Transparency Versus Backroom Deals in Bargaining*

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Abstract

We design an experiment to study the effects of transparency on bargaining processes. We show that whether transparency arises endogenously depends on the degree of competition between subjects. In a competitive setting there is no transparency: subjects use private communication channels to compete for favors from those in power and establish backroom deals. In the absence of competition the bargaining process is transparent: subjects communicate publicly and outcomes are more egalitarian. We further show that in a competitive setting, imposing transparency by requiring all communication to be public reduces the observed competition between subjects and leads to more egalitarian outcomes.

1 Introduction

Article I, Section 5, Clause 3 of the United States Constitution mandates that “Each House shall keep a Journal of its Proceedings.” Today, the Congressional Record provides an accurate and full account of all floor activities in the House and the Senate so that the public and other elected officials can know of what is said when Senators and Representatives discuss a bill on the floor.¹

However, while much of the debating of laws takes place on the Senate and House floors, it is well known that politicians routinely engage in private discussions, form agreements and

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¹The Congressional Record is published by the Government Printing Office and is publicly available at http://www.gpo.gov/fdsys/browse/collection.action?collectionCode=CREC.
establish quid pro quos in order to get bills passed. While ubiquitous, backroom dealing has been the object of much political outcry. A recent example is from Senator Jeff Sessions who declared on January 16th, 2014:

“The Senate is where the great issues of our time are supposed to be examined, reviewed, and discussed before the whole nation. Yet, in the last few years, we have witnessed the dramatic erosion of Senators' rights and the dismantling of the open legislative process [...] All of us, both parties, have a responsibility to stop and reverse these trends. It’s in the national interest. It’s the right thing to do. All of us owe our constituents an open, deliberative process where the great issues of the day are debated in full and open public view [...] The democratic process is messy, sometimes contentious, and often difficult. But it is precisely this legislative tug of war, this back and forth, which forges national consensus. While secret deals may keep the trains running on time, they often keep them running in the wrong direction.”

This sentiment is neither new nor unique. Senators from both parties have tried to increase transparency by using two approaches. The first approach removes the possibility of backroom dealmaking by simply forcing transparency. The second approach is to increase the size of the majority needed to pass a bill, rendering backroom dealing simply impractical. Given that each House “may determine the Rules of its Proceedings,” both solutions are possible to implement. However, little is known about the effects of these solutions on the bargaining process. This is precisely the goal of the current paper.

2The Universal Health Care Act is a point in case. Indeed, in exchange for their support of the bill, a number of Senators received special provisions, which received colorful and sometimes disparaging names such as the “Louisiana Purchase,” the “Gator Aid” the “Cornhusker Kickback,” the “Montana Earmark,” the “New England Handouts,” and the “Dodd Clinic.” The “Louisiana Purchase” earmarks is money for the states in which every county was affected by Hurricane Katrina (only Louisiana would qualify). The “Gator Aid” gives transitional extra aid to Florida for its Medicare Advantage enrollees. The “Cornhusker kickback” earmark allows for $100,000,000 to fund Medicaid recipients in Nebraska. The “Montana Earmark” provides $300,000 for the Center for Asbestos Related Disease in Montana. The “New England Handouts” provide $600,000,000 for Medicaid funding to Vermont and Massachusetts. The “Dodd clinic” earmark provides $100,000,000 for a new health care facility in Connecticut.

3Senator Jim DeMint while chairman of the Senate Steering Committee, declared on December 13th, 2009 that “Americans are disgusted by the earmarks, kickbacks, and backroom deals.” Ten days later on December 23rd while holding the senate floor offered “an amendment that would ban the practice of trading earmarks for votes.” See http://www.gpo.gov/fdsys/pkg/CREC-2009-12-23/pdf/CREC-2009-12-23-bk2.pdf page S13832. Senator Mike Lee on April 10th 2013 stated: “I hope others will join me and my colleagues in demanding that our discussions take place in full view of the American people.” See http://www.gpo.gov/fdsys/pkg/CREC-2013-04-10/pdf/CREC-2013-04-10-senate.pdf page S401. This approach has also been suggested by Senators Elizabeth Warren and Thad Cochran, who, on January 8th, 2014, supported such a ban affirming that “increased transparency will shut down backroom deal-making and ensure that Congress, citizens and watchdog groups can hold regulatory agencies accountable for strong and effective enforcement that benefits the public interest.” http://www.warren.senate.gov/?p=press_release&id=310


5See Article I, Clause V, Section II of the United States Constitution.
In this paper we study (1) the effects of backroom dealing on bargaining outcomes (2) how increasing the size of the majority impacts the results of the bargaining process (3) when and whether transparency arises endogenously in a bargaining process and (4) whether imposing transparency reduces quid pro quos or simply shifts the conversations once held in the backroom into the public sphere.

In our experiment we use the multilateral bargaining setup of Baron-Ferejohn (1989), which is an \( n \)-player extension to the alternating offers Rubinstein bargaining game. We start with a baseline in which subjects are not allowed to communicate and then vary whether transparency is imposed or not by changing the communication tools available to the subjects: we either let subjects choose whether to send public or private messages (communication is unrestricted)\(^6\) so that they can choose whether or not to be transparent, or we impose transparency by making all communication exclusively public.\(^7\) The second element we vary is captured by the voting rule, that is, the size of the majority needed to reach an agreement. Varying the size of the majority needed to reach an agreement can be viewed as varying the degree of competition between non-proposers for a place in the coalition. Indeed, when the proposer of a bill only needs a simple majority of votes, non-proposers need to compete for a place in the coalition and competition between them is high. When unanimity is required, all non-proposers are in the coalition and the competition between them is low. In short, the size of the majority needed is negatively related to the degree of competition between players. These two dimensions (changing the availability of communication tools and the size of the majority) echo the two avenues used in the legislature to influence transparency that we discussed above.

While models have incorporated the ability of people to communicate, how people choose to do so has yet to be evaluated. Empirically, this question is difficult to tackle as by definition, when deals are secret, they take place outside of the public eye and it is all but impossible to confirm with certainty whether any quid pro quos took place. By providing a controlled environment in which we can vary a single element and keep all others constant, the laboratory provides an ideal setting in which we can evaluate how subjects use communication tools and how the impact of communication may vary depending on the voting rules in place.

We have four results. We start by showing that the mere introduction of unrestricted communication has an asymmetric impact on bargaining outcomes that depends on the voting rule: when competition is high, as in the simple majority setting, allowing for communication increases proposer shares; when competition is low, as in the unanimity setting, allowing for communication reduces proposer shares.

We then show that when subjects can choose whether or not to be transparent, whether transparency arises endogenously depends on the voting rule and the degree of competition between non-proposers. Indeed, the unrestricted communication tool is used very differently

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\(^6\) All communication takes place via computer terminals. When communication is unrestricted, subjects are allowed to send any kind of text message to any one in their group, whether all members or only a subset.

\(^7\) Here, all messages are public and sent to all members of the group.
in the two voting rules. When competition is high as in the majority rule, subjects choose to engage in backroom conversations. In a non-competitive setting, as in the unanimity rule, subjects eschew backroom deals and use the communication tool in a transparent way by making public statements: transparency arises endogenously.

