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Anna Merkel and Christoph Vanberg

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Legislative bargaining with joint production: An experimental study*

Anna Merkel† and Christoph Vanberg‡

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Abstract

We conduct 3-person bargaining experiments in which the surplus being divided is produced by completing a prior task. Using a Baron-Ferejohn framework, we investigate how differences in contributions to production affect bargaining under different decision rules. Under unanimity rule, all proposals and agreements constitute convex combinations of the equal and proportional splits. Contrary to our predictions, this pattern largely persists under majority rule. In sharp contrast to prior experiments in which an exogenous surplus is divided, few subjects attempt to build minimum winning coalitions when the surplus is jointly produced.

JEL: C79, C92, D63, D70

Keywords: multilateral bargaining, claims, fairness, majority rule, experiments

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†Department of Economics, University of Heidelberg, Bergheimer Str. 58, 69115 Heidelberg, Germany, anna.merkel@awi.uni-heidelberg.de

‡Corresponding Author: Department of Economics, University of Heidelberg, vanberg@uni-hd.de

1 Introduction

Whenever groups of individuals collaborate in productive activities, decisions must be made about how to distribute gains resulting from joint production. Unless the division is contractually specified ex ante, it must instead be negotiated ex post. For example, governments need to distribute the tax budget across different departments and private companies need to decide how to allocate revenues across different divisions. Such negotiations are likely to be especially complicated when different group members have made different 'contributions' to the prior productive activity, inducing disagreement about the degree of 'proportionality' that should prevail.[1] How are such disagreements handled under different decision rules? This is what we want to investigate in this paper.

A number of authors have experimentally shown that joint production can lead to the establishment of 'subjective claims' to a resulting surplus, and investigated how such claims affect bargaining behavior. In these experiments, groups of two or more subjects 'produce' a joint surplus by completing a real effort task such as answering trivia questions. Subsequently, subjects bargain over how to distribute that surplus. In a bilateral context, Gächter and Riedl (2005) and Karagözoğlu and Riedl (2014) find that subjects *expect* distributions to reflect relative contributions (e.g. the number of correct answers given), and also judge such proportionality as *fair*. Further, they show that bargaining outcomes reflect these considerations. Gantner et al. (2016) extend the analysis to a three-player context, comparing the impact of contributions under three different bargaining procedures, all of which require unanimous consent to reach agreement. They also find that fairness judgments reflect individual contributions, but to a lesser extent than suggested by a strict norm of proportionality.

To our knowledge, this is the first paper to experimentally investigate *majority rule* bargaining with joint production. All prior experiments on bargaining with joint production have looked at either bilateral situations or at multilateral situations with unanimity rule. There are many interesting situations, however, where distributive decisions are made using majority rule. Examples include labor-management negotiations, coalition formation, bargaining over distributive politics, and budget negotiations in national or international organizations.

As an example, consider budget allocation decisions within the European Union. Here,

[1] Such disagreements are likely to be especially pronounced in contexts where relative contributions are difficult to assess, or where they are perceived to result from 'luck' as opposed to 'effort' (Hoffman and Spitzer, 1985; Konow, 2003; Fischbacher et al., 2009; Almås et al., 2010; Becker, 2013).

representatives from different member states bargain over how to allocate resources, both across different budget categories (e.g. agriculture, regional development, etc.) and within categories, to projects located in specific member states. Although many expenditures serve to create shared benefits for all member states (e.g. defense, administration), there is some truth to the common perception that the process ultimately boils down to the splitting of a cake between the separate member states. Likewise, a widely held view is that some member states are entitled to a larger slice of that cake than others, because they have made larger contributions in the form of membership fees.[2]

There are good reasons to believe that bargaining behavior and outcomes under majority rule are different from those observed under unanimity rule. Under unanimity rule, each player holds veto power which can be used to defend one's claim. This is fundamentally different under majority rule, where players can form minimum winning coalitions and exclude certain group members from the allocation. Prior experiments on majority rule bargaining over an exogenous surplus have consistently shown that most games end with such agreements. Hence, an important question is whether we continue to observe such outcomes when all players hold claims to the surplus. If so, an interesting question is which player is more likely to be included in a coalition - the one who has a larger or a smaller claim?

In this paper, we experimentally investigate how claims based on contributions to production affect bargaining behavior under both unanimity and majority rule. In our experiment, groups of 3 subjects bargain over a surplus which they have previously produced by separately engaging in an individual real effort task. The bargaining procedure is a finite horizon version of the Baron and Ferejohn (1989) game (henceforth BF game). Our main treatment variable (exogenously manipulated) is the number of votes required to pass a proposal (majority vs. unanimity rule). In addition, we observe a number of different (endogenously determined) situations in terms of the relative contributions the group members have made, depending on their individual performance in the real effort task. We investigate and compare how the resulting claims affect proposals, voting behavior, passage rates, and final outcomes under each rule.

[2] For example, in the recent 'Brexit' referendum, Britain's rising net contributions, calculated as the fees contributed to the EU minus received transfers, was one of the most contentious issues. Not only EU critics but also the popular media discussed this issue as an argument against UK's continued membership. Net contributions were also a central topic during Scotland's first independence referendum in 2014 which would have enabled Scotland to become and independent member of the EU. Prior to the referendum, the government examined Scotland's potential role within the EU and critically pointed out that Scotland was likely to become a net contributor.

Our main findings are the following. Under both rules, proposals and voting behavior are significantly affected by claims. Under unanimity rule, virtually all proposals and outcomes constitute convex combinations of the three-way equal split and the split that is exactly proportional to relative contributions. This result is consistent with prior evidence discussed in the next section. More surprisingly, we observe a very similar pattern under majority rule. In particular, the vast majority of proposals allocate positive shares to all participants. This result stands in stark contrast to comparable experiments on BF bargaining in which subjects divide 'manna from heaven' and most subjects propose minimum winning coalitions.

Under both decision rules, we find that players who have made relatively smaller contributions tend to make more equal (i.e. less proportional) proposals. This pattern is more pronounced under majority rule. In combination with the fact that players with lower claims are more likely to support more equal proposals, this leads to more equal outcomes under majority rule when a majority (i.e. two players) have made relatively small contributions. Finally, we find that majority rule leads to a higher passage rate than unanimity rule, especially when group members have made different contributions to the surplus.

The rest of the paper is organized as follows. Section 2 discusses related literature. Section 3 presents our experimental design. Section 4 summarizes our hypotheses. Results are presented in section 5. Section 6 concludes. Further analyses and experimental instructions are provided in an online Appendix (included in the present version for review).

2 Related Literature

Our paper contributes to a recent literature analyzing how claims, resulting from joint production, affect behavior and outcomes in experimental bargaining games. For a review on bargaining games with joint production see Karagözoğlu (2012). Most closely related are three recent studies which examine the role of claims in bilateral (Gächter and Riedl, 2005; Karagözoğlu and Riedl, 2014) and multilateral bargaining (Gantner et al., 2016). In these experiments, subjects earn endowments by answering a series of quiz questions. These endowments are then combined to form a common surplus. Subsequently, either two (Gächter and Riedl, 2005; Karagözoğlu and Riedl, 2014) or three (Gantner et al., 2016) subjects bargain over the distribution of the surplus using unanimity rule. A common finding in all three papers is that subjects who have made higher contributions are offered more compared to subjects with lower contributions. Further evidence suggests that individuals derive 'subjective claims' which reflect their relative contributions to the jointly produced surplus. According to Schlicht (1998), claims (or 'entitlements') are "rights, as perceived by the individual (...) that go along with a motivational disposition to defend them" (Schlicht, 1998, p.24). Moreover, he defines obligations as the counterpart of claims, i.e. people will feel obliged to comply with what they perceive as another person's right. Hence, claims appear to capture what a person *expects* to receive as well as her subjective fairness view.

In sum, several prior studies have found evidence that claims have a significant impact on bargaining under unanimity rule, i.e. when all group members must consent to the final agreement. In contrast, there is to our knowledge no experimental evidence on the effects of claims under majority rule. The key difference is that a majority coalition (in our case 2 players) can, in principle, ignore the claims of a minority player, as his consent to the allocation is not required. If no player can enforce his own claim by vetoing a potential agreement, do claims become meaningless?

Of obvious relevance to this point are several studies looking at two-person dictator games with a jointly produced surplus. Cappelen et al. (2007) conduct an experiment in which subjects contribute endowments earned in a prior investment stage. Importantly, endowments are a combination of the sum a subject decided to invest in one of two projects and a randomly determined high or low interest rate paid for each dollar invested. Both subjects in a pair decide how to allocate the joint surplus and one (randomly chosen) decision is implemented. Subjects are repeatedly matched and thus take decisions in different distributional situations which allows the authors to classify subjects into types. They find that a majority of subjects can be classified as 'liberal egalitarian' or 'libertarian' types and thus take the investment made by the other subject into account when choosing an allocation. Almås et al. (2010) conduct dictator games with children in grades 5 to 13 where the surplus is the result of a real effort task. They find that as children get older, their offers more strongly reflect the contributions of their partners. In a recent meta study on dictator game behavior, Engel (2011) finds that dictators tend to give less if they have earned the endowment or take less from the receiver if she has earned the endowment. Overall, these experiments provide evidence that dictators tend to 'respect' a recipient's claim, at least to some extent, even though the recipient has no veto power. Applied to our own context, this suggests that subjects may be reluctant to form minimum winning coalitions under majority rule, and instead allocate positive shares to all players.

The previous findings from unanimity bargaining and the dictator game appear to be compatible with the idea that behavior is motivated by fairness concerns which take claims into account. Thus, the literature examining 'fairness' of outcomes in situations with joint production is also informative for this paper. For example, Selten (1988) discusses the role of the so-called 'equity principle' for understanding behavior in allocation tasks and bargaining games. He defines a 'proportional equity rule' as follows: "The proportional equity rule can be thought of as a modification of the equal division principle. Whereas the equal division principle prescribes the same reward for every person, the proportional equity rule prescribes the same reward for every unit of achievement." Among others, he discusses reward allocation experiments conducted by Mikula (1972) and Mikula and Uray (1973). In these experiments, subjects first engage in a task and subsequently one subject is asked to allocate a sum of money. As summarized by Selten (1988), subjects tend to divide equally if performance in the task was equal. If performance was however unequal, there was a tendency towards more proportional distributions. Konow (2003) reviews a very large collection of empirical studies (mostly experiments and vignette surveys) to assess the degree to which different conceptions of 'justice' are descriptive of how people commonly make impartial fairness judgments. He proposes "a multi-criterion theory of justice' (...) in which three justice principles are interpreted, weighted, and applied in a manner that depends on context." (Konow, 2003, p. 1235) These principles are *equity*, *efficiency*, and *need*. In discussing evidence on the 'equity principle', he cites extensive experimental and survey evidence showing that subjects consider it fair to distribute resources in a way that is proportional to all variables under a person's control, such as work effort. In the multilateral bargaining game discussed above, Gantner et al. (2016) find that impartial fairness assessments, elicited from independent and unaffected participants, are a convex combination of proportionality and equality, giving rise to pluralism of fairness norms which might guide individual behavior in these situations.

An important finding is that such fairness perceptions can be self-servingly biased. For example, Gantner et al. (2016) find that low contributors are more likely than high contributors to judge an egalitarian division of the surplus as fair. Further evidence comes from an experiment by Konow (2000), in which all subjects perform the same real effort task (prepare a given amount of letters) but earn different piece rates. The funds of both subjects are then pooled and either the subject with the higher piece rate or an uninvolved third person decides how to allocate the funds among the two subjects. The results of the experiment indicate that partial subjects are more likely to deviate from the accountability principle than impartial subjects, indicating a self-serving bias. In summary, these findings suggest that (at least a majority of) people judge proportionality as fair, and that the degree of proportionality they favor might be self-servingly biased. We conjecture that such judgments are likely to affect bargaining behavior under majority rule.

Finally, we add to a vast experimental literature on the Baron and Ferejohn bargaining game (McKelvey, 1991; Fréchette et al., 2003, 2005a,b,c; Diermeier and Morton, 2005; Agranov and Tergiman, 2014, 2016; Miller and Vanberg, 2013, 2015). The central findings of that literature can be briefly summarized as follows. First, most proposers form minimum winning coalitions (MWCs) under majority rule, especially after gaining some experience with the game. Second, the most commonly observed proposals and agreements implement equal splits (either overall or within a MWC). Third, unanimity rule leads to more delay as compared to majority rule.[3] To our knowledge, we are the first to report on a Baron-Ferejohn experiment involving the division of a previously produced surplus. Baranski (2016) studies a majoritarian BF game in which the surplus to be allocated is the result of voluntary contributions. His main interest is how allowing subjects to bargain over the distribution affects incentives to contribute. Our context differs from this in several respects. First, performance in the real effort task is not a strategic choice given that players are not informed about the decision rule when they earn their contributions. Second, differences in performance result at least in part from luck, such that there is likely more disagreement about the distribution of the surplus. These design choices reflect the fact that we are interested in the influence of claims (as exogenous parameters) on bargaining behavior.

3 Experimental Design

The experiment consists of of two stages, a 'production' stage followed by a 'bargaining' stage. In the production stage, subjects individually earn 'points' by answering a series of trivia questions organized into 12 'blocks'. Each block consisted of 2 multiple choice questions on different topics (i.e. geography, history, arts, science). On each block, subjects could earn either zero, one, or three points, depending on whether neither, one, or both questions were answered correctly. Each block contained one 'easy' question that we expected most subjects to answer correctly, and a second question that varied in difficulty. After completing the production stage, each subject thus had 'produced' a list of 12

[3] Recent findings by Agranov and Tergiman (2016) suggest that free communication (chatting) between the group members leads to more unequal agreements under majority rule and to more equal allocations under unanimity rule. In addition, communication virtually eliminates delay under both rules.

separate scores, each either 0,1, or 3 points.

After all subjects had completed the production stage, they proceeded to the bargaining stage. This consisted of 12 separate rounds. In each round, subjects were matched into groups of three. Each group was then assigned a surplus equal to 5 EUR times the sum of three randomly and independently chosen scores, one from each of the lists that they had previously produced. Thus, the scores contributed by the members of a group would usually come from different 'quiz blocks'. The sampling of scores was done with replacement, so that it was possible for a given subject to have the same quiz block selected multiple times over the course of the experiment. Each subject was informed about the quiz block selected for her and about the number of points she had earned. In addition, they were informed about the number of points contributed by the other players, as well as each group member's percentage share of all contributed points. Subjects were *not* informed about the quiz block selected for the other two group members.

