside option for responders in bargaining under the mandatory budget rules. Proposers have an incentive to maintain or increase allocations to the public good over the current status quo as insurance against the possibility that they lose their status as a proposer in the future (the roles of proposer and responder change with a fixed probability in each round of our dynamic bargaining supergames). This is why public good provision can grow close to the Pareto efficient level in the steady states of dynamic bargaining games under the mandatory budget rules.

2 Model and Experimental Design

The model we implement in the laboratory was originally proposed as a dynamic game of public good bargaining by Bowen et al. (2014) (BCE). It involves bargaining between two parties about the allocation of an endowment across both public and private accounts under alternative budget rules and over an indefinite horizon.

Specifically, two parties repeatedly bargain with one another in an indefinite sequence of rounds over how to allocate a fixed endowment – in our experiment 100 points – across a group account (public good) and two private accounts, one for each of the two parties. The points assigned to the group account contribute to the earnings of both members of the pair, while the points assigned to each of the two private accounts only accrue to the earnings of the individual parties who own those private accounts.

At the start of each new sequence of rounds (supergame), the two members of each party are randomly paired and are equally likely to be chosen to be the proposer (the other player is the responder). Following the first round of the sequence, if the game continues, the current proposer continues to be the proposer in the next round with probability p, and with probability $1-p$, the proposer and responder switch roles. We chose to set $p = .60$ throughout all treatments of the experiment so that there is some persistence to players remaining in the same proposer/responder roles from one round to the next of each sequence, but also allowing for political change (i.e., changes in the majority party which monopolizes the proposer power) to occur, here with probability $1-p = .40$.

The players in each pair are also randomly assigned to be either a high or a low type player, which refers to how they value the public good (as explained below). Each pair has one high and one low type player and this designation does not change over the course of the supergame.

In each pair, the proposer chooses an allocation of the 100 points (endowed anew each round) to the "group" account, the "private" account of the proposer and the private account of the responder in each round. The allocations across all three accounts must sum to exactly 100 points. If the responder (matched with the proposer) accepts this proposal, the round payoffs for the proposer and responder in the pair are realized according to the agreed upon proposal. A player with X points in their own private account and Y points in the group account would have round earnings calculated as follows:

$$\text{Player points earned} = X + \theta_i \ln Y, \quad i \in \{L, H\}.$$

Here, if the player is a "low" type, then $\theta_L = 25$ in all treatments. If the player is a "high" type, then $\theta_H = 40$ or $\theta_H = 55$ depending on the treatment conditions.

Once a sequence ended, subjects were randomly rematched into new pairs and their types (high or low) and initial assignments as either the proposer or responder were newly and randomly assigned at the start of the next sequence. In this way, subjects in each experimental session played multiple indefinitely repeated games (supergames) of public and private good bargaining as either high or low types (in terms of their valuation for the public good) and also traded off proposer and responder roles according to the Markovian switching probability p as described above.

Our experiment consists of two treatment variables, (1) the *budget rule*, which is either "discretionary" or "mandatory" as discussed in further detail below and (2) for the mandatory treatments only, the degree of political polarization which is measured by the difference, $\theta_H - \theta_L$. As noted earlier, we always have $\theta_L = 25$. In the baseline "aligned" treatment the high type has $\theta_H = 40$ and in the "polarized" treatment, the high type has $\theta_H = 55$ (accordingly $\theta_H - \theta_L$ is larger in the polarized treatment). Note that the discretionary treatment uses the same θ values as the baseline aligned treatment, $(\theta_H, \theta_L) = (40, 25)$.

At the start of each new sequence, the default number of points, Y, in the group account is set to one in both the mandatory and discretionary treatments. Thus, under the logarithmic specification for the public good component for the period utility function, there will be a zero payoff from this default level. The default number of points in the two private accounts (which enter utility linearly) are both 0.

Following BCE, we distinguish alternative budget rules from one other according to whether the public good levels that are agreed upon in previous rounds of a given sequence are persistent or not. If there is disagreement under the *discretionary* budget rules, then the points allocated to the group account are reset to one and both private accounts are reset to zero. In other words, there is no persistence to public good levels in the discretionary treatment.

By contrast, under the *mandatory* budget rules, if a proposal is accepted, the accepted amount in the group account becomes the new status quo default public good amount for future rounds of that same sequence. In the event that there is disagreement about future proposals within that same sequence (supergame) then, under the mandatory rule, both the proposer and the responder's private accounts default to zero points but the group account defaults to the status quo level - the most recently agreed to public good allocation in the sequence – so that both players may still receive some positive utility benefit from a disagreement outcome.

Thus, we implement three treatments. In the discretionary, aligned (D) treatment (just called the "discretionary treatment" hereafter), $(\theta_H, \theta_L) = (40, 25)$ and the discretionary budgeting rule is in place. In the mandatory-aligned treatment (Ma) $(\theta_H, \theta_L) = (40, 25)$ and in the mandatory-polarized treatment (Mp) $(\theta_H, \theta_L) = (55, 25)$, and in these two treatments, the mandatory budgeting rule is in place.[2] These parameter choices imply that the Pareto efficient level for the public good allocation is $\theta_H + \theta_L = 65$ in the aligned treatment

[2]Our mandatory-aligned and mandatory-polarized treatments correspond to the 'low-polarization' and 'high-polarization' cases of mandatory budget rules in Bowen et al. (2014).

and 80 in the polarized treatment.[3] We required the proposer to allocate at least 1 point to the group account to prevent outcomes with negative payoffs ($\ln Y$ for $0 \leq Y < 1$ can result in a large negative number). Note one difference of this theory from standard public good or voluntary contribution games is that the utility from the public good allocation is nonlinear (logarithmic) which enables unique interior solutions; utility from private point allocations is linear as is more typical in those games.[4] Finally, our design is between-subjects; each session consisted of 10 subjects who participated in multiple supergames or "sequences" all conducted under the same treatment conditions (i.e., the budget rule, discretionary or mandatory, and the values of the public good weighting parameters (θ_H, θ_L) are held fixed in every session of the treatments).

At the end of each round of a sequence there is a one-fifth chance that the current sequence does not continue on with another round. We thus implement bargaining over an indefinite horizon with a discount factor of $\delta = .80$ using the method of random termination. After learning whether the most recent proposal was accepted or not, subjects were shown a randomly drawn integer from 1-5 inclusive at the end of each round. They were instructed that if a 5 was drawn then the sequence would end; otherwise the sequence would continue with another round and in that case, the status quo level for the public good in the mandatory treatments would carry forward as well.

We drew the random numbers in advance and we used several different sequences of random number draws across both the discretionary and mandatory treatment sessions. This design ensures that the length of sequences are the same between mandatory and a discretionary sessions so that we can more readily compare the dynamic data between the different treatments. The realized number of rounds for our sessions are as shown in Table 1. For instance, for the first two sessions, 1-2 of treatments D, Ma, and Mp, we had 7

Table 1: Number of Realized Rounds

D1,2, Ma1,2, Mp1,2		D3,4, Ma3,4, Mp3,4		D5, Ma5, Mp5	
Sequence	Rounds	Sequence	Rounds	Sequence	Rounds
1	3	1	6	1	3
2	4	2	1	2	8
3	4	3	5	3	6
4	6	4	2	4	5
5	12	5	10	5	1
6	6	6	6	6	10
7	4	7	3	7	3
		8	3	8	3
		9	5		
	39		41		39

[3]Under the induced logarithmic utility specification for the public good payoff, it can be easily shown that the Pareto efficient level for the public good allocation in the dynamic bargaining games described in this section is $\theta_H + \theta_L$; see Bowen et al. (2014), Sec.II.

[4]The experimental literature exploring Baron-Ferejohn type legislative bargaining usually involves allocation of private points *only* among three or more players. As noted earlier, Fréchette et al. (2012) is an exception in that they allow both public and private (particularistic) goods, similar to our study, but in a multilateral bargaining setting. While they examine static multi-stage bargaining games,their utility is linear in both the private and public goods.

sequences (supergames) lasting various numbers of rounds that summed to 39 rounds in total.

At the end of a session, we randomly chose two sequences from all sequences played in a session and we paid subjects according to the points they earned in the final rounds of the two chosen sequences.[5] The points subjects earned in those two final rounds were converted into money at the fixed and known rate of 15 points = US$1 and the point totals thus calculated were paid together with a $7 show-up fee.

The experiment was computerized and programmed using oTree (Chen et al. (2016)). On the relevant decision screens, we reminded subjects of the history of all group (public good) and private points in the previous rounds as well as the status quo public good levels to aid them in making decisions. They also had access to online calculators.

All sessions were conducted in the Experimental Social Science Laboratory (ESSL) at UC Irvine. Prior to making any decisions on the networked computer workstations of the laboratory, subjects were given written instructions which were also read aloud. See Appendix A for a copy of these instructions for the aligned treatment (both the Discretionary and Mandatory versions). After the instructions were read, subjects completed a quiz (which can be found at the end of the instructions given in the Appendix). Subjects' quiz answers were reviewed by the experimenter; if a subject got a quiz question wrong, the experimenter went over the correct answer with the subject before the experiment began.

Subjects were undergraduate students at UC Irvine pursuing a variety of different major programs of study. They were recruited using the Sona systems software. Each subject participated in just one session. Total average earnings (including the show-up payment) were $24.03 for a two-hour experimental session.

3 Equilibrium and Hypotheses

In the dynamic bargaining game described in section 2, subjects should maximize their discounted payoffs (discount factor $\delta = .80$) over an indefinite sequence of allocation decisions with the induced stage utility given by $u_t = X_t + \theta_i \ln Y_t$. Assuming they do so, Figure 2 shows the resulting Markov perfect equilibrium public good allocations. These equlibrium allocations are plotted as a function of the status quo level for the public good (on the horizontal axis) for the two mandatory treatments (aligned, Ma and polarized, Mp) for the parameter (θ) values that we used in the experiment. Figure 2 shows the predicted public good allocations, Y, proposed by both high and low type proposers. For most status quo levels, the proposer should allocate the remainder of the endowment to his own private account, giving zero to the responder, thereby exercising *full proposer power*. Figure B.1 in the Appendix presents predicted private point allocations X for both proposers and responders in the two mandatory treatments.

These are of course, the rational actor model predictions under standard, money maximizing preferences as specified above. Later, in section 4.7, we show that a modified version of the discretionary model with other-regarding preferences results in a slight increase in public good allocations and less than full exercise of proposer power.

In the equilibrium for the discretionary (aligned) treatment (which is not shown in any figure), each type of player proposes his static equilibrium level for the public good,

[5] Here we follow the practice recommended by Sherstyuk et al. (2013).

$Y^* = \theta_i$. The logic here directly follows from the first order condition from the static, one-shot maximization problem which yields $-1 + \frac{\theta_i}{Y} = 0$, or $Y = \theta_i$ Thus, in the discretionary aligned treatment $Y^* = 40$ or 25 depending on whether the proposer is a high or low type (the interior optimum for the stage utility with the assumption of full proposer power $X_{t,proposer} = 100 - Y_t$), and all remaining points go to the proposer's own private account (See Proposition 1 of Bowen et al. (2014)).

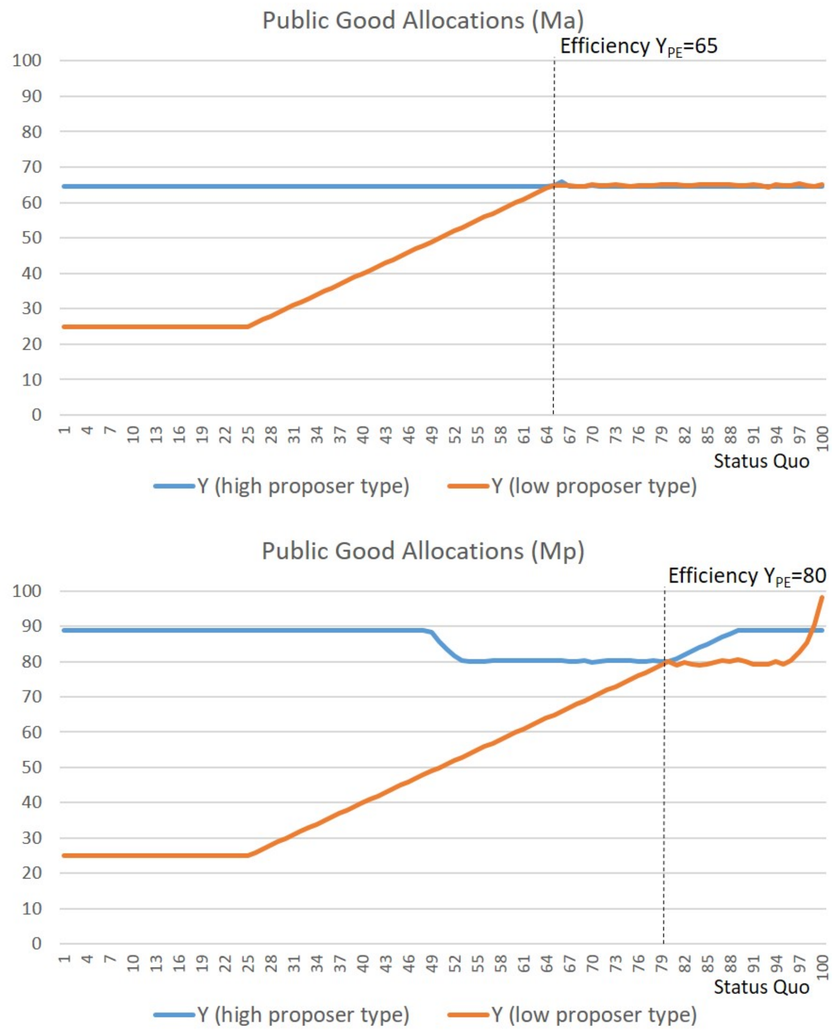


Figure 2: Markov Perfect Equilibrium Predictions for Public Good Allocations in the two Mandatory Treatments, as a function of the Status Quo Level. Top panel: Mandatory-aligned (Ma); Bottom panel: Mandatory-polarized (Mp)

Under the mandatory rule, the two parties have an incentive to maintain the level of public good provision at least as high as the status quo level (the so-called *status quo effect*), as illustrated in Figure 2. Maintenance of the current public good allocations provides proposers with some insurance against the future possibility of losing proposer power (which happens with probability $1 - p$ in the next round if one was a proposer in the current round). Once in the role of a responder, a higher status quo level for public goods reinforces the player's bargaining power, and anticipating this, proposers operating under the mandatory rule have an incentive to push up or maintain public good allocations, relative to those under the discretionary rule.

This dynamic incentive results in the eventual growth of public good amounts up to the Pareto efficient level ($\theta_H + \theta_L$) under the mandatory regimes. The achievement of the Pareto efficient level of public good provision stands in contrast to the perpetual oscillation between each type's static equilibrium levels of public good provision (θ_H and θ_L) that is predicted to occur under the discretionary budget rule.

To clarify these differences, Bowen et al. (2014) introduce the notion of the "dynamic optimum" (Y^*_{DO}) which is roughly the public good allocations that maximize the dynamic payoff of each proposer type (*high* or *low*) under full proposer power;

$$Y^*_{DO}(high) = \frac{1 + \delta - 2\delta p}{1 - \delta p}\theta_H, \quad Y^*_{DO}(low) = \theta_L$$

where δ is discount factor, or probability of random termination in our experiment, and p is the Markov probability of the roles switching between proposer and responder from round to round. It is always the case that $Y^*_{DO}(high) > \theta_H$ unless $\delta = p = 0$.[6]

Basically, if the status quo level of the public good is below the (type-specific) dynamic optimum, each type has an incentive to raise public goods to their own dynamic optimum level immediately; if the status quo level is above the dynamic optimum but below the Pareto efficient level, then each type will maintain the current status quo; finally, for a status quo level above Pareto efficiency, both types propose the efficient level in equilibrium (see Figure 2). These patterns for equilibrium public good offers largely hold without exception in the mandatory-aligned (Ma) case. However, the high type's equilibrium public good proposals may *overshoot* the Pareto efficient level when the status quo is lower (below half of the endowment) or is above the efficient level in the mandatory-polarized (Mp) case (and there is a small region of irregularity in low type's proposals for status quo levles close to the full endowment of 100). With the initial status quo being 1 point in the group account at the start of each sequence (which is the case for all treatments of our experiment), the equilibrium dynamics predict that the public good allocations in the steady states are equal to the high type's dynamic optimum: $Y^*_{SS} = Y^*_{DO}(high) \approx 64.615$ in the Ma treatment and the Pareto efficient level $Y^*_{SS} = \theta_H + \theta_L = 80$ in the Mp treatment, respectively, for our parameter choices. Markov perfect equilibrium is formally characterized in Proposition 3 (Ma or *low-polarization*) and Proposition 4 (Mp or *high-polarization*), and equilibrium steady states are characterized in Proposition 5 of Bowen et al. (2014).

Thus, our experiment is designed to test the status quo effect of mandatory budget rules that institutionalize a relationship between current decisions and future payoffs, which theoretically leads to efficiency gains. In particular, we propose to test hypotheses that are informed by the equilibrium theory. Since in equilibrium, all proposals are accepted, our data analysis will mainly focus on accepted proposals, though we will also examine factors affecting the acceptance of proposals.[7]

[6] The two mandatory treatments, aligned or polarized, are distinguished by whether $Y^*_{DO}(high) < \theta_H + \theta_L$ or not, which are named as *low-* or *high-polarization* cases, respectively, in Bowen et al. (2014).

[7] Bowen et al. (2014), Sec.III, show that any equilibrium is payoff equivalent to the one where (i) responders

Given our design and research questions, we have the following testable hypotheses:

Hypothesis 1 *For fixed θ_H and θ_L, public good provision is higher under mandatory budget rules than under discretionary budget rules.*

Specifically, under our parameterization, starting from the status quo level of $Y = 1$, public good provision is predicted to grow close to or to achieve the Pareto efficient public good levels under the mandatory budget rules but will remain below this level under the discretionary budget rules.

Hypothesis 2 *An increase in the efficient public good provision amount results in an increased steady state allocation to the public good under the mandatory rules.*

Under our parameterization, an increase in political polarization (θ_H increasing from 40 to 55) results in a higher level of efficient public good provision. It follows that, as we move from Ma ($\theta_H = 40$) to Mp ($\theta_H = 55$) we should observe greater allocations to the public good by both proposer types eventually. Specifically, even the proposer type whose importance parameter for public good utility doesn't change (the low type in our experiment) has an incentive to increase their public good allocations according to a change in the importance parameter of their opponent type (if the change in the latter parameter results in a change in the Pareto efficient public good amount).

Hypothesis 3 *In all treatments, proposers exercise proposer power by generally proposing 0 private points to responders and keeping all points in excess of the public good allocation for their own private accounts.*

The testable private point prediction of the model is summarized in the above Hypothesis 3. The theory predicts that in all settings, proposers exercise full proposer power, which means that when the status quo public good allocation is below the Pareto efficient level, any points not allocated to the public good are primarily, if not exclusively, allocated to the proposer's own private account and not to the responder's private account. Figure B.1 in the Appendix shows predictions for private point allocations as a function of the status quo public good level in our parameterization of the two mandatory treatments. When this status quo amount is below the Pareto efficient level, private points allocated to the responder are always zero in the Ma treatment, and sometimes marginally different from zero for certain status quo levels in the Mp treatment (see Figure B.1 in the Appendix for details). Similarly, in the discretionary treatment there is never any allocation of points to the responder's private account. While other bargaining games (e.g., ultimatum bargaining or legislative bargaining) also predict the full exercise of proposer power, a difference here is that there is also a public good component to players' payoffs that benefits both players and thus it is of interest to understand whether or not the presence of this public good component works to strengthen the use of proposer power.

Hypothesis 4 *Under discretionary budget rules, in equilibrium both high and low types propose distinct levels for the public good (which are their static equilibrium amounts, $\theta_H =$*

accept when they are indifferent between accepting and rejecting, and (ii) the equilibrium proposals are always accepted.

40 and $\theta_L = 25$) no matter how many rounds are played in a supergame of the public and private good bargaining task.

As mentioned before, the logic here follows directly from the first order condition for the static optimization. Since an agreement about public good allocations in the current round has no implications for future rounds, the incentives for proposing the static equilibrium levels θ_i for the group account (public good) are still maintained in the dynamic games of the discretionary treatment.

The theory also has predictions regarding the dynamics of behavior and the convergence of public good allocations to steady states over time for the mandatory treatments, which are summarized in the following hypothesis:

Hypothesis 5 *Under mandatory rules, starting from the initial status quo level of $Y = 1$ (out of an endowment of 100), both types will propose public good amounts that should converge over time to the steady state levels - that is the high type's dynamic optimum ($Y^*_{SS} \approx 64.615$) in the Ma treatment and the Pareto efficient level ($Y^*_{SS} = 80$) in the Mp treatment.*

Finally, we consider some efficiency measures that can be used to evaluate the performance of the different budget rules. As a measure of aggregate efficiency, we look at the ratio of actual payoffs earned from accepted allocations to payoffs that would have been obtained at Pareto optimal allocations. Given the predicted public good allocations across treatments, we have the following:

Hypothesis 6 *Aggregate efficiency will be higher in the two mandatory treatments as compared with the discretionary treatment.*

The difference in efficiency between the two mandatory treatments is more ambiguous, and we will address this topic later in section 4.9 when we evaluate hypothesis 6.

In the next section we evaluate each of these six hypotheses using the data from our experiment.

4 Experimental Results

We report on results from 5 sessions of each of our three treatments, 15 sessions in total. As noted, there are 10 subjects per session; thus we report on data from 150 subjects.

Recall that the discretionary (D) and mandatory-aligned (Ma) treatments only involve a change in the status quo rule for the public good; the values of $(\theta_H, \theta_L) = (40, 25)$, are kept constant between these two treatments. By contrast, the mandatory-polarized (Mp) treatment involves both the mandatory rule for the status quo level of the public good and a greater difference between θ_H and θ_L (i.e., greater polarization) namely $(\theta_H, \theta_L) = (55, 25)$ and thus a higher level for efficient public good provision.

As noted earlier, we focus here and throughout the paper on *accepted* proposal amounts in keeping with the theory and since acceptance rates are generally high.

4.1 Overview

We begin with an overview of the main outcome variables from our experiment. Table 2 reports for each treatment, mean values for each of five main outcome variables: (1) proposal acceptance rates, (2) accepted amounts allocated to the public good, disaggregated by high or low type proposers; (3) accepted amounts allocated to the proposers' private account, disaggregated by high or low type proposers; (4) accepted amounts allocated to the responders' private account, disaggregated by high or low type responders, and (5) aggregate efficiency levels achieved. Means are reported for all rounds of all supergames. The table also shows in square brackets the equilibrium predictions based on actual realizations for the proposer types and given the actual status quo levels for the public good that were realized in the experimental games, which is most relevant for the mandatory treatments.

Table 2: Overview of Main Outcome Variables, All Rounds

	Discretionary (D)	Mandatory-aligned (Ma)	Mandatory-polarized (Mp)
Acceptance rates	88.64%	77.09%	79.10%
Public good allocations	50.81	62.58	71.88
by high type prop.	[40]	[64.76]	[84.35]
Private goods to high	34.66	19.47	11.72
type proposers	[60]	[35.17]	[15.07]
Private goods to low	14.53	17.96	16.40
type responders	[0]	[0.07]	[0.58]
Public good allocations	43.33	51.72	57.43
by low type prop.	[25]	[45.26]	[51.65]
Private goods to low	48.53	33.81	30.93
type proposers	[75]	[50.79]	[47.82]
Private goods to high	8.15	14.46	11.63
type responders	[0]	[3.95]	[0.53]
Public good allocations	47.16	57.12	64.55
by both type prop.	[32.69]	[54.94]	[67.77]
Private goods allocated	41.42	26.69	21.46
to both type prop.	[67.31]	[43.03]	[31.67]
Private goods allocated	11.42	16.20	13.99
to both type resp.	[0]	[2.02]	[0.55]
Aggregate efficiency	96.02%	97.77%	97.87%

Notes. (i) Public good allocations and private point divisions are all as observed in accepted proposals. (ii) Predictions (in square brackets) are based on realized types of proposers/responders and realized status quo levels. (iii) Aggregate efficiency is measured as the ratio of the sum of proposer's and responder's actual payoffs to the same sum of payoffs that would have been achieved at Pareto optimum.