Third, we show that public and private statements serve opposite purposes. When subjects choose to communicate via backroom channels, each subject lobbies for himself and competes for favors from those in power. On the other hand, when subjects choose to make public statements, these statements serve to promote equality and more egalitarian distributions of resources between all the players.

Finally, we show that imposing transparency leads to less opportunity for those who hold power to use the system for their own interests. Indeed, within the majority setting, imposing public communication and removing the possibility of backroom deals, leads to more egalitarian outcomes. The content of conversation changes depending on the communication structure that we impose: public communication channels don’t simply substitute for private ones, and agreements that took place behind closed doors do not take place publicly. In fact, a noticeable feature of public communication tools is that subjects refrain from using them to lobby for themselves.

This paper contributes to a growing literature that studies effects of transparency on political and economic outcomes. The issue of transparency has been studied in various other contexts. These include the optimal design of fiscal institutions (Gavazza and Lizzeri (2009), Alt and Lassen (2006)); mass-media competition to deliver news embedded in the model of political elections (Stromberg (2004)); career concerns (Prat (2005) and (Levy (2007)); political recruitment (Mattozzi and Merlo (2007)); transparency of individual voting in a legislative context (Carey (2012)). In this paper we look at a new aspect of transparency: the transparency of the negotiation process itself.

Our paper also contributes to the empirical and experimental literatures that investigate bargaining outcomes. Much of these literatures have concentrated on the study of proposer power and the distribution of resources. For empirical work see Knight (2005 and 2008) as well as Larcinese, Snyder and Testa (2013). Experimental work is reviewed in Morton (2012) and includes McKelvey (1991), Frechette, Kagel and Lehrer (2003) and Diermeier and Morton (2004). So far, the experimental literature has not addressed the issue of transparency. In fact, all but two papers have left communication out of the equation altogether. Here, we are the

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Knight (2005) provides an empirical test of whether proposal power is valuable in negotiations over budget allocations of congressionally earmarked transportation projects across congressional districts in 1991 and 1998. The results of the estimation support the key qualitative prediction of legislative bargaining model: the existence of proposer power. In the second paper, Knight (2008) analyzes the relationship between legislative representation, bargaining power and the geographic distribution of federal funds both theoretically and empirically. The results suggest that increases in representation lead to increases in jurisdiction spending. The underlying mechanism highlights the importance of two channels: control over agenda captured by the proposer power and the vote cost channel that plays a role in forming the cheapest possible coalition.

Two recent papers have allowed subjects to communicate in a legislative bargaining setting (see Agranov and
first to address the question of how transparency can arise endogenously, whether or not this
depends on the voting rules in place, and how communication structures impact behavior and
bargaining outcomes.

Our paper is structured in the following way. The theory and experimental design are in
Sections 2 and 3, respectively. Our experimental results are in Section 4. Finally, Section 5
concludes.

2 Theoretical Model and Predictions

We use a classical divide-a-dollar game in which a group of $N \geq 3$ players decides how to
allocate a fixed budget of $\$1$ among themselves using the $q$-voting rule, where $q \leq N$. This
game provides an ideal setup to study the effects of competition on bargaining behavior. Indeed,
by varying just one parameter $q$ we are able to change the amount of competition that group
members experience, while keeping all other aspects of the group decision-making process
constant. The parameter $q$ represents the degree of consensus required to reach the agreement
with high values of $q$ corresponding to low competition between group members.

The procedural rules surrounding the passage of bills are varied. For example, in the
European Union’s Council of Ministers, some proposals require a simple majority of votes to
pass, while others require unanimous consent. In parliamentary democracies, simple majority
rules are commonly used to pass motions on the floor or to form a coalitional government. In
the United States Congress, some bills require the support of a simple majority while others
require the support of a two thirds majority. In this paper we focus on two voting rules
commonly used in practice: the unanimity rule ($q = N$) and the majority rule ($q = \frac{N+1}{2}$).

Conducting an experiment on bargaining requires choosing a bargaining protocol. We use
the standard protocol of Baron and Ferejohn (1989), which has two advantages: it is straight-
forward to explain to subjects and it captures the essential features of group decision-making.
At the beginning of the first bargaining stage, one group member is chosen at random to make
a proposal. A proposal is a vector $(x^i_1, ..., x^i_N)$ that specifies the share of each group member
($x^i_j$ indicates the share offered to member $j$ by member $i$, $x^i_j \geq 0$, $\forall j$). Proposals have to satisfy
the budget constraint $\sum_{j=1}^{N} x^i_j \leq 1$. The proposed allocation is observed by all group members
and is immediately voted on. If $q$ members support the proposal, then it is implemented and the
committee adjourns. If it is rejected (gets less than $q$ votes) then the budget shrinks by a factor
of $(1 - \delta)$, the committee moves to the next bargaining stage and the process repeats itself (with

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10 Theoretical studies of the effects of voting procedures on the policy outcomes date back to Condorcet (1785)
and Buchanan and Tullock (1962). For the dynamic model of legislative bargaining with public goods see
Battaglini, Nunnari and Palfrey (2012) who analyze theoretically Markov perfect equilibrium under different
voting rules and study this prediction experimentally.

11 In fact, each House can determine the size of the majority needed.
a (possibly) new proposer being chosen at random etc...) until a proposed distribution receives $q$ votes. Committee members have preferences that depend only on their own share. The factor $(1 - \delta)$ represents the cost of delay in reaching an agreement and allows for efficiency comparisons between different final allocations. Finally, in some treatments, we allow group members to engage in cheap-talk communication after a member was chosen to make a proposal and before he/she submits proposed allocation.

In the remainder of this section we discuss the main trade-offs that arise in this setup and refer the reader to Appendix A for the derivation of the equilibrium. Our discussion is focused on understanding how the degree of competition/consensus $q$ and the availability of cheap-talk communication affects bargaining outcomes.

The general structure of the symmetric stationary subgame perfect equilibrium in this bargaining game is independent of the degree of competition $q$ and the availability of communication channels. In this equilibrium, the proposer randomly selects $q - 1$ other committee members (the coalition partners) and offers them an allocation that makes them exactly indifferent between supporting the bill and rejecting it. The proposer appropriates the remainder of the budget. The committee members that are not invited into the coalition (if those exist) get zero shares. Non-proposers support any bill that gives them at least as much as their continuation value and reject any bill that gives them an amount below that. Thus, in the equilibrium, all proposals pass without delay and the distribution of resources depends on the voting rule in place, $q$.

The crucial difference between simple majority and unanimity voting rules follows from the equilibrium strategy of the proposer described above. A simple majority rule allows the proposer to pass the bill with the support of a sub-group of members only, which creates an internal competition between non-proposers for a place in the coalition. The Unanimity rule requires the proposer to obtain the support of all members of the group, which completely removes this internal competition between non-proposers. The symmetry in members’ discount factors and recognition probabilities implies that non-proposers’ continuation values are the same irrespective of the parameter $q$ (and equals $\frac{\delta}{n}$). Due to the necessity to allocate a higher number of positive shares when the unanimity rule is implemented, the share of resources that the proposer is able to appropriate when unanimity is required is smaller than in the simple majority case.