These design features were chosen with three goals in mind. First, the presence of an easy question in every quiz block was meant to ensure that all subjects would have a positive claim, at least in most games. Second, the more difficult questions should lead to heterogeneity in claims, as some but not all subjects will score 3 points on the quiz block chosen for them. Third, differences in difficulty between blocks implies that individual contributions constitute a noisy signal of relative performance. That is, subjects could not be sure whether differences in the number of points contributed were due to good performance (answering difficult questions) or luck (having an easy quiz block chosen).[4]

The bargaining game itself followed a finite horizon Baron-Ferejohn framework. That is, bargaining proceeded over a finite number of discrete rounds. Within each round, the sequence of events was as follows. First, all subjects were asked to propose a division of the surplus. Next, all subjects voted either 'yes' or 'no' on each of the three proposals made in their group. Once the votes had been cast, *one* of the three proposals was randomly selected and the votes were counted.[5] Depending on the treatment, the proposal passed if either a majority (two) or all three subjects voted 'yes'. In that case, the game ended. Otherwise, the surplus shrank by 20% and bargaining proceeded to a new round. If the surplus fell

[4]Note that the element of 'luck' is indeed present because a given subject's quiz scores for different games are drawn *with replacement*. Therefore some subjects will be luckier than others even if they perform equally well, and even if we aggregate across all games played.

[5]In the standard formulation of the BF game, the proposer is selected at the beginning of the round and only one proposal is made. Our procedure allows us to observe three times as many proposals and votes. Although this does not alter the SSPE predictions, it may impact real behavior if subjects react to the additional information provided. However, any such effects are of course present in all our treatment conditions.

below 2 EUR (i.e. after 8 rounds of bargaining), the game was terminated and all group members earned 0 EUR.[6] At the end of the experiment, one of the 12 bargaining games was randomly chosen and subjects were paid according to the corresponding outcome.

The experiment was conducted at the AWI Lab at the University of Heidelberg, Germany, in June 2016 and January 2017. In total, 198 students, from various disciplines, participated (108 in the June and 90 in the January sessions). We conducted twelve sessions, six for each treatment (majority and unanimity rule). Each session involved 18 subjects, divided into three matching groups of six participants.[7] Due to no-shows, we conducted three sessions with 12 subjects. Hence, in total we have 33 matching groups (17 for majority and 16 for unanimity rule). Upon entering the laboratory, subjects were randomly assigned to isolated computer terminals. Paper instructions (reproduced in the Appendix) were handed out and questions were answered in private. The experiment was programmed in z-Tree (Fischbacher, 2007). Sessions took approximately 70 minutes, and average earnings amounted to 13 EUR (highest: 23.5 EUR, lowest: 4 EUR) including a 4 EUR show-up fee.

4 Benchmark predictions and hypotheses

While the BF bargaining game admits multiple subgame perfect equilibria, the prior literature has typically focused on symmetric and stationary equilibria, which are (essentially) unique. For the finite horizon version, the relevant equilibrium concept is Symmetric Markov Perfect Equilibrium (SMPE). See Norman (2002) for a detailed analysis. As established there, the unique SMPE has three interesting properties which can be tested empirically. The first is that proposers attempt to form minimum winning coalitions in which only the number of individuals required to vote yes receive positive offers. Second, these 'coalition partners' are offered exactly their continuation value, i.e. the amount that they expect to receive if the current proposal were to fail. This implies an unequal distribution of the surplus, favoring the proposer. Third, the first proposal passes without delay. All three of these predictions are independent of the decision rule being employed. The predicted outcomes for our version of the game ($n = 3$ players and discount factor

[6] This feature of our design implies that ours is a finite horizon BF game.

[7] Admittedly, these are small matching groups. However, we believe that repeated game effects within the matching groups are unlikely. First, subjects were not told about the size of the matching group. In the instructions they were informed that they would be re-matched at the beginning of each round. Second, the identifying labels on the decision screens changed randomly between games. The advantage of implementing small matching groups is that we obtain 3 independent observations for each session.

Table 1: Symmetric equilibrium proposals

	Proposer share	Responder share
Majority rule	73%	27% (to one)
Unanimity rule	46%	27% (to both)

$\delta = .8$) are presented in Table 1.

Naturally, these SMPE predictions are unaffected by the prior production phase conducted in our experiment. By definition, they are based on the assumption that all players employ the same strategy, effectively ignoring any differences in the relative contributions they have made to the surplus. Under unanimity rule, the SMPE corresponds to the only subgame perfect equilibrium. The fact that players can selectively build coalitions under majority rule, leads to multiple and asymmetric equilibria. Hence, in these cases players could use the relative contributions to coordinate on asymmetric and / or non-stationary equilibria of the game (see Norman, 2002). For this reason, it is especially interesting to study how claims affect behavior under majority rule.

In addition to the SMPE predictions, we formulate a number of additional hypotheses which are based on the idea that players are motivated by material self-interest as well as notions of fairness, which take claims into account (Konow, 2000, 2003). Players are assumed to be heterogeneous in how much weight they place on either of these two motives. As outlined in Section 2, prior evidence on unanimity rule bargaining appears to support this idea, and demonstrates that such preferences have a systematic impact on behavior and outcomes. We separately formulate our additional hypotheses for situations with *symmetric claims* (i.e. all group members have made the same contribution) and situations with *heterogeneous claims* (i.e. the group members have made different contributions).

Symmetric Claims Situations with symmetric claims are those where all three group members have contributed either 1 point (5 EUR) or 3 points (15 EUR) to the surplus. Various theories of fairness, such as summarized by Konow (2003) suggest that the unique 'fair' outcome in this situation is an equal split. This should motivate 'fair-minded' players to propose the equal split, and to vote for it (and against other proposals). Anticipating this behavior, even purely self-interested players should do the same under unanimity rule, knowing that anything else is likely to only increase delay.[8] Thus, under *unanimity rule*, we hypothesize that subjects will propose and agree on the equal split.

[8] That is, if at least one of the players in a given group is 'fair-minded' in the way outlined, no unequal division can pass under unanimity rule.

Hypothesis 1. *In symmetric situations with unanimity rule, most proposers suggest three-way equal splits. Group members more often vote 'yes' on such proposals than on unequal splits. Therefore, equal splits pass with higher probability.*

The predictions implied for *majority rule* are less straightforward. Since proposers can build minimum winning coalitions, 'selfish' (or less 'fair-minded') players may attempt to do so, hoping that the included player will vote 'yes', either because he is also selfish, or because the larger share that he can be given (e.g. 50% instead of 33%) is enough to outweigh his fairness concerns. Thus, depending on (beliefs about) the distribution of types in a population, 'selfish' proposers will build minimum winning coalitions, and perhaps make relatively generous offers to their partners within such coalitions. This could result in a mix of three-way and two-way equal splits being proposed. When voting, fair-minded players should be more likely to support 'grand' proposals that are equal splits, and all players should be more likely, ceteris paribus, to support proposals that allocate larger shares to them. In sum, it appears difficult to predict which allocations will be proposed under majority rule. Relative to unanimity rule, however, we can expect minimum winning coalitions to be more common. We therefore formulate the following hypothesis to be compared against the results obtained.

Hypothesis 2. *In symmetric situation with majority rule, proposers attempt to build minimum winning coalitions. These coalitions are more likely to pass the larger the share offered to the coalition partner.*

Asymmetric claims Our second set of hypotheses is formulated for situations in which the group members have made different contributions, leading to heterogeneous claims. Given that high contributors *expect* to receive higher shares, and indeed people regard this as *fair* (Gächter and Riedl, 2005; Gantner et al., 2016), it is difficult for proposers to ignore claims under unanimity rule, as doing so is likely to result in failure of their proposal. Thus, players with larger contributions should receive higher offers. This prediction is in line with the existing evidence on the effect of heterogeneous claims under unanimity rule (Gächter and Riedl, 2005; Karagözoğlu and Riedl, 2014; Gantner et al., 2016).

Hypothesis 3. *In asymmetric situations with unanimity rule, shares offered are increasing in relative points contributed.*

In the presence of a self-serving bias, proposals should be more proportional the larger a player's contribution, as material self-interest and fairness concerns are aligned in these cases. Similarly, when voting, players with higher contributions should more often vote 'yes' the more proportional a proposal than individuals with lower contributions.

Hypothesis 4. *In asymmetric situations with unanimity rule, individuals with larger contributions more often suggest, and are more likely to vote 'yes' on the proportional split than members with smaller contributions.*

When claims are asymmetric, individuals are likely to differ in how much proportionality they perceive as 'fair', thus causing heterogeneity in fairness views. This, in turn, may lead to more delay in negotiations in asymmetric as compared to symmetric situations. In line with this prediction, Karagözoğlu and Riedl (2014) find that the bargaining duration significantly increases in treatments where subjects derive heterogeneous claims based on performance feedback relative to treatments in which no performance feedback is provided.

Hypothesis 5. *Under unanimity rule, delay occurs more frequently when players have asymmetric claims than when claims are symmetric.*

One reason why claims are likely to influence bargaining outcomes under unanimity rule is that all players have *veto power* which can be used to enforce claims as well as fairness perceptions. As was already discussed, this situation is fundamentally altered when *majority rule* is used. A player seeking to maximize his payoff may propose a minimum winning coalition excluding one responder. When responder claims differ, it is even conceivable that the proposer would systematically discriminate against the player with the larger claim, as she might be perceived as more 'expensive'. This hypothesis may fail if players' fairness conceptions cause them to be reluctant to exclude others from the winning coalition. As mentioned above, evidence from dictator games with prior production indicate that many subjects are indeed reluctant to exclude others in situations where they could do so. Note, however, that the frequency of minimum winning coalitions in (standard) Baron-Ferejohn experiments is significantly larger than the frequency of zero offers in standard dictator games. That is, subjects in multilateral bargaining games appear to be more willing to allocate nothing to one player. Therefore we tentatively conjecture that this willingness to exclude a player from payment will persist in our setting, even when the surplus is jointly produced. These considerations lead us to formulate the following hypothesis.

Hypothesis 6. *In asymmetric situations with majority rule, proposers attempt to build minimum winning coalition.*

Should this hypothesis prove to be true, an interesting follow-up question is which responder is more likely to be included in a minimum winning coalition. When responder 'claims' differ, two competing considerations may play a role. On the one hand, the responder with the larger claim may appear more deserving, and thus fairness concerns may dictate that she be included in the coalition. On the other hand, it appears likely that the responder with the smaller claim will be 'cheaper' - i.e. more likey to vote 'yes' for a given share being offered. Thus, proposers may strategically exclude the player with the larger claim. Which of these considerations prevails more often is an empirical question. We will organize our analysis around the following hypothesis.

Hypothesis 7. *When the responders' contributions differ, proposers who build minimum winning coalitions are more likely to include responders with smaller contributions.*

As under unanimity rule, heterogeneous claims are likely to cause more disagreement in subjective fairness ideals which will lead to more delay in negotiations as compared to situations with homogeneous claims.

Hypothesis 8. *Under majority rule, delay occurs more frequently when players have asymmetric claims.*

Majority versus Unanimity rule All hypotheses formulated thus far concern the effects of claims *within* each of our treatments (majority and unanimity rule). Finally, we formulate two hypotheses regarding differences between the two treatments. First, claims should affect proposals (and final outcomes) more strongly under unanimity than under majority rule. Under unanimity rule, the existence of veto power implies that claims and fairness perceptions can be enforced. Under majority rule, in contrast, subjects can trade off fairness against higher shares for themselves which might cause less fair-minded players to propose minimum winning coalitions and even relatively fair-mindeded individuals might propose less proportional and more equal divisions of the surplus. Thus, under majority rule proposals and final outcomes should shift away from the proportional split.

Hypothesis 9. *Proposals and final outcomes under majority rule are less proportional than under unanimity rule whenever the proposer has made a smaller contribution.*

The final hypothesis concerns the length of the bargaining process under both decision rules. Given that under majority rule less members need to consent, majority rule should lead to faster agreement than unanimity rule. This effect should be particularly pronounced in situations with heterogeneous claims as group members are more likely to hold conflicting fairness views. The final hypothesis is also in line with previous research conducted on the BF bargaining game. For example, Miller and Vanberg (2013, 2015) and Miller et al. (2017) find that delay occurs more frequently under unanimity rule.

Hypothesis 10. *Delay occurs more frequently under unanimity than under majority rule, especially in situations involving heterogeneous claims.*

5 Results

As indicated above, we purposefully designed the quiz blocks such that most subjects should earn at least one point, and some would earn three points. We did this because we want to focus on situations where all group members have made positive contributions, but the size of these contributions may differ. Table 2 summarizes the frequency with which we observed various constellations of points within the bargaining groups that were formed in both treatments. By focusing on situations where all contributions are positive, we lose approximately 25% of the data. We analyze these excluded cases in the Online Appendix. Also, we have relatively few observations where all subjects contributed either one point or three points. Since the *relative* contributions are the same in these situations, we will pool these data in the subsequent analysis.

Table 2: CONSTELLATIONS OF POINTS CONTRIBUTED

		Number of games	
Contributions	Surplus	Unanimity rule	Majority rule
(1,1,1)	15 EUR	20	30
(3,3,3)	45 EUR	47	39
(1,1,3)	25 EUR	87	117
(1,3,3)	35 EUR	140	116
not all positive	various	90	106
Total		408	384

As is typically done in the literature on Baron-Ferejohn bargaining, most of our empirical analysis will focus on the first round of bargaining. Given our method of having all subjects make a proposal, we observe three proposals per game. In situations where relative contributions differ, we will distinguish cases according to whether the proposer has made a relatively large or small contribution.[9] With this in mind, Table 3 presents

[9]Recall that, by design, individual contributions can take on only two values, 1 and 3.

the number of proposals we observed in each of five possible situations. Here and later, the first coordinate of the contribution vector (in bold) denotes the relative contribution of the *proposer*. When responder contributions differ, they are ordered such that the smaller contributor is listed first (i.e. the second coordinate). When responder contributions are the same, they are ordered alphabetically according to the letter i.d. (‘A’, ‘B’, or ‘C’) that players were randomly assigned at the start of the game.

Table 3: Situations observed (first round)

Percentage Contributions†	Number of proposals Unanimity rule	Majority rule
(**33**,33,33)	201	207
(**20**,20,60)	174	234
(**60**,20,20)	87	117
(**14**,43,43)	140	116
(**43**,14,43)	280	232
Total	882	906

† The first coordinate is the proposer’s percentage contribution.