Indeed, as Table 2 reveals, proposals are accepted on average more than 75% of the time. A general finding observed across all treatments is that amounts allocated to the public good by low proposer types are greater than equilibrium predictions, while amounts allocated by high proposer types are lower than equilibrium predictions in the mandatory treatments.

On the other hand, both types of *proposers* allocate less, on average, to their own private accounts and more, on average, to the private accounts of their matched responders. Despite these differences, efficiency, as measured by the ratio of total payoffs earned to the Pareto optimum payoff level, is generally quite high, in excess of 95%.

4.2 Acceptance Rates

We begin by discussing responder's acceptance rates of proposals made by proposers. As Table 2 reveals, acceptance rates differ from the equilibrium prediction of 100%, and are highest for the discretionary treatment and lower for the two mandatory treatments. Details on acceptance rates by treatment and session are found in Table B.1 in the Appendix.

Table 3: Mann-Whitney Tests of Differences in Acceptance Rates Across Treatments

	Alt.H.	p-values
High	D≠Ma	0.009
Type	D≠Mp	0.076
Proposer	Ma≠Mp	0.094
Low	D≠Ma	0.012
Type	D≠Mp	0.016
Proposer	Ma≠Mp	0.917
Both	D≠Ma	0.009
Type	D≠Mp	0.012
Proposer	Ma≠Mp	0.530

Notes. p-values for tests of differences in acceptance rates between treatments are reported. The column 'Alt.H.' states the alternative hypotheses that acceptance rates between any two treatments are *not* the same (2-sided test). D=Discretionary, Ma=Mandatory-aligned, Mp=Mandatory-polarized.

The difference in acceptance rates between the discretionary and mandatory treatments likely reflects the fact that under the discretionary rule, the rejection of a proposal means that earnings are zero while under the mandatory rule, if the status quo level of the public good, $Y > 1$, rejection still results in a positive payoff to both players and this status quo payoff level can grow large over time, i.e., the status quo is endogenous. Thus, the mandatory rule gives responders greater bargaining power that gets stronger as the status quo points become higher, and empirically, this results in higher rates of rejection (lower acceptance rates) under the two mandatory rules as compared with the discretionary rule. Indeed, the difference in acceptance rates between the discretionary treatment and either of the two mandatory treatments (Ma or Mp) is significant at the 5% level as revealed in Table 3 which reports on Mann-Whitney tests using session level mean data (5 sessions per treatment) over various sub-intervals. We observe in Table 2 that the difference in acceptance rates between the discretionary and mandatory treatments is around 10 percentage points, on average. Table 3 reveals that there is *no* difference in acceptance rates between the two mandatory treatments, Ma and Mp. Summarizing this discussion we have:

Result 1 *Acceptance rates across all treatments are less than 100%. Acceptance rates are significantly higher in the discretionary treatment as compared with the two mandatory treatments. There are no significant differences in acceptance rates between the two mandatory treatments.*

4.3 Determinants of Responder Acceptance Decisions

Table 4: Responders' Acceptance Decisions, All Treatments

VARIABLES	$y = 1$ if a proposal is accepted			
	(1)	(2)	(3)	(4)
Constant	0.197	2.013***	0.140	1.943***
	(0.256)	(0.326)	(0.255)	(0.325)
Public good alloc.s	0.025***	0.007**	0.025***	0.007**
	(0.002)	(0.003)	(0.002)	(0.003)
Private points	0.036***		0.036***	
(responder)	(0.004)		(0.004)	
Status quo	-0.009***	-0.009***	-0.010***	-0.010***
	(0.002)	(0.002)	(0.002)	(0.002)
Diff. Private pts.		-0.018***		-0.018***
(pro.-res.)		(0.002)		(0.002)
Ma	-0.466*	-0.466*	-0.439	-0.439
	(0.281)	(0.281)	(0.285)	(0.285)
Mp	-0.510*	-0.510*	-0.480	-0.480
	(0.290)	(0.290)	(0.301)	(0.301)
High type	-0.600***	-0.600***	-0.597***	-0.597***
(proposer)	(0.082)	(0.082)	(0.081)	(0.081)
Sequence	0.005	0.005	0.005	0.005
	(0.018)	(0.018)	(0.018)	(0.018)
Round			0.016	0.016
(in sequence)			(0.017)	(0.017)
Observations	2985	2985	2985	2985
Pseudo-R^2	0.133	0.133	0.134	0.134

Notes. (i) Random-effect probit models are estimated with clustering at the session level for responder's acceptance decisions about proposed allocations. The estimation is based on all proposals (not necessarily accepted). (ii) Ma=1 if treatment=Ma ($\theta_H = 40$); Mp=1 if treatment=Mp ($\theta_H = 55$). (iii) Diff. Private pts.=Difference between proposer's and responder's private points. (iv) Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. (v) $Ma - Mp = 0.044$ (0.1352), 0.044 (0.1352), 0.041 (0.138), 0.041 (0.1385) in columns (1)-(4), respectively, are all *not* statistically significant (standard errors in parentheses). (vi) We use McFadden's Pseudo $R^2 = 1 - Ln(L_M)/Ln(L_0)$, where $Ln(L_M)$ and $Ln(L_0)$ are the log likelihood from the full model and the model only with constant, respectively.

We next examine the determinants of responder acceptance decisions using a Probit regression analysis. Here the binary dependent variable is equal to 1 if the proposal was accepted and 0 otherwise. The results from our analysis are reported in Table 4 for all treatments and in Table 5 for the two mandatory treatments only.

Table 5: Responders' Acceptance Decisions, Mandatory Treatments Only

VARIABLES	$y = 1$ if a proposal is accepted		
	(1)	(2)	(3)
Constant	-0.394**	1.561***	-0.707***
	(0.191)	(0.220)	(0.128)
Public good alloc.s	0.028***	0.009***	0.022***
	(0.001)	(0.003)	(0.002)
Private points (responder)	0.039***		0.040***
	(0.005)		(0.006)
Status quo, SQ	-0.010***	-0.010***	
	(0.002)	(0.002)	
Diff. Private pts (pro.-res.)		-0.020***	
		(0.002)	
Mp	-0.070	-0.070	-0.158
	(0.142)	(0.142)	(0.128)
High type (propoer)	-0.613***	-0.613***	-0.577***
	(0.086)	(0.086)	(0.101)
Sequence	-0.004	-0.004	
	(0.018)	(0.018)	
Round (in sequence)	-0.009	-0.009	
	(0.015)	(0.015)	
Public×low SQ			0.006***
			(0.001)
Private×high SQ			-0.014***
			(0.004)
Observations	1990	1990	1990
Pseudo-R^2	0.150	0.150	0.137

Notes. (i) Random-effect probit models are estimated with clustering at the session level for responders' acceptance decisions about proposed allocations. The estimation is based on all proposals (not necessarily accepted). (ii) Mp=1 if treatment=Mp ($\theta_H = 55$). (iii) Diff. Private pts.=Difference between proposer's and responder's private points. (iv) Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. (v) Low SQ (dummy) indicates the cases when the status quo public good is below Pareto efficient level while high SQ (dummy) indicates the opposite case. (vi) We use McFadden's Pseudo $R^2 = 1 - Ln(L_M)/Ln(L_0)$, where $Ln(L_M)$ and $Ln(L_0)$ are the log likelihood from the full model and the model only with constant, respectively.

In Table 4 we observe that responders are more likely to accept offers the higher is the proposer's allocations to the public good and the higher is the proposer's allocation to the responder's private point balance. We further observe that responder acceptance decisions are *decreasing* with increases in the status quo amount of the public good in the two mandatory treatments, Ma and Mp. The latter result follows from the fact that in the discretionary treatment the status quo level is not changing but it generally rises over time in the mandatory treatments. Intuitively, as the status quo level rises, it is easier for responders to reject proposals as the positive status quo level of the public good guarantees that they will get some positive payoffs from the public good (upon rejection). Finally, we observe that controlling for public and private good allocations, the status quo public good level and treatment effects, proposals made by *high* type players (those who value the public good more) are significantly more likely to be rejected by their opponent low type responders. The latter finding is our first indication that *fairness concerns* may play a role in responders' acceptance decisions. We will explore such concerns in more detail later in sections 4.6 and 4.7.

These results remain largely robust if we restrict attention to the two mandatory treatments only, as reported on in Table 5. In the analysis of Table 5 we further explore if acceptance decisions depend on whether the status quo level of the public good is below the efficient level (low SQ) or above the efficient level (high SQ). We find that, in a way to facilitate the theory predictions, when the status quo level is below the efficient level, a higher allocation to the public good leads to a greater likelihood of acceptance by responders, and this effect is highly significant. When the status quo level is above the efficient level, higher private points awarded to the responder lead to a small but significant reduction in acceptance rates by responders.

We further consider differences in mean allocations to public good and private points between accepted and rejected proposals - see Table B.2 and Figure B.2 in Appendix. There we show that public good and responder private points are significantly greater in accepted proposals as compared with rejected proposals while proposer private points are significantly lower in accepted proposals as compared with rejected proposals. This evidence further confirms that responders consider both public good levels and their own private points in deciding whether to accept proposals, as was already shown in the probit regression results.

4.4 Effect of Mandatory Rules on Public Good Levels

We now consider the main treatment effect of adopting mandatory budget rules for public good provision relative to the discretionary budget rule case. We first focus on a comparison of the mandatory-aligned (Ma) and discretionary (D) treatments as they are most comparable (have the same θ values). We report the following finding.

Result 2 *Consistent with Hypothesis 1, public good provision is higher in the mandatory-aligned treatment than in the discretionary treatment.*

Support for Result 2 comes from Figure 3 which reports mean public good allocations by treatment and proposer type over all rounds and for the first rounds of sequences. Further Table 6 provides results from non-parametric tests on accepted public good amounts by treatment over all rounds or round 1 only using session level averages (session level data on public good allocations reported on in Tables B.3-B.5 of the Appendix). In Table 6, and those that follow (about nonparametric tests), we used one-sided tests whenever we have specific directional predictions from the theory and two-sided tests otherwise.

We first compare allocations to the public good in the discretionary treatment (D) with the mandatory-aligned treatment (Ma). Since the θ values do not change between these two treatments, the comparison of D vs. Ma provides the cleanest test of the effect of changing the bargaining rules. We observe that over all rounds of all sequences, the mean agreed upon public good allocation proposed by both high and low types in the Ma treatment is around 10 points higher than the mean for the discretionary treatment and this difference

Notes. D=Discretionary, Ma=Mandatory-aligned, Mp=Mandatory-polarized. Error bars indicate 95% confidence intervals.

Figure 3: Mean Accepted Allocation to Public Good, All Sequences

is significant at the 5% level using the Mann-Whitney test on session level data as revealed in Table 6.

Using a random-effects Tobit regression analysis (to account for data censoring) and *all* data on accepted public good amounts from all treatments, Table 7 confirms that public good provision is, on average, significantly higher in the Ma treatment as compared with the baseline D treatment in most specifications including those with round and sequence numbers.

We note further that in the discretionary treatment, Table 2 reveals that there is con-

Table 6: Nonparametric Tests for Differences in (Accepted) Public Good Allocations

	All Rounds		Round 1	
	Alt.H.	p-values	Alt.H.	p-values
High	D<Ma	0.008	D<Ma	0.059
P.Type	Ma<Mp	0.014	Ma<Mp	0.008
Low	D<Ma	0.038	D≠Ma	0.251
P.Type	Ma<Mp	0.087	Ma≠Mp	0.917
Both	D<Ma	0.024	D<Ma	0.059
P.Types	Ma<Mp	0.008	Ma<Mp	0.301
D	Low<High	0.059	Low<High	0.022
Ma	Low<High	0.014	Low<High	0.022
Mp	Low<High	0.005	Low<High	0.022

Notes. p-values for tests of differences in accepted public good offers between two different treatments or between two different types of proposers within a treatment are reported. The columns 'Alt.H.' state the alternative hypotheses that the public good offers in the 1st treatment are less than those in the 2nd treatment or that the public good offers by low type proposers are less than those by high type proposers in each of the 3 treatments (1-sided test); the predicted public good amounts for the low type in round 1 are the same across all 3 treatments (2-sided test). D=Discretionary, Ma=Mandatory-aligned, Mp=Mandatory-polarized. P.Type=proposer type.

siderable *over*-allocation to the public good in that mean accepted public good amounts are greater than theoretical predictions.[8] We see considerably less over-allocation in the mandatory-aligned (Ma) treatment.

We further observe in Figure 3 and in Table 7 that, consistent with the theory, average allocations to the public good in the mandatory-polarized treatment (Mp) are also significantly greater than in the discretionary treatment (D) by somewhere between 12-20 points, though in this case, the additional change in the degree of polarization between the D and Mp treatment is a confounding factor.

We next consider the impact on allocations to the public good under the two mandatory rules when there is an increase in polarization, that is, we make a comparison between mean allocations by low and by high types in the mandatory-aligned (Ma) and the mandatory-polarized (Mp) treatment. We have:

Result 3 *Consistent with Hypothesis 2, when there is an increase in polarization (hence a change in treatments from Ma to Mp in the experiment), then under the mandatory rules, both types increase their allocations to the public good.*

Support for Result 3 comes from Figure 3 and Tables 6 and 8. From Figure 3 we observe that average allocations to the public good are higher for both high and low types in the mandatory-polarized (Mp) treatment relative to the allocations of these same types in the

[8]Note that the predicted public good amounts (in square brackets) for the mandatory treatments in Table 2 and other tables *condition on the realized status quo level of the public good* at time a proposal is made, which differs by round and across sessions.

Table 7: Tobit Regression Analysis of Accepted Public Good Allocations, All Treatments

VARIABLES	Accepted public good allocations		
	(1)	(2)	(3)
Constant	40.462***	47.468***	47.735***
	(1.969)	(1.948)	(2.140)
Private Points (responder)	-0.641***	-0.654***	-0.634***
	(0.029)	(0.029)	(0.029)
Ma	13.143***	9.494***	4.739
	(2.399)	(2.702)	(3.000)
Mp	20.330***	15.621***	11.946***
	(2.395)	(2.696)	(2.981)
High Type (proposer)	15.304***	15.117***	15.221***
	(0.756)	(0.760)	(0.755)
Sequence	0.904***		-0.195
	(0.160)		(0.264)
Ma×Seq.			1.770***
			(0.386)
Mp×Seq.			1.775***
			(0.384)
Round (in sequence)	0.564***	-0.094	
	(0.137)	(0.223)	
Ma×Rd.		0.980***	
		(0.331)	
Mp×Rd.		1.247***	
		(0.332)	
Observations	2436	2436	2436
Pseudo-R^2	0.036	0.035	0.037

Notes. (i) Random-effect tobit model is estimated with lower bound=1 and upper bound=100 in the dependent variable. The estimation is based on accepted proposals. (ii) Ma=1 if treatment=Ma ($\theta_H = 40$); Mp=1 if treatment=Mp ($\theta_H = 55$). (iii) Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. (iv) We use McFadden's Pseudo $R^2 = 1 - Ln(L_M)/Ln(L_0)$, where $Ln(L_M)$ and $Ln(L_0)$ are the log likelihood from the full model and the model only with constant, respectively.

mandatory-aligned (Ma) treatment. Using Mann-Whitney tests on session level averages over all rounds, as reported on in Table 6 we find that this difference is significant for either types at the 5% or 10% level of significance. That is, for each type (high or low), we reject the null hypothesis that mean allocations to the public good are the same in treatments Ma and Mp in favor of the alternative that mean allocations are higher in Mp as compared with Ma. Finally, Table 8, reports on another Tobit regression analysis for accepted public good allocations but for the mandatory treatments only and confirms this finding. Across several different specifications, we see that accepted public good allocations are significantly higher in the Mp treatment as compared with the baseline Ma treatment at the 1% or 5% significance level.[9]

[9]The same tobit models in Tables 7-8 are estimated separately for each of high and low type proposers

Table 8: Tobit Regression Analysis of Accepted Public Good Allocations, Mandatory Treatments Only

VARIABLES	Accepted public good allocations (1)	(2)	(3)
Constant	49.429***	53.350***	49.077***
	(1.824)	(1.727)	(1.984)
Private points	-0.750***	-0.766***	-0.752***
(responder)	(0.036)	(0.036)	(0.036)
Status quo	0.199***	0.216***	0.190***
	(0.016)	(0.016)	(0.014)
Mp	6.158***	6.346***	6.055**
	(1.812)	(2.172)	(2.524)
High type	15.115***	15.071***	15.117***
(proposer)	(0.882)	(0.890)	(0.883)
Sequence	0.921***		0.920***
	(0.194)		(0.273)
Mp×Seq.			0.031
			(0.378)
Round	-0.217	-0.227	
(in sequence)	(0.190)	(0.248)	
Mp×Rd.		-0.100	
		(0.331)	
Observations	1554	1554	1554
Pseudo-R^2	0.062	0.060	0.062

Notes. (i) Random-effects Tobit model is estimated with a lower bound=1 and upper bound=100 in the dependent variable. The estimation is based on accepted proposals. (ii) Mp=1 if treatment=Mp ($\theta_H =$ 55). (iii) Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. (iv) We use McFadden's Pseudo $R^2 = 1 - Ln(L_M)/Ln(L_0)$, where $Ln(L_M)$ and $Ln(L_0)$ are the log likelihood from the full model and the model only with constant, respectively.

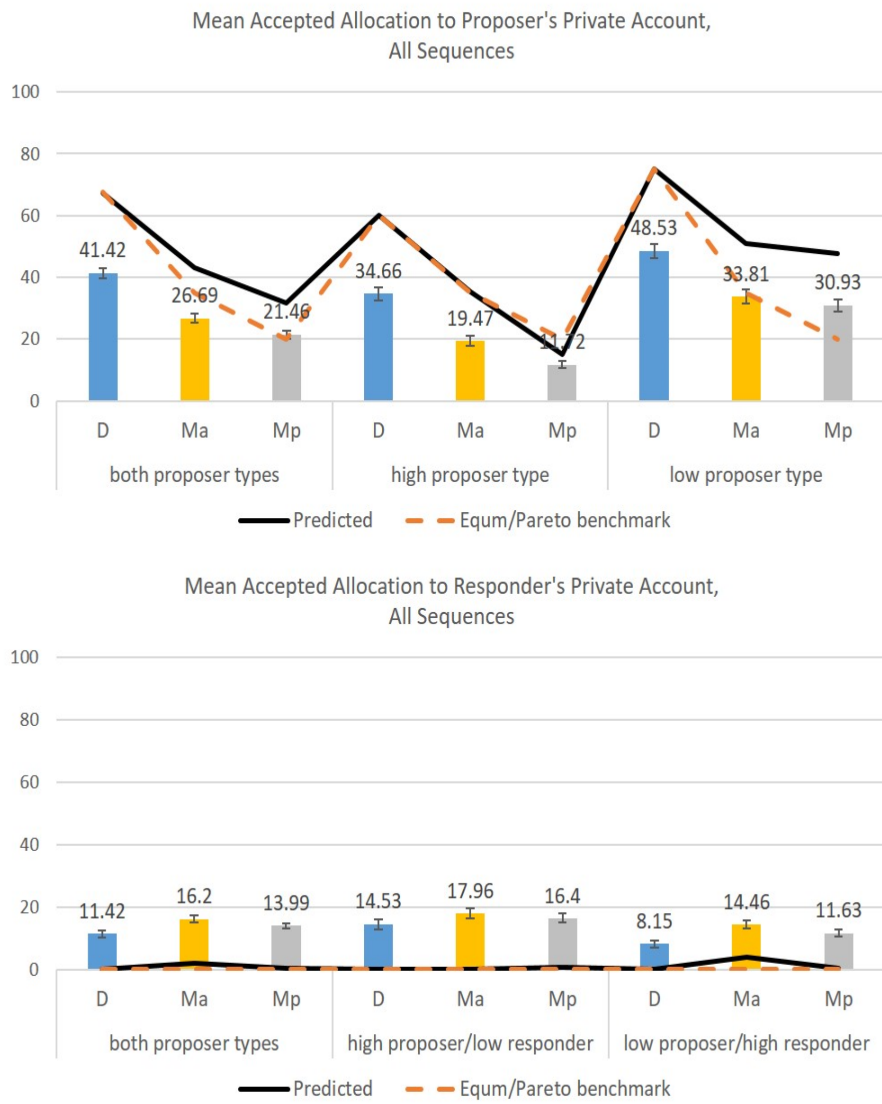
Finally, we also examined mean first round choices over all sequences, since in the first round, the status quo level is the same across the three treatments - see the bottom panel of Figure 3. There we see that high types across the two mandatory treatments proposed higher allocations to the public good in round 1 than did low types which suggests that high types understood and acted upon the insurance role. Further, high types were especially responsive to changes in the bargaining rule, by monotonically increasing their round 1 allocation to the public good as the bargaining rule changed from D to Ma to Mp. Finally, as Table 6 shows, these differences in round 1 behavior are often significant.

4.5 Accepted Allocations to Private Accounts of Proposer and Responder

Thus far, we have focused on accepted allocations to the *public good* benefiting both players. However, it is also of interest to consider the amounts allocated to the proposer and respon-

and the results are shown to be robust in the subsamples of fixed proposer types in Appendix Tables B.6-B.7.

der's *private accounts*. Here again we focus on *accepted* proposals made by the proposer to his/her own private account and to the opponent's (responder's) private account. Mean amounts for both allocations are reported on in Table 2 and illustrated in Figure 4.



Notes. D=Discretionary, Ma=Mandatory-aligned, Mp=Mandatory-polarized. Error bars indicate 95% confidence intervals.

Figure 4: Mean Accepted Allocation to Private Account, All Sequences

Figure 4 and the non-parameteric tests reported in Table 9[10] reveal that, consistent with theoretical predictions, private points allocated to proposers are significantly higher in the discretionary treatment as compared with the Ma treatment, where they are significantly

[10]Based on the session level data in Tables B.8-B.10 for proposers and Tables B.11-B.13 for responders.

Table 9: Nonparametric Tests for Differences in Accepted Private Points to Proposer and Responder

Private Points (Proposer)			Private Points (Responder)		
	Alt.H.	p-values		Alt.H.	p-values
High	D>Ma	0.014	D	Low>High	0.040
P.Type	Ma>Mp	0.005	Ma	Low>High	0.069
Low	D>Ma	0.059	Mp	Low>High	0.112
P.Type	Ma>Mp	0.174	Pool	Low>High	0.005
Both	D>Ma	0.024			
P.Types	Ma>Mp	0.014			

Notes. p-values for tests of differences in accepted proposers' private points between 2 different treatments or in accepted responders' private points between 2 different types within the same treatment. The columns 'Alt.H.' state the alternative hypotheses that the proposers' private points in the 1st treatment are *greater* than those in the 2nd treatment, e.g., D>Ma, or that the private points assigned to low type responders are *greater* than those assigned to high types in each of the 3 treatments or all treatments pooled together, Low>High (1-sided test). D=Discretionary, Ma=Mandatory-aligned, Mp=Mandatory-polarized. P.Type=proposer type.

higher than in the Mp treatment. We further note that accepted private points to low type responders are significantly greater than accepted private points to high type responders.

However, in all cases accepted points allocated to the proposer's private accounts lie below the predicted amounts based on the realized status quo level (solid line) or using the Pareto efficient equilibrium benchmark (dashed line) in Figure 4 That is, proposers of both types *under*-allocate to their own private accounts on average and they *over*-allocate to the responder's private account on average, relative to theoretical predictions.

While the equilibrium suggests that a proposal will be accepted so long as there is sufficient provision of public goods but zero private points to responders, especially given a status quo below the Pareto efficient level, such proposals are typically rejected in our laboratory experiment and proposers had to offer private points as well to their responders at most realized status quo levels. Indeed, as Tables B.15-B.16 in the Appendix show, mean proposed amounts to the proposer's private account and to the responder's private account, independent of the acceptance decision are, respectively, slightly greater and lower than are the same amounts conditional on acceptance of the proposal in Appendix Tables B.8 and B.11.[11] We understand this as proposers not being able to fully exercise their *proposer power*, a widely observed phenomenon in the empirical bargaining literature.

4.6 Allocations within the 2D Simplex

Figure 5 summarizes, using a 2-dimensional simplex, the frequency of *accepted* allocation vectors made by high and low proposer types. The advantage of this approach relative to our analysis thus far is that, instead of looking at one-dimensional analysis of public or private points, here we can consider the behavior of allocation vectors in multidimensional (bargaining) choice spaces. In each panel of the figure, the first coordinate, on the horizontal

[11] Proposed public good amounts, independent of acceptance, are also shown in Table B.14.