In the experiments we use a group of $N = 5$ members, which bargain over a budget of 250 tokens, and the budget shrinks by 20% following a rejection. We vary the degree of competition for a place in the coalition from a simple majority $q = 3$ to unanimity $q = 5$. Table 1 summarizes the equilibrium predictions discussed above.

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**Table 1**

<table>
<thead>
<tr>
<th>$q$</th>
<th>Summary of Equilibrium Predictions</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

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12In other words $(1 - \delta) = 0.2$. 
Proposer share | Coalition member share | Size of the coalition
--- | --- | ---
Majority $q = 3$ | 170 tokens (68%) | 40 tokens (16%) | 3 members
Unanimity $q = 5$ | 90 tokens (36%) | 40 tokens (16%) | 5 members

Table 1: Distribution of resources in the symmetric SSPE in tokens (and % of budget).

3 Experimental Design

All the experiments were conducted at the California Social Sciences Experimental Laboratory (CASSEL) at UCLA between January 2012 and January 2013. The subjects were recruited from the general undergraduate population of UCLA and no subject participated in more than one experimental session. All the interactions between participants were performed through the computer terminals using the MULTISTAGE software.\textsuperscript{13}

Treatments differ in two dimensions: the presence/type of communication available to the bargainers (no communication, unrestricted communication or public communication only) and the voting rule used to pass the proposal (majority or unanimity). Complete instructions for one of the treatments are presented in the Appendix. Each session lasted about one hour. The total of 460 subjects participated in all the sessions.

In all treatments we implemented the standard Baron-Ferejohn bargaining protocol described in Section 2. Before the beginning of each bargaining session, subjects were randomly divided into groups of 5 members and each was randomly assigned an ID number. At the beginning of each bargaining session, one of the five members is randomly chosen to be the proposer. His/her assigned ID number is revealed to the entire group. The proposer proposes an allocation that is observed by all members of the group, with shares to each member clearly indicated. After that, all members of the group including the proposer vote to accept or reject the proposed allocation. If the allocation receives $q$ or more votes then it passes and the bargaining session is over. If the allocation receives less $q$ votes, then the budget shrinks by 20\% and the bargaining continues with a random selection of a (possibly) new proposer from the same group. This process repeats itself until a proposer’s allocation gets at least $q$ votes and passes. Under the simple majority rule, $q$ is equal to 3 and under the unanimity rule $q$ is equal to 5. After each bargaining session subjects are randomly re-matched to form new groups of 5 voters each and are assigned new ID numbers. Random matching between bargaining sessions is used because we are interested in the one-shot bargaining game as opposed to repeated bargaining. At the end of the experiment, we sum up all the tokens earned by each subject in all bargaining sessions and convert them to the US dollars using the rate 50 tokens = $1.

In the Majority Baseline treatment, no communication was allowed.

The Majority Unrestricted treatment was similar to the Majority Baseline treatment except

\textsuperscript{13}This software was developed from the open source Multistage package and available for download at http://software.ssel.caltech.edu/
for one feature. After the proposer was determined and his/her ID number revealed to the
group members, but before the proposer submitted his proposal, members of the group could
communicate with each other using a chat tool. This chat tool allowed subjects to send any
message they wanted to any subset of members in their group. For instance, members could
send private messages that would be delivered only to a particular member or to a subset of
members, and they could also send public messages that would be observed by all members of
the group. The duration of the communication was in the hands of the proposer: the chat tool
was disabled when the proposer submitted his proposal for a vote. Our software recorded all
the messages sent by subjects during the communication stage.

The Majority Public treatment was identical to the Majority Unrestricted treatment except
that subjects were only allowed to send messages that would be received by all the other mem-
bers of their group. The Majority Public Long treatment was identical to the Majority Public
treatment except that it had twice the number of bargaining sessions: 30 sessions versus 15
sessions.

The Unanimity Baseline and Unanimity Unrestricted treatments were identical to the
Majority Baseline and Majority Unrestricted treatments, respectively, except that passing the
proposal required all 5 members of the committee to support it. Table 2 summarizes the details
of all our experiments.

<table>
<thead>
<tr>
<th>Treatment</th>
<th># Exp. Sessions</th>
<th># Bargain. Sessions</th>
<th>Total Subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Majority Baseline</td>
<td>3</td>
<td>15</td>
<td>95</td>
</tr>
<tr>
<td>Majority Unrestricted</td>
<td>3</td>
<td>15</td>
<td>110</td>
</tr>
<tr>
<td>Majority Public</td>
<td>3</td>
<td>15</td>
<td>80</td>
</tr>
<tr>
<td>Majority Public Long</td>
<td>1</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Unanimity Baseline</td>
<td>3</td>
<td>15</td>
<td>80</td>
</tr>
<tr>
<td>Unanimity Unrestricted</td>
<td>3</td>
<td>15</td>
<td>75</td>
</tr>
</tbody>
</table>

Table 2: Experimental Design

4 Results

4.1 Bargaining outcomes with unrestricted communication.

In this subsection, we start by exploring the effect of communication on bargaining outcomes
when communication is unrestricted (subjects are free to choose how to communicate -publicly
or privately) under both voting rules. In other words, we focus on the Majority Unrestricted
and Unanimity Unrestricted treatments. We evaluate bargaining outcomes through two lenses:
efficiency of the process and the distribution of resources.
Efficiency

Efficiency in this setup is measured by the probability of delays occurring. Indeed if during the voting stage a proposer was unable to gather the required number of votes, delays in implementing a budget occur and an inefficiency is created since the budget shrinks by 20% before a new round of voting can take place. Previous experimental studies have documented higher delays in bargaining situations in which unanimity (as opposed to a simple majority) is required to pass a proposal (see Miller and Vanberg (2013)). This has served as support for the theoretical argument by Buchanan and Tullock (1962) that less-than-unanimity decision rules are more efficient.

We find that the effects of communication on efficiency depend on the voting rule in place. Indeed, delays are relatively rare with or without communication under the majority rule (15% and 12.6% of the time in the last five periods, respectively). In the unanimity rule, the fraction of delays when no communication is allowed is staggeringly high at 43.8%. Communication reduces the amount of delays from 43.8% to 6.7%, and dramatically improves efficiency.\textsuperscript{14}

Distribution of Resources

Table 3 presents the predicted shares and observed mean and median shares of proposers in the majority and unanimity rules. We focus here on the proposals that passed right away in the last five bargaining periods.\textsuperscript{15}

<table>
<thead>
<tr>
<th></th>
<th>Majority</th>
<th>Unanimity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Theory</td>
<td>170</td>
<td>90</td>
</tr>
<tr>
<td>Baseline</td>
<td>Mean</td>
<td>110</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>110</td>
</tr>
<tr>
<td>Unrestricted Communication</td>
<td>Mean</td>
<td>144</td>
</tr>
<tr>
<td></td>
<td>Median</td>
<td>150</td>
</tr>
</tbody>
</table>

\textbf{Table 3:} Shares of proposers in tokens. In bold is the lab data closest to theoretical predictions for each treatment.  
Note: Last five bargaining periods with no delays.