5.1 Symmetric claims

We begin by discussing the situations where all subjects have contributed the same number of points (either 1 or 3). Figure 1 displays the distribution of proposals within a simplex. In this and the following figures, the simplex is defined such that the shares allocated to responders 1 and 2 are measured along the horizontal and vertical axes, respectively. As mentioned above, responders are ordered alphabetically according to the letter i.d. they were assigned on the decision screen. The south-west corner would correspond to a proposal where the proposer demands the entire pie, and the right and top corners represent points where everything is allocated to responder 1 and responder 2, respectively. For orientation, a number of focal points are highlighted. Equal splits (both two- and three way) are marked in blue. The proportional split (reflecting claims) is marked in red. (In the symmetric case, the proportional split is identical to the three-way equal split.) The size of the bubbles reflect the relative frequency of the corresponding proposals, and the pie charts within the bubbles display the fraction of proposals that pass (in green) and fail (in red). Finally, each (sub)figure contains information about the three most frequently observed proposals. For

Figure 1: Proposals and passage rates, $c = (33, 33, 33)$

(a) Unanimity rule ($N = 201$) (b) Majority rule ($N = 207$)

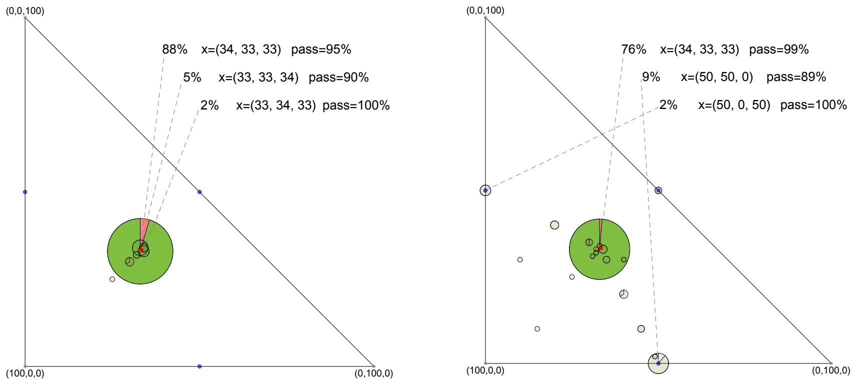
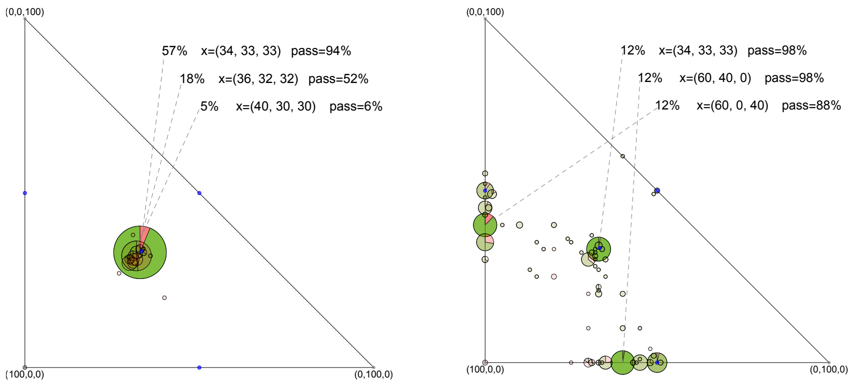


Figure 2: Proposals and passage rates, no claims†

(a) Unanimity rule ($N = 339$) (b) Majority rule ($N = 354$)



† These data are taken from a previous experiment (Miller and Vanberg, 2013)

example, the most frequently observed proposal under unanimity rule is an equal split.[10] It accounts for 88% of all offers, and it passes 95% of the time.

As can be easily recognized by inspecting Figure 1, behavior in the symmetric situation is quite similar under both rules. In particular, the vast majority of proposals are either equal splits or very close to equal splits, and these proposals almost always pass. Overall, 94% and 95% of proposals pass under unanimity and majority rule, respectively (see Table 5 below). Under majority rule, we observe only few minimum winning coalitions being proposed and all of them suggest the two-way equal split.

[10] Although the figure displays these as $(34, 33, 33)$, these may include some proposals that were actually $(33, 33, 33)$. The simplex is constructed such that the first coordinate is 100 minus the other two, i.e. we are assuming that all proposals sum to 100.

While this behavior was to be expected under unanimity rule (see Hypothesis 1), it is somewhat surprising under majority rule. As mentioned, previous experiments on the BF game without claims have found that most proposers build minimum winning coalitions (MWCs), excluding one responder from payment. As an example, consider Figure 2, which presents the distribution of proposals in a prior BF experiment without claims (Miller and Vanberg, 2013). Our results suggest that the willingness to completely exclude one player from payment is substantially reduced when the surplus being distributed has been jointly produced. Comparing our own and results reported in Miller and Vanberg (2013), we find that the fraction of MWCs is significantly lower in our sample (Chi-squared test, 11% vs. 66%, $p < 0.01$, $N_1 = 207$ and $N_2 = 354$). Thus, we can reject Hypothesis 2.[11]

One reason why individuals might propose a three-way equal split more often than a MWC is that MWCs may be less likely to pass. Although we have only few relevant observations, we find that the passage rate in MWCs is smaller than in grand coalitions (85% versus 96%). To test for significance, we compare the fraction of passed proposals in grand and minimum winning coalitions for each matching group. We do not find that the difference in passage rates is statistically significant (Wilcoxon matched-pairs signed-ranks test, $p = 0.53$, $N = 13$).[12] To the extent that subjects could have anticipated or learned this over time, the fact that few MWCs are proposed suggests that individuals indeed regard it as fair to respect other subjects' claims.

To analyze how the location of a proposal affects voting behavior, we run a Random-effects probit regression using the voting decision as dependent variable.[13] The independent variables are the Euclidean distance to the equal (proportional) split and the period. Under both decision rules, we find that the probability to vote 'yes' decreases significantly as the distance to the equal split increases (Average marginal effect; Unanimity rule $\beta = -0.02$, $p < 0.01$; Majority rule $\beta = -0.01$, $p < 0.01$). Hence, deviations from the equal split result in higher disapproval.[14]

Result 1. *In symmetric situations, the vast majority of proposers suggest a three-way equal split under both decision rules. Under majority rule, only a small number of proposers*

[11]It should be noted that the frequency of MWCs increases over time. If we focus only on the final 4 periods, it is 17%. This is still substantially smaller than what is observed in periods 9-12 of Miller and Vanberg (2013) (79%, $p < 0.01$, $N_1 = 48$ and $N_2 = 96$)

[12]We observe MWCs being proposed in 13 of 17 matching groups in the majority rule treatment.

[13]Each individual votes on the proposals of both other group members in every game. We use panel methods assuming that voting decisions are uncorrelated with individual characteristics.

[14]Given that all MWC proposals suggest a two-way equal split, we cannot test the second part of Hypothesis 2.

attempt to build a minimum winning coalition. Those that do always propose a two-way equal split. Under both decision rules, proposals are more often rejected, the larger the distance to the equal split. (Consistent with Hypothesis 1, inconsistent with Hypothesis 2.)

5.2 Asymmetric claims, unanimity rule

Next we look at situations in which the group members have contributed different amounts to the surplus. We begin by considering behavior under unanimity rule.

Figure 3 displays the distribution of proposals and corresponding passage rates in the $c = (20, 20, 60)$ situation. The left panel depicts cases in which the proposer has contributed 20%, the right panel those in which his contribution is 60%.

Three patterns are immediately visible. First, virtually all proposals are located on a line connecting the *proportional* (marked in red) to the *three-way equal* split (blue). Second, the distribution of proposals shifts away from the equal split and towards the proportional split when the proposer's own contribution is relatively larger (right panel). In these cases, the proposer suggests the proportional split almost twice as often (57% vs. 30%). Finally, the proportional split passes less often when the proposer has made a comparatively large contribution (68% vs. 85%) but this difference is only marginally significant (Wilcoxon matched-pairs signed-ranks test, $N = 30$, $p = 0.1$).

The corresponding distributions for the $c = (14, 43, 43)$ situation are depicted in Figure 4. Again, the left and right panels depict the cases where the proposer's contribution is relatively small (i.e. 14%) or large (43%). In the second asymmetric situation, we observe the exact same pattern as in the previously discussed $c = (60, 20, 20)$ situation.

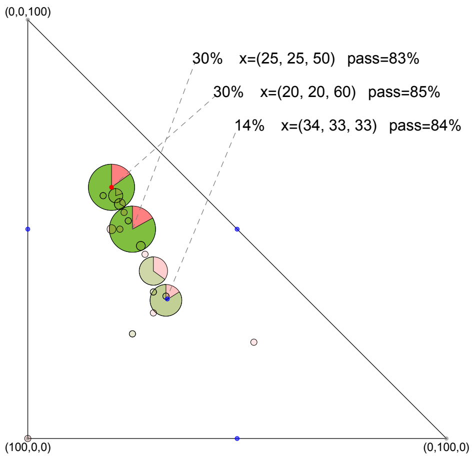
Given that virtually all proposals in both asymmetric situations are somewhere in between the equal and proportional splits, it follows immediately that offers are affected by claims. Table 4 summarizes the average offers made in all situations and in both treatments. Focusing on the middle column for now, we can see that the ordinal ranking of offers received matches that of the claims in all situations. This pattern is consistent with Hypothesis 3.

Result 2. *In asymmetric situations with unanimity rule, shares offered are increasing in relative points contributed. (Consistent with Hypothesis 3.)*

In order to assess the statistical significance of these patterns, we take advantage of the fact that almost all proposals are located along the line connecting the proportional to the three-way equal split. This allows us to reduce the data to a single dimension, as

Figure 3: PROPOSALS AND PASSAGE RATES, $c = (20, 20, 60)$, UNANIMITY RULE

(a) $(20, 20, 60)$ $(N = 174)$



(b) $(60, 20, 20)$ $(N = 87)$

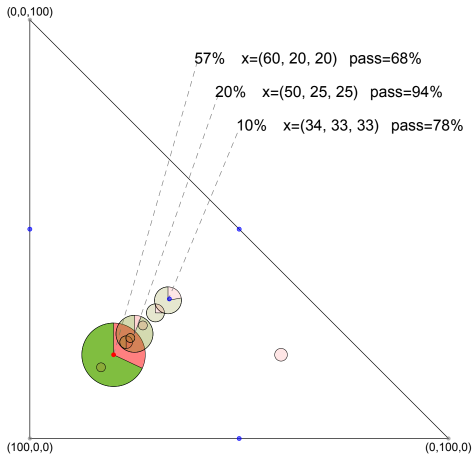
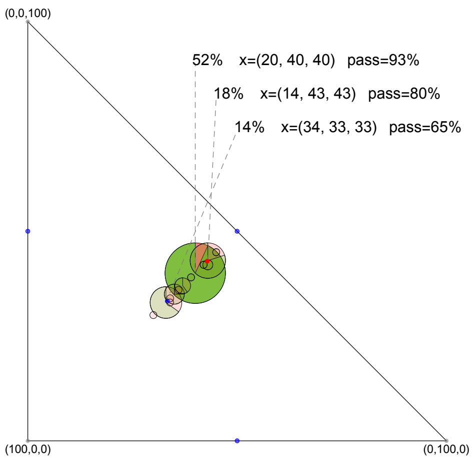


Figure 4: PROPOSALS AND PASSAGE RATES, $c = (14, 43, 43)$, UNANIMITY RULE

(a) $(14, 43, 43)$ (N=140)



(b) $(43, 14, 43)$ (N=280)

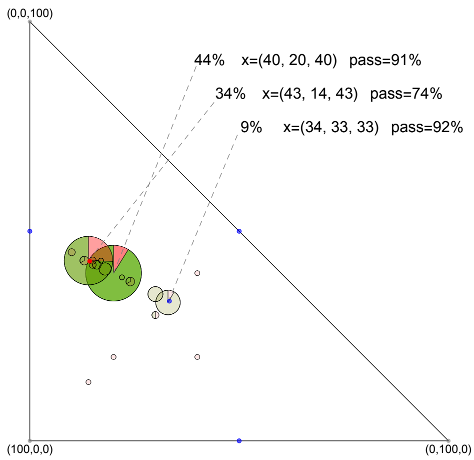


Table 4: Average proposed shares[†]

Percentage Contributions (c_0, c_1, c_2)	*Unanimity Rule* Average Offers (y_0, y_1, y_2)	*Majority Rule* Average Offers (y_0, y_1, y_2)
(**33**, 33, 33)	(33, 33, 33)	(36, 34, 30)
(**20**, 20, 60)	(26, 25, 49)	(31, 29, 40)
(**60**, 20, 20)	(53, 24, 23)	(55, 25, 20)
(**14**, 43, 43)	(22, 39, 39)	(28, 39, 33)
(**43**, 14, 43)	(40, 19, 40)	(43, 16, 41)

[†] When responder contributions are the same, they are ordered according to the letter i.d. assigned to them in the corresponding bargaining game.

follows. For each proposal y_i, we identify its *scalar projection* onto the line described by the equation

$$y_i = (1 - a_i) \cdot \text{equal split} + a_i \cdot \text{proportional split}$$

The corresponding value of a_i characterizes the point on the line which is closest to the proposal, i.e. whose connecting vector is orthogonal to the line. Thus, $a_i = 0$ corresponds to the equal, and $a_i = 1$ to the proportional split. After we identify the a_i for each proposal, we can look at the distribution of the a_i as well as its effect on voting and passage rates.

Figure 5 displays the distribution of a_i values in the $c = (20, 20, 60)$ situation. As above, the left and right panels show the situation where the proposer's own contribution is 20% and 60%, respectively. Within each bar, the lighter region represents the fraction of proposals that passed. Comparing the right to the left panel, we see that the distribution appears to be shifted to the right, with nearly twice as much weight on the proportional split (located at $a_i = 1$) when the proposer's own contribution is large. Using paired matching group averages as our unit of observation, we find that this difference is statistically significant (Wilcoxon matched-pairs signed-ranks test, $p < 0.01$, $N = 16$).