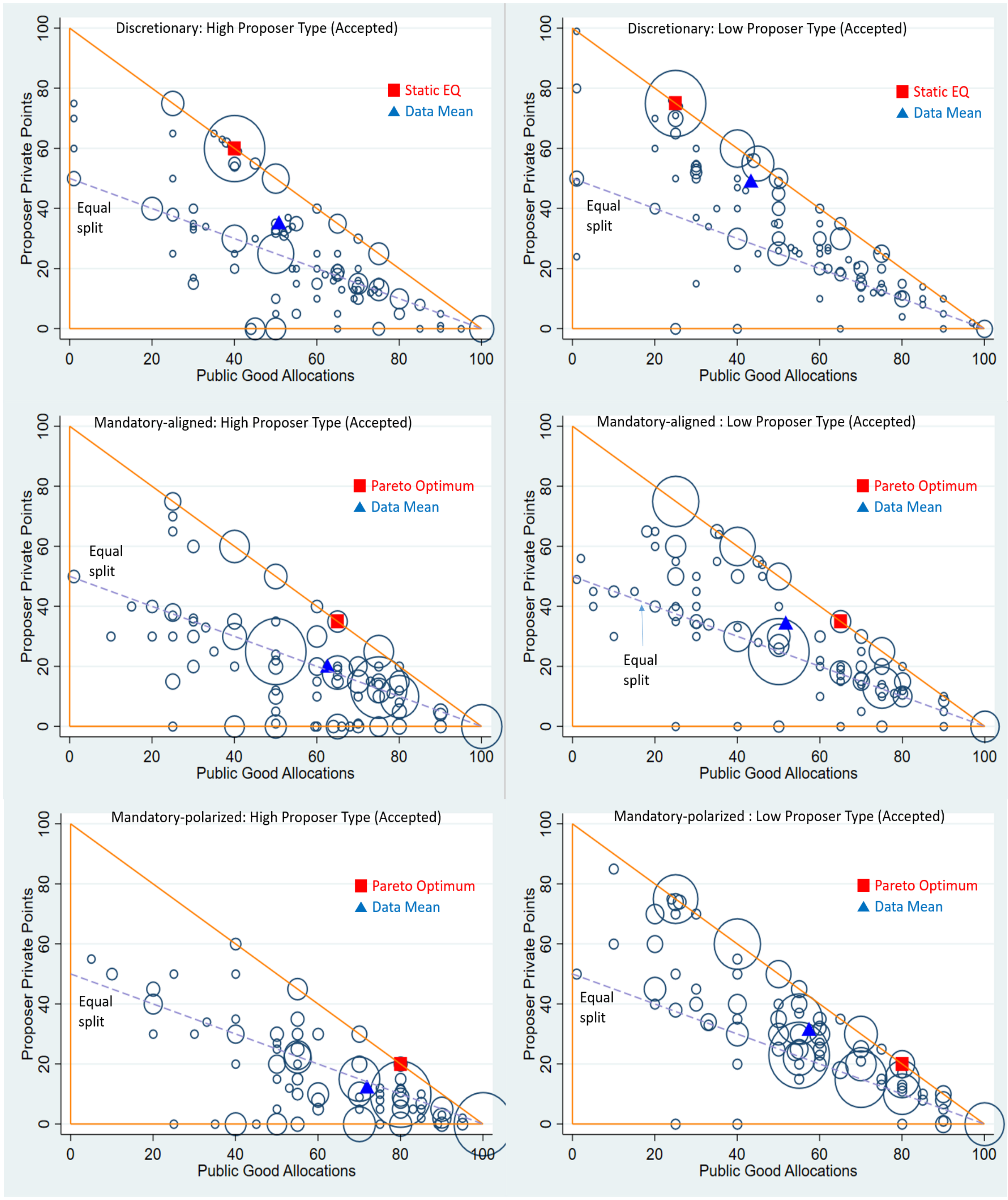


Figure 5: Bubble Plots of Allocation Vectors by Proposer Types and Treatments, Accepted Proposals Only

axis, is the amount allocated to the public good and the second coordinate, on the vertical axis, is the proposer's allocation to his own private account. The allocation to responders' private account is the residual amount. Thus, the coordinate pair (50,25) corresponds to case where the proposer allocated 50 points to the public good, 25 points to his own private account and the remaining 25 points went to the responder's private account.[12] The size of a bubble centered at each observed coordinate pair is proportional to the count of observations with that allocation vector; the smallest bubble corresponds to a single observation. These figures also show the mean accepted allocation from the experimental data (Data Mean, indicated by the solid triangles) along with the static equilibrium prediction in the discretionary treatment and the Pareto optimum allocation in the two mandatory treatments (the solid squares) for reference purposes.

One key finding from these simplex figures is that most *accepted* proposals do *not* lie on the hypotenuse of the simplex triangle where the proposer exercises full proposer power, keeping all points not allocated to the public good for himself. Instead, the most frequently observed accepted proposals involve an equal division of private points between the proposer and the responder. Such "equal split" allocations are defined as those for which the proposer divides the amount *not* allocated to the public good equally between himself and the responder. These equal split allocations are found along the dashed line labeled "equal split" in Figure 5. While we observe these equal split outcomes in all three treatments, the frequency of such equal split allocations is greater in the two mandatory treatments.

A second key finding concerns the mean accepted allocations relative to theoretical predictions. We see a large difference in public good allocations between the discretionary treatment and the two mandatory treatments which is consistent with theoretical predictions (and earlier findings). In the discretionary treatment, the upper row of Figure 5, we observe a large mass of observations around the static equilibrium allocation. By contrast, as we move from the discretionary to the two mandatory treatments, the middle and bottom panels, we see an increase in the accepted amounts allocated to the public good, as indicated by the rightward movement of the data mean allocation. This movement is away from the static equilibrium and toward the Pareto efficient outcome. The shift is particularly pronounced for high proposer types and only less so for low proposer types. In Figures B.3- B.5 in the Appendix, we provide further evidence of similar movements over time, between the first and second halves of sessions, in the mean accepted allocations in all three treatments. In the discretionary treatment there is a very slight movement toward the static equilibrium while in the two mandatory treatments there is a more pronounced movement toward the Pareto optimum allocation over time.

A further observation from the 2D simplex Figure 5 is that in the two mandatory treatments, low type proposers' accepted allocations assign greater points to their own private accounts than do high type proposer's accepted allocations. Low type proposer's accepted allocations generally lie *on or above* the equal split line, while high type proposer's accepted allocations generally lie *on or below* the equal split line. The difference is largely due to some high types proposing allocations at the *lower* bound of the simplex (the horizontal leg of the triangle) where high type proposers are giving *all* of the endowment points in excess

[12] Also note that the three vertices of the 2-dimensional simplex in Figure 5 represent proposals: that allocate all available resources to the group account $(100, 0)$; that allocate all resources to the proposer's private account $(0, 100)$; or that allocate all resources to the responder's private account $(0, 0)$.

of the public good to the responder. We seldom see this type of allocation behavior in the case of low type proposers suggesting that fairness motivations are playing an important role since low type *responders* (matched with high type proposers) don't get the same benefit from the public good as do high type *responders* (matched with low type proposers).

In the two mandatory treatments, it may be puzzling to find that low type proposers are proposing public good amounts that are substantially below the Pareto optimum level, as is also revealed in Figure 3. Figure 5 suggests that low types in the two mandatory treatments appear to be allocating too much, on average, to their own private accounts, particularly in the Mp treatment (see also Figure 4 for low types' over-allocation to their own private accounts, relative to the Pareto benchmark - drawn as the dashed line). However, Figures 3-4 also reveal that low type proposers have actually over-allocated to public goods and under-allocated to their own private account in the two mandatory treatments, taking into account the predictions based on the realized status quo levels of the public good (i.e., the predictions depicted as the solid line). Thus, it seems that a reason for the under-allocation to the public good by the low proposer types is that the status quo level of the public good is not high enough in the time frame of our experiment to justify their allocating the Pareto efficient amount to the public good.[13] Of course, the status quo level depends on the behavior of both high and low type proposers. The high proposer types in the mandatory treatments are generally closer to the Pareto optimal public good levels, particularly in the Ma treatment.

Based on Figure 5, we summarize our findings regarding proposer power in relation to Hypothesis 3 as follows:

Result 4 *Inconsistent with Hypothesis 3 proposers do not exercise full proposer power by allocating zero private points to responders. This is particularly evident in the mandatory treatments, where sizeable fractions of proposers divide points net of the public good allocation equally between their own private accounts and those of responders.*

4.7 Behavioral model predictions

How can we explain the departures we observe from theoretical predictions, specifically the non-zero allocation of private points to responders and the consequent effects on the allocations to the public good? One candidate explanation is that subjects have *other-regarding* preferences; they dislike unequal payoffs. We further assume that such inequity aversion preferences are captured by the Fehr and Schmidt (FS 1999) specification, a common assumption. We consider the optimization problem under FS preferences for allocations in the discretionary model only in order to abstract from dynamic game considerations (under mandatory rules) that would further complicate such an analysis. Consider a responder of type i (i = high or low); a proposer of type $-i$ has allocated X_r points to the responder and X_p points to himself. The responder's FS preferences are given by:

$$U_r^{FS}(X_p, X_r, Y) = X_r + \theta_i \ln Y - \epsilon \max\left\{\left[(X_p + \theta_{-i} \ln Y) - (X_r + \theta_i \ln Y)\right], 0\right\}$$

[13]Indeed, we find that that status quo public good levels faced by low proposer types are lower than those faced by high proposer types in both mandatory treatments.

where ϵ is the responder's disutility from disadvantageous inequality, or envy. The responder accepts the proposal if $U_r(X_p, X_r, Y) \geq 0$. Under FS preferences, the proposer's utility is:

$$U_p^{FS}(X_p, X_r, Y) = X_p + \theta_{-i} \ln Y - \gamma \max \left\{ \left[(X_p + \theta_{-i} \ln Y) - (X_r + \theta_i \ln Y) \right], 0 \right\}$$

Here γ is the proposer's guilt parameter. FS assume that $\epsilon > \gamma$. The proposer maximizes U_p by choice of Y and X_r subject to the responder's acceptance constraint and $X_p = 1 - Y - X_r$ (Here we normalize the 100 point endowment to 1). If the responder's constraint holds with an equality ($U_r(X_p, X_r, Y) = 0$) then one can show that $Y^* = \theta_H + \theta_L$, which is higher than the level of contributions to the public good that we actually observe. Therefore, we rule this case out.

Instead we focus on the more promising case where the responder's constraint is *not* binding ($U_r(X_p, X_r, Y) > 0$), which yields (for details, see Appendix C):

$$Y^{FS} = \theta_{-i} + \frac{\gamma}{1-\gamma}\theta_i.$$

In our discretionary treatment, $\theta_H = .4$ and $\theta_L = .25$. From a meta study by Nunnari and Pozzi (2022), the mean estimates of the two FS preference parameters are $\epsilon = 0.467$ (with a 95% CI of $[0.302, 0.642]$) and $\gamma = 0.331$ (with a 95% CI of $[0.266, 0.396]$). Using these mean estimates, we report in Table 10 the allocations that proposers of each type would make and responders would accept if both had FS preferences in the discretionary treatment, which we compare with the mean allocations found in our experimental data.

Table 10: Predicted Allocations under FS Preferences, Discretionary Treatment

	FS Predictions			Means Exp. Data		
Proposer Type	Y^*	$\underline{X}_r$	$\overline{X}_p$	Y	X_r	X_p
High	0.524	0.175	0.301	0.508	0.145	0.346
Low	0.448	0.329	0.223	0.433	0.082	0.485

Notes. $\underline{X}_r$ is a lower bound for the responder's private points X_r and thus given Y^* we have an upper bound $\overline{X}_p = 1 - Y^* - \underline{X}_r$ for the proposer's private points (Details in Appendix C).

The FS other-regarding preference model explains well the public good levels assuming the responder's constraint is non-binding. However, it does not explain private point allocations very well. In particular, the mean experimental private points allocated to the responder (the proposer) are below (above) the predicted FS lower (upper) bounds for these private points as shown in Table 10. Instead of relying on meta study estimates for ϵ and γ, we could also directly derive values for the FS parameters using the mean allocations in our data. Doing so, we find that while the implied γ from our data is close to the meta study estimate of 0.331, the implied ϵ value is close to zero or even negative, which is inconsistent with the FS assumption that $\epsilon > \gamma$.[14]

To better explain the heterogeneity in private point allocations that we observe, we consider a simpler model of other regarding concerns that is suggested by the allocations

[14] It is not clear that the FS approach is so relevant to the quasi-linear preference specification of the environment that we consider.

we observe in the 2D simplex (Figure 5). Specifically, we conjecture that proposers first decide on some level for the public good amount, Y, and then decide how to allocate the remaining private points, $100-Y$, between themselves and responders, taking into account the possibility that their proposal might be rejected. If we regard proposer power in our context as the ability of the proposer to take all (or most of) the points not allocated to the public good for themselves, then the evidence from our experiment suggests that subjects may be heterogeneous in the extent to which they exercise this proposer power, possibly according to different risk attitudes toward the likelihood of rejection (Roth et al. 1991).[15]

In order to further explore such heterogeneity, we consider how proposers allocate the private points remaining after their public good choices among all accepted proposals and we define this term by α. Specifically, let us define $\alpha = X_p/(100-Y)$, as the proportion of the remaining allocation (after the choice of Y) that the proposer gives to himself.[16] Figure 6 provides a histogram of α values across the three treatments and the two proposer types, high on the left and low on the right.

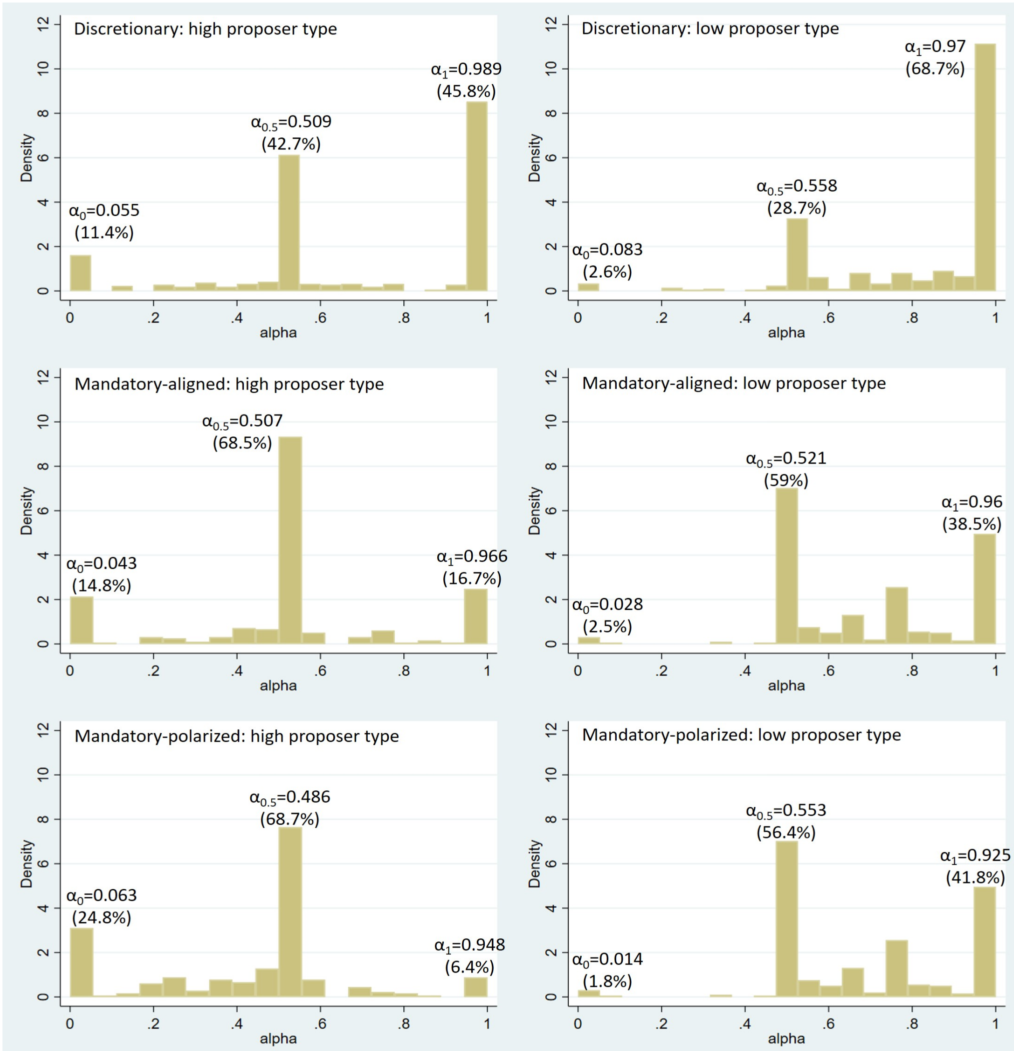
Examination of Figure 6 reveals that there appear to be three prominent α-types across all treatments and proposer types. First, the $\alpha = 1$ (α_1) type corresponds to those who exercise full proposer power. Second, the $\alpha = 0.5$ ($\alpha_{0.5}$) type corresponds to those who split the private points equally. Finally, there is the surprising $\alpha = 0$ (α_0) type that is particularly prominent among high type proposers and less so among low-type proposers. This type of proposer *doesn't exercise proposer power at all*, and cedes all of the private points remaining after the public good allocation to the responder.

Given the evidence for these three α-types from Figure 6, we estimated a finite mixture model (FMM) to identify the mean α values for each of these three behavioral types, together with their proportions in our subject population (see Moffatt (2016) Ch.8). The finite mixture model assumes that the total number of types is finite and that the parameters of the type distributions, along with the "mixing proportions" (parameters revealing the proportion of subjects of each type), are estimated by the method of maximum likelihood estimation (MLE). While the results of this estimation are reported in Appendix C, Table C.1, we do report in Figure 6 the estimated α coefficients for each of the three behavioral types, α_0 $\alpha_{0.5}$ and α_1 from the FMM estimation along with their estimated proportions in the population. For instance, in the discretionary treatment, with high proposer types (the upper left panel of Figure 6), the FMM estimates that with three behavioral (alpha) types, proportion 11.4% have an α near 0 (estimate is 0.055), while proportion 42.7% have an α near 0.5 (estimate is 0.509), and proportion 45.8% have an α near 1 (estimate is 0.989). The estimates for other treatments and preference types are also close to 0, 0.5 and 1.0, respectively.

Second, the proportion of α_1 types - those who exercise full proposer power - is greater for low proposer types than for high proposer types in all three treatments. We conjecture that this is owing to different rejection rates and norms of behavior depending on which type is in the proposer role. The proportion of α_0 types - those exercising *no* proposer power - is small, but is significantly greater for high proposer types than for low proposer types across all three treatments. As the high proposer types earn a higher payoff from the public good, a

[15]Theory predicts full proposer power every time in the discretionary treatment, and most of the time when the status quo level of public good is below Pareto optimum, in the mandatory treatments.

[16]In the case where $Y = 100$, α is treated as "missing" since in that case there are no remaining private points to be divided between proposer and responder.



Note. $\alpha = \frac{X_p}{100-Y}$ (if $Y < 100$; α is "missing" if $Y = 100$) where Y =public good allocations, X_p =proposer private points. The histogram is based on accepted proposals.

Figure 6: Proposer's Own Private Points as a Proportion of Non-Public Good Private Points by Treatment and Proposer Type

larger proportion of these high proposer types offer nearly all of the private points in excess of the public good allocation to their low-type player match (especially when the allocated public good level is high, close to the full endowment). This allocation of nearly all private points to the responder is generally at odds with theoretical predictions, but it appears to be the price that some high proposer types are willing to pay in order to get their proposals accepted by low type responders. Further, and consistent with the last observation, the proportion of equal split, the $\alpha_{0.5}$ type, is always greater among *high* proposer types as compared with low proposer types. Finally, comparing the discretionary treatment with the two mandatory treatments, we observe that in the discretionary treatment, regardless of whether the proposer is a high or low type, we have that the proportion of α_1 types are greatest followed by $\alpha_{0.5}$ and then by α_0 types. By contrast, in the two mandatory treatments, we find that the proportion of $\alpha_{0.5}$ types is always the largest regardless of the proposer type (high or low). Second rank goes to the α_1 types, with an exception in case of Mp-high proposers where the proportion of α_0 types is second largest.

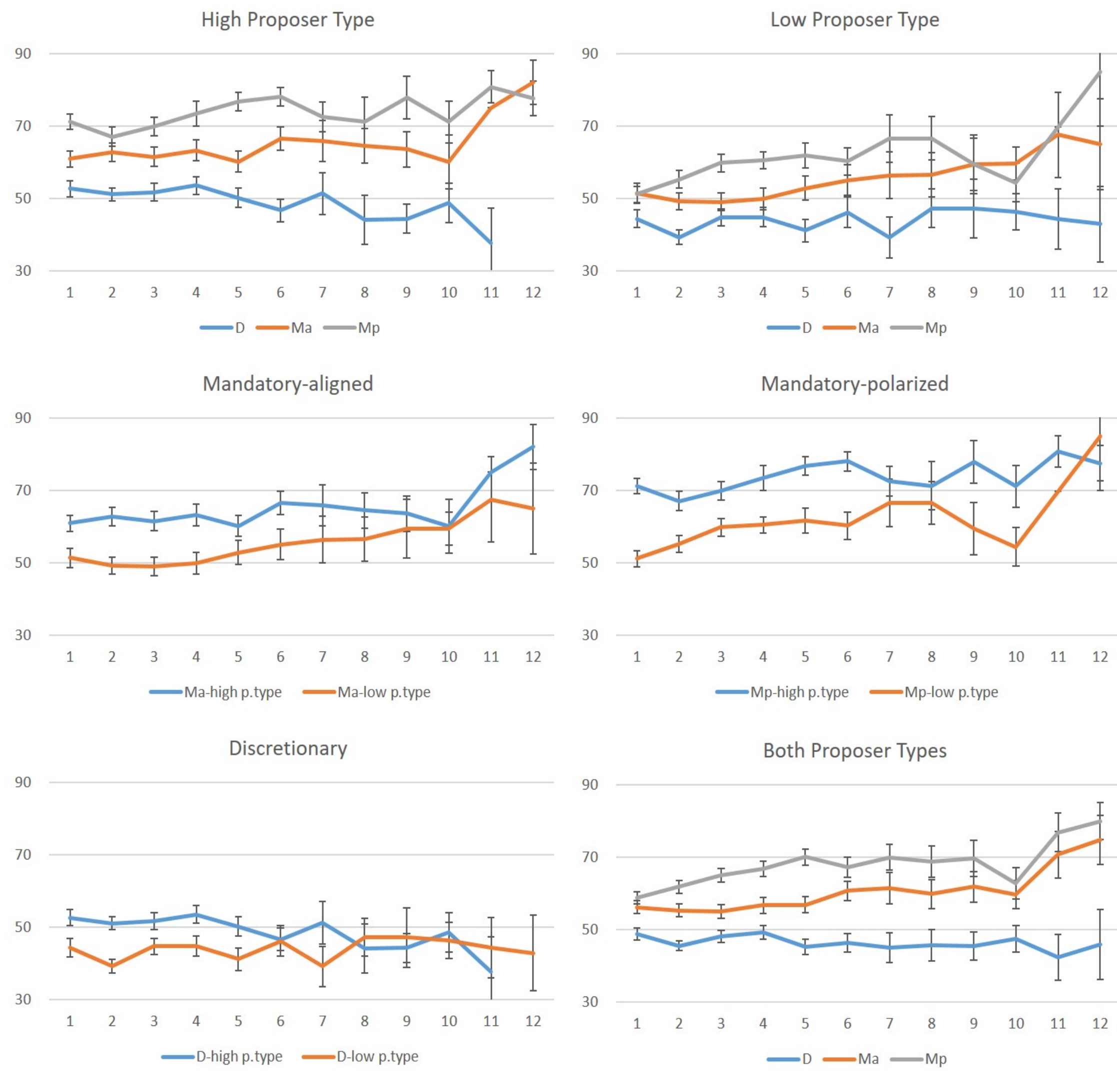
Overall, these findings suggest that proposer power, as measured by α is greatest in the discretionary treatment. In the mandatory treatments, the persistence of the status quo level of the public good increases the amount allocated to the public good, but this persistence also works to weaken proposer power, particularly among high proposer types. Fairness or "inequity-aversion" concerns require proposers, particularly high type proposers to divide the private points remaining after the public good allocation equally between themselves and the responders. A small but sizeable fraction of the (mainly) high proposer types elect to give *all* of the private points in excess of the public good allocation to the responder, likely in acknowledgment of the higher return these high proposer types earn from the public good. The need to behave in an equitable manner to ensure adoption of proposals by both parties in the two mandatory treatments likely explains why the Pareto optimum level is not achieved in those two treatments, though subjects do get close to this level over the rounds of each supergame.