The introduction of unrestricted communication has opposite effects on proposer power in the two treatments. While the average share of the proposer increases from 110 tokens to 144 tokens in the Majority treatment when communication is available, it decreases in the

\textsuperscript{14}A two-sided test of proportions at the group level shows these are statistically different with \(p<0.001\). At the session level, the two-sided test is also supports the improvement in efficiency with a \(p\)-value as good as it can be with three sessions for each treatment (\(p=0.014\)).

\textsuperscript{15}Appendix B presents the same results looking at all proposals that passed regardless of when, as well as all proposals that were submitted regardless of if they passed right away. The conclusions are identical.
Unanimity treatment from 64 tokens to 50 tokens.\textsuperscript{16}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{Mean proposer shares as a fraction of theoretical prediction for both the Majority and Unanimity treatments, with and without communication. The 95\% confidence intervals for proposer shares as a fraction of what is theoretically predicted are represented for each treatment. Notes: Last five bargaining periods with no delays.}
\end{figure}

Figure 1 presents proposer power in the four treatments as a fraction of what is theoretically predicted. While proposers enjoy significantly higher shares of resources than coalition partners in both voting rules when there is no communication,\textsuperscript{17} proposers under-exploit their power relatively to the prediction of stationary SSPE: they extract 64.6\% of what is theoretically predicted under the majority rule and 71\% under the unanimity rule. This echoes a well-known and robust finding in bargaining games, which establishes the failure of the proposers to extract equilibrium rents in bargaining games without communication.\textsuperscript{18} Adding communication brings proposer shares about 20 percentage points closer to the theory in the Majority treatment (indeed they go from 64.6\% of the theoretically predicted shares to 84.6\%). In the Unanimity treatment proposer shares drop by about 15 percentage points away from the theory (going from 71\% of the theoretically predicted shares to 55.8\%). In other words, even though without communication proposers can extract similar fractions of the theory regardless of the

\textsuperscript{16}Ranksum tests confirm that shares of the proposers significantly increase with communication in the majority setting ($p < 0.001$), while they significantly decrease in the unanimity setting ($p < 0.001$). The unit of observation is, for each subjects when he/she was a proposer, the average number of tokens that they were able to collect (one observation per subject). This conclusion follows through if instead we use a session as the unit of observation.

\textsuperscript{17}A Ranksum test in each of the treatments shows proposers receive more shares than other coalition members (p-value<0.001). The unit of observation is the average number of tokens that a each subject captures when he/she is a proposer. This conclusion follows through if instead we use a session as the unit of observation.

\textsuperscript{18}The under-exploitation of proposer power is found in Frechette, Kagel and Lehrer (2003), Frechette, Kagel and Morelli (2005a) and (2005b) and Battaglini, Nunnari and Palfrey (2012). Agranov and Tergiman (2014) use the data from the majority treatment where communication was unrestricted to show that simply allowing committee members to engage in unrestricted communication largely reconciles laboratory outcomes with the theoretical predictions. Similar conclusions can be found in Baranski and Kagel (2014).
competition between subjects, the introduction of communication brings a divide between the two voting rules.

A related and noteworthy aspect of the data is that in the Unanimity treatment, not only does communication reduce proposer power, but it removes it all together: with communication, 94.3% of splits are exact equal splits with all members earning exactly 50 tokens (this fraction is only 13.3% when no communication is allowed). The distribution of resources is presented in Table 4. With respect to the Majority treatment, we observe a vast majority of minimum winning coalitions, with or without communication, with a higher share in the communication treatment. Thus, adding communication in the Majority treatment not only increases proposer shares, but it concentrates the distribution of resources to fewer members.

<table>
<thead>
<tr>
<th>Distribution of Resources</th>
<th>Majority Baseline</th>
<th>Majority Unrestricted</th>
<th>Unanimity Baseline</th>
<th>Unanimity Unrestricted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Double Zero strategy(^a)</td>
<td>73.5%</td>
<td>87%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Single Zero strategy(^b)</td>
<td>2.4%</td>
<td>1.4%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>All Inclusive strategy(^c)</td>
<td>24.1%</td>
<td>11.6%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Equal Split strategy(^d)</td>
<td>8.4%</td>
<td>4.4%</td>
<td>13.3%</td>
<td>94.3%</td>
</tr>
</tbody>
</table>

Table 4: Strategies used by the Proposers in the last five bargaining periods.

\(^a\)These are proposals in which exactly two of the five members in a group receive exactly zero tokens.
\(^b\)These are proposals in which only one of the five members in a group receives exactly zero tokens.
\(^c\)These are proposals in which no members receive zero tokens.
\(^d\)These are proposals in which all members receive exactly 50 tokens, corresponding to an equal split of the resources.

In summary, the effect of unrestricted communication on both voting rules is large but asymmetric. In the Majority treatment unrestricted communication does not change efficiency, but concentrates the distribution of resources and increases the share held by the proposer. In the Unanimity treatment the opposite is true: unrestricted communication promotes equal splits, decreases proposer power and improves efficiency.

4.2 Competition and Transparency

Our next step is to analyze how subjects under the majority and unanimity rules use the unrestricted communication channels that are offered to them. As non-proposers are responsible for the vast majority of all relevant messages that were sent during the negotiations stage in both

\(^{19}\)Focusing on all proposals in the first stage regardless of whether they passed shows the same pattern: 88% are equal splits when communication is allowed and only 7.5% when communication is not allowed.
treatments, we focus our analysis on the content of the messages from non-proposers and refer the reader to Appendix C for the analysis of messages from proposers.20

Communication content is summarized in Table 5. The content is broken down into the categories only for the subsample of subjects whose messages were classified as “relevant”.21 In the Majority treatment, 84 out of the 110 subjects at one point or another in the last five bargaining periods when they were non-proposers, used the chat messages in a way that was directly relevant to the game. So did 62 of the 75 subjects in the Unanimity treatment. In both cases this represents just over three quarters of our subjects.22

*Transparency versus backroom deals: does the voting rule matter?*

In the unrestricted communication treatment subjects were given the choice as to whether to use public or private messages. Thus, we start by exploring how subjects used the communication tools available to them: did transparency arise? did subjects instead choose to communicate in the backroom? did this depend on the voting rule?

In the “Public Messages” section of Table 5, we look at those subjects who communicated a relevant message publicly at least once. This represents 15.5% of subjects in the Majority treatment and 98.4% in the Unanimity treatment. In the “Private Messages” section of the table, we look at those subjects that communicated a relevant message privately at least once. This fraction is 92.9% in the Majority treatment and 8.1% in the Unanimity treatment.23 The last row of the “Public Messages” section shows that the fraction of subjects who sent all their messages publicly is 7.1% in the Majority treatment, and 91.9% in the Unanimity treatment. The last row of the “Private Messages” section shows that the fraction of subjects who sent all their relevant messages privately are 84.5% in the Majority treatment, and 1.6% in the Unanimity treatment.

In short, the type of communication channels is very different depending on the degree of competition between non-proposers. When competition for a place in the coalition is intense, almost all conversations happen behind closed doors and there is no transparency. When competition is low, subjects eschew private communication channels and transparency arises endogenously with virtually all communication taking place in the public sphere.

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20The conclusions reached in this section remain intact if one considers the whole conversation that each group (proposers included) engaged in as the unit of observation rather than separating the conversation into the single messages sent by the different bargainers (see Appendix D).