The corresponding distribution of a_i values for the $c = (14, 43, 43)$ situation are displayed in Figure 6. Again, we see that the distribution shifts to the right, i.e. towards the proportional split, when the proposer has made a relatively large contribution (right panel). To test for significance, we compare the average values of a_i in all matching groups and find a significant difference (Wilcoxon matched-pairs signed-ranks test, $p < 0.01$, $N = 16$). Hence, in both asymmetric situations we find that proposals are more proportional if the

Figure 5: Distribution of a_i values, $c = (20, 20, 60)$, unanimity rule

(a) $(20, 20, 60)$ (N=174) (b) $(60, 20, 20)$ (N=87)

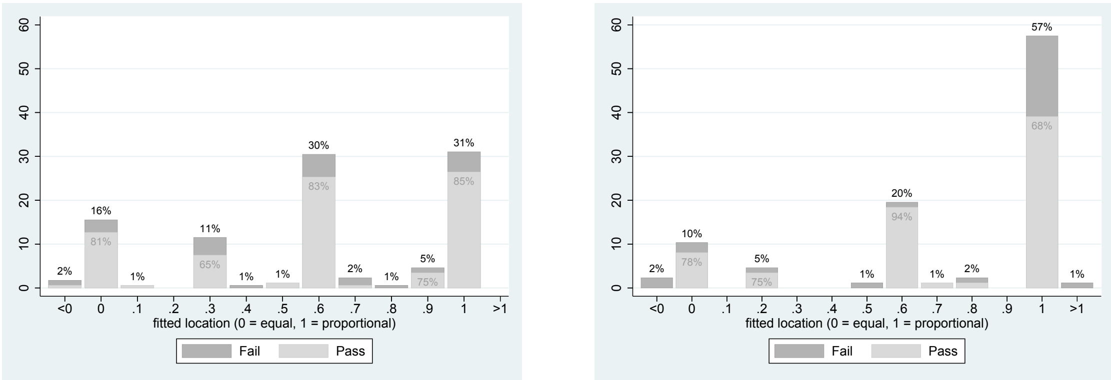
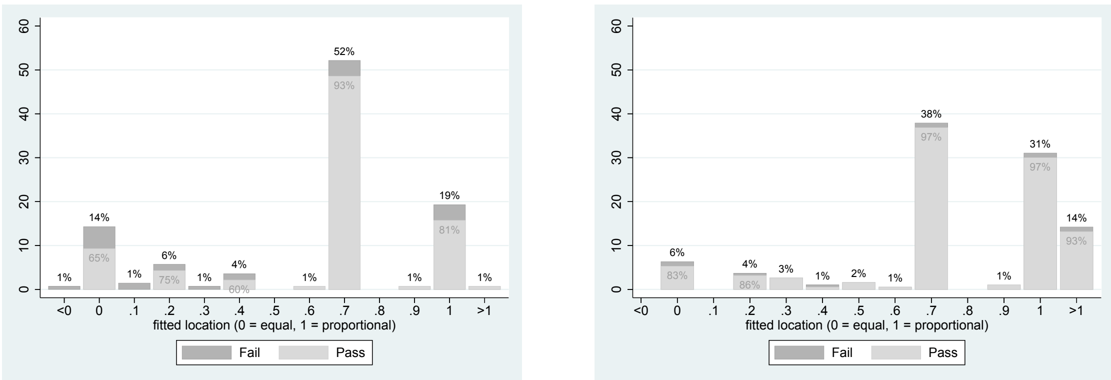


Figure 6: Distribution of a_i values, $c = (14, 43, 43)$, unanimity rule

(a) $(14, 43, 43)$ (N=140) (b) $(43, 14, 43)$ (N=280)



proposer himself has made a relatively large contribution. This supports the first part of Hypothesis 4.

To assess the effect of proposal location on voting behavior, we run Random-effects probit regressions. Results for unanimity rule are summarized in the top part of Table 5. In each regression, the dependent variable is the voting decision, coded as $v_i = 1$ if a subject votes 'yes' and $v_i = 0$ otherwise. The independent variables are a_i and the period. For the $(20, 20, 60)$ situation, we find that the coefficient on a_i is positive and significant for responder 2 but insignificant for responder 1. That is, the subject with the larger claim is significantly more likely to vote yes if the proposal is closer to the proportional split. We observe a similar pattern in the $(43, 14, 43)$ situation. Namely, the coefficient on a_i is positive and significant for responder 2 but negative and significant for responder 1.

Hence, in this situation the individual with the larger claim is more likely to vote yes if the proposal is closer to the proportional split while the opposite is true for the individual with the smaller claim. We also find that the coefficient of a_i is positive in the $(14, 43, 43)$ situation where both responders have made a relatively large contribution. In contrast, we find no significant opposite effect of a_i on voting in the $(60, 20, 20)$ situation, where both responders have made a relatively small contribution. In summary, our results indicate that responders with relatively large contributions vote 'yes' more often the more proportional a proposal. On the other hand, we find only partial evidence that individuals with lower contributions less often vote 'yes', as suspected in the second part of Hypothesis 4.

Result 3. *In asymmetric situations and under unanimity rule, individuals who have made relatively large contributions make proposals that are closer to the proportional split than do individuals who have made relatively small contributions. Responders with large contributions are more likely to vote 'yes' on proposals closer to the proportional split. (Partially consistent with Hypothesis 4.)*

Table 5: Effect of proportionality on responder votes (grand coalitions)

		(20, 20, 60)	(43, 14, 43)	(60, 20, 20)	(14, 43, 43)
Unanimity rule	Responder 1	-.03	-.48 ***	-.09	.22 ***
	Responder 2	.24 ***	.07 *		
	# of obs	(174)	(280)	(174)	(280)
	# of ids	(74;60)	(67;85)	(74)	(85)
Majority rule	Responder 1	-.14***	-.70 ***	-.48***	.34***
	Responder 2	.44 ***	.19 ***		
	# of obs	(234)	(232)	(234)	(232)
	# of ids	(90;67)	(57;86)	(90)	(86)

Responder 1's contribution corresponds to the second individual in the contribution vector, responder 2 to the third. The table reports average marginal effects of proposal location. ($a_i = 0$ and $a_i = 1$ correspond to equal and proportional splits.) The coefficient can *roughly* be interpreted as the effect of proposing the proportional rather than the equal split. (However, it is not evaluated at the equal split.) Under majority rule, we only include 'fitted' grand coalitions in our regressions.

Turning to rates of passage, it is apparent that proposals fail more often in the asymmetric situation (Figures 3 and 4) than in the symmetric situation (Figure 1, left panel). Table 6 presents information on the overall passage rates in each of the situations observed. Pooling all asymmetric situations, the overall rate of passage under unanimity rule is 79%, as compared to 94% in the symmetric situation. By comparing average passage rates within each matching group, we find that this difference is significant (Wilcoxon signed-ranks test, $p = 0.01$, $N = 16$). This supports our Hypothesis 5.

Table 6: PASSAGE RATE BY SITUATION (ALL FIRST ROUND PROPOSALS)

	(33,33,33)	(20,20,60)	(60,20,20)	(14,43,43)	(43,14,43)	Total
Unanimity rule	94%	78%	71%	82%	81%	83%
	189/201	136/174	62/87	115/140	228/280	730/882
Majority rule	95%	93%	84%	76%	95%	90%
	196/207	217/234	98/117	88/116	220/232	819/906
Rank Sum p†	0.95	0.01	0.67	0.89	< 0.01	< 0.01

† Rank sum tests are based on fraction passed within each matching group (16 and 17 observations for unanimity and majority rule, respectively).

Result 4. *Under unanimity rule, the passage rate is larger in situations where claims are symmetric as compared to situations in which claims are asymmetric. (Consistent with Hypothesis 5.)*

5.3 Asymmetric claims, majority rule

Now we turn to the majority rule treatment, and continue to look at situations where subjects have heterogeneous claims. Figures 7 and 8 display the distribution of proposals and the corresponding passage rates in detail. A salient pattern in these figures is that proposals are concentrated in three distinct areas. As in the unanimity rule treatment, the vast majority is located along a line connecting the three-way equal to the proportional split. In addition, a small number of proposals are located along either the horizontal or vertical axis, corresponding to minimum winning coalitions with responder 1 or responder 2, respectively.

Looking only at the grand coalitions in the $c = (20, 20, 60)$ and the $c = (14, 43, 43)$ situations, we observe that the distribution of proposals shifts towards the proportional split when the proposer's contribution is relatively larger (right panels). In these cases the proposer suggests the proportional split three times as often in the $c = (20, 20, 60)$ (12% vs. 39%), and almost twice as often in the $c = (14, 43, 43)$ situation (18% vs. 34%). Although we observe few minimum winning coalitions ((20,20,60) 16%, (60,20,20) 19%, (14,43,43) 9%, (43,14,43) 18%), the distribution of offers within these coalitions seems to reflect claims. That is, a two-way equal split is proposed if both coalition partners have made the same contribution, whereas partners with higher (lower) contributions are offered more (less) than the two-way equal split. For example, in the (20,20,60) the average offers to responder 1 and 2 are 50 and 62%, respectively. In the (43,14,43) situation average

Figure 7: Proposals and passage rates, $c = (20, 20, 60)$, majority rule

(a) $(20, 20, 60)$ (N=86) (b) $(60, 20, 20)$ (N=43)

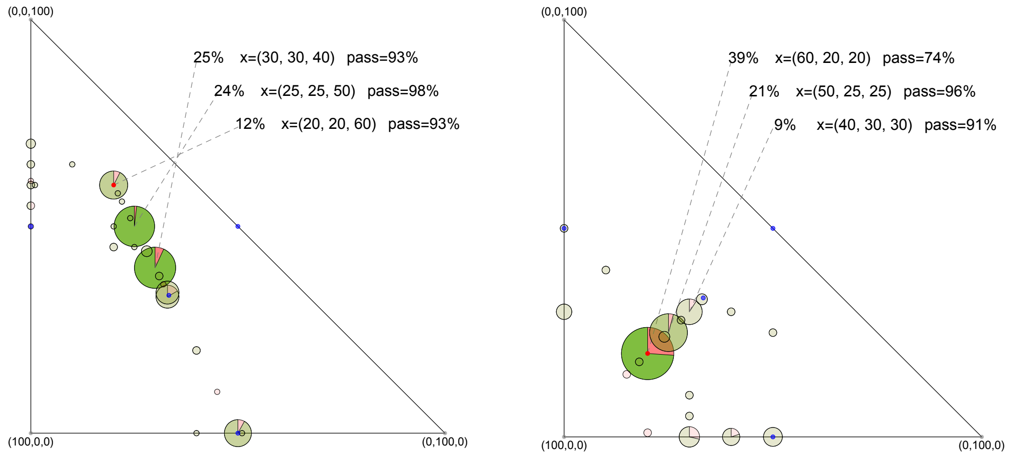
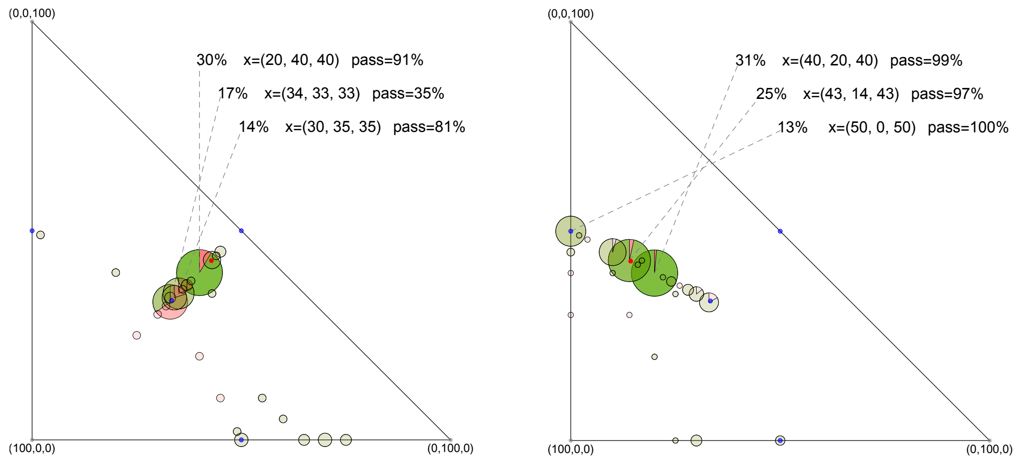


Figure 8: Proposals and passage rates, $c = (14, 43, 43)$, majority rule

(a) $(14, 43, 43)$ (N=86) (b) $(43, 14, 43)$ (N=43)



offers within MWCs are 37% to responder 1 and 50% to responder 2.

To study the composition and frequency of MWCs in more detail, we split proposals into three categories according to whether they are closest to one of the axes or the line connecting the equal and the proportional splits (extending out beyond those points).[15] Thus, by this definition, a proposal that allocates a very small share to one responder would be classified as a 'fitted' minimum winning coalition. Note that this measure will classify *more* proposals as MWCs than a more 'strict' definition would. The percentage of proposals that are thereby categorized as 'fitted' MWCs and 'fitted' grand coalitions is summarized in Table 7. The left and right parts of the table provide information on all periods and on the last 4 periods, respectively.

Table 7: Proposed coalition composition, majority rule

	All periods				Periods 9-12			
	MWC with		Grand		MWC with		Grand	
Situation	resp. 1	resp. 2	coalition	N	resp. 1	resp. 2	coalition	N
(33,33,33)	10%	3%	87%	207	15%	6%	79%	48
(20,20,60)	12%	5%	83%	234	18%	3%	79%	94
(60,20,20)	18%	5%	77%	117	26%	6%	68%	47
(14,43,43)	12%	1%	87%	116	24%	0%	76%	38
(43,14,43)	3%	15%	82%	232	5%	25%	70%	76
Total	10%	7%	83%	906	16%	10%	74%	303

Notes: 'Situations' are defined such that the first coordinate is the proposer, the second and third are responder percentage contributions.