4.8 Evolution of Accepted Public Good Amounts Over Time

In this section we explore in further detail, the evolution of public good provision over time. Figure 7 shows mean public good allocations over all *rounds* of a supergame, with standard error bars (see also Table B.17 in the Appendix). Note that due to our use of random termination to implement a discount factor of $\delta = .80$, earlier rounds in a supergame will have more observations than later rounds (larger standard errors in later rounds accordingly) and that the longest supergame in any session was 12 rounds. The top panel of Figure 7 shows mean public good allocations by proposer type, high or low, across all three treatments. The two middle panels and the bottom left panel show mean public good allocations by high and low types for each of the three treatments Ma, Mp and D. Finally, the bottom right panel shows mean public good allocations for both proposer types combined, across all three treatments.

The clear impression given by Figure 7 is that over the course of a supergame there is on average, good separation in mean public good amounts across treatments, offered by the high and low proposer types. Further, in both of the mandatory treatments we observe an upward trend in public good allocations while in the discretionary treatment we see a constant or even a declining trend in mean public good amounts.

We next consider each treatment in turn, beginning with the discretionary treatment. Recall from Hypothesis 3 that for the discretionary treatment, high and low types should simply propose their static equilibrium amounts in each round that they serve as the proposer, specifically $Y = \theta_H = 40$ for high types and $Y = \theta_L = 25$ for low types, ignoring any dynamic aspects of the repeated game. As Table 2 and Figure 3 reveal, in the discretionary (D) treatment, accepted proposals made by high types average 50.81 while those made by low types average 43.3 over all rounds. These levels are *greater* than the static equilibrium levels of 40 and 25 respectively. However, as Table 6 reveals, we can reject the null hypothesis that accepted public good offers by low types are the same as accepted public



Notes. D=Discretionary, Ma=Mandatory-aligned, Mp=Mandatory-polarized. p.type=proposer type. Error bars show standard errors. Horizontal axis indicates rounds in a sequence (supergame).

Figure 7: Mean (Accepted) Public Good Allocations over Rounds

good offers by high types in favor of the alternative that the latter offers by high types are significantly greater than the former offers by low types at the 10% level of significance ($p = .059$). Further, as Figure 8 below reveals, there is not much change in the accepted public good allocations proposed by high and low types over the first and second halves of each session; that is, while accepted amounts proposed by both types are greater than the static equilibrium levels, they are not increasing or decreasing by much over time. A similar observation follows from the bottom left panel of Figure 7. We summarize this finding as follows.

Result 5 *Consistent with Hypothesis 4 in the discretionary treatment, accepted public good proposals by high types are greater than accepted public good proposals by low types, and do not change much over time. Both types' accepted public good proposal amounts are greater than the static equilibrium levels* $(\theta_H, \theta_L) = (40, 25)$.

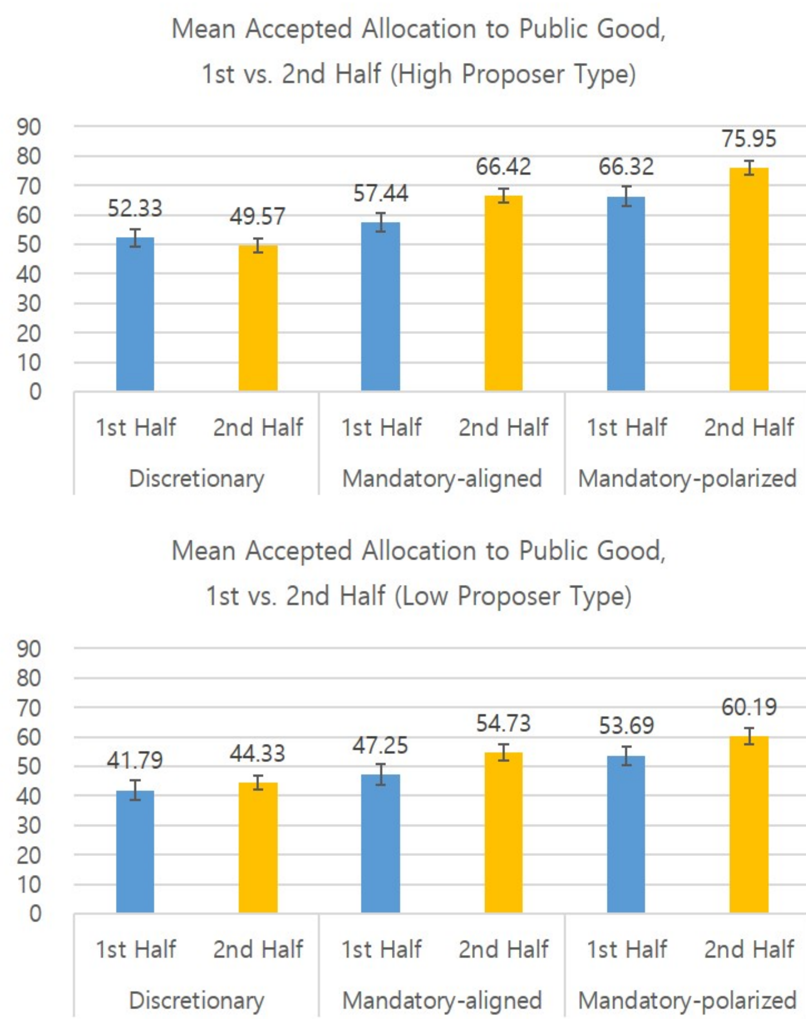
We next go back to Table 7 and compare the evolution of accepted public good amounts over time in the mandatory treatments relative to the discretionary treatment using Tobit regressions that account for data censoring. Specifically, we report on random-effect tobit regressions and we include round and sequence numbers to consider behavior over time. The dependent variable is accepted public good amounts within the implemented limits between 1 and 100.

In these regressions in Table 7, the discretionary treatment serves as the baseline. We see in specification (1) that the baseline accepted public good amount is about 40 and is increasing in the mandatory-aligned (Ma) treatment by about 13 and increasing further in the mandatory-polarized (Mp) treatment by around 20. Further, the inclusion of sequence and round numbers in specification (1) suggests that allocations to the public good are growing over time. However, disaggregating this effect further using interaction variables, Ma×Round and Mp×Round in specification (2) and Ma×Sequence and Mp×Sequence in specification (3) we see that the growth in public good allocations over time is owing to the two mandatory treatments (Ma and Mp); including the interactive terms, the coefficients on the round or sequence number variables for the baseline discretionary treatment are no longer significantly different from zero. This finding is consistent with the theory which predicts that accepted public good amounts should be growing over time in the mandatory treatments due to the role played by the status quo public good level in dynamic bargaining under mandatory rules. These same results generally continue to hold if we disaggregate accepted public good allocations by the *type* of player (high or low) who made the proposal as in Table B.6 reported on in the Appendix (with stronger effects of learning by high type).

We next look for more explicit evidence of dynamic adjustment *within* a sequence (indefinitely repeated game) in the mandatory treatments, since in those treatments, each new sequence starts with a status quo level for the public good reset to the initial condition, $Y = 1$, and then, depending on whether proposals are accepted or not, the status quo level for the public good can increase over time.

Looking at the data from the first and second half of sessions (available upon request), we observe that acceptance rates remain roughly constant over time and consistently below the 100% equilibrium prediction across treatments (the 95% confidence intervals of mean acceptance rates - viewed as sample proportions - were *overlapping* between the first and the second half of sessions for all three treatments).

We notice further in Figure 8 that both high and low types tend to increase their public good allocations over time in the two mandatory treatments, while there is not much change in public good allocations over time in the discretionary treatment (the 95% confidence intervals of mean public good allocations in accepted proposals were *non-overlapping* between the first and the second half of sessions for the two mandatory, Ma and Mp, treatments, for each of the two types, high and low, of proposers, while the same intervals were *indeed* overlapping between the two halves for either type of proposers in the discretionary treatment). The latter observation is consistent with the notion that players may be learning to play according to the dynamic equilibrium predictions of the theory with greater experience.



Notes. 1st Half=Sequences (supergames) 1-4, 2nd Half=Sequences 5-7,8,9. Error bars indicate 95% confidence intervals.

Figure 8: Mean Accepted Allocation to Public Good by Proposer Type, 1st vs. 2nd Half of Session

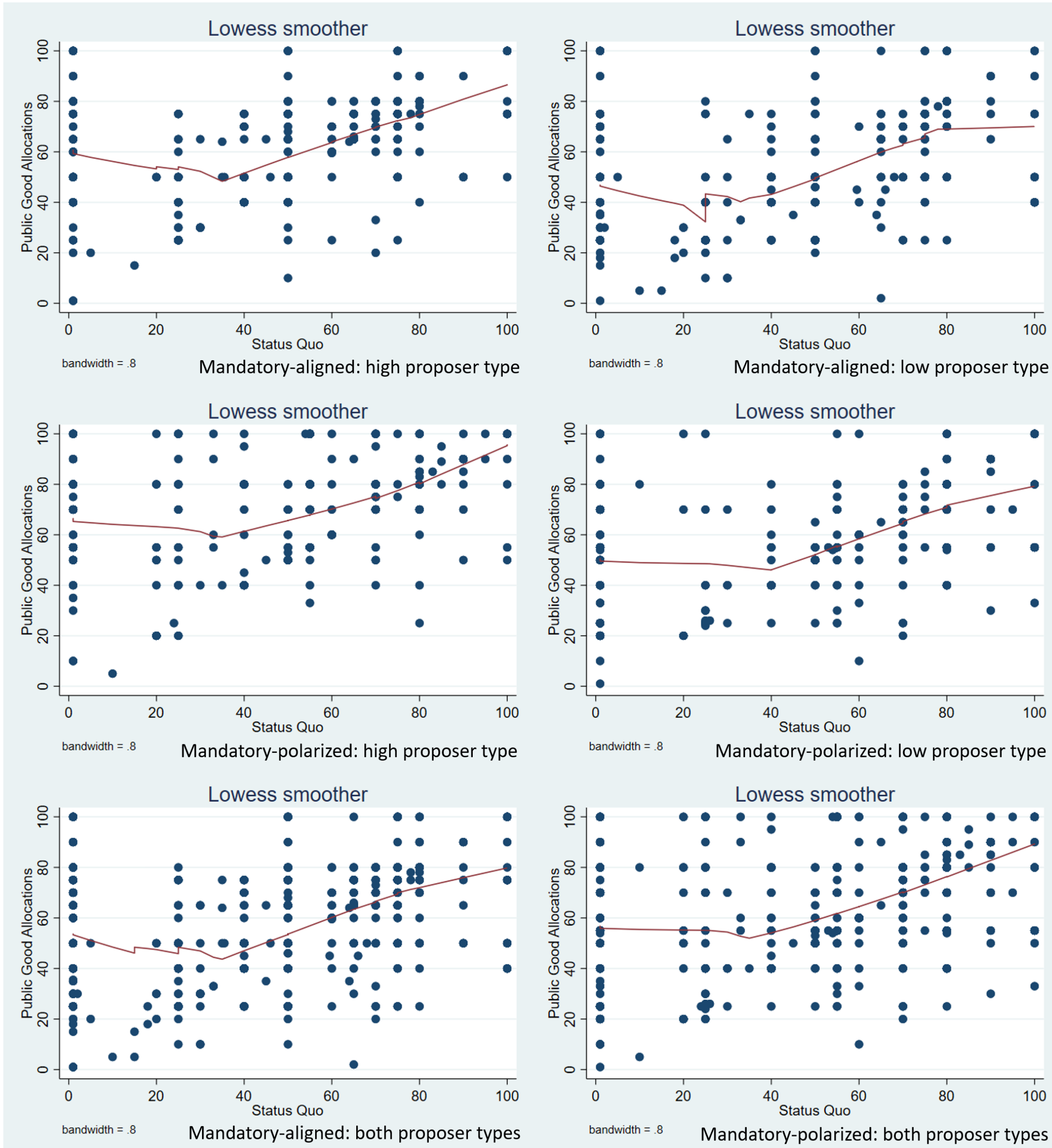


Figure 9: Scatter Plot of (Accepted) Public Good Allocations by Status Quo Default Level, Mandatory Treatments Along with Lowess Filter.

Figure 9 shows scatter plots of accepted public good amounts as a function of the status quo level at the time the proposal was made. In addition, we show the fit of Lowess filters to these data. The top panels are for the high and low proposer types in the mandatory-aligned (Ma) treatment, the middle panels are for the high and low types in the mandatory-polarized (Mp) treatment, and the bottom panels consider both proposer types combined in Ma (left) and Mp (right). By comparison with the theoretical predictions in Figure 2, we find both differences and similarities. On the one hand, we observe that for the low types (the right columns of the top and middle panels), the pattern of public good allocations as a function of the status quo level is qualitatively similar to the Markov perfect equilibrium path. On the other hand, for the high types (the left columns of the top and middle panels) public good allocation levels should be more or less constant according to the equilibrium while the data shows a clearly increasing pattern as status quo levels increase.

By way of an explanation, we note that the lowest status quo value ($Y = 1$) is more likely to be observed, as it is the initial state of all supergames, and there is a wide variance of public good allocation amounts for this status quo level for both high and low proposer types. This large initial variance reflects some initial learning/coordination that the theory does not address. Further, as the probit regressions in Tables 4-5 revealed, proposals by high type proposers are significantly more likely to be rejected by low type responders across all treatments (while the Markov equilibrium, as depicted in Figures 2 and B.1, assumes no rejection). The greater rejection of high type proposals may cause these high type players to increase their allocations to the public good in order to gain acceptance.

To better understand the repeated game dynamics *within* a supergame (or sequence), we consider a simple first order autoregressive model of the convergence behavior of different outcome variables, which we label y. Specifically, we consider the model

$$y_{j,t} = \lambda y_{j,t-1} + \mu_j + \epsilon_{j,t} \tag{1}$$

where $y_{j,t}$ denotes the time t value of variable j. We are particularly interested in two main outcome variables, namely the accepted amount of the public good in period t, PG_t and the status quo level for the public good in period t, SQ_t in the two mandatory treatments, as both of these variables are expected to converge to steady states over time.

Provided that estimates of λ are less than 1, the steady state public good and status quo amounts over a supergame are well approximated by estimates of the limiting value of equation (1), namely, by $\frac{\mu}{1-\lambda}$. Estimation of equation (1) for the accepted public good amount (PG) are reported on in Table 11 while estimates for the status quo level of the public good (SQ) are reported on in Table 12.

These tables reveal several things. First estimates for λ are generally less than 1 providing evidence of weak convergence over time across all treatments. Second, the limiting estimated values for $\frac{\mu}{1-\lambda}$ in the two mandatory treatments are greater than in the discretionary treatment and are close to, but often fall just short of predicted steady state values for these two mandatory treatments. For instance, considering both proposer types in treatment Ma (Ma-both) a 95% confidence interval for the estimated limiting value of the public good allocation or the status quo level does not include the steady state level of 64.615, though the data are very close to this level. For high type proposers in treatment Ma (Ma-high), the 95% confidence interval for the estimated limiting value of the public good allocation overshoots the predicted steady state level of 64.615. Similarly, for the Mp treatment, considering both proposer types (Mp-both), a 95% confidence interval for the estimated limiting value of the public good allocation or the status quo level does not include the steady state level of 80, though again the data are very close to this level. For high proposer types in Mp (Mp-high), the 95% confidence interval for the estimated limiting value of the public good allocation does include the predicted steady state level of 80. A third finding from Tables 11- 12 is that the 95% confidence intervals for the estimated limiting values of accepted public good allocations and status quo levels are non-overlapping

Table 11: Test of Convergence to Steady States for the Accepted Public Good (PG) Amount

Treat & P.Types		1st Half λ	1st Half $\frac{\mu}{1-\lambda}$	2nd Half λ	2nd Half $\frac{\mu}{1-\lambda}$	All Rounds λ	All Rounds $\frac{\mu}{1-\lambda}$	Steady States
D-both	Coef.	0.376	47.277	0.418	46.248	0.397	46.688	32.5†
	Std.Err.	0.051	1.894	0.043	1.429	0.033	1.139	
	95% LB	0.276	43.565	0.332	43.447	0.332	44.455	
	95% UB	0.476	50.990	0.503	49.049	0.461	48.921	
D-high	Coef.	0.542	58.681	0.324	50.362	0.433	53.360	40
	Std.Err.	0.065	3.501	0.063	1.756	0.045	1.682	
	95% LB	0.413	51.820	0.201	46.920	0.343	50.063	
	95% UB	0.670	65.543	0.447	53.804	0.522	56.656	
D-low	Coef.	0.244	39.421	0.504	40.812	0.375	40.574	25
	Std.Err.	0.071	2.489	0.059	2.463	0.046	1.675	
	95% LB	0.103	34.542	0.388	35.984	0.285	37.291	
	95% UB	0.385	44.300	0.620	45.640	0.464	43.858	
Ma-both	Coef.	0.510	54.341	0.480	62.858	0.511	59.749	64.615
	Std.Err.	0.051	2.467	0.045	1.777	0.033	1.515	
	95% LB	0.409	49.505	0.391	59.375	0.446	56.780	
	95% UB	0.611	59.176	0.568	66.342	0.577	62.718	
Ma-high	Coef.	0.475	62.435	0.511	75.837	0.519	70.717	64.615
	Std.Err.	0.072	3.451	0.058	2.980	0.045	2.418	
	95% LB	0.333	55.671	0.398	69.007	0.430	65.978	
	95% UB	0.617	69.199	0.625	81.677	0.608	75.457	
Ma-low	Coef.	0.519	43.807	0.432	52.938	0.486	49.538	64.615
	Std.Err.	0.068	3.419	0.061	2.277	0.045	1.996	
	95% LB	0.384	37.105	0.311	48.474	0.397	45.626	
	95% UB	0.655	50.509	0.553	57.401	0.575	53.449	
Mp-both	Coef.	0.345	64.257	0.463	72.629	0.430	69.537	80
	Std.Err.	0.058	2.156	0.044	1.767	0.035	1.419	
	95% LB	0.231	60.031	0.376	69.166	0.362	66.756	
	95% UB	0.459	68.482	0.550	76.093	0.498	72.318	
Mp-high	Coef.	0.445	77.000	0.457	83.095	0.473	81.339	80
	Std.Err.	0.077	4.646	0.054	2.569	0.043	2.481	
	95% LB	0.293	67.894	0.350	78.061	0.388	76.477	
	95% UB	0.597	86.107	0.564	88.130	0.557	86.201	
Mp-low	Coef.	0.290	54.065	0.413	61.564	0.376	58.460	80
	Std.Err.	0.080	2.474	0.065	2.203	0.050	1.692	
	95% LB	0.132	49.215	0.285	57.247	0.277	55.144	
	95% UB	0.447	58.915	0.541	65.882	0.475	61.776	

Notes. The model $PG_t = \lambda PG_{t-1} + \mu$ is estimated, based on accepted proposals; and the estimated parameters, and their standard errors and 95 % confidence intervals are reported (λ and μ are estimated by OLS and then $\frac{\mu}{1-\lambda}$, by the delta method; Moffatt (2016)). D=Discretionary, Ma=Mandatory-aligned, and Mp=Mandatory-polarized. P.Type=proposer type. Static equilibrium is provided instead of steady state for D in the last column. † 32.5 is the average between static equilibrium values 40 and 25 but there's no steady states in D (perpetual oscillation between the 2 values instead).

across all three treatments (when both proposer types combined, and in 2nd Half and All

Table 12: Test of Convergence to Steady States for the Status Quo (SQ) Public Good Amount

Treat & P.Types		1st Half λ	1st Half $\frac{\mu}{1-\lambda}$	2nd Half λ	2nd Half $\frac{\mu}{1-\lambda}$	All Rounds λ	All Rounds $\frac{\mu}{1-\lambda}$	Steady States
Ma-both	Coef.	0.350	57.663	0.413	63.724	0.397	61.498	64.615
	Std.Err.	0.040	2.270	0.035	1.934	0.027	1.588	
	95% LB	0.272	53.215	0.344	59.934	0.343	58.385	
	95% UB	0.428	62.112	0.482	67.514	0.451	64.611	
Mp-both	Coef.	0.373	65.105	0.381	72.127	0.400	69.086	80
	Std.Err.	0.039	2.638	0.031	1.804	0.025	1.624	
	95% LB	0.296	59.936	0.320	68.591	0.351	65.904	
	95% UB	0.451	70.275	0.442	75.662	0.450	72.268	

Notes. The model $SQ_t = \lambda SQ_{t-1} + \mu$ is estimated, based on accepted proposals; and the estimated parameters, and their standard errors and 95% confidence intervals are reported (λ and μ are estimated by OLS and then $\frac{\mu}{1-\lambda}$, by the delta method; Moffatt (2016)).D=Discretionary, Ma=Mandatory-aligned, and Mp=Mandatory-polarized. P.Type=proposer type.

Rounds); that is, there is *good separation* in these limiting values as we move from the discretionary treatment to treatment Ma and then to treatment Mp. For instance, considering both proposer types and all rounds, Table 11 reveals that the estimated limiting accepted public good allocation in the discretionary treatment (D-both) is 46.688 with a 95% confidence interval of [44.455, 48.921]; for the Ma treatment the estimated limit for both proposer types (Ma-both) is 59.749 with a 95% confidence interval of [56.780, 62.718]; and finally for the Mp treatment the estimated limit for both proposer types (Mp-both) is 69.537 with a 95% confidence interval of [66.756, 72.318]; We summarize these findings as follows:

Result 6 *Regarding Hypothesis 5, in the mandatory treatments, accepted public good allocations are converging toward steady state levels, but estimated limits often fall just short of steady state predictions. Still there is good separation of the long-run mean public good allocations across treatments in terms of 95% confidence intervals. A similar pattern obtains for the convergence of the status quo level.*

4.9 Efficiency

In this section we consider efficiency across all three treatments. To enable a consistent comparison, we calculate efficiency as the ratio of actual payoffs from accepted allocations to those that would have been obtained at the Pareto optimal allocations as was already done in the overview Table 2. While the Pareto optimum allocation is not an equilibrium under the discretionary rules, using the Pareto optimum payoff levels as a benchmark enables comparisons across all three treatments. Here we report both *aggregate* efficiency measures, defined as the sum of proposers' and responders' actual payoffs relative to the Pareto optimum payoff level, and *individual* type-specific payoffs: proposer/responder and high/low types payoffs relative to the Pareto optimum. To be precise, the denominator of both the aggregate and individual efficiency measures uses the same (hypothetical) aggre-

Table 13: Aggregate and Individual Efficiency

	Efficiency	PO Prediction
D: Aggregate-both p.types	96.02%	
D: Aggregate-high p.type	97.03%	
D: Aggregate-low p.type	94.96%	
Ma: Aggregate-both p.types	97.77%	
Ma: Aggregate-high p.type	98.42%	
Ma: Aggregate-low p.type	97.13%	
Mp: Aggregate-both p.types	97.87%	
Mp: Aggregate-high p.type	98.66%	
Mp: Aggregate-low p.type	97.10%	
D: Proposer-high p.type	61.15%	65.93%
D: Responder-low r.type	35.88%	34.07%
D: Proposer-low p.type	45.22%	45.49%
D: Responder-high r.type	49.74%	54.51%
Ma: Proposer-high p.type	59.40%	65.93%
Ma: Responder-low r.type	39.02%	34.07%
Ma: Proposer-low p.type	42.32%	45.49%
Ma: Responder-high r.type	54.80%	54.51%
Mp: Proposer-high p.type	65.77%	70.44%
Mp: Responder-low r.type	32.89%	29.56%
Mp: Proposer-low p.type	35.10%	34.96%
Mp: Responder-high r.type	62.00%	65.04%

Notes. Efficiency data are based on accepted proposals. Aggregate efficiency is measured as the ratio of the sum of the proposer's and responder's actual payoffs to the same sum of payoffs that would have been obtained at Pareto optimum. Individual (proposer/responder) efficiency is the ratio of individual proposer's or responder's actual payoff to the same sum of payoffs for both players at the Pareto optimum. Note that aggregate and individual efficiency measures use the same denominator, namely the Pareto optimal payoffs to both players, hence the sum of proposer and responder efficiencies in matched cells gives back the aggregate efficiency in the corresponding cell (e.g., 61.15 + 35.88 = 97.03). The final column shows the hypothetical decomposition of aggregate efficiency at Pareto optimum into individual ones, assuming that proposers take all private points. p.type=proposer type, r.type=responder type. PO=Pareto optimum.

gate payoff at the Pareto optimum since we are interested in how aggregate efficiency is decomposed individually between high and low type proposers and responders. The results are shown in Table 13 and nonparametric tests for differences in these efficiency measures are reported in Table 14.[17]

As Table 13 reveals, *aggregate* efficiency is very high across all treatments in excess of 90%. The rows for each treatment (D, Ma, Mp) labeled "Aggregate-both p.types" repeat the efficiency measures reported on earlier in Table 2. These aggregate numbers are re-

[17]Table B.18 in the Appendix presents an alternative version of individual efficiency where the denominator is the individual type/role's portion of the Pareto optimal payoff. In matches between high proposers and low responders, the low types get more than their own share of Pareto optimum payoffs while the high types get less, which reflects fairness concerns but contrasts with the original efficiency measures reported in Table 13. On the other hand, in matches between low proposers and high responders, there is more ambiguity as to which type fares better in terms of relative payoffs.

calculated according to whether the proposer was a high or low type. The final 12 rows of Table 13 show proposers' or responders' average *share* of the Pareto optimal payoff and these percentages are further distinguished by the player's type, high or low. We further report the Pareto Optimum (PO) share predictions for comparison purposes. Note that the actual efficiency shares for the Proposer and the Responder add up to the aggregate actual efficiency percentage in the first part of the table. For example, the numbers in the row "D: Proposer-high p.type" and in the row "D: Responder-low r.type" sum up to the numbers in the row "D: Aggregate-high p.type."