21“Relevancy” was broadly defined so that messages that were in anyway related to the game were counted as relevant. Examples of relevant messages include those that discuss the structure of the game, proposals, consequences of rejecting a proposal and strategies. The full transcripts of the chats and the classifications are available from the authors upon request.

22In other words our sample sizes are now 84 and 62 subjects for the Majority and Unanimity treatments, respectively.

23These are not disjoint groups, some subjects sent relevant messages both publicly and privately.
Table 5: Content of messages from Non-proposers in the Majority and Unanimity Unrestricted treatments in the last five bargaining periods.

<table>
<thead>
<tr>
<th></th>
<th>Majority Unrestricted</th>
<th>Unanimity Unrestricted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total subjects</td>
<td>110</td>
<td>75</td>
</tr>
<tr>
<td>Nb subjects who send relevant chats</td>
<td>84 (76.4%)</td>
<td>62 (82.7%)</td>
</tr>
<tr>
<td><strong>Public Messages</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% who send public messages at least once&lt;sup&gt;a&lt;/sup&gt;</td>
<td>15.5%</td>
<td>98.4%</td>
</tr>
<tr>
<td>% who lobby for fairness&lt;sup&gt;b&lt;/sup&gt;</td>
<td>76.9%</td>
<td>91.8%</td>
</tr>
<tr>
<td>% who lobby for themselves&lt;sup&gt;c&lt;/sup&gt;</td>
<td>23.1%</td>
<td>6.6%</td>
</tr>
<tr>
<td>% who exclusively send public messages&lt;sup&gt;d&lt;/sup&gt;</td>
<td>7.1%</td>
<td>91.9%</td>
</tr>
<tr>
<td><strong>Private Messages</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% who send private messages at least once&lt;sup&gt;e&lt;/sup&gt;</td>
<td>92.9%</td>
<td>8.1%</td>
</tr>
<tr>
<td>% subjects who lobby for fairness&lt;sup&gt;f&lt;/sup&gt;</td>
<td>5.1%</td>
<td>40%</td>
</tr>
<tr>
<td>% subjects who lobby for themselves&lt;sup&gt;g&lt;/sup&gt;</td>
<td>97.5%</td>
<td>80%</td>
</tr>
<tr>
<td>% who exclusively send private messages&lt;sup&gt;h&lt;/sup&gt;</td>
<td>84.5%</td>
<td>1.6%&lt;sup&gt;i&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>a</sup>Looking only at the subjects who send at least one relevant message in the first stage of the last five elections, this is the fraction of subjects who have done that at least once with public chats.

<sup>b</sup>Looking at subjects who have sent a relevant chat message publicly at least once, this is the fraction who have used at least one such public message to lobby for fairness.

<sup>c</sup>Looking at subjects who have sent a relevant chat message publicly at least once, this is the fraction who have used at least one such public message to lobby for themselves.

<sup>d</sup>This is the fraction of subjects who send all their relevant messages in the first stage of the last five elections with public chats.

<sup>e</sup>Looking only at the subjects who send at least one relevant message in the first stage of the last five elections, this is the fraction of subjects who have done that at least once with private chats.

<sup>f</sup>Looking at subjects who have sent a relevant chat message privately at least once, this is the fraction who have used at least one such private message to lobby for fairness.

<sup>g</sup>Looking at subjects who have sent a relevant chat message publicly at least once, this is the fraction who have used at least one such private message to lobby for themselves.

<sup>h</sup>This is the fraction of subjects who send all their relevant messages in the first stage of the last five rounds with private chats.

<sup>i</sup>This represents a single subject.
Transparency versus backroom deals: content of messages

In a large fraction of cases, non-proposers who use public messages use them to ask proposers for an equal distribution of resources or use them to express concern for the welfare of all members of the group (though not necessarily equal). These fractions are 76.9% and 91.8% in the Majority and Unanimity treatments, respectively. The fraction of non-proposers who have used relevant public messages at least once to lobby for themselves is much smaller. These fractions are 23.1% and 6.6% in the two treatments, respectively. It is worth pointing out that while the magnitude of these fractions vary across treatments, in both cases the fraction of subjects who use the public messages to lobby for themselves is significantly lower than the fraction of subjects who use the public messages to lobby for equality or fairness.

When subjects choose to send private messages, a significantly smaller fraction of subjects use these types of messages to pressure the proposer to offer a more equal split of the budget. This is true in both treatments. Indeed, only 5.1% of the subjects who send relevant private messages in the Majority treatment use them to ask for equal or fair distributions. This fraction is 40% in the Unanimity treatment. Instead of being used to lobby for equality, relevant private messages are used to lobby for one’s own fate: 97.5% of private messages in the Majority treatment are used to lobby for one’s self. This fraction represents 80% of messages in the Unanimity treatment.

Statistical tests confirm that in both treatments lobbying for one’s own self is more likely to be done privately, while lobbying for fairness is more likely to be done publicly.

To summarize our results, how the communication tool is used depends on the degree of competition between subjects. When competition between non-proposers for a place in the coalition is high, as in the Majority treatment, communication is primarily bilateral, and deals are established in backroom conversations. On the other hand, when the competition is low, as in the Unanimity treatment, communication is public. This difference is important as different types of communication channels are used to transmit different types of information. Indeed,

---

24 The most often observed messages that were classified as “lobby for fairness” are similar to the following: “Equal is nice,” “Let’s just do 50 each,” and “Just play fair.”
25 These percentages do not need to add up to 100. Indeed, any given subject can use the public messages for both fairness motives as well as selfish ones, or may use these messages for neither. For example, some subjects use public messages in a relevant way, but not to talk about shares, instead talking about how rejecting an offer leads to a decrease in the number of tokens to distribute. It is also possible that the percentages sum up to more than 100 as is the case in the Majority treatment, some subjects used private messages to indicate that splitting equal would be “nice” but all they need to vote in favor was a particular amount.
26 The remaining relevant messages have largely to do with timing, wanting the round to end at the first stage to not “loose tokens,” interpreting the incentives and so on.
27 The most often observed messages that were classified as “lobby for themselves” are similar to “I’ll vote yes for [amount here],” or “Give me [amount here] for an automatic yes.” Some messages were classified as both, for example: “Equal is nice but I’ll vote yes as long as I get [amount here].”
28 It is worth stressing that in the Unanimity treatment, the fraction of subjects who use private messages is low at 8.1%, which represents only 5 subjects out of the 62 who use the chat messages in a “relevant” way.
29 A two-sided test of proportions at the individual level (one observation per individual) shows these are statistically different with p < 0.001 for each treatment. At the session level, the two-sided tests of proportion also support the same conclusions with p-values as good as they can be with three sessions for each treatment (p=0.014).
public messages contain requests for fairness and in general express pro-social behavior, while private messages are used to lobby for one’s own interest.

### 4.3 Imposing Transparency

How transparent the political processes should be is the object of much debate. Previously we saw that in the Majority Unrestricted treatment most conversations were private and deals were struck in the backroom. Should debates be public? Are backroom channels necessary for competition to actually take place?