In every situation, we find that the vast majority of proposers (83%) build grand rather than minimum winning coalitions (MWCs). Although the fraction of MWCs increases somewhat over time, it remains low even in the last four experimental periods (26%). This evidence is inconsistent with Hypothesis 6. Comparing the fraction of MWCs across situations, we find that they are more frequent in asymmetric (18%) than in symmetric situations (13%). This difference persists, although smaller in size, in the last 4 periods (21% vs. 27%) and is significant (Wilcoxon matched-pairs signed-ranks test, $p = 0.06$, $N = 10$). Turning to the composition of MWCs, we do not find evidence that proposers

[15]For this purpose, we compute the scalar projection onto the line connecting the three-way equal and the proportional split. Thereafter, we calculate the Euclidean distance (ϵ) of the vector connecting a proposal to this line. In addition, we measure the distance to the horizontal and the vertical axes which are x_2 and x_1 respectively. By comparing the length of the three vectors, we are able to identify a proposal as 'fitted grand coalition' (i.e. $\epsilon < x_1$ and $\epsilon < x_2$) etc.

systemically exclude members with higher claims as conjectured in Hypothesis 7. In the (20,20,60) situation, proposers are indeed more likely to include responder 1 who has contributed a smaller share (Wilcoxon matched-pairs signed-ranks test, $p = 0.08$, $N = 8$). However, in the (43,14,43) situation, proposers are more likely to include responder 2 who has made a larger contribution (Wilcoxon matched-pairs signed-ranks test, $p < 0.01$, $N = 10$). This is despite the fact that responder 2 is offered higher shares when included in a MWC than responder 1 (see above). Hence, when responders have different claims, it appears that the proposer is more likely to include the responder who has contributed the same share as the proposer. Thus, we do not find that the responder with the higher claim is systematically excluded. This evidence stands in contrast to our Hypothesis 7.[16]

Result 5. *In asymmetric situations with majority rule, the vast majority of proposers attempt to build grand coalitions. Those who do build minimum winning coalitions are more likely to include the responder who has made the same contribution as themselves. (Inconsistent with Hypotheses 6 and 7.)*

Focusing only on the 'fitted' grand coalitions, Figures 9 and 10 provide histograms of the a_i values (calculated as above - see Subsection 5.2). Among the 'fitted' grand coalitions, we observe the same pattern as in the unanimity rule treatment. Namely, in both figures, the distribution of proposals seems to be shifted to the right, i.e. towards the proportional split, when the proposer has made a relatively large contribution (right panels). Using matching group averages of a_i as unit of observation, we find that the average values of a_i are indeed significantly larger when the proposer has made a relatively large contribution in both situations (Wilcoxon matched-pairs signed-ranks test; (20,20,60), $p < 0.01$, $N = 17$; (14,43, 43), $p < 0.01$, $N = 16$).

Result 6. *In asymmetric situations with majority rule, proposers with larger contributions are more likely to suggest the proportional split.*

Turning to voting behavior, we explore how the location of a proposal affects the decision to vote 'yes'. We do so separately for grand and minimum winning coalitions, starting

[16]In addition, we find that whenever responders have the same claims, proposers are more likely to include responder 1. Remember that we ordered responders according to the letter i.d. they received on the decision screen. That is, if the proposer's i.d. is 'A', responder 1 corresponds to the individual displayed as 'B' on the decision screen. If the proposer's i.d. was instead 'B' responder 1 corresponds to the individual displayed as 'A' on the decision screen. Hence, in both of these cases responder 1 is the person displayed below the proposer on the decision screen which might have affected the likelihood of receiving a positive offer.

with the latter. As would be expected, the most important determinant of voting on MWC proposals is whether a subject is included in the proposed coalition. If not, virtually all subjects (96%) vote 'no'. In contrast, those included vote 'yes' in 92% of all cases. To test how the location of a proposal affects the decision to vote 'yes' within a MWC, we run a Random-effects probit regression[17], with the voting decision as dependent and the period as well as the share being offered as the independent variables. Our tests reveal that coalition members are more likely to vote 'yes' the higher the share they are offered (Average marginal effect, $\beta = 0.01$, $p = 0.04$).

In a second step, we explore voting behavior within the 'fitted' grand coalitions that we observe in the majority rule treatment. For this purpose, we again run a set of Random-effects probit models, using the voting decision as dependent and the period as well as a_i as independent variables. The bottom half of Table 5 reports the average marginal effects of a_i on the decision to vote yes. In the $(20, 20, 60)$ and the $(43, 14, 43)$ situations, the coefficient on a_i is negative (and significant) for responder 1 and positive (and significant) for responder 2. Consistent with this pattern, we find that the coefficient on a_i is negative (and significant) in the $(60, 20, 20)$ and positive (and significant) in the $(14, 43, 43)$ situation. Hence, our findings indicate that individuals with relatively large claims are more likely to vote yes if a proposal is closer to the proportional split while the opposite holds for individuals with smaller claims.

Result 7. *In asymmetric situations with majority rule, responders with larger contributions more often vote 'yes' the more proportional a proposal suggested in a grand coalition. Responders included in a MWC more often vote 'yes' the larger the share they are being offered.*

In a last step we explore passage rates. As displayed in Table 6, we observe that 89% of the proposals pass in the asymmetric situations. This is significantly smaller than the passage rate in symmetric situations which amounts to 95% (Wilcoxon matched-pairs signed-ranks test, $p = 0.01$, $N = 17$) which supports our Hypothesis 8.[18]

[17]Each subject votes on the proposals of the other two group members. We use the voting decisions of each individual as panel variable assuming that voting decisions are independent of individual characteristics.

[18]We also do not find that the passage rate is larger in grand than in minimum winning coalitions (Wilcoxon matched-pairs signed-ranks test, $p = 0.18$, $N = 12$) although this result is based on few observations. If subjects were able to anticipate or learn this over time, the fact that we observe few MWCs suggests that individuals prefer to form grand coalitions. We are unable to test this conjecture given that we did not elicit beliefs over passage rates.

Result 8. *Under majority rule, the passage rate is larger in situations where claims are symmetric as compared to situations in which claims are asymmetric. (Consistent with Hypothesis 8.)*

5.4 Majority versus Unanimity rule

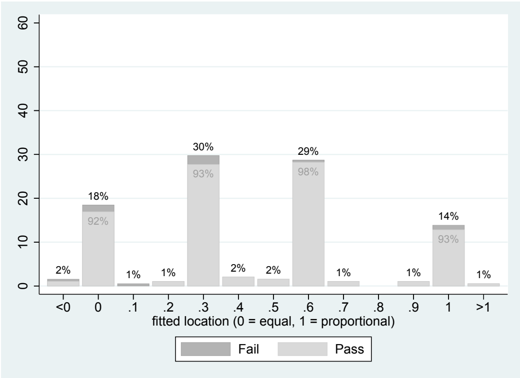
So far, we have separately discussed outcomes under both rules. In contrast to our hypotheses, we find a remarkable number of similar patterns. First, average shares offered increase in relative points contributed under both decision rules (see Table 4). Hence, offers reflect claims even under majority rule. Second, we find that offers under both rules are concentrated on a line connecting the three-way equal and proportional splits, moving closer to the proportional split if the proposer has made a relatively larger contribution. Third, individuals with relatively large contributions are more likely to vote 'yes' the closer a proposal to the proportional split. In this section, we analyze how the decision rule itself affects offers as well as passage rates and explore differences in these common patterns.

We start by comparing the distribution of grand coalition offers (i.e. distribution of a_i) between treatments. The corresponding distributions for the $(20, 20, 60)$ situation are displayed in the left panels of Figures 5 and 9. It appears that the distribution is shifted to the right (i.e. towards the proportional split) under unanimity as compared to majority rule. In particular, we observe almost twice as many proportional proposals under unanimity rule (31% vs. 14%). This is also the case in the $(14, 43, 43)$ situation, depicted in the left panels of Figures 6 and 10. Here, the fraction of proportional proposals is 19% under unanimity and only 5% under majority rule. By comparing the average values of a_i across matching groups, we find that proposals are indeed significantly closer to the proportional split under unanimity rule in both situations (Wilcoxon rank-sum test; $(20, 20, 60)$, $p = 0.02$; $(14, 43, 43)$, $p = 0.01$; $N = 33$). In contrast, we do not find that the decision rule has a significant effect in the $(43, 14, 43)$ (Wilcoxon rank-sum test, $p = 0.26$, $N = 32$) and the $(60, 20, 20)$ situations, i.e. when the proposer has made a relatively large contribution (Wilcoxon rank-sum test, $p = 0.8$, $N = 33$). These findings lend partial support for our Hypothesis 9.

Result 9. *Proposals under majority rule are less proportional (and more equal) as compared to unanimity rule in situations where the proposer's contribution is relatively small. In contrast, the degree of proportionality does not differ significantly when the proposer has made a relatively large contribution. (Partially consistent with Hypothesis 9.)*

Figure 9: DISTRIBUTION OF a_i VALUES IN 'FITTED' GRAND COALITIONS, $c = (20, 20, 60)$, MAJORITY RULE

(a) $(20, 20, 60)$ (N=195)



(b) $(60, 20, 20)$ (N=90)

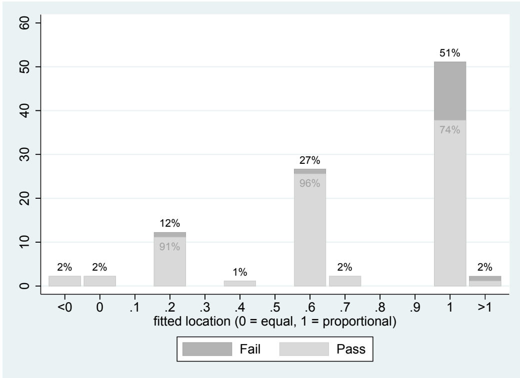
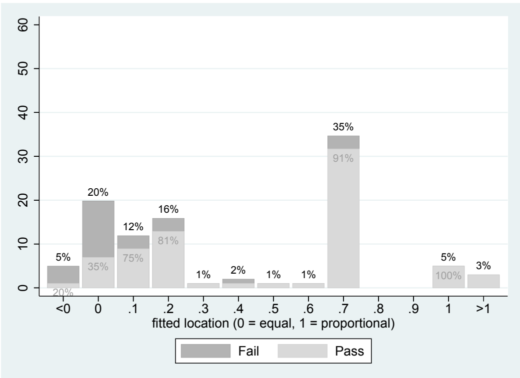
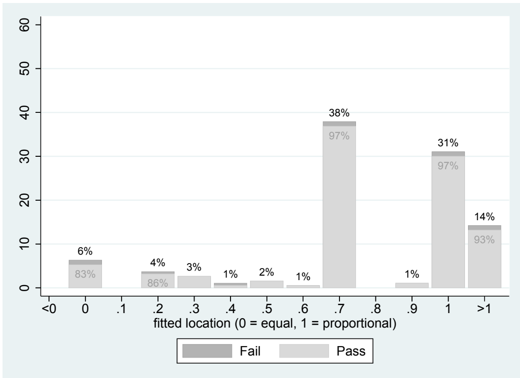


Figure 10: DISTRIBUTION OF a_i VALUES IN 'FITTED' GRAND COALITIONS, $c = (14, 43, 43)$, MAJORITY RULE

(a) $(14, 43, 43)$ (N=101)



(b) $(43, 14, 43)$ (N=190)



As stated in Hypothesis 10, we are also interested in how the decision rule affects the incidence of delay. Given that delay is costly in our setting, this allows us to comment on the efficiency of agreements reached under both decision rules. Table 6 above summarizes the passage rates under both decision rules for each situation observed in our experiment. Averaged over all situations (including the symmetric ones), we find that the passage rate is significantly higher under majority than under unanimity rule (83% vs. 90%, Wilcoxon rank-sum test, $p < 0.01$, $N = 33$). This difference in passage rates is slightly higher in the asymmetric situations (78% vs. 89%, Wilcoxon rank-sum test, $p < 0.01$, $N = 33$). However, when comparing the passage rates in each situation separately, we find no significant differences in the $(60, 20, 20)$ situation, nor in the $(14, 43, 43)$ situation. Hence, we only find partial support for our Hypothesis 10.

Result 10. *On average, the passage rate is significantly higher under majority as compared to unanimity rule, especially when considering asymmetric situations only. However, when comparing the passage rates under unanimity and majority rule for each situation separately, we do not find significant differences in the* $(60, 20, 20)$ *and the* $(14, 43, 43)$ *situations. (Partially consistent with Hypothesis 10.)*

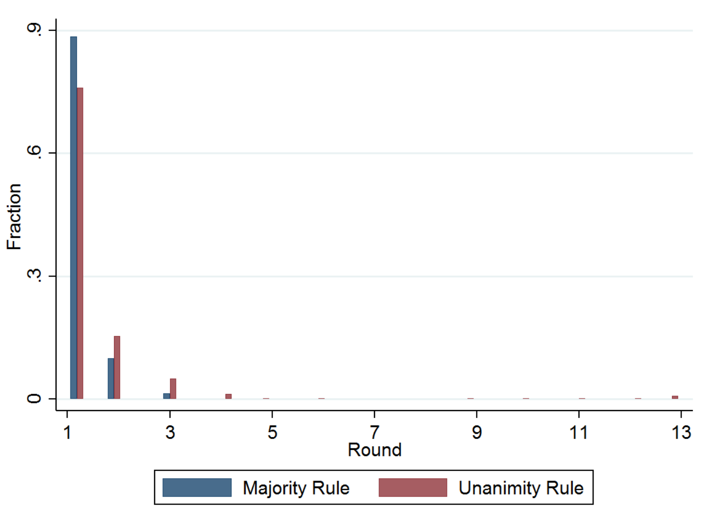
5.5 Final Outcomes

So far, our analysis has focused on the first proposals within each game. In this section, we will instead analyze final outcomes. As a first step, we want to assess how the decision rule affects the length of the bargaining process, i.e. how many rounds of bargaining were necessary before a given group reached agreement. Figure 11 plots the distribution of bargaining rounds in the majority and the unanimity rule treatment. Although many groups reach an immediate agreement under both rules (89% under majority and 82% under unanimity rule), we observe significantly more groups which continue to bargain over several rounds in the unanimity rule treatment (Wilcoxon rank-sum test, $p < 0.01$, $N = 33$). Hence, this is additional support for the hypothesis that unanimity rule leads to more delay as compared to majority rule.

To study final outcomes, we restrict our analysis to the first randomly selected proposal which passes.[19] In situations where the group members have made different contributions,

[19] The number of observations that we observe for each constellation of points can be inferred from Table 2. Only one of the groups in the $(1, 1, 3)$ situation did not reach an agreement in the unanimity treatment. As in the previous sections, we will focus on relative contributions and, thus, pool the cases in which all group members have either contributed one or three points.

Figure 11: Rounds before reaching agreement

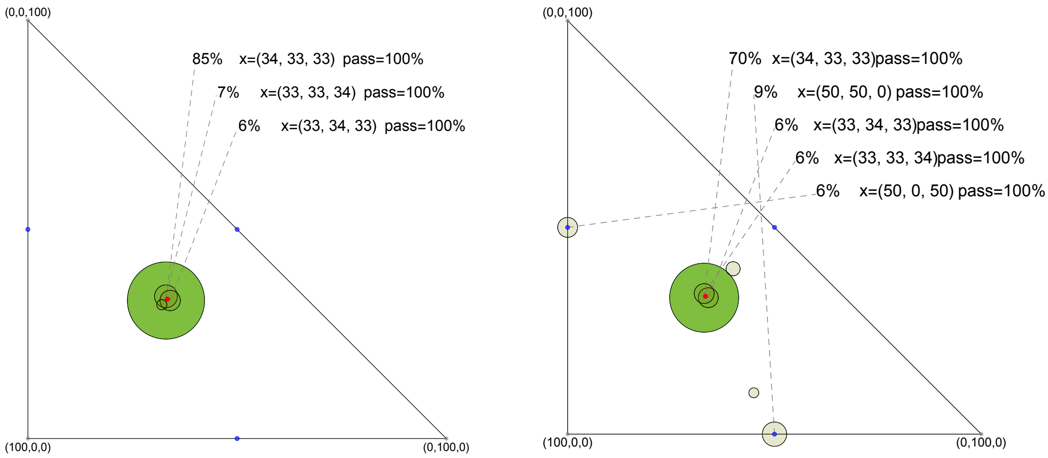


we will not distinguish between the points contributed by the proposer and the two responders, but instead simply study the share of the surplus received by each group member.