Table 14: Nonparametric Tests for Differences in Efficiency

Across Treatment (SUM)			Pro. vs Res. (INDIV)		
	Alt.H.	p-values		Alt.H.	p-values
High	D<Ma	0.087	High Pro.	D: P>R	0.022
P.Type	D<Mp	0.038	vs.	Ma: P>R	0.022
	Ma≠Mp	0.602	Low Res.	Mp: P>R	0.022
Low	D<Ma	0.125		Pool: P>R	0.0004
P.Type	D<Mp	0.300	Low Pro.	D: P<R	0.112
	Ma≠Mp	0.753	vs.	Ma: P<R	0.022
Both	D<Ma	0.125	High Res.	Mp: P<R	0.022
P.Types	D<Mp	0.071		Pool: P<R	0.0006
	Ma≠Mp	0.917			

Notes. SUM=Mann-Whitney tests of differences in aggregate efficiency between two different treatments; INDIV=Wilcoxon signed rank tests of differences in individual efficiency between high-type proposer and low-type responder, or vice versa, within each treatment or in all 3 treatments pooled together. The session level data for aggregate and individual efficiency are based on accepted proposals. The columns 'Alt.H.' state the alternative hypotheses that aggregate efficiency are *higher* in D than in Ma or Mp (1-sided) or aggregate efficiency are *not* the same between Ma and Mp (2-sided) in the left part; and that individual efficiency is *higher* for high-type proposer/responder than for low-type responder/proposer within each treatment or all treatments pooled together (1-sided) in the right part. D=Discretionary, Ma=Mandatory-aligned, Mp=Mandatory-polarized. P.Type=proposer type, Pro.=proposer, Res.=responder.

As Table 13 reveals, we observe slightly higher aggregate efficiency in the mandatory treatments relative to the discretionary treatment, but as the Mann-Whitney test results using session level averages in Table 14 reveal, these differences are only significant when the proposer is a high type. This finding is surprising since the mandatory treatments should lead to higher efficiency due to the role played by the endogenous status quo default. However, as we have already noted, there is over-allocation to the public good in the discretionary treatment and this behavior raises payoffs to levels that are not far from the Pareto optimal benchmark. At the same time, in the two mandatory treatments, the desire for equal sharing is more pronounced (see the finite mixture model results and the allocations in the 2D simplex) and these fairness concerns reduce allocations to the public good. The net effect of these two behaviors is to move payoffs in all treatments to be closer together so that efficiency differences across treatments are minimal. Further, we do not find efficiency differences between the two mandatory treatments.

While there are no large differences in aggregate efficiency across treatments, Tables 13 and 14 reveal an interesting difference in individual efficiency by player type. Specifically, we find strong evidence that high type proposers or high type responders achieve a greater share of total payoffs (greater efficiency) than do (their matched) low type responders or proposers. The differences are consistent with what would be predicted in the Pareto optimum (PO) as also reported in Table 13 (under PO predictions), and mainly reflect the fact that high types get more utility value from public good allocations than do low types. We summarize these findings as follows:

Result 7 *Efficiency (actual payoffs achieved relative to the Pareto optimum) is high across all treatments in excess of 90%. The evidence for Hypothesis 6 is mixed with aggregate efficiency being marginally significantly higher in the Mp treatment but not in the Ma treatment as compared with the D treatment. Further, high types achieve a significantly larger individual share of the efficient aggregate payoff level regardless of whether they are in the proposer or the responder role.*

5 Conclusions and Suggestions for Future Research

We have reported on an experimental test of a model of public good bargaining due to Bowen et al. (2014). The main innovation of this model is the consideration of mandatory versus discretionary bargaining rules for public good provision. Under mandatory rules, the status quo level of public good provision becomes endogenous; once parties agree on a public good provision level, that level becomes the new status quo level. Thus, in the event of a break-down in bargaining between the two political parties, public good provision defaults to the status quo level which may be positive unlike in the discretionary case where the status quo level or the disagreement value is always zero. Theoretically, the problem of underprovision of the public good in the discretionary environment can be eliminated in the mandatory setting because the mandatory bargaining rules raise the bargaining power of the out-of-power party. Indeed, under mandatory rules, efficient public good provision becomes possible. The aim of our experiment is to test this important insight.

We consider both discretionary and mandatory bargaining rules and in the latter case, we further consider the degree of political polarization of the two parties as measured by differences in the weights that they attach to public good provision.

Consistent with the theory, we find that public good allocations are significantly higher under mandatory budget rules than under discretionary rules and that under the mandatory rules, pairs of players are very close to achieving the efficient level of public good provision. Still, they fall just short. What can explain this behavior? As we have seen, acceptance rates are increasing in both the public good amount and the private points offered to responders. The latter result is inconsistent with the theoretical prediction that proposers exercise full proposer power, but it is consistent with findings from many ultimatum bargaining experiments. At the same time, low type proposers are not offering as large an allocation to the public good as high type proposers are (while the former types over-allocate and the latter types under-allocate on average, with respect to the equilibrium predictions conditional on the realized status quo levels for the public goods, in the mandatory treatments) and this behavior by the low types largely accounts for the shortfall in public good provision relative to the Pareto efficiency benchmark. This bias by the low types may reflect the low type's smaller payoff from the public good relative to the high types in combination with fairness concerns. Further, many proposers in the mandatory treatment, particularly the high types are choosing to reduce their own private points from equilibrium levels to fund the private points allocated to the responder. That is, proposers are heterogeneous in their exercise of proposer power, consistent with prior legislative bargaining experiments. The main difference of course, is that we are considering bargaining over public good provision which benefits all players. Here we observe that while our subjects fall short of achieving the efficient outcome, they do come tantalizingly close to reaching that benchmark.

Still, consistent with theoretical predictions, we find that as political polarization increases, both proposer types increase their allocations to the public good under the mandatory rules since the change in polarization leads to a higher efficient public good level. By contrast, under the discretionary rules, each proposer type makes public good allocations that are higher than the predicted static equilibrium levels, but that are further away from the Pareto efficient levels than under the mandatory rules. A main takeaway from our findings is that they help to rationalize the use of mandatory rather than discretionary budget rules in bargaining over public good expenditures between political parties.

We see several directions for future research on this topic. First, it would be useful to consider longer indefinite sequence lengths than in our study as that would allow more time for the status quo bargaining mechanism in the mandatory treatments to enable subject to possibly achieve convergence to the Pareto optimum. This change might be achieved by increasing the discount factor or by using the block random termination method of Fréchette and Yuksel (2017). Alternatively, we could consider changing the initial status quo level for the public good, e.g., to be at the Pareto optimum level. Second, it would be of interest to give subjects some pilot experience with several indefinite sequences involving both discretionary and mandatory bargaining rules and then ask them to choose which set of bargaining rules they would like to operate under – Bowen et al. (2017) suggest an interesting theory along this line. Third, it would be of interest to vary the duration of proposer power; we currently only consider a single value for p, the probability that a proposer remains in power. Changing p can affect the insurance motivation without changing the Pareto optimum public good levels, which is different from changing the degree of polarization $(\theta_H - \theta_L)$. Finally, it would be of interest to connect our experimental design more closely with the Baron-Ferejohn legislative bargaining experiments, for example, by Fréchette et al. (2012) that involve three or more parties as well as both public and private goods in a dynamic bargaining game thereby enabling the study of majority rule rather than unanimous consent for implementation of bargaining outcomes. We leave all of these interesting extensions to future research.

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Appendix for Online Publication Only

A Instructions used in the Aligned (Mandatory/Discretionary) Treatment

Here we present the instruction used in the low polarization treatment where the low type's $T = 25$ and the high type's $T = 40$. Differences in the wording between the Mandatory and Discretionary Treatments are indicated.

Overview

Welcome to this experiment in the economics of decision-making. Funding for this experiment has been provided by the UC Irvine School of Social Sciences. We ask that you not talk with one another and that you silence your mobile devices for the duration of today's session.

For your participation in today's session you will be paid in cash at the end of the experiment. Different participants may earn different amounts of money. The amount you earn depends partly on your decisions, partly on the decisions of others, and partly on chance. Thus, it is important that you listen carefully and fully understand these instructions before we begin. There will be a short comprehension quiz following the reading of these instructions which you will all need to complete before we can begin the experimental session.

The experiment will make use of the computer workstations, and all interactions by you and others will take place through these networked computers. You will interact anonymously with one another and your data records will be stored only by your ID number; your name or the names of other participants will not be revealed at any time during today's session or in any write-up of the findings from this experiment.

Today's session will involve a number of "sequences." Each sequence consists of a number of "rounds." In each round you will view some information and make a decision. Your decision together with the decisions of others determine the amount of points that you earn each round. At the end of the session, we will randomly select two sequences from those played in today's session. Your point earnings from the final rounds of the two chosen sequences will be converted into dollars at a conversion rate of 15 points = \$1. Your earnings from the final rounds of the two chosen sequences and your \$7 show-up payment will be paid to you in cash and in private at the end of the session.

Specific Details

At the start of each new sequence, participants will be randomly matched in pairs. Each pair of participants will interact together in all rounds of that sequence. At the beginning of each new sequence, one member of the pair will be randomly selected as the "high" type and the other will be the "low" type. Your assignment to either type is equally likely – it is like flipping a coin – and your type assignment will last for all rounds of that sequence. At the start of any subsequent sequence, you will again be randomly assigned a type as either "high" or "low".

In each round, each pair must decide how to allocate 100 points between a group account and two private accounts. The points assigned to the group account will contribute to the earnings of both members of the pair, while the points assigned to the two private accounts will only accrue to one or the other individual participant's earnings.

[Mandatory Treatment: At the start of each new sequence, it will be randomly determined with equal probability whether you will be the Proposer or the Responder in the first round. Your role as a proposer or responder is different from your type (high or low). The proposer moves first and chooses an allocation of the 100 points to the group account, to his/her own private account and to the other player's private account. The proposer does this by typing a number in the box for each account on the computer screen. Note that the allocation to the group account must be at least 1 point and that the allocations across all three accounts must sum to exactly 100 points; if this is not the case, the Proposer will see an error message and will have to resubmit his or her proposal. When the proposer is satisfied with the allocation of 100 points to the three accounts, s/he clicks the NEXT button, which then sends the proposed allocation to the responder for his or her consideration. After viewing the proposed allocation, the responder matched with the proposer decides whether to Accept or Reject the proposal. The responder does this by clicking the button next to either the YES (to accept) or NO (to reject the proposer's proposal). If the responder chooses YES, the Proposer's allocation of points to the three accounts is implemented. The amount in the group account becomes the default amount in the event that any future proposals are rejected. If the responder chooses NO, both the proposer and responder get zero points in their private accounts, but they will get the default number of points in the group account. Initially, the default number of points in the group account is 1 point, but whenever a pair agree to a proposal, the amount in the group account they agreed to becomes the new default group account number of points. The amount of points in each private account is always zero upon the rejection of a proposal; only the group account amount may be positive in the event of a rejection.]

[Discretionary Treatment: At the start of each new sequence, it will be randomly determined with equal probability whether you will be the Proposer or the Responder in the first round. Your role as a proposer or responder is different from your type (high or low). The proposer moves first and chooses an allocation of the 100 points to the group account, to his/her own private account and to the other player's private account. The proposer does this by typing a number in the box for each account on the computer screen. Note that the allocation to the group account must be at least 1 point and that the allocations across all three accounts must sum to exactly 100 points; if this is not the case, the Proposer will see an error message and will have to resubmit his or her proposal. When the proposer is satisfied with the allocation of 100 points to the three accounts, s/he clicks the NEXT button, which then sends the proposed allocation to the responder for his or her consideration. After viewing the proposed allocation, the responder matched with the proposer decides whether to Accept or Reject the proposal. The responder does this by clicking the button next to either the YES (to accept) or NO (to reject the proposer's proposal). If the responder chooses YES, the Proposer's allocation of points to the three accounts is implemented. If the responder chooses NO, both the proposer and responder get 1 point in the group account and zero points in their own private account.]

After the responder has made his/her decision, both players will be informed of the

Points in the Group Account	Points in Your Own Account	Points in the Other's Account	High Type Player's Payoff	Low Type Player's Payoff
100	0	0	184.21	115.13
75	25	0	197.70	132.94
75	0	25	172.70	107.94
75	13	12	185.70	120.94
65	35	0	201.98	139.36
65	0	35	166.98	104.36
65	18	17	184.98	122.36
50	50	0	206.48	147.80
50	0	50	156.48	97.80
50	25	25	181.48	122.80
40	60	0	207.56	152.22
40	0	60	147.56	92.22
40	30	30	177.56	122.22
25	75	0	203.76	155.47
25	0	75	128.76	80.47
25	38	37	166.76	118.47
1	99	0	99.00	99.00
1	0	99	0.00	0.00
1	50	49	50.00	50.00

Table A.1: Some example allocations of the 100 points and payoffs earned by high and low type players

outcome of the round, namely the proposal of the proposer, whether or not the responder accepted or rejected it, the points earned for the round and the cumulative point total for the sequence. For your convenience, a scrollable history of this same information will appear on the round decision screen of all players.

Point Earnings

If you have X points in your own private account and there are Y points in the group account in a round, then your earnings in that round is calculated according to the following formula:

$$\text{My points} = X + T \ln Y \tag{A.1}$$

where $T = 25$ if you are the Low type and $T = 40$ if you are the High type and ln is the natural logarithm of Y, the allocation of points to the group account. As you can see from formula (A.1), you earn more from the group account if you are in a high type ($T = 40$), than if you are a low type ($T = 25$), which is also illustrated in Figure 1. Your total number of points can be obtained by shifting up the graph of the relevant log payoff (for your type) in the figure by the amount of the points in your own private account. Please note that the type of the other player in your pair is always the opposite of your own type. In Table 1, we provide an illustration of some possible points that you could earn from various allocations of the 100 points between you, the other player and the group account. These point calculations are based on formula (A.1). Note that these payoffs in points depend on whether your type is high or low. This schedule is meant to be illustrative and is *not* an exhaustive list of possible point earnings from all possible allocations by each type.

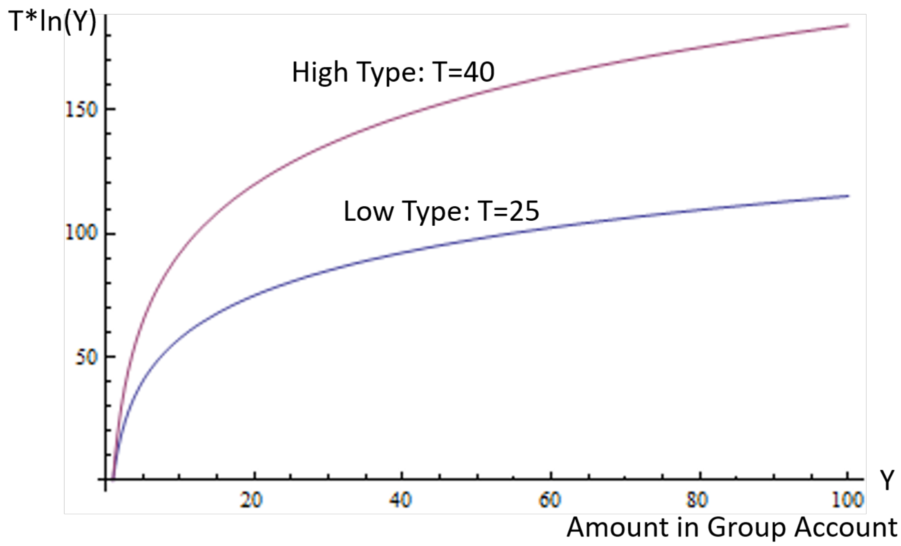


Figure A.1: Payoff graph of the logarithmic part of the payoff for each type.

For your convenience, a calculator will be available to you to help with calculating your point earnings from different allocations of the 100 points to the group and individual accounts.

Sequences, Rounds, Player Roles and Types

At the end of each round of a sequence there is a 1/5 (20 percent) chance that the current sequence does not continue with another round. On the screen where you see the results of the just completed round, the computer program will randomly choose a number (an integer) from 1 to 5, inclusive. If the random number is a 1,2,3, or 4, the sequence will continue with another round. Otherwise, if a 5 is drawn, the round that was just played is the final round of the sequence.

If the sequence continues with another round, then the roles of proposer and responder in each pair of players may also change as well. Specifically, if you were a proposer last round, then you will remain a proposer in the new round with probability 0.6 and you will switch to being a responder in the new round with probability 0.4. Symmetrically, if you were a responder last round, then in the new round you will be a proposer with probability 0.4 and you will remain a responder with probability 0.6.

If the random draw was a 5 so that the sequence ended, then, depending on the time available, a new sequence will begin. You will be randomly matched to another player to begin play of a new sequence. For the new sequence, you will be randomly chosen to be either a high or low type. Additionally, one member of the pair will be randomly selected to be the proposer and the other the responder in the first round of the new sequence. Thereafter, the proposer/responder roles will continue with probability 0.6 and switch with probability 0.4 at the start of each new round of the sequence, provided that the sequence continues with a new round. Your role and your type will always be displayed on your decision screen. Remember that you and the other player in your pair will remain the same in all rounds of a given sequence. At the start of each new sequence, participants are randomly paired anew, so the participant you are matched with can change from sequence to sequence.

Feedback

At the end of each round, you will be reminded of the round number, your role (proposer or responder), your type (high or low), the allocation the proposer in your pair made to the group account, to his/her own private account and to the other player's private account, and whether the responder accepted or rejected it. In addition, you will learn your point earnings for the round. Please record this information on your record sheet under the appropriate headings.

Earnings

Following completion of the final sequence, we will randomly select two sequences from all sequences played in today's session assuming two or more sequences are played.[18] We will then pay you according to the points you earned in the final rounds (when a 5 was drawn) of those two chosen sequences. Your points from those two final rounds will be converted into dollars at the rate of 15 points = $1. Since you do not know which rounds will be the final rounds and which sequences will be chosen for payment, you will want to do your best in all rounds of all sequences played in today's session. In the final screen, you will be informed of which two sequences were selected for payment and how much you earned in the final rounds of those two sequences. In addition, you are guaranteed $7 for showing up and completing today's session. Your total earnings from the two randomly chosen sequences and your show-up payment will be paid to you in cash and in private.

Questions?

Now is the time for questions. If you have a question about any aspect of these instructions, please raise your hand and an experimenter will answer your question.

Quiz

Before we start today's experiment we ask you to answer the following quiz questions that are intended to check your comprehension of the instructions. The numbers in these quiz questions are illustrative; the actual numbers in the experiment may be quite different. Before starting the experiment we will review each participant's answers. If there are any incorrect answers we will go over the relevant part of the instructions again.

1. You will be matched with a new partner in every round of a sequence. Circle one: True False.

[18] If, by chance only one sequence is played, then your earnings from the final round of that sequence will be doubled for payment purposes.

2. If you are a high type, you can be matched with a partner in either a high or a low type. Circle one: True False.

3. If you are a low type, your payoff from the group account is higher than that of a high type. Circle one: True False.

4. You must propose to assign at least one point to the group account. Circle one: True False.

5. If you are a proposer in the current round, then you are more likely to be a proposer in the next round than your partner. Circle one: True False.

   You are more likely to be a proposer in the next round if your proposal in this round is accepted than if it is rejected. Circle one: True False.

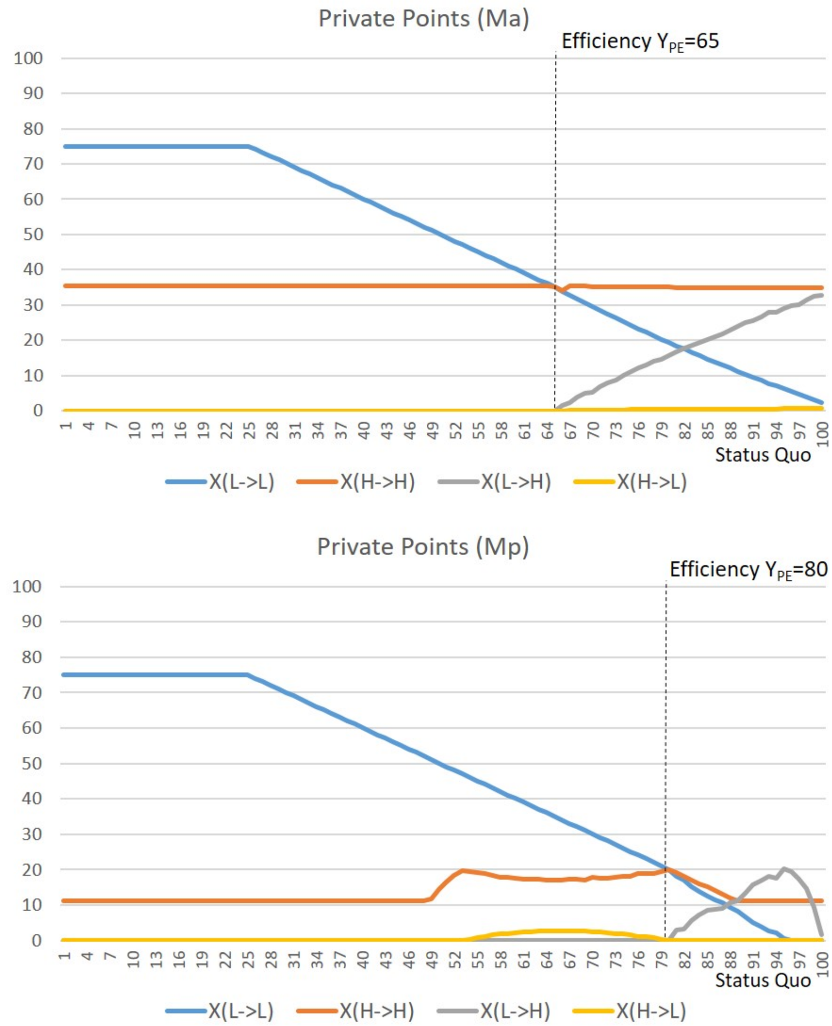
6. Suppose you propose to assign 50 points to the group account and your proposal is accepted in this round. Then if the proposal (submitted either by you or by your partner) in the next round is rejected, there are _______ points in the group account for the calculation of your total points in the next round.

7. Suppose that the current proposal in the first round of a sequence assigns 25 points to your own private account and 75 points to the group account. Then (i) if the proposal is accepted, your payoff is _______ if you are a high type and _______ if you are a low type; (ii) if the proposal is rejected, your payoff is _______ if you are a high type and _______ if you are a low type.