To investigate this we take the majority rule and vary the communication channels available to the subjects. We compare the treatment where communication was unrestricted to the Majority Public treatment where all messages were sent to all members of the group.

<table>
<thead>
<tr>
<th></th>
<th>Majority Unrestricted</th>
<th>Majority Public</th>
</tr>
</thead>
<tbody>
<tr>
<td>Session 1</td>
<td>147.6</td>
<td>114.8</td>
</tr>
<tr>
<td>Session 2</td>
<td>145.2</td>
<td>107.2</td>
</tr>
<tr>
<td>Session 3</td>
<td>140.0</td>
<td>90.2</td>
</tr>
<tr>
<td>Average</td>
<td>144</td>
<td>104</td>
</tr>
</tbody>
</table>

**Table 6:** Proposer power in the Majority Unrestricted and Majority Public treatments in the first-stage proposals that passed in the last five periods.

A first step is to compare proposer shares in both of these treatment. Table 6 shows the average proposer share for all sessions of the Majority treatments, for the different types of communication channels allowed. By the end of the game, proposers in the Public treatment enjoy much smaller shares on average (104 tokens) than in the Unrestricted treatment (144 tokens).\(^{30}\) In other words, private communication channels allow proposer to extract over 40% higher shares relative to a situation in which all messages are forced to be public.\(^{31}\)

In order to ensure that these results aren’t simply due to learning being slowed down in the Public treatment, we ran the Majority Public Long treatment, a 30-round session of the Majority Public treatment, thus giving subjects twice the amount of experience. Doubling the amount of experience for the subjects does not impact the distribution of proposer shares, as can be seen from Figure 2 where we show the cumulative distribution functions for proposer shares in the Majority Unrestricted, Majority Public and Majority Public Long treatments.

\(^{30}\)These averages are weighted by the relative size of each session.

\(^{31}\)Both a Ranksum test as well as a Kolmogorov-Smirnov test show that the median and distribution of proposer shares across these two treatments are significantly different (both p-values are below 0.01). For both these tests we use a single observation per subject: the average share the subject kept when he/she was a proposer. This conclusion follows through if instead we use a session as the unit of observation.
**Figure 2:** CDF of Proposer shares in the Majority Unrestricted, Majority Public and Majority Public Long treatments in first-stage passing proposals of the last five rounds in each of those treatments.

Even though the game is identical, the exogenous change in communication channels available to the subjects is not innocuous. An analysis of the chat messages can shed light on why that is. Indeed, the chat usage and content is very different between the two treatments.

**Figure 3:** Intensity and relevance of chat messages in the Majority treatment.

Figure 3 shows the fraction of non-proposers that use the chat tool on average for each period in the first five and last five periods for each treatment. It also shows, in the shaded blocks, the fraction of subjects that used the chat tool to send *relevant* messages on average in each period in the first five and last five periods for each treatment. The first element to note...
is that regardless of the types of communication tool available, a majority of non-proposers use the chat tool at each period, whether in the first of last five periods. However, how relevant these messages are differs by treatment. When communication is unrestricted, by the last five periods, about 65% of non-proposers are sending relevant messages in each period. That means that on average, in each period, between two and three of the four non-proposers in each group are sending relevant messages. When communication is public only, barely more than 20% of non-proposers send relevant messages each period in the last five periods. That means that on average, in each period, less than one of the four non-proposers is sending a relevant message. In terms of dynamics, relevancy starts at a high level and then increases in the unrestricted treatment but starts low and even decreases slightly throughout the game in the Public treatment.

Figure 4 shows the content of messages. The solid line in each panel shows the fraction of subjects who have used the communication tool to lobby for themselves at least once up to that point. For example, by period 3, half of our subjects had already used the communication tool to lobby for themselves when communication is unrestricted. By the end of the game in period 15, over 90% of subjects in the unrestricted communication treatment have used the communication tool to lobby for themselves at least once. These fractions are about 25% and 50% when communication is forced to be public. The dashed line in each panel shows the fraction of non-proposers who are using the chat tool to lobby for themselves in each particular bargaining period. For example, in period 9, about 60% of non-proposers are lobbying for themselves when communication is unrestricted. This fraction is only about 10% when communication has to be public: this means that on average, since each group has four non-proposers, each group is unlikely to have even one of its non-proposers lobby for himself if communication is forced to be public. The solid and dashed lines with the square marker symbols show the same things, but for message content in which the subjects are lobbying for fairness.

As can be seen from Figure 4, when we compare the lines with the square marked symbols across treatments, we can see that when communication is forced to be public, the conversations that were about lobbying for fairness are similar in frequency period-by-period to when communication was unrestricted. By the end of the game, in the unrestricted treatment, about 30% of subjects have lobbied for fairness at least once. This fraction is slightly higher at 40% when communication is forced to be public. On the other hand, those conversations in which one lobbied for one’s own self is significantly smaller in the public treatment. The two non-marked lines (solid and dashed) in the unrestricted treatment lie far above those in the public treatment. Indeed, towards the end of the game, only about 10% of non-proposers are expressing those kinds of thoughts when all their conversations are public. This is as opposed to about 60% when non-proposers can use backroom channels to communicate. This represents a drop of over 80%. In addition, while in the unrestricted treatment most of the relevant conversations
are about lobbying for one’s own self, in the public treatment, conversations related to fairness are just as frequent (though both happen with low frequency). Finally, we note that the solid unmarked line in the Public treatment is a lot flatter than the one in the unrestricted treatment, indicating that the subjects who use the communication tool to lobby for themselves over the course of the game tend to be the same ones.

As described at the beginning of the Results section and further investigated in Appendix C, most of the “action” happens on the part of the non-proposers. Among those proposers who send relevant messages, an interesting difference between the Majority Public and the Unrestricted treatments occurs, and this difference is similar in spirit to what we observed for the non-proposers. In the Public treatment, among those proposers who sent at least one relevant message in the last five bargaining periods, almost 73% did so to select partners through “vague” means at least once, for example, asking the others to guess their favorite color, or sport, or to tell a joke.\(^{34}\) The corresponding percentage for the Unrestricted treatment is only 11%. On the other hand, in the Unrestricted treatment, 83% of proposers who sent at least one relevant message, did so to select their partners by establishing clear quid pro quos at least once.\(^ {35}\) This fraction is far less at 27% in the Public treatment.\(^ {36}\) Thus, in the Unanimity treatment, proposers are far more likely to discuss prices directly, essentially choosing the cheapest members to be part of the coalition. In the Public treatment, they use the communication tool

\(^{34}\)Examples include: “First two to guess my favorite color gets [sic] money.” “I’m thinking of a number between 1 and 100.”

\(^{35}\)Examples are of the following nature: “Will you vote yes for 40?,” “name your price,” “how’s 50?”

\(^{36}\)We acknowledge that the small number of observations for which proposers are sending relevant messages (here 18 and 11 for the Unrestricted and Public treatments, respectively) means that these percentages have to be taken with a grain of salt. However, despite these small sample sizes, these differences between treatments are statistically significant. To compare how likely it is to use the communication tool to select coalition partners according to price across treatments, we take the subjects who sent at least one relevant message and record whether at least one of those messages was to select coalition partners according to price (and did the same for selecting partners via “vague” means). Thus we have only one observation per subject. The p-values are strictly less than 0.01 for two-sided tests of proportions. The small sample size is due to the fact that only one in five subjects are proposers, and because most proposers didn’t use the chat tool to send relevant messages.
to decide who will be in the coalition as opposed to how much each person will receive.