Given the large share of proposals which pass immediately, we would expect that the final outcomes resemble initial proposals, analyzed in detail in the last sections. Figures 12 to 14 depict the distribution of final outcomes in all three situations. (In each Figure, players are ordered according to the size of their contribution, from low to high.) The left panels depict the distribution of final outcomes under unanimity rule, the right panels those under majority rule. Indeed, we observe the exact same patterns as in the previous sections: First, final bargaining outcomes are quite similar under both decision rules. Most notably, we continue to observe few minimum winning coalitions being formed under majority rule. Second, almost all grand coalitions are located on a line connecting the equal and the proportional splits. However, comparing the left and right panels of Figures 13 and 14, we see that outcomes move away from the proportional split under majority rule. For example, in the $(14, 43, 43)$ situation, the fraction of proportional outcomes falls from 49% to 34% when moving from unanimity to majority rule. Using scalar projections (see above), we find that outcomes are indeed significantly less proportional under majority rule in the (20,20,60) situation (Ranksum test,$p = 0.09$ $N = 33$) but not in the (14,43,43) situation (Ranksum test, $p = 0.14$). Hence, outcomes are less proportional under majority rule when a majority of individuals have made relatively small contributions (i.e. in the (20,20,60) situation) but not if a majority of individuals have made relatively large contributions (i.e. in the (14,43,43) situation).

Figure 12: FINAL OUTCOMES IN $c = (33, 33, 33)$

(a) Unanimity rule (N=67) (b) Majority rule (N=69)



Result 11. *The final outcomes in grand coalitions are less proportional under majority as compared to unanimity rule if at least two group members have contributed less than 33% to the surplus. Otherwise, we do not find any difference between the final outcomes in the majority and unanimity rule treatments.*

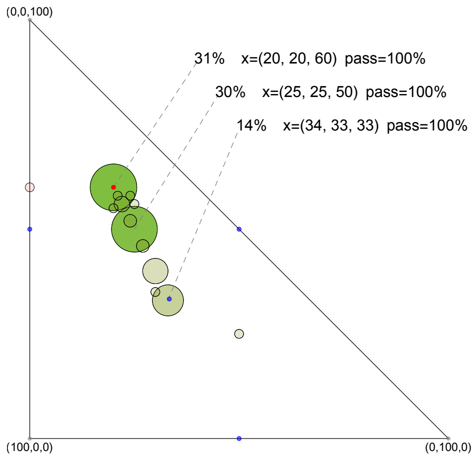
As noted above, we observe few MWCs among the final outcomes. Using the same classification of proposals as above, 17% of the final outcomes can be classified as fitted minimum winning coalitions, while 82% are grand coalitions. Table 8 depicts the relative frequency with which we observe MWCs for each pair of group members in all periods (left) and the last 4 periods (right). As in our previous analysis, we do not find evidence that group members with higher contributions are systematically excluded from MWCs. For example, in the (20,20,60) situation 20% of final outcomes suggest a MWC. Of these, 11% include the group member who has contributed 60% to the surplus.

Table 8: COALITION COMPOSITION, FINAL AGREEMENTS (MAJORITY RULE)

	MWC			Grand	Fitted MWC			Fitted Grand	
Situation	1&2	1&3	2&3	coalition	1&2	1&3	2&3	coalition	N
(33,33,33)	9%	6%	0%	86%	10%	6%	0%	84%	69
(20,20,60)	9%	3%	8%	81%	9%	3%	8%	80%	117
(14,43,43)	3%	4%	11%	82%	3%	4%	11%	81%	116
Total	6%	4%	7%	82%	7%	4%	7%	81%	302

Figure 13: Final outcomes in $c = (20, 20, 60)$

(a) Unanimity rule (N=87)



(b) Majority rule (N=117)

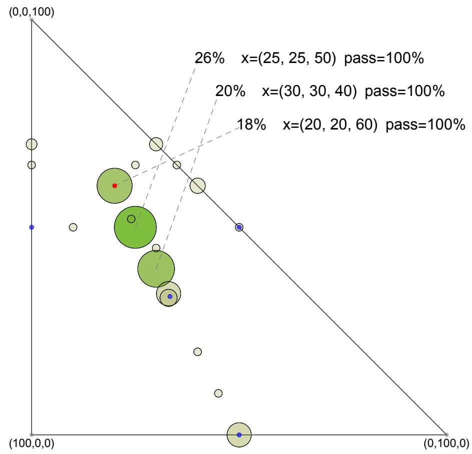
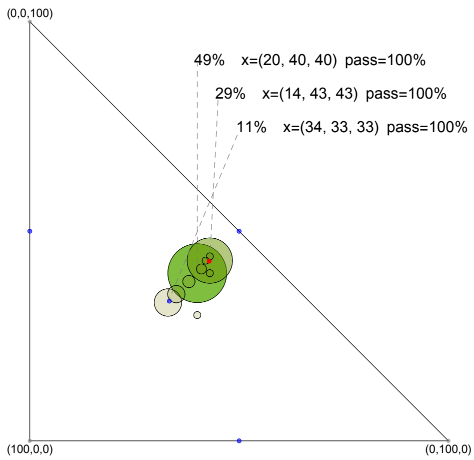
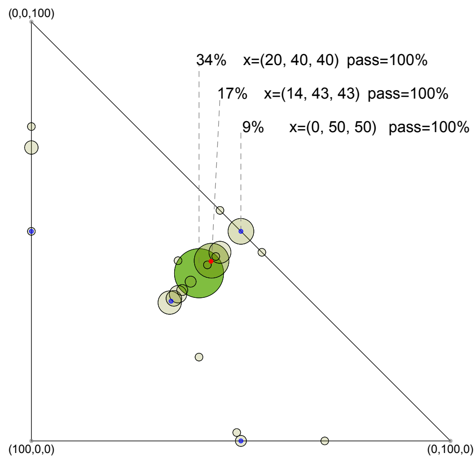


Figure 14: Final outcomes in $c = (14, 43, 43)$

(a) Unanimity rule (N=140)



(b) Majority rule (N=116)



6 Conclusion

We experimentally investigate how claims, derived from relative contributions to a commonly produced surplus, affect bargaining behavior and outcomes under two decision rules, namely unanimity and majority rule. Under unanimity rule, each group member possesses veto power which may be used to defend one's claim. Hence, while unanimity rule might result in fair (in the sense of proportionality) outcomes, endowing each party with veto power could cause severe delay. Majority rule, on the other hand, enables a minimum winning coalition to ignore the claims of a minority member. While this may reduce the degree of proportionality reflected in final outcomes and, consequently, be deemed unfair, requiring fewer group members to consent might allow groups to reach an agreement more quickly.

We study how claims affect fairness and efficiency in a laboratory experiment in which groups of three subjects first jointly produce a surplus and then bargain over the distribution of the surplus. Bargaining takes place in a finite horizon Baron and Ferejohn framework. Across treatments, we vary whether two or all three group members have to agree on a proposed division of the surplus. In line with previous evidence, we find that claims affect proposals and final outcomes under unanimity rule. Specifically, offers received increase in relative points contributed. A closer inspection reveals that virtually all proposals are located between the equal and the proportional split. In addition, we find that proposals are closer to the proportional split if the proposer has made a relatively large contribution, and hence benefits from receiving the proportional instead of the three-way equal share. Studying voting behavior, we find that individuals with higher claims are also more likely to vote yes the closer the proposal to the proportional split.

Turning to majority rule, we detect many similar patterns. In contrast to previous experiments without claims, we find that a majority of proposers suggests a grand instead of a minimum winning coalition and that average offers reflect the ranking of contributions. This is despite the fact that minimum winning coalitions are as likely to pass as grand coalitions. Although we observe few minimum winning coalitions, proposers are more likely to include group members who have made the same contributions. This behavior might result from the fact that there is a clear norm to share the benefits equally with partners who have contributed the same amount, while it is more difficult to assess how much needs to be offered to individuals with higher or lower contributions. Within grand coalitions, proposals are closer to the proportional split if the proposer has made a relatively large contribution. Thus, under both decision rules we find that proposers attempt to implement the proportional split more often if they have made a relatively large contribution. Conversely, they attempt to distribute the surplus more equally whenever they have made a relatively small contribution. In these latter cases, we find that proposals as well as final outcomes outcomes are closer to the equal split under majority as compared to unanimity rule. In terms of efficiency, we find that majority rule leads to a higher passage rate, especially in situations in which individuals have made different contributions.

While we do find that the decision rule affects proposer behavior, final outcomes as well as the incidence of delay, these differences are not as large as one might have expected based on previous Baron and Ferejohn experiments without claims. In these papers, differences in offers under unanimity and majority rule are mostly driven by the fact that proposers form minimum winning coalitions under majority rule. Our results suggest that the willingness to do so is substantially reduced when all individuals have contributed to the surplus via a real effort task. This result is likely to reflect fairness perceptions, i.e. proposers deliberately choose to respect claims because they regard this as fair.

Our paper shows that the differences between the two decision rules are instead more subtle in the presence of claims. In particular, we do observe that individuals strategically propose and approve less proportional distributions whenever this is to their own advantage and whenever the decision rule leaves them more discretion to ignore the claims of other group members (as under majority rule). This results in less proportional outcomes, whenever a majority of group members has contributed relatively little. Given that individuals seem to balance their offers between two prevalent fairness norms, proportionality and equality, this behavior may be indicative of a self serving bias in fairness norms. That is, in a given situation, individuals opportunistically choose the fairness norm which suits their own interests most (Messick and Sentis, 1983; Cappelen et al., 2007). Although the consequences for high contributors are not as drastic as, for example, being excluded from a coalition, this behavior certainly shows that individuals are willing to ignore the claims to the benefit of more equality within the group.

These (latter) findings may also be relevant for real world instances of bargaining with claims, such as budget allocation within the EU. Several recent reforms of the EU decision rules appear to be motivated by settling the conflict between redistribution from richer to poorer member states and preserving proportionality at the same time. While redistribution from poorer to richer member states is an explicit goal of the EU, richer member states provide most of the budget and also represent a majority of the population. Hence, preserving proportionality might be an important goal in order to secure support from the voters in these countries and to preserve the EU's legitimacy. Several recent voting reforms have indeed shifted voting rights from newer and poorer member states to older and richer member states. Research in political science suggests that this voting reform has led to more proportional outcomes which come at the cost of less equal outcomes. For example, with the 2004 enlargement the EU moved from the traditionally employed unanimity rule to a system with qualified majority rule and country voting weights, allocated roughly approximate to population. It has been shown that members with higher voting weights were in fact able to secure higher shares of structural and agricultural funds (Aksoy, 2010). The latest reform implemented a system of double majority, according to which a proposal passes if it is approved by 55% of the member states who represent at least 65% of the population. Effectively, this reform has been found to redistribute voting weights from newer towards older EU15 members, especially to Germany (Leech and Aziz, 2013). Although our experiment is not directly applicable to the complex institutional setting of the EU, we believe that it captures some relevant facts on how decision rules affect the distribution of benefits and may, thus, be informative for the public discourse about optimal decision rules.

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——— APPENDIX For online Publication ———

A Analysis of excluded cases

In this section, we provide an analysis of all cases in which at least one of the group members has contributed 0 points to the surplus. We excluded these cases because they are relatively rare and do not occur in every matching group, leaving us with few independent observations to test for differences between and within treatments. Table 9 summarizes the frequency with which we observed the various constellations of points. As in pour main analysis above, we will pool data from the first and second as well as the third and forth situation in which the relative contributions are the same.

Given that all subjects in each group make a proposal, we observe three proposals for each game. Table 10 presents the number of proposals we observe in each of the 7 possible situations. The first coordinate of the contribution vector denotes the relative points of the proposer. In situations where relative contributions differ, we will distinguish whether the proposer has made no, an intermediate or a large contribution. When responder contributions differ, the responder with the smaller contribution is listed first. When

Table 9: Constellation of points contributed (excluded cases)

Contributions	Surplus	Number of games Majority rule	 Unanimity rule
(0,0,1)	5 EUR	12	3
(0,0,3)	15 EUR	8	5
(0,1,1)	10 EUR	24	10
(0,3,3)	30 EUR	15	29
(0,1,3)	20 EUR	43	42
Total		102	89

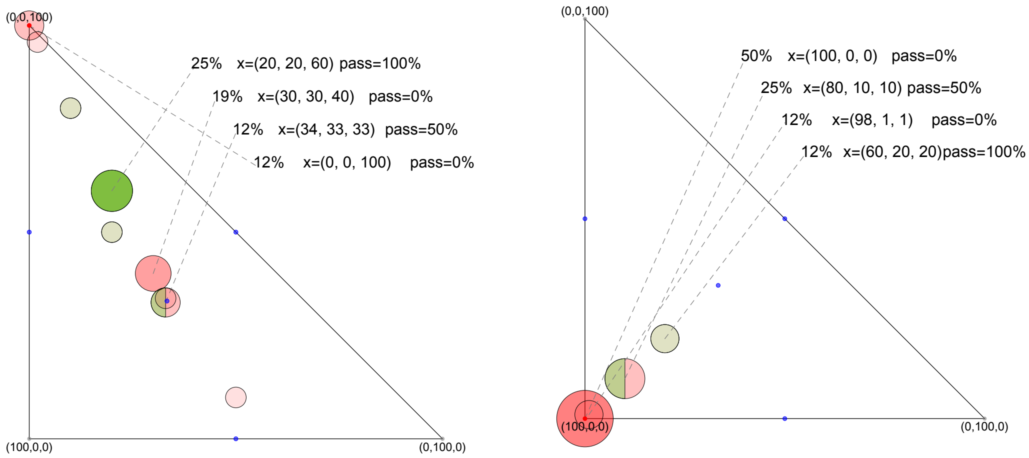
Table 10: Situations observed (Excluded cases)