8. The current round has a 1/5 chance of being the last round of a given sequence. Circle one: True False.

   Any round reached in a given sequence has a 1/5 chance of being the last round of that sequence. Circle one: True False.

B Additional Tables and Figures



Note: $X(L \to L)$ is private points allocated by a low type proposer to that proposer's own private account; $X(L \to H)$ is private points allocated by a low type proposer to the matched high type responder's private account; $X(H \to H)$ is private points allocated by a high type proposer to that proposer's own private account; $X(H \to L)$ is private points allocated by a high type proposer to the matched low type responder's private account.

Figure B.1: Markov Perfect Equilibrium Predictions for Private Point Allocations in the two Mandatory Treatments, as a function of the Status Quo Level. Top panel: Mandatory-aligned (Ma); Bottom panel: Mandatory-polarized (Mp).

Table B.1: Proposal Acceptance Rates - Session Level Averages

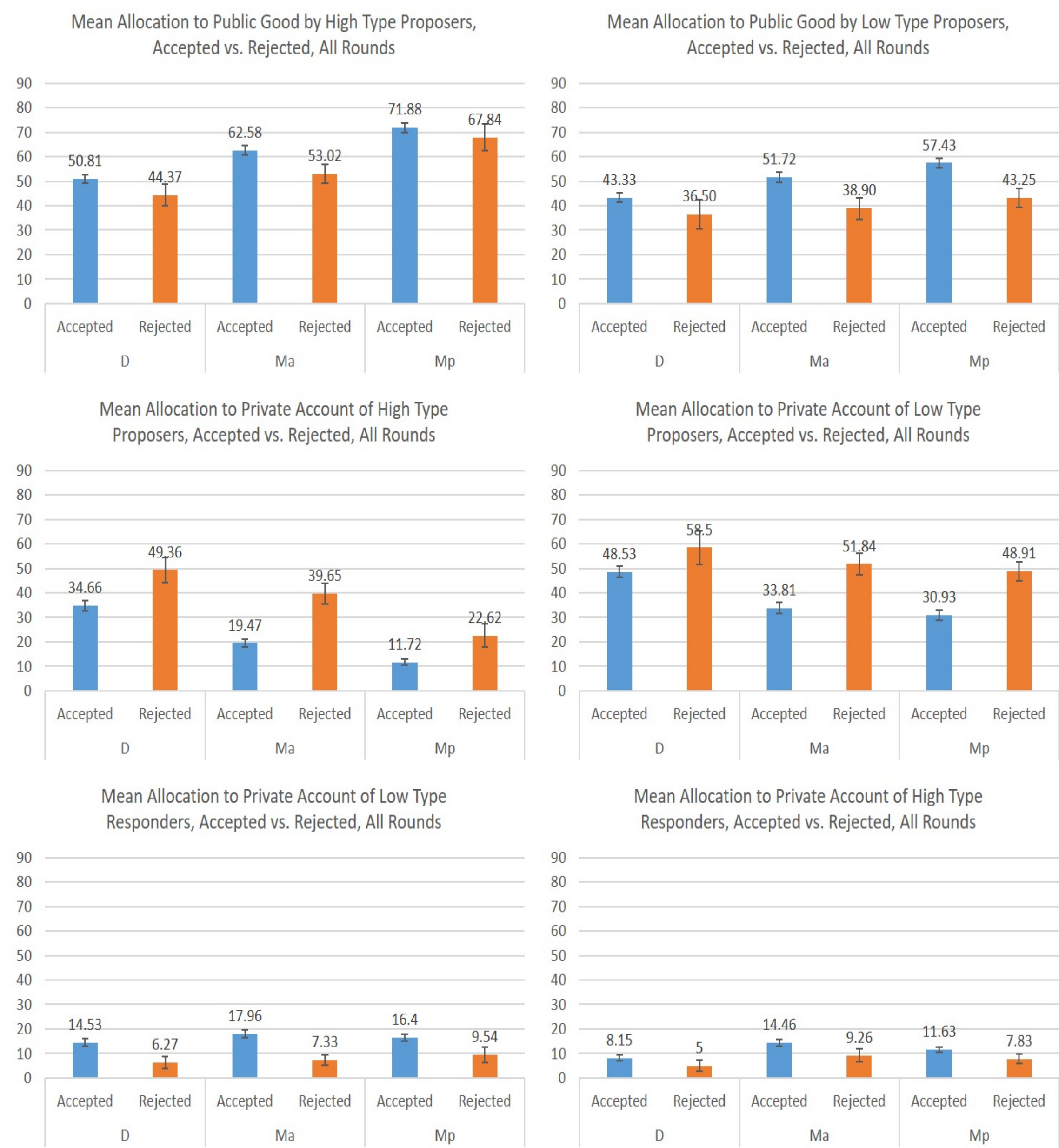
Treat	Acpt#	N	1st Half	Acpt#	N	2nd Half	Acpt#	N	All Rnds
D1	78	85	0.9176	99	110	0.9000	177	195	0.9077
D2	71	85	0.8353	95	110	0.8636	166	195	0.8513
D3	62	70	0.8857	112	135	0.8296	174	205	0.8488
D4	65	70	0.9286	126	135	0.9333	191	205	0.9317
D5	96	110	0.8727	78	85	0.9176	174	195	0.8923
D	372	420	0.8857	510	575	0.8870	882	995	0.8864
Ma1	67	85	0.7882	84	110	0.7636	151	195	0.7744
Ma2	65	85	0.7647	82	110	0.7455	147	195	0.7538
Ma3	56	70	0.8000	104	135	0.7704	160	205	0.7805
Ma4	45	70	0.6429	107	135	0.7926	152	205	0.7415
Ma5	85	110	0.7727	72	85	0.8471	157	195	0.8051
Ma	318	420	0.7571	449	575	0.7809	767	995	0.7709
Mp1	60	85	0.7059	87	110	0.7909	147	195	0.7538
Mp2	65	85	0.7647	73	110	0.6636	138	195	0.7077
Mp3	60	70	0.8571	114	135	0.8444	174	205	0.8488
Mp4	58	70	0.8286	105	135	0.7778	163	205	0.7951
Mp5	90	110	0.8182	75	85	0.8824	165	195	0.8462
Mp	333	420	0.7929	454	575	0.7896	787	995	0.7910

Notes. N is the number of proposals and Acpt# is the number accepted. D=Discretionary, Ma=Mandatory-aligned, and Mp=Mandatory-polarized. 1st half=Sequences (supergames) 1-4, 2nd half=Sequence 5-7,8,9, All Rnds= all rounds.

Table B.2: Wilcoxon Signed Ranks Tests of Public Goods & Private Points in Accepted vs. Rejected Proposals using Session Level Averages (p-values)

	Alternative Hypothesis	D	Ma	Mp
Public Good to High Type Proposers	Accepted≠Rejected	0.043	0.043	0.345
Public Good to Low Type Proposers	Accepted≠Rejected	0.080	0.043	0.043
Public Good to Both Type Proposers	Accepted≠Rejected	0.043	0.043	0.080
Private Point to High Type Proposers	Accepted≠Rejected	0.043	0.043	0.043
Private Point to Low Type Proposers	Accepted≠Rejected	0.043	0.043	0.043
Private Point to Both Type Proposers	Accepted≠Rejected	0.043	0.043	0.043
Private Point to Low Type Responders	Accepted≠Rejected	0.043	0.043	0.080
Private Point to High Type Responders	Accepted≠Rejected	0.043	0.043	0.043
Private Point to Both Type Responders	Accepted≠Rejected	0.043	0.043	0.080

Notes. p-values for tests of differences in public good and private point offers between accepted and rejected proposals are reported. The second column states the alternative hypotheses that public good or private point allocations between accepted and rejected proposals are *not* the same (two-sided test). D=Discretionary, Ma=Mandatory-aligned, Mp=Mandatory-polarized. 1st Half=Sequences (supergames) 1-4, 2nd Half=Sequences 5-7,8,9.



Notes. D=Discretionary, Ma=Mandatory-aligned, Mp=Mandatory-polarized. Error bars indicate 95% confidence intervals.

Figure B.2: Comparison of Public Goods & Private Points Offered in Accepted vs. Rejected Proposals

Table B.3: Mean Accepted Public Good Allocations

	1st Half			2nd Half			All Rounds		
Treat	Observed	Predicted	N	Observed	Predicted	N	Observed	Predicted	N
D1	43.026	34.038	78	38.677	33.485	99	40.593	33.729	177
D2	58.620	33.451	71	58.832	31.632	95	58.741	32.410	166
D3	45.565	33.226	62	45.714	32.366	112	45.661	32.672	174
D4	44.477	33.769	65	44.317	33.095	126	44.372	33.325	191
D5	46.375	31.875	96	48.603	30.385	78	47.374	31.207	174
D	47.543	33.185	372	46.888	32.324	510	47.164	32.687	882
Ma1	60.313	56.900	67	64.917	58.480	84	62.874	57.779	151
Ma2	48.262	51.988	65	60.671	55.380	82	55.184	53.880	147
Ma3	51.875	50.838	56	55.125	54.789	104	53.988	53.406	160
Ma4	39.333	44.133	45	57.224	56.837	107	51.928	53.076	152
Ma5	56.853	53.918	85	67.201	59.733	72	61.599	56.585	157
Ma	52.470	52.225	318	60.406	56.868	449	57.116	54.943	767
Mp1	56.250	67.132	60	67.184	66.990	87	62.721	67.048	147
Mp2	59.431	65.269	65	69.356	70.679	73	64.681	68.131	138
Mp3	59.917	64.241	60	65.482	71.313	114	63.563	68.874	174
Mp4	61.724	67.280	58	68.286	68.860	105	65.951	68.298	163
Mp5	61.511	63.835	90	70.827	69.560	75	65.745	66.437	165
Mp	59.907	65.382	333	67.963	69.526	454	64.554	67.772	787

Notes. D=Discretionary, Ma=Mandatory-aligned, Mp=Mandatory-polarized. 1st Half=Sequences (supergames) 1-4, 2nd Half=Sequences 5-7,8,9.

Table B.4: Mean Accepted Public Good Allocation Proposed by High Types

	1st Half			2nd Half			All Rounds		
Treat	Observed	Predicted	N	Observed	Predicted	N	Observed	Predicted	N
D1	47.894	40.000	47	44.643	40.000	56	46.126	40.000	103
D2	61.175	40.000	40	56.143	40.000	42	58.598	40.000	82
D3	47.500	40.000	34	47.218	40.000	55	47.326	40.000	89
D4	51.789	40.000	38	51.147	40.000	68	51.377	40.000	106
D5	53.250	40.000	44	50.393	40.000	28	52.139	40.000	72
D	52.335	40.000	203	49.574	40.000	249	50.814	40.000	452
Ma1	65.486	64.792	37	72.239	64.833	46	69.229	64.814	83
Ma2	54.886	64.692	35	72.639	64.754	36	63.887	64.723	71
Ma3	56.800	64.677	25	61.733	64.735	45	59.971	64.714	70
Ma4	46.211	64.737	19	59.200	64.755	55	55.865	64.750	74
Ma5	57.872	64.746	47	69.681	64.786	36	62.994	64.763	83
Ma	57.436	64.733	163	66.424	64.772	218	62.579	64.755	381
Mp1	60.313	86.810	32	75.872	83.220	39	68.859	84.838	71
Mp2	66.371	84.271	35	73.765	84.841	34	70.014	84.552	69
Mp3	61.400	85.178	25	70.082	83.466	61	67.558	83.963	86
Mp4	67.833	84.688	30	78.208	84.344	53	74.458	84.469	83
Mp5	72.690	84.212	42	84.459	83.825	37	78.203	84.031	79
Mp	66.317	84.966	164	75.946	83.899	224	71.876	84.350	388

Note. D=Discretionary, Ma=Mandatory-aligned, and Mp=Mandatory-polarized. 1st Half=Sequences (supergames) 1-4, 2nd Half=Sequences 5-7,8,9.

Table B.5: Mean Accepted Public Good Allocations Proposed by Low Types

	1st Half			2nd Half			All Rounds		
Treat	Observed	Predicted	N	Observed	Predicted	N	Observed	Predicted	N
D1	35.645	25.000	31	30.907	25.000	43	32.892	25.000	74
D2	55.323	25.000	31	60.962	25.000	53	58.881	25.000	84
D3	43.214	25.000	28	44.263	25.000	57	43.918	25.000	85
D4	34.185	25.000	27	36.310	25.000	58	35.635	25.000	85
D5	40.558	25.000	52	47.600	25.000	50	44.010	25.000	102
D	41.787	25.000	169	44.326	25.000	261	43.328	25.000	430
Ma1	53.933	47.167	30	56.053	50.789	38	55.118	49.191	68
Ma2	40.533	37.167	30	51.304	48.043	46	47.053	43.750	76
Ma3	47.903	39.677	31	50.085	47.203	59	49.333	44.611	90
Ma4	34.308	29.077	26	55.135	48.462	52	48.192	42.000	78
Ma5	55.592	40.526	38	64.722	54.681	36	60.034	47.412	74
Ma	47.248	39.071	155	54.727	49.409	231	51.724	45.258	386
Mp1	51.607	44.643	28	60.125	53.802	48	56.987	50.428	76
Mp2	51.333	43.100	30	65.513	58.333	39	59.348	51.710	69
Mp3	58.857	49.286	35	60.189	57.326	53	59.659	54.128	88
Mp4	55.179	48.629	28	58.173	53.077	52	57.125	51.520	80
Mp5	51.729	46.004	48	57.553	55.671	38	54.302	50.276	86
Mp	53.686	46.378	169	60.187	55.527	230	57.434	51.652	399

Note. D=Discretionary, Ma=Mandatory-aligned, and Mp=Mandatory-polarized. 1st Half=Sequences (supergames) 1-4, 2nd Half=Sequences 5-7,8,9.

Table B.6: Tobit Regression Analysis of Accepted Public Good Allocations by Proposer Types

VARIABLES	Public good-high p.type			Public good-low p.type		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	57.112***	65.743***	61.362***	43.082***	45.400***	49.876***
	(2.342)	(2.315)	(2.469)	(2.613)	(2.510)	(2.994)
Private Pts.	-0.856***	-0.861***	-0.840***	-0.484***	-0.489***	-0.488***
(responder)	(0.039)	(0.039)	(0.039)	(0.048)	(0.047)	(0.048)
Ma	12.530***	8.447***	5.890*	12.161***	10.434***	4.464
	(2.823)	(3.185)	(3.558)	(3.111)	(3.555)	(4.215)
Mp	22.672***	18.873***	17.439***	17.630***	14.762***	12.079***
	(2.821)	(3.193)	(3.546)	(3.101)	(3.516)	(4.137)
High Type						
(proposer)						
Sequence	1.322***		0.566*	0.175		-0.661
	(0.196)		(0.308)	(0.242)		(0.414)
Ma×Seq.			1.441***			1.579***
			(0.477)			(0.596)
Mp×Seq.			1.142**			1.090*
			(0.473)			(0.576)
Round	0.286*	-0.401		0.723***	0.347	
(in seq.)	(0.166)	(0.285)		(0.194)	(0.306)	
Ma×Rd.		1.147***			0.463	
		(0.412)			(0.470)	
Mp×Rd.		1.067**			0.807*	
		(0.412)			(0.466)	
Observations	1221	1221	1221	1215	1215	1215
Pseudo-R^2	0.052	0.048	0.052	0.014	0.014	0.013

Note. (i) Random-effect tobit model is estimated with lower bound=1 and upper bound=100 in the dependent variable. (ii) Columns (1)-(3) Public good allocations by high proposer type; (4)-(6) by low proposer type. (iii) Ma=1 if treatment=Ma ($\theta_H = 40$); Mp=1 if treatment=Mp ($\theta_H = 55$). (iv) Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. (v) We use McFadden's Pseudo R^2, $1 - Ln(L_M)/Ln(L_0)$, where $Ln(L_M)$ and $Ln(L_0)$ are the log likelihood from the full model and the model only with constant, respectively.

Table B.7: Tobit Regression Analysis of Accepted Public Good Allocations by Proposer Types, Mandatory Treatments Only

VARIABLES	Public good-high p.type			Public good-low p.type		
	(1)	(2)	(3)	(4)	(5)	(6)
Constant	67.595***	73.789***	66.707***	52.890***	53.042***	52.485***
	(2.158)	(2.037)	(2.331)	(2.695)	(2.505)	(3.009)
Private pts.	-0.987***	-1.018***	-0.991***	-0.606***	-0.608***	-0.606***
(responder)	(0.042)	(0.043)	(0.042)	(0.061)	(0.061)	(0.061)
Status quo	0.106***	0.127***	0.107***	0.178***	0.180***	0.173***
	(0.018)	(0.018)	(0.016)	(0.024)	(0.024)	(0.021)
Mp	9.086***	9.739***	11.149***	4.583*	4.975	4.991
	(2.187)	(2.579)	(2.984)	(2.663)	(3.158)	(3.821)
High type						
(proposer)						
Sequence	1.436***		1.662***	0.082		0.129
	(0.224)		(0.317)	(0.298)		(0.433)
Mp×Seq.			-0.450			-0.080
			(0.440)			(0.581)
Round	0.049	0.066		-0.114	-0.061	
(in seq.)	(0.206)	(0.280)		(0.288)	(0.371)	
Mp×Rd.		-0.209			-0.119	
		(0.369)			(0.498)	
Observations	769	769	769	785	785	785
Pseudo-R^2	0.091	0.084	0.091	0.026	0.026	0.026

Note. (i) Random-effects Tobit model is estimated with a lower bound=1 and upper bound=100 in the dependent variable. (ii) Columns (1)-(3) Public good allocations by high proposer type; (7)-(9) by low proposer type. (iii) Mp=1 if treatment=Mp ($\theta_H = 55$). (iv) Standard errors in parentheses: *** p<0.01, ** p<0.05, * p<0.1. (v) We use McFadden's Pseudo R^2, $1 - Ln(L_M)/Ln(L_0)$, where $Ln(L_M)$ and $Ln(L_0)$ are the log likelihood from the full model and the model only with constant, respectively.

Table B.8: Mean Accepted Private Points Allocated to Proposer's Account

	1st Half			2nd Half			All Rounds		
Treat	Observed	Predicted	N	Observed	Predicted	N	Observed	Predicted	N
D1	49.513	65.962	78	54.040	66.515	99	52.045	66.271	177
D2	24.296	66.549	71	24.274	68.368	95	24.283	67.590	166
D3	39.177	66.774	62	42.205	67.634	112	41.126	67.328	174
D4	50.446	66.231	65	53.397	66.905	126	52.393	66.675	191
D5	35.823	68.125	96	34.436	69.615	78	35.201	68.793	174
D	39.608	66.815	372	42.739	67.676	510	41.418	67.313	882
Ma1	25.552	40.852	67	19.667	39.421	84	22.278	40.056	151
Ma2	31.000	47.144	65	22.293	41.237	82	26.143	43.849	147
Ma3	37.964	47.887	56	30.519	44.212	104	33.125	45.498	160
Ma4	37.489	55.855	45	24.393	40.063	107	28.270	44.738	152
Ma5	26.376	44.628	85	19.750	36.663	72	23.338	40.975	157
Ma	30.761	46.509	318	23.800	40.573	449	26.686	43.034	767
Mp1	28.500	32.280	60	20.920	32.223	87	24.014	32.246	147
Mp2	25.000	34.229	65	19.014	28.352	73	21.833	31.120	138
Mp3	23.983	35.428	60	20.675	28.456	114	21.816	30.860	174
Mp4	21.707	32.368	58	19.019	30.547	105	19.975	31.195	163
Mp5	23.400	35.711	90	15.853	29.653	75	19.970	32.957	165
Mp	24.441	34.170	333	19.275	29.843	454	21.461	31.674	787

Note. D=Discretionary, Ma=Mandatory-aligned, and Mp=Mandatory-polarized. 1st Half=Sequences (supergames) 1-4, 2nd Half=Sequences 5-7,8,9.

Table B.9: Mean Accepted Private Points Allocated to Proposer's Account: Proposed by High Type

	1st Half			2nd Half			All Rounds		
Treat	Observed	Predicted	N	Observed	Predicted	N	Observed	Predicted	N
D1	43.106	60.000	47	43.911	60.000	56	43.544	60.000	103
D2	19.300	60.000	40	22.452	60.000	42	20.915	60.000	82
D3	31.235	60.000	34	31.600	60.000	55	31.461	60.000	89
D4	43.816	60.000	38	47.426	60.000	68	46.132	60.000	106
D5	25.341	60.000	44	23.571	60.000	28	24.653	60.000	72
D	32.709	60.000	203	36.245	60.000	249	34.657	60.000	452
Ma1	21.568	35.124	37	14.370	35.062	46	17.578	35.090	83
Ma2	23.400	35.257	35	11.389	35.147	36	17.310	35.201	71
Ma3	31.520	35.313	25	17.422	35.206	45	22.457	35.244	70
Ma4	28.947	35.236	19	19.200	35.175	55	21.703	35.191	74
Ma5	21.936	35.171	47	14.417	35.129	36	18.675	35.153	83
Ma	24.454	35.208	163	15.734	35.145	218	19.465	35.172	381
Mp1	21.406	12.925	32	6.795	15.754	39	13.380	14.479	71
Mp2	14.971	15.180	35	12.353	14.656	34	13.681	14.922	69
Mp3	13.280	14.026	25	10.508	16.131	61	11.314	15.519	86
Mp4	12.400	14.745	30	7.943	14.986	53	9.554	14.899	83
Mp5	14.190	15.295	42	7.865	15.534	37	11.228	15.407	79
Mp	15.299	14.514	164	9.098	15.472	224	11.719	15.067	388

Note. D=Discretionary, Ma=Mandatory-aligned, and Mp=Mandatory-polarized. 1st Half=Sequences (supergames) 1-4, 2nd Half=Sequences 5-7,8,9.

Table B.10: Mean Accepted Private Points Allocated to Proposer's Account: Proposed by Low Type

	1st Half			2nd Half			All Rounds		
Treat	Observed	Predicted	N	Observed	Predicted	N	Observed	Predicted	N
D1	59.226	75.000	31	67.233	75.000	43	63.878	75.000	74
D2	30.742	75.000	31	25.717	75.000	53	27.571	75.000	84
D3	48.821	75.000	28	52.439	75.000	57	51.247	75.000	85
D4	59.778	75.000	27	60.397	75.000	58	60.200	75.000	85
D5	44.692	75.000	52	40.520	75.000	50	42.647	75.000	102
D	47.893	75.000	169	48.935	75.000	261	48.526	75.000	430
Ma1	30.467	47.916	30	26.079	44.697	38	28.015	46.118	68
Ma2	39.867	61.012	30	30.826	46.003	46	34.395	51.928	76
Ma3	43.161	58.027	31	40.508	51.081	59	41.422	53.473	90
Ma4	43.731	70.923	26	29.885	45.232	52	34.500	53.796	78
Ma5	31.868	56.324	38	25.083	38.197	36	28.568	47.505	74
Ma	37.394	58.393	155	31.411	45.695	231	33.813	50.794	386
Mp1	36.607	54.400	28	32.396	45.604	48	33.947	48.845	76
Mp2	36.700	56.453	30	24.821	40.292	39	29.986	47.319	69
Mp3	31.629	50.714	35	32.377	42.642	53	32.080	45.852	88
Mp4	31.679	51.250	28	30.308	46.408	52	30.788	48.103	80
Mp5	31.458	53.575	48	23.632	43.400	38	28.000	49.079	86
Mp	33.314	53.245	169	29.187	43.838	230	30.935	47.823	399

Note. D=Discretionary, Ma=Mandatory-aligned, and Mp=Mandatory-polarized. 1st Half=Sequences (supergames) 1-4, 2nd Half=Sequences 5-7,8,9.