To summarize this section, while the fraction of non-proposers who at one point or another lobbied for fairness is slightly higher in the Public treatment than in the Unrestricted one, the larger difference between the two treatments is the fact that in the public treatment the fraction of non-proposers who lobby for themselves in each period is 80% lower than when subjects can use private communication channels. As a result, proposers keep a lower fraction of the budget and outcomes are more egalitarian. So, the competition generated by the structure of the game is tempered by the fact that transparency is imposed on the players. Transparency also has an effect on proposers. When proposers send relevant messages, there is a big difference in how proposers approach forming a coalition: they are direct and to the point in the Unrestricted treatment (and these conversations are predominantly private) but they are vague when these conversations are forced to be public. The reluctance of both non-proposers to lobby for their own interests and of proposers to ask questions related to price in public means that proposers are unable to exploit the competition between non-proposers in the Public treatment. This difference in behaviour between these two treatments ultimately leads to lower proposer shares in the Public treatment compared to the Unrestricted setting.

5 Conclusion

This paper shows that communication tools significantly alter bargaining outcomes and subjects’ behavior. How they alter these is a function of both the structure of the game (here the degree of consensus needed to reach an agreement) and of the communication structure itself. When individuals have full control over which communication tools to use, we document that in a low competition setting in which unanimity is required for a proposal to pass, transparency arises endogenously: subjects use the communication tool to communicate publicly. In a high competition setting in which only a simple majority of votes are required for a proposal to pass, transparency is absent and subjects use the communication tool to establish backroom deals. We demonstrate that different communication channels are used for different purposes: public channels are used to express preferences for fairness while private channels are used to lobby for one’s own share.

Perhaps the most surprising feature of this experiment is the fact that even within a given voting rule, whether or not subjects can communicate privately matters a great deal. Indeed, imposing transparency by removing private communication channels changes the bargaining outcomes of the game, and agreements that took place behind closed doors do not take place publicly. In other words, the communication channel modifies how bargaining takes place even when the rules of the game are identical. While subjects privately established quid pro quos when they had the choice of which communication channel to use, they almost entirely refrain from such behavior if communication is forced to be public.
Outside the laboratory, in “real” legislative processes, there is, by definition, no record of what is said in backroom conversations. However, one can imagine that the content of these conversations is very different than what politicians may say publicly. Examples of quid pro quos being discussed in the open are very difficult to find. The following is a clear example of a case in which Senators are weary of stating in public what they may have no trouble stating in private. In the recent debate on tax reform, in order to receive drafted feedback in legislative language on a proposed law, the head of the Senate Finance Committee had to set up specific guarantees so that individual Senators’ support for preserving certain loopholes would not be made public.\(^{37}\) On the other hand, it is very easy to find public statements in which politicians are appealing to fairness. A recent example is from Speaker John Boehner, who, on September 30th, 2013, while debating the Universal Health Care Act on the House floor, peppered his speech with references to fairness and stated only wishing to do “what’s fair for the American People.”\(^{38}\)

In our laboratory experiment we have the advantage that we can observe what happens behind closed doors, and public conversations are indeed very different than private ones. That this phenomenon happens in the laboratory is even more surprising given that in the laboratory all identities are protected and it is impossible for the subjects to know with whom they are grouped. There are no reputations, or policy preferences to speak of in this game either. The fact that subjects behave differently when communication is forced to be public in this very simplified framework suggests that a strong alternative force is at play. Our paper provides a strong basis for future theoretical and empirical work on how communication channels interact with stated preferences and actual behavior.

\(^{37}\)Each submission would be given its own ID number and be kept on password-protected servers, with printed versions kept in locked safes. In addition, these requests would be kept secret by the National Archives for 50 years.

References


A Theoretical Predictions

Benchmark Model without Communication

We will describe here how to obtain distribution of resources for any $q$ in the stationary symmetric subgame perfect equilibrium, which gives a unique prediction. This unique equilibrium has the following features. The proposer randomly selects $q - 1$ other committee members and allocates to them an amount that makes each coalition partner just indifferent between supporting the bill and rejecting it. The proposer appropriates the remainder of the budget. The committee members that are not invited to be part of coalition (if those exist) get zero shares. Non-proposers support any bill that give them at least as much as their continuation value and reject any amount below that.

Denote by $x^p_q$, $x^c_q$ and $x^{NC}_q$ the shares of the proposer, the coalition members and non-coalition members when $q$ voting rule is implemented. Recall that the budget constraint is $x^p_q + (q - 1)x^c_q = 1$. Therefore, the continuation value of the non-proposer is

$$
\delta \left[ \frac{1}{N} \cdot x^p_q + \frac{q - 1}{N} \cdot x^c_q + \left( 1 - \frac{q - 1}{N} \right) \cdot 0 \right] = \frac{\delta}{N}
$$

is the same irrespectively of $q$. Thus, if simple majority is required to pass the proposal, the proposer appropriates

$$
x^p_{\frac{N+1}{2}} = 1 - (q - 1) \frac{\delta}{N} = 1 - \frac{N - 1}{2N} \delta
$$

and gives $x^c_{\frac{N+1}{2}} = \frac{\delta}{N}$ to $\frac{N-1}{2}$ other randomly selected members. If, instead, unanimous consensus is required to pass the bill, then proposer gets a smaller share of

$$
x^p_{q=N} = 1 - (q - 1) \frac{\delta}{N} = 1 - \frac{N - 1}{N} \delta
$$

and gives $x^c_{q=N} = \frac{\delta}{N}$ to all other members.

Bargaining with Communication

Consider an extended version of bargaining model described above, in which after the proposer is selected and before he/she submits the bill, committee members can talk to each other. Communication is unrestricted in the sense that any member can send any (number of) messages to any subset of members in the committee. After the communication stage is over, bargaining proceeds as described by the protocol in the benchmark model.

Obviously, the set of all subgame-perfect equilibria in the bargaining game with communication is even larger than the one in the benchmark game. Thus, to be able to obtain some theoretical predictions in this case and to compare those to the SSSPE of the bargaining game
without communication, we will restrict our attention to symmetric subgame perfect equilibria, in which committee members use stationary strategies. By definition, stationary strategies cannot condition on history of play. Therefore, in the model in which committee members first communicate with each other and then vote on the proposed allocation, the stationary equilibrium concept does not allow bargainers to condition their votes on the conversations that preceded current voting stage. Rather, a vote cast for or against the proposed allocation may condition only on the proposed distribution of resources (or only on member’s own share in the proposed distribution if members care only about their own payoff).

Thus, bargaining game with communication admits a unique SSSPE for any \( q \)-voting rule, in which bargaining process and distribution of resources are the same as in the unique SSSPE of the benchmark bargaining game without communication.