Percentage	Number of proposals	
Contributions	Majority rule	Unanimity rule
(0,0,100)	40	16
(100,0,0)	20	8
(0,50,50)	39	39
(50,0,50)	78	78
(0,25,75)	43	42
(25,0,75)	43	42
(75,0,25)	43	42
Total	306	267

Figure 15: Proposals and passage rates, $c = (0, 0, 100)$, Unanimity rule

(a) $(0, 0, 100)$ (N=16)

(b) $(100, 0, 0)$ (N=8)



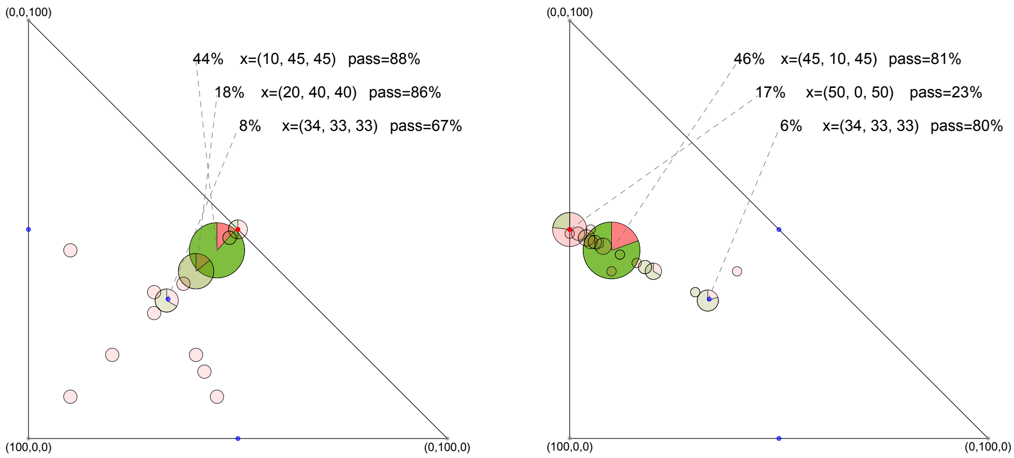
responder contributions are the same, they are ordered alphabetically, according to the letter i.d. that players were assigned at the beginning of the game.

Unanimity Rule We begin by discussing outcomes under unanimity rule. Figures 15 to 17 display the distribution of proposals under unanimity rule. In all figures, the left panels display the cases in which the proposer has contributed nothing, while the right panels display cases in which the proposer has made a positive contribution.

In the $c = (0, 0, 100)$ and the $c = (0, 50, 50)$ situation we observe that a large majority of proposals is located on a line connecting the equal and the proportional splits. Proposals which are not located on this line are almost always rejected. In the $c = (0, 25, 75)$ situation, proposals are *concentrated around* the line connecting the equal and the proportional

Figure 16: Proposals and passage rates, $c = (0, 50, 50)$, Unanimity rule

(a) $(0, 50, 50)$ (N=39) (b) $(50, 0, 50)$ (N=78)

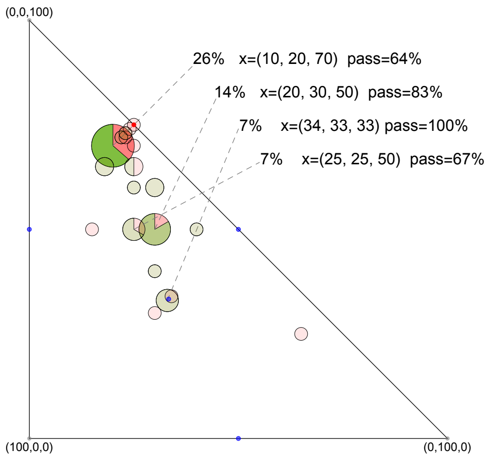


splits. The fact that proposals are farther away from the line might be explained by the fact that all subjects have contributed different amounts, making it more complicated to target points on the line. As in our main analysis, we find that the distribution of proposals appears to be closer to the proportional split whenever the proposer has contributed a positive share (right panels) as compared to having contributed nothing. We do, however, observe that proportional splits pass with a small probability in all situations (i.e. 0% passage rate in the $(0, 0, 100)$ situation). As in our main analysis, we take advantage of the fact that all proposals are located on or *close to* the line connecting the equal and the proportional split. This allows us to reduce the data to a single dimension by identifying the scalar projection (see section 5.2) onto this line for each proposal. Hence, each proposal is characterized by a parameter a_i where $a_i = 0$ corresponds to the equal and $a_i = 1$ to the proportional split. We use the average values of a_i within each matching group to test for differences in distributions in situations where proposers have made smaller as compared to having made larger contributions. Only in the $c = (0, 50, 50)$ situation we find that proposals are indeed closer to the proportional split when the proposer's contribution is 50% compared to cases in which the proposer has contributed nothing (Wilcoxon matched-pairs signed-ranks test, $p = 0.02$, $N = 12$). In all other cases, we do not find any significant differences ($(0, 0, 100)$ versus (100,0,0): $p = 0.12$, $N = 6$; $(0, 25, 75)$ versus $(75, 0, 25)$: $p = 0.66$, $N = 13$).[20]

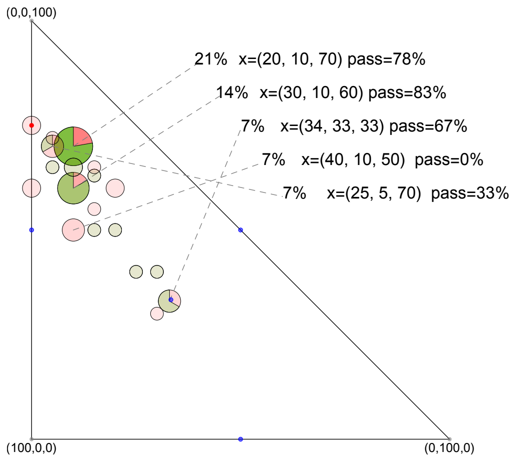
[20]Given that we do not observe any constellation of points in all 16 matching groups, the number of observations that we use for our tests ranges from 6 to 13.

Figure 17: Proposals and passage rates, $c = (0, 25, 75)$, Unanimity rule

(a) $(0, 25, 75)$ (N=42)



(b) $(25, 0, 75)$ (N=42)



(c) $(75, 0, 25)$ (N=42)

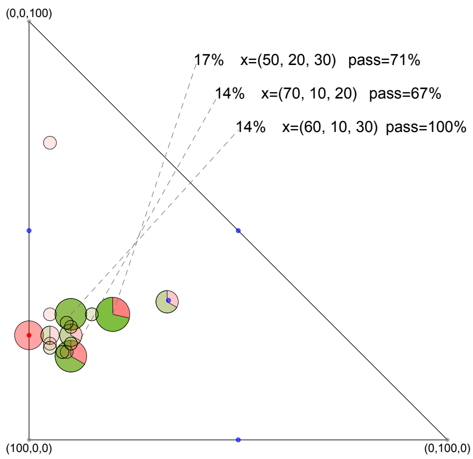
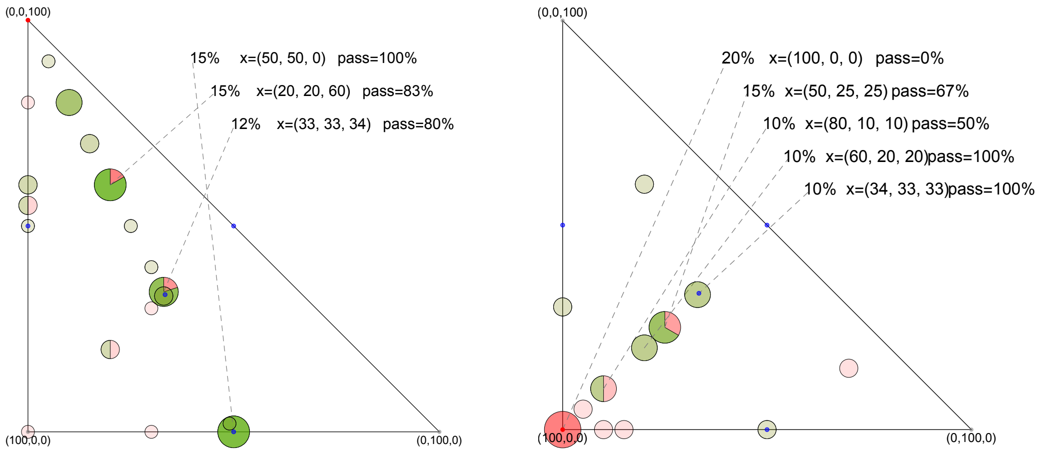


Figure 18: Proposals and passage rates, $c = (0, 0, 100)$, Majority rule

(a) $(0, 0, 100)$ (N=40) (b) $(100, 0, 0)$ (N=20)



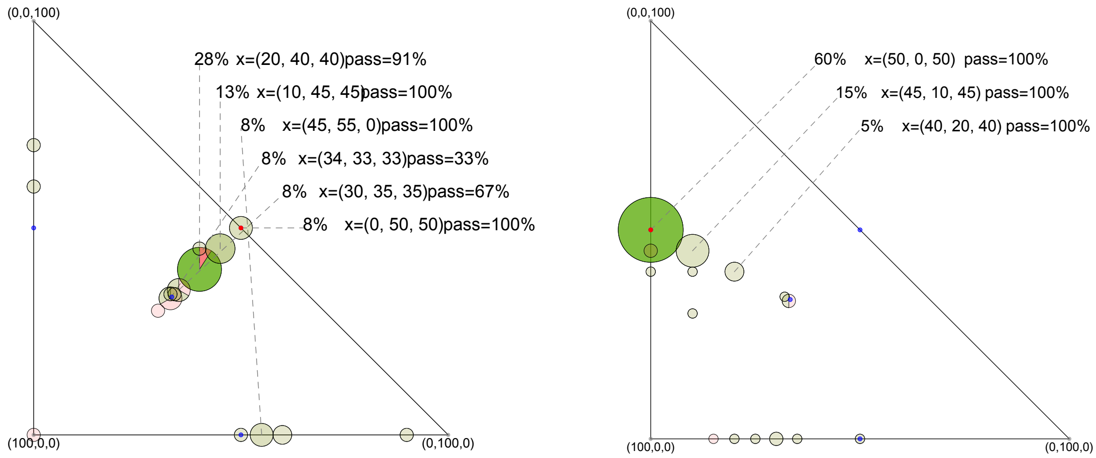
Majority Rule In the following, we will present the results for majority rule. We begin our discussion of results by looking at the size of coalitions under majority rule. Table 11 summarizes the share of proposals which can be classified as minimum winning coalitions (MWCs), proportional splits, and grand coalitions. Given that in all situations, the proportional split is essentially a MWCs (i.e. one group member receives 0), we distinguish between proposals which suggest a proportional split and attempted minimum winning coalitions. The left and right parts of the table provide information on all periods and on the last 4 periods, respectively. Most notably, we find that the vast majority of proposers suggest grand instead of minimum winning coalitions in all situations (24% vs. 52%). This difference is, however, much smaller in the last 4 rounds (37% vs. 39%), i.e. after subjects have gained some experience.

Interestingly, we observe that 23% of the proposers suggest the proportional split. This fraction is especially high in situations where the proposer has made a positive contribution. The high fraction of proportional proposals is indeed interesting given that we observe few minimum winning coalitions being proposed in this and the previous Results section. Thus, our findings suggest that proposers may be more willing to offer nothing to some group members if such proposals can be justified by proportionality.

In order to study the composition of minimum winning coalitions, we computed the inclusion frequencies for each responder. In contrast to our results in subsection 5.3, we

Figure 19: Proposals and passage rates, $c = (0, 50, 50)$, Majority rule

(a) $(0, 50, 50)$ (N=39) (b) $(50, 0, 50)$ (N=78)

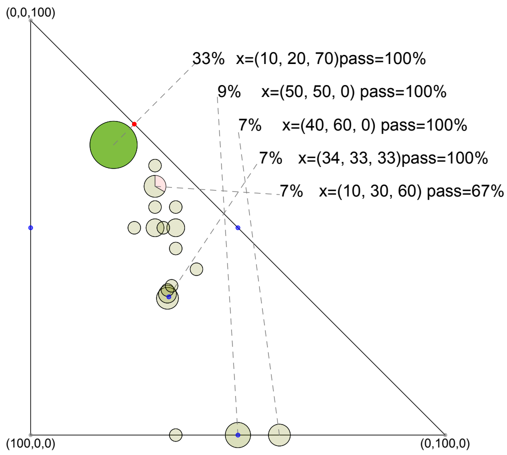


do not find that proposer are more likely to include the individual who has made the same contribution in the first 4 situations. For example, in the $(50, 0, 50)$ situation, proposers are more likely to include responder 1 instead of responder 2 who has contributed the same share of points as the proposer. However, given that the proposer more often includes the responder with the lower claim, this finding is consistent with Hypothesis 7. In the last three situations, where all group members have made different contributions, we find that proposers are more likely to include responder 2 (who has contributed a positive amount in all cases) if the proposer has made a positive contribution himself. Instead, if the proposer has contributed nothing, responder 2 is never included.