Table B.11: Mean Accepted Private Points Allocated to Responder's Account

	1st Half			2nd Half			All Rounds		
Treat	Observed	Predicted	N	Observed	Predicted	N	Observed	Predicted	N
D1	7.462	0.000	78	7.283	0.000	99	7.362	0.000	177
D2	17.085	0.000	71	16.895	0.000	95	16.976	0.000	166
D3	15.258	0.000	62	12.080	0.000	112	13.213	0.000	174
D4	5.077	0.000	65	2.286	0.000	126	3.236	0.000	191
D5	17.802	0.000	96	16.962	0.000	78	17.425	0.000	174
D	12.849	0.000	372	10.373	0.000	510	11.417	0.000	882
Ma1	14.134	2.248	67	15.417	2.099	84	14.848	2.165	151
Ma2	20.738	0.868	65	17.037	3.384	82	18.673	2.271	147
Ma3	10.161	1.276	56	14.356	0.999	104	12.888	1.096	160
Ma4	23.178	0.011	45	18.383	3.101	107	19.803	2.186	152
Ma5	16.771	1.454	85	13.049	3.604	72	15.064	2.440	157
Ma	16.769	1.266	318	15.794	2.559	449	16.198	2.023	767
Mp1	15.250	0.588	60	11.897	0.787	87	13.265	0.706	147
Mp2	15.569	0.502	65	11.630	0.968	73	13.486	0.749	138
Mp3	16.100	0.332	60	13.842	0.231	114	14.621	0.266	174
Mp4	16.569	0.352	58	12.695	0.593	105	14.074	0.507	163
Mp5	15.089	0.454	90	13.320	0.787	75	14.285	0.605	165
Mp	15.652	0.448	333	12.762	0.632	454	13.985	0.554	787

Note. D=Discretionary, Ma=Mandatory-aligned, and Mp=Mandatory-polarized. 1st Half=Sequences (supergames) 1-4, 2nd Half=Sequences 5-7,8,9.

Table B.12: Mean Accepted Private Points Allocated to Responder's Account: Proposed by High Type

	1st Half			2nd Half			All Rounds		
Treat	Observed	Predicted	N	Observed	Predicted	N	Observed	Predicted	N
D1	9.000	0.000	47	11.446	0.000	56	10.330	0.000	103
D2	19.525	0.000	40	21.405	0.000	42	20.488	0.000	82
D3	21.265	0.000	34	21.182	0.000	55	21.213	0.000	89
D4	4.395	0.000	38	1.426	0.000	68	2.491	0.000	106
D5	21.409	0.000	44	26.036	0.000	28	23.208	0.000	72
D	14.956	0.000	203	14.181	0.000	249	14.529	0.000	452
Ma1	12.946	0.084	37	13.391	0.105	46	13.193	0.095	83
Ma2	21.714	0.051	35	15.972	0.099	36	18.803	0.076	71
Ma3	11.680	0.010	25	20.844	0.059	45	17.571	0.042	70
Ma4	24.842	0.027	19	21.600	0.070	55	22.432	0.059	74
Ma5	20.191	0.083	47	15.903	0.085	36	18.331	0.084	83
Ma	18.110	0.059	163	17.842	0.082	218	17.957	0.072	381
Mp1	18.281	0.266	32	17.333	1.026	39	17.761	0.683	71
Mp2	18.657	0.549	35	13.882	0.503	34	16.304	0.526	69
Mp3	25.320	0.796	25	19.410	0.403	61	21.128	0.517	86
Mp4	19.767	0.567	30	13.849	0.670	53	15.988	0.633	83
Mp5	13.119	0.493	42	7.676	0.641	37	10.570	0.562	79
Mp	18.384	0.520	164	14.955	0.629	224	16.405	0.583	388

Note. D=Discretionary, Ma=Mandatory-aligned, and Mp=Mandatory-polarized. 1st Half=Sequences (supergames) 1-4, 2nd Half=Sequences 5-7,8,9.

Table B.13: Mean Accepted Private Points Allocated to Responder's Account: Proposed by Low Type

	1st Half			2nd Half			All Rounds		
Treat	Observed	Predicted	N	Observed	Predicted	N	Observed	Predicted	N
D1	5.129	0.000	31	1.860	0.000	43	3.230	0.000	74
D2	13.935	0.000	31	13.321	0.000	53	13.548	0.000	84
D3	7.964	0.000	28	3.298	0.000	57	4.835	0.000	85
D4	6.037	0.000	27	3.293	0.000	58	4.165	0.000	85
D5	14.750	0.000	52	11.880	0.000	50	13.343	0.000	102
D	10.320	0.000	169	6.739	0.000	261	8.147	0.000	430
Ma1	15.600	4.917	30	17.868	4.513	38	16.868	4.691	68
Ma2	19.600	1.821	30	17.870	5.954	46	18.553	4.322	76
Ma3	8.935	2.296	31	9.407	1.716	59	9.244	1.916	90
Ma4	21.962	0.000	26	14.981	6.306	52	17.308	4.204	78
Ma5	12.539	3.150	38	10.194	7.122	36	11.399	5.082	74
Ma	15.358	2.536	155	13.861	4.896	231	14.462	3.948	386
Mp1	11.786	0.957	28	7.479	0.594	48	9.066	0.728	76
Mp2	11.967	0.447	30	9.667	1.374	39	10.667	0.971	69
Mp3	9.514	0.000	35	7.434	0.032	53	8.261	0.019	88
Mp4	13.143	0.121	28	11.519	0.515	52	12.088	0.378	80
Mp5	16.813	0.421	48	18.816	0.929	38	17.698	0.645	86
Mp	13.000	0.378	169	10.626	0.634	230	11.632	0.526	399

Note. D=Discretionary, Ma=Mandatory-aligned, and Mp=Mandatory-polarized. 1st Half=Sequences (supergames) 1-4, 2nd Half=Sequences 5-7,8,9.

Table B.14: Proposed Public Good Allocations

	1st Half			2nd Half			All Rounds		
Treat	Observed	Predicted	N	Observed	Predicted	N	Observed	Predicted	N
D1	42.647	34.353	85	38.673	34.136	110	40.405	34.231	195
D2	57.141	33.471	85	56.891	31.682	110	57.000	32.462	195
D3	44.929	33.357	70	45.644	32.556	135	45.400	32.829	205
D4	43.000	33.786	70	42.867	33.111	135	42.912	33.341	205
D5	46.000	32.227	110	48.706	31.000	85	47.179	31.692	195
D	46.898	33.357	420	46.263	32.591	575	46.531	32.915	995
Ma1	56.965	55.774	85	62.573	59.486	110	60.128	57.868	195
Ma2	47.459	53.697	85	56.600	54.570	110	52.615	54.189	195
Ma3	49.714	51.291	70	53.356	55.818	135	52.112	54.272	205
Ma4	40.114	51.498	70	55.985	57.798	135	50.566	55.646	205
Ma5	54.041	55.528	110	65.441	59.697	85	59.010	57.345	195
Ma	50.258	53.829	420	58.143	57.319	575	54.815	55.846	995
Mp1	51.835	67.218	85	63.782	68.840	110	58.574	68.133	195
Mp2	58.082	67.034	85	64.845	71.498	110	61.897	69.552	195
Mp3	57.857	66.014	70	63.444	72.577	135	61.537	70.336	205
Mp4	59.286	67.856	70	69.533	71.429	135	66.034	70.209	205
Mp5	59.809	65.093	110	68.988	70.106	85	63.810	67.278	195
Mp	57.433	66.530	420	66.026	71.021	575	62.399	69.125	995

Note. D=Discretionary, Ma=Mandatory-aligned, and Mp=Mandatory-polarized. 1st Half=Sequences (supergames) 1-4, 2nd Half=Sequences 5-7,8,9.

Table B.15: Proposed Private Points Allocated to Proposer's Account

	1st Half			2nd Half			All Rounds		
Treat	Observed	Predicted	N	Observed	Predicted	N	Observed	Predicted	N
D1	50.506	65.647	85	54.727	65.864	110	52.887	65.769	195
D2	26.635	66.529	85	26.427	68.318	110	26.518	67.538	195
D3	40.629	66.643	70	43.756	67.444	135	42.688	67.171	205
D4	52.286	66.214	70	55.000	66.889	135	54.073	66.659	205
D5	37.636	67.773	110	35.459	69.000	85	36.687	68.308	195
D	40.955	66.643	420	43.953	67.409	575	42.687	67.085	995
Ma1	29.318	41.870	85	22.555	38.099	110	25.503	39.743	195
Ma2	34.259	45.123	85	28.564	42.011	110	31.046	43.367	195
Ma3	41.614	47.686	70	34.659	41.829	135	37.034	43.829	205
Ma4	40.971	48.017	70	28.230	38.806	135	32.580	41.952	205
Ma5	31.818	42.940	110	22.129	36.293	85	27.595	40.043	195
Ma	34.964	44.802	420	27.816	39.622	575	30.833	41.809	995
Mp1	34.565	32.279	85	22.945	30.468	110	28.010	31.257	195
Mp2	27.294	32.290	85	23.991	27.645	110	25.431	29.669	195
Mp3	27.671	33.657	70	24.489	27.180	135	25.576	29.392	205
Mp4	25.743	31.818	70	19.178	28.011	135	21.420	29.311	205
Mp5	27.236	34.497	110	18.447	29.160	85	23.405	32.171	195
Mp	28.555	33.015	420	21.958	28.386	575	24.743	30.340	995

Note. D=Discretionary, Ma=Mandatory-aligned, and Mp=Mandatory-polarized. 1st Half=Sequences (supergames) 1-4, 2nd Half=Sequences 5-7,8,9.

Table B.16: Proposed Private Points Allocated to Responder's Account

	1st Half			2nd Half			All Rounds		
Treat	Observed	Predicted	N	Observed	Predicted	N	Observed	Predicted	N
D1	6.847	0.000	85	6.600	0.000	110	6.708	0.000	195
D2	16.224	0.000	85	16.682	0.000	110	16.482	0.000	195
D3	14.443	0.000	70	10.600	0.000	135	11.912	0.000	205
D4	4.714	0.000	70	2.133	0.000	135	3.015	0.000	205
D5	16.364	0.000	110	15.835	0.000	85	16.133	0.000	195
D	12.148	0.000	420	9.784	0.000	575	10.782	0.000	995
Ma1	13.718	2.357	85	14.873	2.415	110	14.369	2.389	195
Ma2	18.282	1.180	85	14.836	3.420	110	16.338	2.443	195
Ma3	8.671	1.023	70	11.985	2.354	135	10.854	1.899	205
Ma4	18.914	0.485	70	15.785	3.396	135	16.854	2.402	205
Ma5	14.141	1.533	110	12.429	4.009	85	13.395	2.612	195
Ma	14.777	1.369	420	14.041	3.059	575	14.352	2.345	995
Mp1	13.600	0.502	85	13.273	0.692	110	13.415	0.609	195
Mp2	14.624	0.676	85	11.164	0.857	110	12.672	0.778	195
Mp3	14.471	0.329	70	12.067	0.243	135	12.888	0.272	205
Mp4	14.971	0.326	70	11.289	0.559	135	12.546	0.480	205
Mp5	12.955	0.410	110	12.565	0.734	85	12.785	0.551	195
Mp	14.012	0.455	420	12.016	0.593	575	12.858	0.535	995

Note. D=Discretionary, Ma=Mandatory-aligned, and Mp=Mandatory-polarized. 1st Half=Sequences (supergames) 1-4, 2nd Half=Sequences 5-7,8,9.

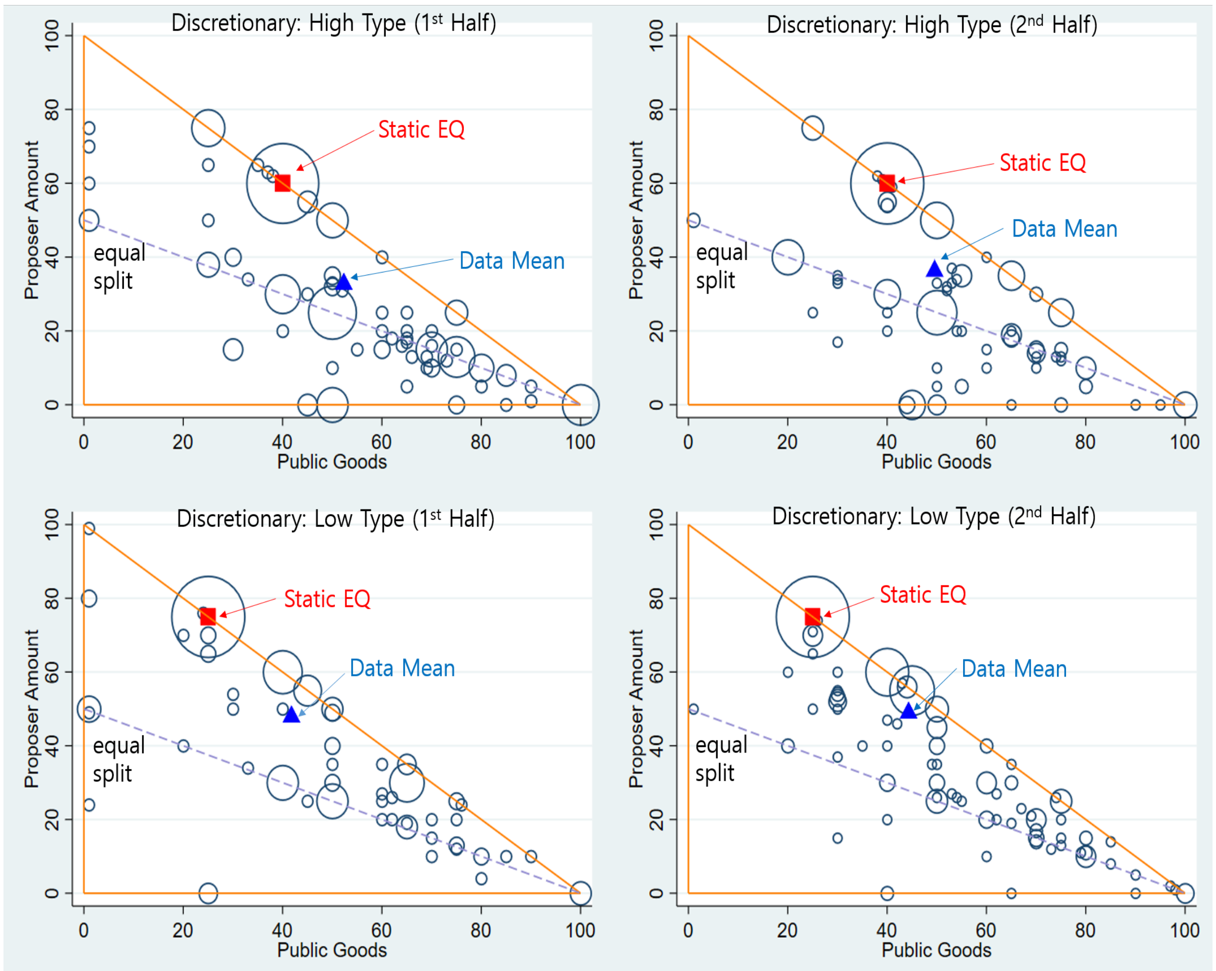


Figure B.3: Bubble Plots of Allocations by Proposer Types, First and Second Halves of Discretionary Treatment Sessions

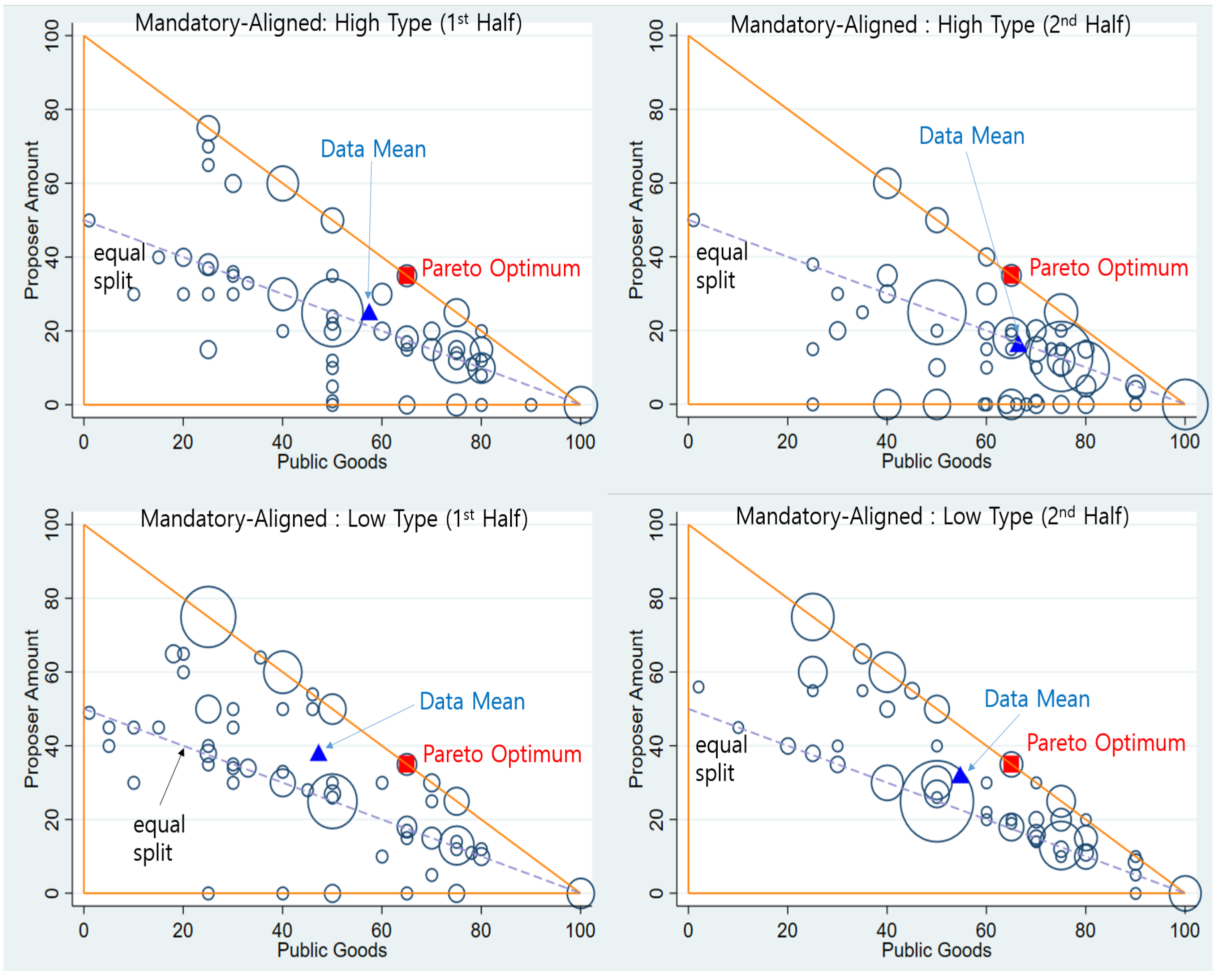


Figure B.4: Bubble Plots of Allocations by Proposer Types, First and Second Halves of Mandatory Aligned Treatment Sessions

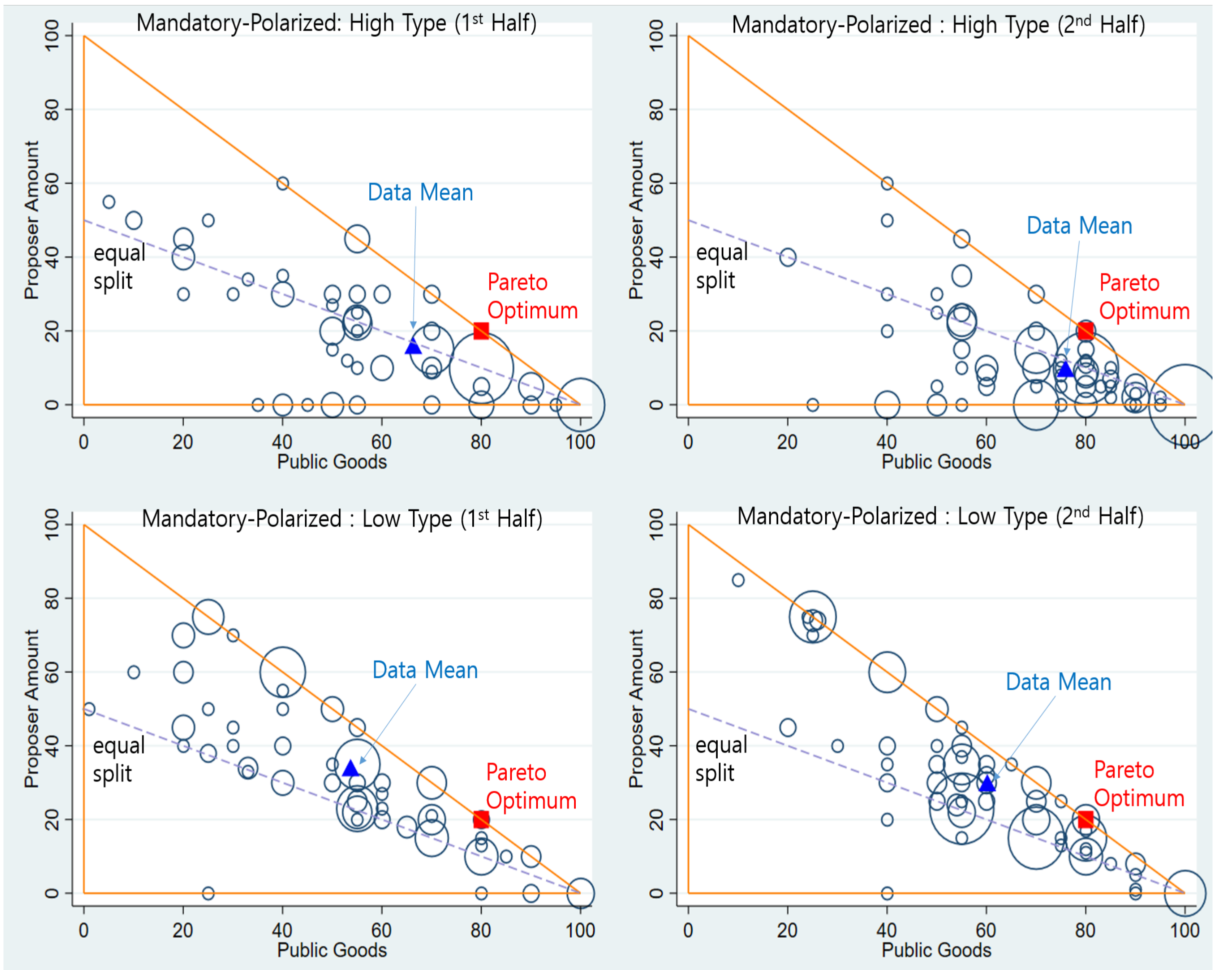


Figure B.5: Bubble Plots of Allocations by Proposer Types, First and Second Halves of Mandatory Polarized Treatment Sessions

Table B.17: Mean Accepted Public Good Allocations by Round in Supergame.

Rd	D	S.E.	N	Ma	S.E.	N	Mp	S.E.	N
All Subjects									
Rd	D	S.E.	N	Ma	S.E.	N	Mp	S.E.	N
1	48.86	1.65	166	56.20	1.76	171	58.78	1.75	171
2	45.56	1.42	159	55.27	1.78	133	61.79	1.88	138
3	48.18	1.69	155	55.08	1.91	135	65.01	1.81	140
4	49.24	1.87	120	56.69	2.19	96	66.77	2.15	102
5	45.19	2.14	91	56.88	2.23	74	70.06	2.23	79
6	46.41	2.53	68	60.72	2.72	60	67.26	2.72	58
7	45.00	4.15	29	61.46	4.30	24	70.00	3.57	24
8	45.67	4.25	30	59.79	4.09	24	68.80	4.38	25
9	45.39	3.90	23	61.79	4.33	19	69.61	4.97	18
10	47.45	3.60	22	59.71	3.94	17	62.72	4.31	18
11	42.30	6.29	10	70.71	6.49	7	76.88	5.42	8
12	45.89	9.67	9	74.71	6.73	7	80.00	5.16	6
High Proposer Type									
Rd	D	S.E.	N	Ma	S.E.	N	Mp	S.E.	N
1	52.60	2.16	91	60.87	2.18	87	71.23	2.09	65
2	51.08	1.83	85	62.71	2.53	60	66.99	2.65	77
3	51.65	2.40	78	61.45	2.71	66	69.84	2.54	73
4	53.52	2.44	61	63.22	2.95	49	73.40	3.45	50
5	50.15	2.66	41	60.15	2.96	41	76.70	2.53	44
6	46.63	3.13	38	66.43	3.20	30	78.00	2.64	23
7	51.29	5.85	14	65.77	5.69	13	72.50	4.09	14
8	44.07	6.82	15	64.40	4.80	10	71.25	6.66	12
9	44.29	3.99	14	63.55	4.91	11	77.80	5.95	10
10	48.64	5.44	11	60.00	7.48	7	71.11	5.76	9
11	37.67	9.60	3	75.00	0.00	3	80.71	4.42	7
12				82.00	6.18	4	77.50	4.79	4
Low Proposer Type									
Rd	D	S.E.	N	Ma	S.E.	N	Mp	S.E.	N
1	44.32	2.45	75	51.36	2.70	84	51.14	2.21	106
2	39.22	1.98	74	49.15	2.27	73	55.23	2.39	61
3	44.66	2.32	77	48.99	2.48	69	59.76	2.44	67
4	44.81	2.75	59	49.87	2.96	47	60.40	2.31	52
5	41.12	3.13	50	52.82	3.31	33	61.71	3.44	35
6	46.13	4.20	30	55.00	4.19	30	60.20	3.73	35
7	39.13	5.64	15	56.36	6.50	11	66.50	6.50	10
8	47.27	5.27	15	56.50	6.11	14	66.54	5.95	13
9	47.11	8.13	9	59.38	8.10	8	59.38	7.16	8
10	46.27	4.96	11	59.50	4.56	10	54.33	5.30	9
11	44.29	8.34	7	67.50	11.81	4			
12	42.88	10.41	8	65.00	12.58	3	85.00	15.00	2

Note. D=Discretionary, Ma=Mandatory-aligned, Mp=Mandatory-polarized.