## B Predictions - Robustness

Table 7 shows the proposer shares for all proposals submitted in the first stage of a bargaining period, regardless of whether they passed or not (Table 3 in the main body of the text focused on stage 1 proposals that passed). Using this as the restriction criterion for our data analysis does not change the conclusions: communication increases proposer power under the majority rule, but decreases it under the unanimity rule. The fact that there is little difference compared to when we focus only on those proposals that passed right away comes as little surprise since most proposal do pass right away.

<table>
<thead>
<tr>
<th></th>
<th>Majority</th>
<th>Unanimity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Theory</strong></td>
<td>170</td>
<td>90</td>
</tr>
<tr>
<td><strong>Baseline</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>114</td>
<td>68</td>
</tr>
<tr>
<td>Median</td>
<td>120</td>
<td>70</td>
</tr>
<tr>
<td><strong>Unrestricted</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>145</td>
<td>51</td>
</tr>
<tr>
<td>Median</td>
<td>150</td>
<td>50</td>
</tr>
</tbody>
</table>

**Table 7:** Shares of proposers in tokens. In bold is the lab data closest to theoretical predictions for each treatment.

Note: All proposals submitted in the first stage of the last five bargaining periods.

Similarly, we can also assess proposer power by looking at all passed proposals (regardless of whether in the first stage or not). In this case, we must look at this by comparing the fraction of shares the proposer obtains relative to the theory. This is because when a proposal is rejected the budget shrinks by 20% and so absolute amounts are not comparable. However, regardless
of the stage, proposers should be able to keep the same fraction of the budget.\textsuperscript{39} Figure 5 is the counterpart to Figure 1 that only focused on proposals that passed in Stage 1 only. Those graphs are, unsurprisingly, very similar.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure5.png}
\caption{Mean proposer shares as a fraction of theoretical prediction for both the Majority and Unanimity treatments, with and without communication, for all proposals that passed, regardless of the stage. The 95\% confidence intervals for proposer shares as a fraction of what is theoretically predicted are represented for each treatment.}
\end{figure}

Notes: All passing proposals regardless of when they passed.

\section*{C Messages from Proposers}

Table 8 shows the level of messaging activity from proposers. The unit of observation is a subject and all the messages that he/she sent in the last 5 elections when he/she was a proposer. Note that proposers use communication channel much less than do non-proposers. Indeed, in the last 5 election, only 33.3\%, 20.4\% and 42.6\% of proposers did so in the Majority Unrestricted, Majority Public and Unanimity Unrestricted treatments, respectively.

Table 9 shows the strong parallels that exist between the proposers and non-proposers in terms of type of message. For example, proposers in the Majority treatment send more private messages than public ones just as the non-proposers do. The opposite is true in the Unanimity treatment: in the Unanimity treatment proposers also send more public messages. While proposers do not need to lobby for themselves, we observe that they do speak more about fairness in the Unanimity treatment than in the Majority treatment, just as was the case for non-proposers.

\footnote{These fractions are 68\% of the budget in under the majority rule and 36\% under the unanimity rule.}
<table>
<thead>
<tr>
<th></th>
<th>Majority Unrestricted</th>
<th>Majority Public</th>
<th>Unanimity Unrestricted</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of proposers who have sent at least one relevant message</td>
<td>33.3%</td>
<td>20.4%</td>
<td>44.4%</td>
</tr>
<tr>
<td>% of proposers who have sent no messages</td>
<td>57.4%</td>
<td>61.1%</td>
<td>48.2%</td>
</tr>
</tbody>
</table>

**Table 8:** Message activity from proposers in the Majority and Unanimity Unrestricted treatments.

<table>
<thead>
<tr>
<th></th>
<th>Majority Unrestricted</th>
<th>Unanimity Unrestricted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Messages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% who send public messages at least once(^a)</td>
<td>29.4%</td>
<td>95.7%</td>
</tr>
<tr>
<td>Private Messages</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% who send private messages at least once(^b)</td>
<td>85.7%</td>
<td>4.3%</td>
</tr>
<tr>
<td>% who send mention fairness at least once(^c)</td>
<td>11.8%</td>
<td>69.6%</td>
</tr>
</tbody>
</table>

**Table 9:** Type of messages from proposers in the Majority and Unanimity Unrestricted treatments.

\(^a\)This is, looking only at the proposers who send at least one relevant message in the first stage of the last five elections, the fraction of subjects who have done that at least once with public chats.

\(^b\)This is, looking only at the proposers who send at least one relevant message in the first stage of the last five elections, the fraction of subjects who have done that at least once with private chats.

\(^c\)This is, looking only at the proposers who send at least one relevant message in the first stage of the last five elections, the fraction of subjects who have mentioned fairness or intent to do equal split.

**D Group-level Conversations**

The data show a very clear pattern: when competition for a place in the coalition is high, messages are used to lobby for one’s own interest. When the competition between members of the group is low, messages are almost always used when to discuss and lobby for fairness and equality (or more broadly as the expression of social preferences).

In Table 10 we show the fraction of conversations where at least one message was relevant to the game being played as well as the topic of these conversations.\(^40\) A large majority of the conversations in both treatments contain relevant messages regarding the bargaining game:

\(^40\)“Relevancy” was broadly defined so that messages that were in anyway related to the game were counted as relevant. Examples of relevant messages include those that discuss the structure of the game, proposals, consequences of rejecting a proposal and strategies. The full transcripts of the chats and the classifications are available from the authors upon request.
<table>
<thead>
<tr>
<th></th>
<th>High Competition (Majority)</th>
<th>Low Competition (Unanimity)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Relevance</strong>&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fraction of conversations where at least once message is relevant</td>
<td>97%</td>
<td>92%</td>
</tr>
<tr>
<td><strong>Fairness</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fraction of relevant conversations where at least once message relates to fairness</td>
<td>17%</td>
<td>98%</td>
</tr>
<tr>
<td><strong>Self-Interest</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fraction of relevant conversations where at least once message relates to self interest</td>
<td>100%</td>
<td>7%</td>
</tr>
<tr>
<td><strong>Total # of conversations</strong>&lt;sup&gt;b&lt;/sup&gt;</td>
<td>78</td>
<td>63</td>
</tr>
</tbody>
</table>

Table 10: Group-level conversations in the last five bargaining periods in the High and Low Competition treatments when communication is unrestricted.

<sup>a</sup>This is conditional on at least one message being sent in the group (see second note for this table for more details).

<sup>b</sup>The maximum number of conversations in the last five rounds given the number of subjects in the two treatments are 80 and 75 for the Majority and Unanimity treatments, respectively. The number of observed conversations is smaller than the maximum number because in some groups the proposer submitted a proposal right away before any conversations could take place.

97% in the High Competition treatment and 88% for the Low Competition treatment. Moreover, while 100% of conversations in the High Competition Majority treatment contain at least one message in which a bargainer lobbies for himself, this percentage is only 7% in the Low Competition Unanimity treatment. On the other hand, 98% of conversations in the latter treatment contain at least one message about fairness, while this percentage is only 17% in the former treatment.

These results show that the content of the messages is impacted by the intensity of the competition for a place in the coalition: when competition is high, all conversations include messages in which non-proposers lobby for one’s own self, and very few conversations include messages related to notions of fairness. When competition is low, the reverse is true: only a minority of conversation include messages having to do with lobbying for one’s own self and almost all have to do with fairness.