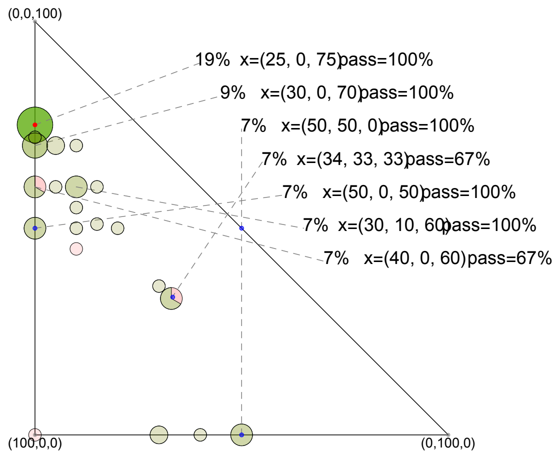
In order to study the distribution of proposals in more detail, we turn to Figures 18 to 20. It is apparent that proposals are concentrated in three areas: as in the unanimity rule treatment, the vast majority of proposals is located on a line connecting the equal and the proportional split. In addition, many proposals are located along either the horizontal or the vertical line, corresponding to minimum winning coalitions with responder 1 or responder 2, respectively. Looking only at the grand coalitions, it appears that the distribution of proposals is closer to the proportional split if the proposer has made a positive contribution (right panels). In these cases, the proposer also suggests the proportional split more often. However, this attempt to distribute the surplus more proportionally leads to a high rejection rate whenever two individuals have contributed less than the equal split ((75,0,25) and (100,0,0)). In order to test whether the distribution is significantly closer to the proportional split whenever the proposer has made a positive contribution (right panels), we

Figure 20: Proposals and passage rates, $c = (0, 25, 75)$, Majority rule

(a) $(0, 25, 75)$ (N=43)



(b) $(25, 0, 75)$ (N=43)



(c) $(75, 0, 25)$ (N=43)

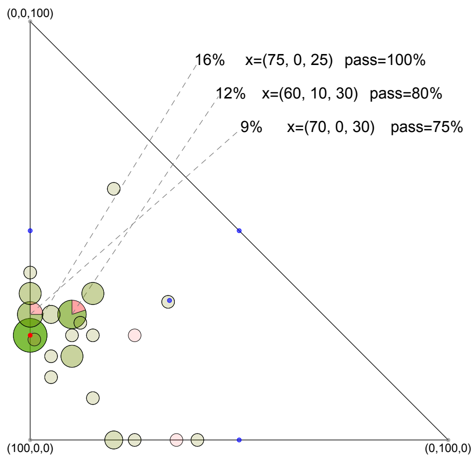


Table 11: Coalition Composition (Excluded cases)

	all periods					periods 9-12				
Situation	MWC with resp.1	resp.2	Propor-tional	Grand	N	MWC with resp.1	resp.2	Propor-tional	Grand	N
(0,0,100)†	18%	15%	0%	65%	40	31%	19%	0%	44%	16
(100,0,0)	15%	5%	20%	60%	20	13%	13%	25%	50%	8
(0,50,50)†	18%	5%	8%	67%	39	44%	11%	0%	44%	9
(50,0,50)	9%	4%	60%	27%	78	28%	0 %	67%	6%	18
(0,25,75)	19%	0%	0%	81%	43	29%	0%	0%	71%	17
(25,0,75)†	14%	26%	19%	40%	43	24%	24%	30%	24%	17
(75,0,25)	12%	19%	16%	53%	43	24%	6%	24%	47%	17
Total	14%	10%	23%	52%	306	27%	10%	23%	39%	102

† In each of these three situations, we observe one proposals in which the proposer suggests 100% for himself. Given that this is neither a minimum winning coalition with responder 1 or responder 2 nor a grand coalition, we can classify less than 100% of the proposals in these three situations.

first compute the number of 'fitted grand coalitions' (see section 5.3) and then compare the average values of a_i within matching groups. Only in the $c = (0, 50, 50)$ situation, we find that the average values of a_i are indeed larger when the proposer has made a positive as compared to no contribution (Wilcoxon matched-pairs signed-ranks test, $p = 0.03$, $N = 12$). Hence, in these cases proposals are indeed significantly closer to the proportional split if the proposer has made a positive as compared to no contribution. In the other two situations, we do not find any difference (Wilcoxon matched-pairs signed-ranks test; (0,0,100) vs. (100,0,0), $p = 0.12$, $N = 6$; (0,0,100) vs. (75,0,25), $p = 0.66$, $N = 13$). Our tests are, however, based on a very small sample because we did not observe each situation in all 17 matching groups.

Turning to the passage rate, Table 12 summarizes the passage rate in each of the situations. First and most notably, the passage rate is smaller compared to the situations in which all group members have made a positive contribution (83% under unanimity, 90% under majority rule, see Table 6). Second, the passage rate is significantly smaller under unanimity as compared to majority rule in all situations except in the $(100, 0, 0)$. Hence, compared to the situations discussed in the main text, we find a more pronounced difference in passage rates between majority and unanimity rule. This further supports our Hypothesis 10.

Table 12: Passage rate by situations (excluded cases)

	(0,0,100)	(100,0,0)	(0,50,50)	(50,0,50)	(0,25,75)	(25,0,75)	(75,0,25)	Total
Unanimity	44%	25%	64%	58%	64%	55%	62%	59%
rule	7/16	2/8	25/39	45/78	27/42	23/42	26/42	155/267
Majority	80%	50%	85%	95%	98%	91%	88%	88%
rule	32/40	10/20	33/39	74/78	42/43	39/43	38/43	268/306
Rank-sum p	0.01	0.89	< 0.01	< 0.01	0.03	< 0.01	0.02	< 0.01
N †	6/8	6/8	12/13	12/13	14/13	14/13	14/13	14/16

† The Wilcoxon rank-sum test test is based on the passage rate within each matching group. The number of observations in the Unanimity / Majority treatment are reported in the bottom row. (Note that we do not observe all situations in every matching group.)

B Instructions (translated from German)

--- Page 1 --

Dear Participant,

Thank you for attending this experiment. Before we describe today's experiment in more detail, we would like to inform you about some general rules:

General rules:

- This experiment lasts for approximately 70 minutes. During this time, you should not leave your seat.
- Please turn off your mobile phone and store it in your pocket or bag. There should not be anything on your table. (A beverage is of course allowed.)
- Please be quiet during this experiment and do not talk to other participants.
- If you have any questions, please raise your hand and wait for the experimenter to attend you at your seat.
- For your participation, you will receive a four Euro show-up fee. However, you can earn more money in this experiment. How much money you can earn depends on your own as well as the choices of other participants.

What happens at the end of this experiment?

Once all participants have finished this experiment, the experimenter will call the participants to the front desk one after another. You will then receive your payment.

--- Page 2 --

Description of the experiment

This experiment has **two parts**.

Part 1 consists of **12 quiz blocks**. In each quiz block you have to answer two questions. For each question, 4 possible answers are given. Only one of these answers is correct.

In each quiz block you can earn between 0 and 3 points by selecting the correct answers: You earn 1 point if you are able to answer one question correctly. If you answer both questions correctly, you earn 3 points. However, if you answer none of the two questions correctly, you will earn 0 points. You will not be informed how many points you collected in any of the quiz blocks.

Please note: **All participants have to answer the exact same questions.**

Part 2 of this experiment also consists of 12 rounds. At the beginning of each round, groups of 3 participants will be randomly formed. For each round, the computer **randomly selects one of the 12 quiz blocks from part 1 for each participant in the group**. The points that the group member have collected in the randomly chosen quiz blocks will be added**. For each point collected, the group receives five Euro.** The group's task is to bargain over the distribution of this surplus.

You will receive more instructions for part 2 after you and all other participants have completed part 1.

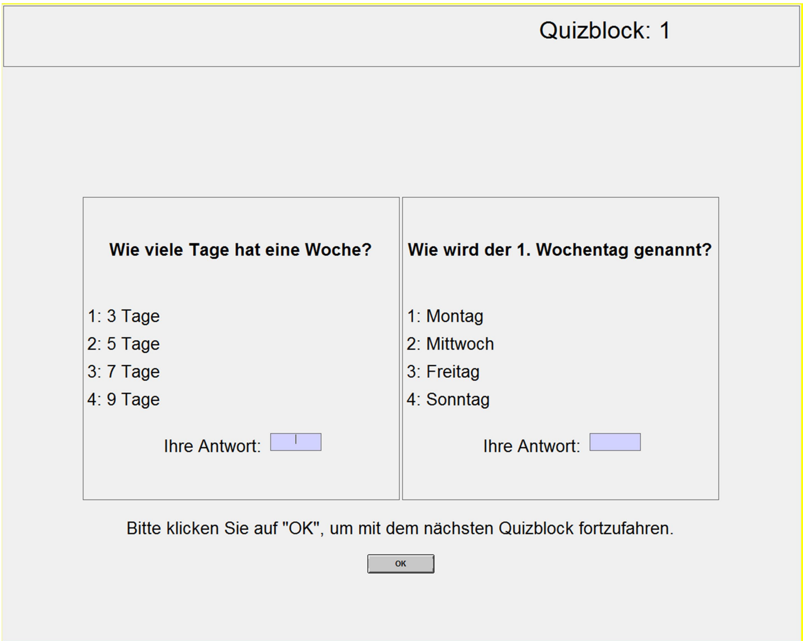
Your payment at the end of the experiment

Once all groups have finished part 2, the computer randomly selects one of the 12 rounds in part 2 of this experiment. All participants receive the amount agreed upon in this randomly selected round.

-- **Page 3** --

Examples for part 1:

Here is an example of what you will see in each of the 12 quiz blocks (in German):



- Displayed on the top right of the screen are the quiz block number.
- The first question is displayed in the left; the second question is displayed in the right box.
- The 4 possible answers are displayed below each question and numbered from 1 to 4.
- Please type the number of the correct answer into the field labeled “Your answer”. For example, if you think that answer number 1 is correct, type “1” into the field.
- As soon as you have typed an answer into both fields, please click on the “OK” button. You will then move to the next quiz block.

-- **Page 4** --

Details for the 2nd part of this experiment

Part 2 of this experiment consists of **12 rounds**. At the beginning of each round, **groups of three participants will be randomly formed**. Thus, you will interact with different participants in each round. No participant will know with whom he or she has been grouped during the experiment.

At the beginning of every round, each participant in a group will be assigned an ID (“A”, “B” or “C”). These IDs remain fixed throughout the round.

In every round, the computer **randomly selects one of the 12 quiz blocks for each participant**. Then, each participant will be informed which quiz block has been drawn for him / her personally and he /she will see how many points he / she has collected in the randomly selected quiz block. You will also be informed about the number of points collected by the other two group members. However, you will not be informed about the quiz block that was selected for the other two participants.

All points collected in the randomly chosen quiz blocks are then added. **The group receives 5 Euro for each point collected by its members.** For example, if all three participants have collected 3 points, the group receives 15 Euro.

The group’s task is to bargain how to divide the surplus which the group has received among the members of the group.

Decisions are made by majority rule, using the following procedure:

First, every participant makes a **proposal** as to how much each group member should receive (expressed in percent of the surplus). Next, all group members **vote “yes” or “no”** on the proposal of each group member. Finally, **one of the proposals** is randomly chosen and votes are counted. If **at least two group members voted “yes**” on the randomly chosen proposal, it **passes** and the round ends. If less than two group members voted “yes”, the proposal is **rejected** and bargaining continues. In this case, the available surplus **shrinks** by 20 percent (e.g. from 15 to 12 Euro). Then, all participants make a proposal and vote on the proposals of all group members. If the randomly chosen proposal is rejected again, the surplus shrinks by 20 percent once more (e.g. from 12 to 8.60 Euro), etc.

The round ends as soon as at least two group members vote “yes” on the randomly chosen proposal. In addition, a round ends if the available surplus **shrinks below 2 Euro**. In this case, all group members receive 0 Euro.

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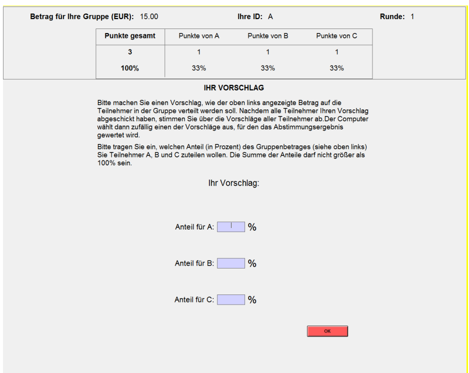
Examples for part 2:

Here is an example of what you will see on the proposal screen (in German):



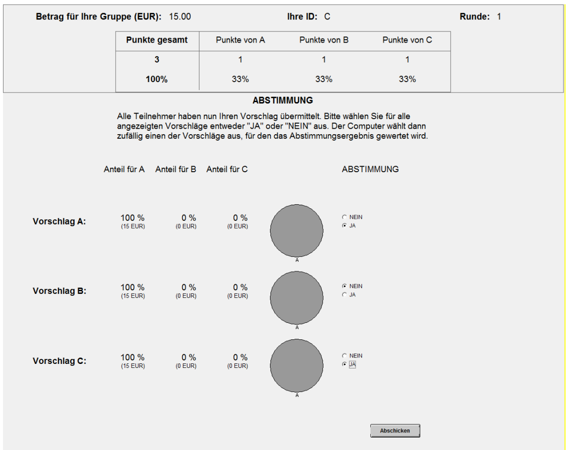
- Displayed on the top are the current period, your id and the available surplus (in Euro).

- The table displays how many points the group has collected in total. In addition, the table reports each group member's contribution in points and his/her share of contributed points in percent. (The displayed shares are rounded.)
- Below, you will find three boxes into which you must type your proposal. You must type the share of the pie (%) you wish to allocate to "A" (upper box), the share of the pie (%) you wish to allocate to "B" (middle box), and the share of the pie (%) you wish to allocate to "C" (lower box). You can allocate at most 100 percent.

After all three participants in the group have submitted a proposal, you will move to the voting screen.

-- Page 6 --

Here is an example of what you will see on the voting screen (in German). In this Example, we assume that all group members propose to give 100 percent off the surplus to participant "A".

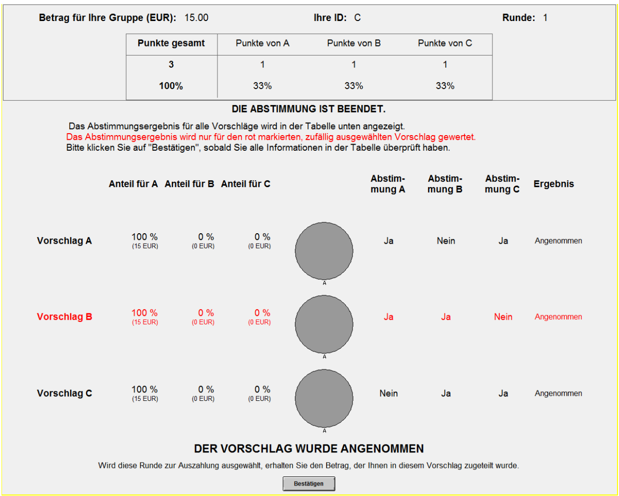


- The top part of the screen contains the same information as the previous proposal screen.
- Below, you will see each of the submitted proposals displayed both numerically (percent share and exact amount in Euro) and graphically (as pie chart).
- To the right of each proposal, you will find the buttons used to vote on the proposals.
- After selecting yes or no for each proposal, click submit to cast your votes.

As soon as all group members have cast their votes, you will move to the Results screen.

-- Page 7 --

Here is an example of what you will see on the Results screen (in German):



- The proposals are displayed on the left side of the screen.
- On the right side, you can see whether the other participants voted “yes” or “no” on a proposal. At the very right, you will be informed whether the proposal has passed or whether it has been rejected.
- The votes will only count for the randomly selected proposal, marked in red.