Table B.18: Aggregate and Individual Efficiency

	1st Half	2nd Half	All Rounds
D: Aggregate-both p.types	94.70%	96.98%	96.02%
D: Aggregate-high p.type	96.35%	97.58%	97.03%
D: Aggregate-low p.type	92.72%	96.41%	94.96%
Ma: Aggregate-both p.types	96.92%	98.37%	97.77%
Ma: Aggregate-high p.type	97.80%	98.88%	98.42%
Ma: Aggregate-low p.type	95.98%	97.89%	97.13%
Mp: Aggregate-both p.types	97.04%	98.48%	97.87%
Mp: Aggregate-high p.type	97.83%	99.27%	98.66%
Mp: Aggregate-low p.type	96.27%	97.71%	97.10%
D: Proposer-high p.type	91.61%	93.68%	92.75%
D: Responder-low r.type	105.52%	105.13%	105.31%
D: Proposer-low p.type	96.61%	101.19%	99.39%
D: Responder-high r.type	89.47%	92.42%	91.26%
Ma: Proposer-high p.type	90.43%	89.85%	90.10%
Ma: Responder-low r.type	112.08%	116.36%	114.53%
Ma: Proposer-low p.type	93.37%	92.80%	93.03%
Ma: Responder-high r.type	98.16%	102.15%	100.55%
Mp: Proposer-high p.type	92.48%	94.04%	93.38%
Mp: Responder-low r.type	110.58%	111.72%	111.24%
Mp: Proposer-low p.type	100.60%	100.27%	100.41%
Mp: Responder-high r.type	93.94%	96.34%	95.32%

Notes. Efficiency data are based on accepted proposals. Aggregate efficiency is measured as the ratio of the sum of proposer's and responder's actual payoffs to the same sum of payoffs that would have been obtained at Pareto optimum. Individual (proposer/responder) efficiency is the ratio of individual proposer's or responder's actual payoff to the (hypothetical) individual payoff at Pareto optimum (assuming all private points going to proposer). All Rounds= all rounds in all sequences (supergames), 1st Half=all rounds in sequences 1-4, 2nd Half=all rounds in sequences 5-7,8,9. p.type=proposer type, r.type=responder type.

C Behavioral Models

How can we explain the departures we observe from theory predictions, specifically the non-zero allocation of private points to responders and the consequent effects on the allocations to the public good? One candidate explanation is that subjects have other-regarding preferences; they dislike unequal payoffs. We further assume that such inequity aversion is captured by Fehr and Schmidt (FS 1999) preferences, a workhorse model.

Consider first the case where the responder is a low type and the proposer (a high type) has allocated X_r points to the responder and X_p points to herself such that $0 \leq X_r \leq X_p$ points to the responder. The responder's FS preferences are given by:

$$U_r^{FS}(X_p, X_r, Y) = X_r + \theta_L \ln Y - \epsilon \max\left\{[X_p + \theta_H \ln Y - X_r - \theta_L \ln Y], 0\right\}$$

where ϵ is the responder's disutility from disadvantageous inequality (or envy). The responder accepts the proposal if $U_r(X_p, X_r, Y) \geq 0$, or if

$$X_r \geq \frac{\epsilon X_p + [\epsilon\theta_H - (1+\epsilon)\theta_L] \ln Y}{1+\epsilon} \tag{C.1}$$

Under FS preferences, the proposer's utility is:

$$U_p^{FS}(X_p, X_r, Y) = X_p + \theta_H \ln Y - \gamma(X_p - X_r) - \gamma(\theta_H - \theta_L) \ln Y$$

Here γ is the high proposer type's guilt parameter. FS assume that $\epsilon > \gamma$ at the individual level. The proposer maximizes U_p by choice of Y and X_r subject to (1) and $X_p = 1 - Y - X_r$ (Here we normalize the 100 point endowment to 1). If equation (1) holds with an equality then one can show that $Y^* = \theta_H + \theta_L$, which is higher than the level of contributions to the public good that we actually observe. Therefore, we rule this case out.

Instead we focus on the more promising case where the responder's constraint is *not* binding, so that equation (1) holds with a strict inequality, which yields:

$$Y^{FS} = \theta_H + \frac{\gamma}{1-\gamma}\theta_L$$

and

$$X_r > \underline{X}_r = \left(\epsilon\big(1 - \theta_H - \frac{\gamma}{1-\gamma}\theta_L\big) + [\epsilon\theta_H - (1+\epsilon)\theta_L] \ln[\theta_H + \frac{\gamma}{1-\gamma}\theta_L]\right)/(1+2\epsilon)$$

If the situation is reversed, so that the proposer is a low type and the responder is a high type, and the responder's constraint again holds with a strict inequality, then we find that

$$Y^{FS} = \theta_L + \frac{\gamma}{1-\gamma}\theta_H$$

and

$$X_r > \underline{X}_r = \left(\epsilon\big(1 - \theta_L - \frac{\gamma}{1-\gamma}\theta_H\big) + [\epsilon\theta_L - (1+\epsilon)\theta_H] \ln[\theta_L + \frac{\gamma}{1-\gamma}\theta_H]\right)/(1+2\epsilon)$$

Note that $\underline{X}_r$ is a lower bound for X_r in both cases and thus given Y^* we compute upper bounds, $\overline{X}_p = 1 - Y^* - \underline{X}_r$ for the proposer's own private allocation for each case. In our discretionary treatment, $\theta_H = .4$ and $\theta_L = .25$. From a meta study by Nunnari and Pozzi (2022), the mean estimates of the two FS preference parameters are $\epsilon = 0.467$ (with a 95% CI of $[0.302, 0.642]$) and $\gamma = 0.331$ (with a 95% CI of $[0.266, 0.396]$). Using these mean estimates, we have the following predictions for allocations by the two player types with FS preferences in the discretionary treatment, which we compare with the mean allocations found in our experimental data.

	FS Predictions			Means Exp. Data		
Proposer Type	Y^*	$\underline{X}_r$	$\overline{X}_p$	Y	X_r	X_p
High	0.524	0.175	0.301	0.508	0.145	0.346
Low	0.448	0.329	0.223	0.433	0.082	0.485

The FS other-regarding preference model explains well the public good levels assuming the responder's constraint is non-binding. However, it does not explain private point allocations so well. In particular, the mean private points allocated to the responder (the proposer) are below (above) the FS preferences lower (upper) bounds as shown in Table xx. Instead of relying on meta study estimates for ϵ and γ, we could directly derive values for these parameter using the mean allocations in our data. Doing so, we find that while γ is close to the meta study estimates, ϵ is close to zero or even negative, which is inconsistent with the FS assumption.

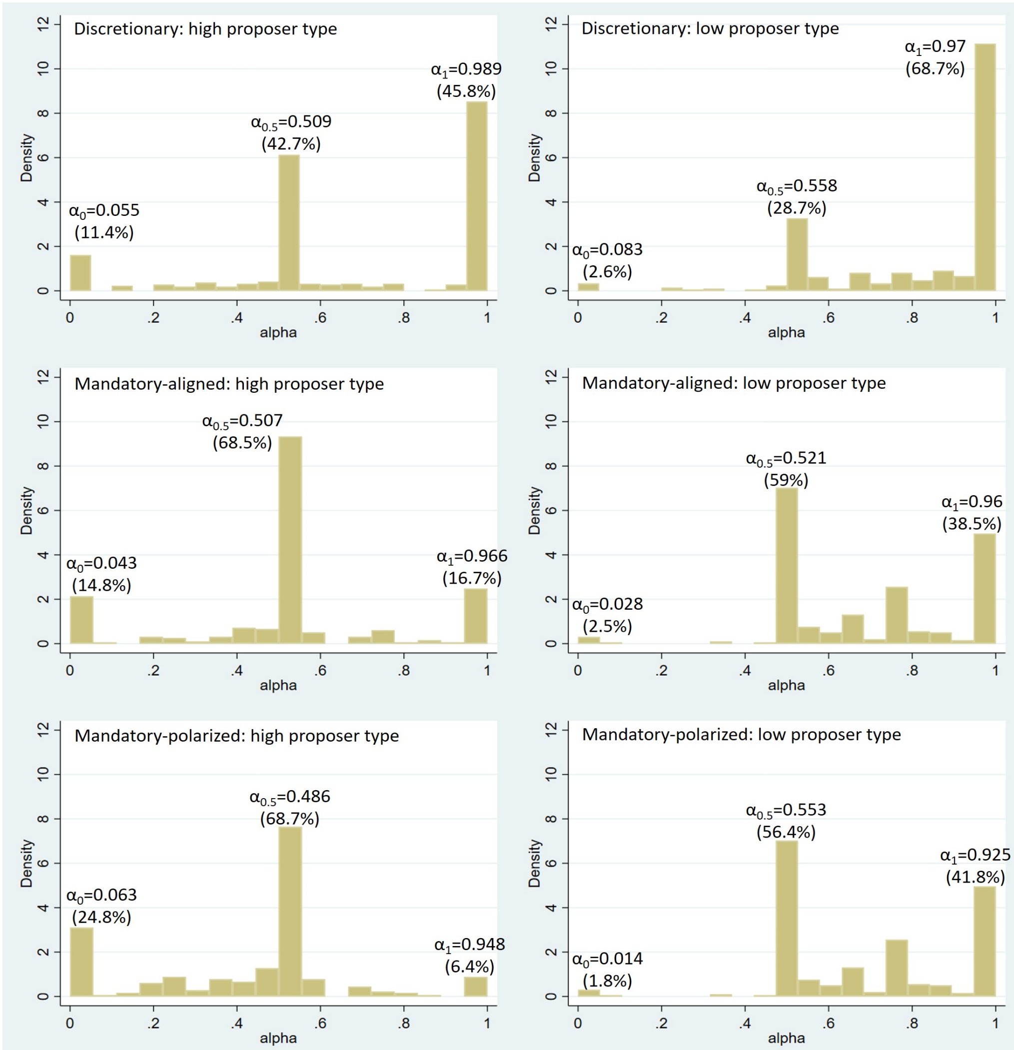
To better explain the heterogeneity in private point allocations that we, we consider a simpler model of other regarding concerns. As revealed by the allocations in the 2D simplex (Figure 5), it seems as though proposers first decide on a level for the public good amount Y and then decide how to allocate the remaining private points $100 - Y$ between themselves and the responder, taking into account the possibility that their proposal might be rejected. If we regard proposer power in our context as the ability of the proposer to take all (or most of) the points not allocated to the public good for themselves, then the evidence thus far suggests that subjects may be heterogeneous in the extent to which they exercise this proposer power, possibly according to different risk attitudes toward the likelihood of rejection (Roth et al. 1991).[19]

In order to further explore such heterogeneity, we consider how proposers allocate the private points remaining after their public good choices among all accepted proposals and we define this term by α. Specifically, let us define $\alpha = X_p/(100 - Y)$, as the proportion of the remaining allocation (after the choice of Y) is determined that the proposer gives to himself.[20] Figure 6 shows the distributions of α across the three treatments and the two proposer types.

Examination of Figure 6 reveals that there appear to be three α-types across all treatments and proposer types. First, the $\alpha = 1$ (α_1) type corresponds to those who exercise full proposer power. Second, the $\alpha = 0.5$ ($\alpha_{0.5}$) type corresponds to those who split the private points equally. Finally, there is the surprising $\alpha = 0$ (α_0) type that is particularly prominent among high type proposers and less so among low-type proposers. This type of proposers

[19] Theory predicts full proposer power every time in the discretionary treatment, and most of the time when the status quo level of public good is below Pareto optimum, in the mandatory treatments (see Figure B.1).

[20] In the case where $Y = 100$, α is treated as "missing" since in that case there are no remaining private points to be divided between proposer and responder.



Note. $\alpha = \frac{X_p}{100-Y}$ (if $Y < 100$; α is "missing" if $Y = 100$) where Y =public good allocations, X_p =proposer private points. The histogram is based on accepted proposals.

Figure C.1: Proposer's Own Private Points as a Proportion of Non-Public Good Private Points by Treatment and Proposer Type

doesn't exercise proposer power at all, and cedes all of the private points remaining after the public good allocation to the responder.

Given the evidence for three α-types from Figure 6, we estimated a finite mixture model to identify the mean α values for these three types, together with their proportions in our subject population (see Moffatt (2016), Ch.8). The finite mixture model assumes that the total number of types is finite and that the parameters of the type distributions, along with the "mixing proportions" (parameters revealing the proportion of subjects of each type), are estimated by the method of maximum likelihood estimation (MLE).

In particular, we estimate the mixture model with three types specified below:

$$\begin{aligned} \text{type } i: &\quad N(\alpha_i, \sigma^2),\ i = 0,\, 0.5,\, 1 \\ \text{mixing proportions}: &\quad p(\alpha = \alpha_i) = p_i,\ i = 0.5,\, 1 \\ &\quad p(\alpha = \alpha_0) \equiv p_0 = 1 - p_{0.5} - p_1. \end{aligned}$$

We assume a common variance σ^2 across each of the three type i's for the convenience of estimation. Hence we have six parameters ($p_{0.5}$, p_1, σ^2, α_0, $\alpha_{0.5}$ and α_1) to be estimated for our three-type finite mixture model (an estimate of p_0 is deduced using the delta method). The density associated with a particular value of α, conditional on the subject being of type α_i, is:

$$f(\alpha|\alpha_i) \;=\; \frac{1}{\sigma}\phi\Big(\frac{\alpha-\alpha_i}{\sigma}\Big)$$

(where ϕ is the standard normal density) and the marginal density associated with an observation of α is obtained by combining conditional densities with the mixing proportions:

$$f(\alpha;\, \alpha_0, \alpha_{0.5}, \alpha_1, \sigma, p_{0.5}, p_1) \;=\; \sum_{i\in\{0,0.5,1\}} p_i \times \frac{1}{\sigma}\phi\Big(\frac{\alpha-\alpha_i}{\sigma}\Big).$$

The above equation for the marginal density is used as the likelihood contribution for each observation. The sample log-likelihood, based on a sample α_1, α_2, ... , α_N is given by

$$LogL \;=\; \sum_{n=1}^{N} \ln f(\alpha_n;\, \alpha_0, \alpha_{0.5}, \alpha_1, \sigma, p_{0.5}, p_1).$$

Maximizing this sample log-likelihood with respect to (α_0, $\alpha_{0.5}$, α_1, σ, $p_{0.5}$, p_1) gives the maximum likelihood estimates of these six parameters. The results of the finite mixture model estimation are reported on in Tables C.1 - C.2.

Table C.1 reveals several interesting findings. First, the estimated α coefficients for each of the three types are indeed close to 0, 0.5 and 1.0, respectively and these hypothesized values often lie within the 95% confidence interval of the α coefficient estimates. Second, the proportion of $\alpha = 1$ types –those who exercise full proposer power– p_1, is greater for low proposer types than for high proposer types in all three treatments. This means that low proposer types are more likely to allocate all of the points in excess of their public good allocation to themselves as compared with the high proposer types; this behavior, amounting to the exercise of full proposer power, is generally consistent with the theoretical predictions (given the status quo levels achieved for the public good in the mandatory treatments). The proportion of $\alpha = 0$ types –those exercising *no* proposer power– p_0 is small, but opposite to the finding for p_1, the value for p_0 is significantly greater for high proposer types than for low proposer types across all three treatments. As the high proposer types earn a higher payoff from the public good, a larger proportion of these high proposer types offer nearly all of the private points in excess of the public good allocation to their low-type player match. This allocation of nearly all private points to the responder is generally at odds with theoretical predictions, but it appears to be the price that some high proposer types are willing to pay in order to get their proposals accepted by low type responders. Further,

Table C.1: Finite Mixture Model with Three Types (MLE)

Treat		High Proposer Type				Low Proposer Type			
		Coef.	S.E.	95% C.I.		Coef.	S.E.	95% C.I.	
D	α_0	0.055	0.009	0.037	0.074	0.083	0.024	0.036	0.130
	$\alpha_{0.5}$	0.509	0.005	0.499	0.518	0.558	0.009	0.541	0.575
	α_1	0.989	0.005	0.980	0.998	0.970	0.005	0.961	0.980
	σ	0.063	0.002	0.059	0.068	0.076	0.003	0.071	0.081
	p_0	0.114	0.015	0.084	0.144	0.026	0.008	0.011	0.041
	$p_{0.5}$	0.427	0.024	0.381	0.474	0.287	0.023	0.241	0.332
	p_1	0.458	0.024	0.411	0.505	0.687	0.024	0.641	0.734
Ma	α_0	0.043	0.011	0.021	0.065	0.028	0.026	-0.023	0.079
	$\alpha_{0.5}$	0.507	0.006	0.496	0.519	0.521	0.005	0.511	0.530
	α_1	0.966	0.015	0.938	0.995	0.960	0.006	0.948	0.972
	σ	0.072	0.003	0.067	0.078	0.067	0.003	0.062	0.072
	p_0	0.148	0.019	0.111	0.186	0.025	0.008	0.009	0.042
	$p_{0.5}$	0.685	0.026	0.634	0.736	0.590	0.026	0.539	0.641
	p_1	0.167	0.022	0.125	0.209	0.385	0.026	0.334	0.435
Mp	α_0	0.063	0.012	0.039	0.088	0.014	0.035	-0.055	0.084
	$\alpha_{0.5}$	0.486	0.007	0.472	0.500	0.553	0.009	0.536	0.571
	α_1	0.948	0.026	0.898	0.999	0.925	0.010	0.905	0.944
	σ	0.089	0.004	0.081	0.097	0.093	0.004	0.086	0.101
	p_0	0.248	0.026	0.198	0.299	0.018	0.007	0.005	0.032
	$p_{0.5}$	0.687	0.028	0.633	0.742	0.564	0.030	0.504	0.623
	p_1	0.064	0.015	0.035	0.093	0.418	0.030	0.358	0.477

Notes. $\alpha = \frac{X_p}{100-Y}$ (if $Y < 100$; α is "missing" if $Y = 100$) where Y =public good allocations, X_p =proposer private points. α_j and p_j are estimated parameter and proportion of each type j. The maximum likelihood estimation of finite mixture model is based on accepted proposals. D=Discretionary, Ma=Mandatory-aligned, Mp=Mandatory-polarized.

and consistent with the last observation, the proportion of equal split, $\alpha = 0.5$ proposer types, $p_{0.5}$, is always greater among *high* proposer types as compared with low proposer types. Finally, comparing the discretionary treatment with the two mandatory treatments, we observe that in the discretionary treatment, regardless of whether the proposer is a high or low type, we have $p_1 > p_{0.5} > p_0$, and these differences are often statistically significant (see the 95% confidence intervals). By contrast, in the two mandatory treatments, we find that the $\alpha = 0.5$ type always has the largest proportion, $p_{0.5} > \max\{p_0, p_1\}$, regardless of the proposer type (high or low). Second rank goes to p_1 with an exception in case of Mp-high proposer types where p_0 takes the second largest proportion. We also found that $p_{0.5}$ increased as we moved from low to high status quo (low status quo being lower than the Pareto efficient level and high status quo being above Pareto efficiency) as shown in Table C.2.

Overall, these findings suggest that proposer power, as measured by α is greatest in the discretionary treatment. In the mandatory treatments, the persistence of the status quo level of the public good increases the amount allocated to the public good, but this persistence also works to weaken proposer power, particularly among high proposer types.

Table C.2: Finite Mixture Model with Three Types (MLE) by Status Quo, Mandatory Treatments Only

Treat		Low Status Quo				High Status Quo			
		Coef.	S.E.	95% C.I.		Coef.	S.E.	95% C.I.	
Ma - high p.type	α_0	0.047	0.012	0.022	0.071	0.022	0.019	-0.016	0.060
	$\alpha_{0.5}$	0.502	0.006	0.489	0.514	0.521	0.008	0.505	0.536
	α_1	0.970	0.013	0.945	0.995	0.992	0.025	0.942	1.042
	σ	0.071	0.003	0.064	0.077	0.070	0.005	0.061	0.079
	p_0	0.158	0.023	0.113	0.204	0.141	0.032	0.078	0.203
	$p_{0.5}$	0.648	0.031	0.588	0.709	0.759	0.039	0.682	0.836
	p_1	0.194	0.026	0.143	0.244	0.100	0.028	0.046	0.154
Ma - low p.type	α_0	0.036	0.027	-0.017	0.089	0.000	0.047	-0.091	0.091
	$\alpha_{0.5}$	0.517	0.006	0.506	0.528	0.525	0.009	0.508	0.541
	α_1	0.968	0.006	0.956	0.980	0.931	0.015	0.903	0.960
	σ	0.064	0.003	0.058	0.069	0.066	0.005	0.057	0.075
	p_0	0.032	0.011	0.010	0.053	0.017	0.012	-0.006	0.041
	$p_{0.5}$	0.544	0.030	0.484	0.604	0.702	0.045	0.615	0.790
	p_1	0.425	0.030	0.366	0.484	0.280	0.044	0.194	0.366
Mp - high p.type	α_0	0.049	0.014	0.021	0.076	0.143	0.022	0.099	0.187
	$\alpha_{0.5}$	0.483	0.007	0.468	0.497	0.505	0.013	0.479	0.531
	α_1	0.939	0.025	0.891	0.988	0.995	0.040	0.917	1.074
	σ	0.087	0.004	0.079	0.095	0.083	0.008	0.068	0.098
	p_0	0.226	0.026	0.175	0.277	0.246	0.054	0.140	0.352
	$p_{0.5}$	0.706	0.029	0.650	0.762	0.681	0.058	0.567	0.796
	p_1	0.068	0.016	0.037	0.098	0.073	0.031	0.011	0.134
Mp - low p.type	α_0	0.000	0.042	-0.082	0.082	0.034	0.051	-0.067	0.134
	$\alpha_{0.5}$	0.559	0.009	0.540	0.577	0.517	0.016	0.486	0.549
	α_1	0.929	0.011	0.908	0.950	0.888	0.020	0.850	0.926
	σ	0.094	0.004	0.086	0.102	0.088	0.009	0.071	0.105
	p_0	0.014	0.006	0.002	0.026	0.039	0.022	-0.004	0.082
	$p_{0.5}$	0.563	0.032	0.499	0.626	0.602	0.061	0.482	0.721
	p_1	0.423	0.032	0.360	0.487	0.359	0.060	0.242	0.477

Notes. $\alpha = \frac{X_p}{100-Y}$ (if $Y < 100$; α is "missing" if $Y = 100$) where Y =public good allocations, X_p =proposer private points. α_j and p_j are estimated parameter and proportion of each type j. The maximum likelihood estimation of finite mixture model is based on accepted proposals. Low status quo is when the status quo level of public good is below Pareto efficiency while high status quo is the opposite case. Ma=Mandatory-aligned, Mp=Mandatory-polarized. p.type=proposer type.

Fairness or "inequity-aversion" concerns require proposers, particularly high type proposers to divide the private points remaining after the public good allocation equally between themselves and the responders. A small but sizeable fraction of the (mainly) high proposer types elect to give *all* of the private points in excess of the public good allocation to the responder, likely in acknowledgment of the higher return these high proposer types earn from the public good. The need to behave in an equitable manner to ensure adoption of proposals by both parties in the two mandatory treatments likely explains why the Pareto optimum level is not achieved in those two treatments, though subjects do get close to this level over the rounds of each supergame.