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ORIGINAL PAPER

A bargaining experiment with asymmetric institutions and preferences

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Abstract
We report results from a laboratory experiment on strategic bargaining with indivisibilities studying the role of asymmetries, both in preferences and institutions. We find that subjects do not fully grasp the equilibrium effects asymmetries have on bargaining power and identify how subjects' observed behavior systematically deviates from theoretical predictions. The deviations are especially pronounced in case of asymmetric institutions which are modelled as probabilities of being the proposer. Additionally, in contrast to previous experimental work, we observe larger than predicted proposer power since subjects frequently propose and accept their second-preferred option. Quantal response equilibrium and risk aversion explain behavior whenever probabilities are symmetric, but less so when asymmetric. We propose the 'recognition is power' heuristic which equates bargaining power with recognition probabilities to explain these findings.

1 Introduction

Bargaining in committees to select among several candidates or alternatives is a widely occurring phenomenon. It is therefore of great interest and importance to understand which factors influence the decisions resulting from these bargaining processes. Consequently, a large empirical and theoretical literature has developed that studies this question. One of the seminal contributions to this strand of research is Baron and Ferejohn (1989) who propose a strategic bargaining framework to study these phenomena. In this framework in each round one player is randomly recognized to make a proposal

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and then the other players vote on it. If the proposal passes, the game ends and payoffs are realized, otherwise the game continues to the next round and again a proposer is chosen randomly.

Building on this work we study the effect of asymmetries—both in terms of institutions and in terms of preferences—on outcomes. It is crucial to understand the implications of asymmetries because these are probably the rule rather than the exception. In contrast to previous work we consider the effect of asymmetries in a setting with indivisibilities which are a common characteristic of bargaining within committees. For example, boards of companies appoint CEOs, parliaments choose Supreme Court judges and university committees hire new faculty. In many of these cases, the lack of side payments implies indivisibility. In such bargaining situations, parties involved are limited in trading off alternatives and instead have to decide between making a bold demand that claims their best alternative or a cautious demand that settles for their second preference. Given that both asymmetries and indivisibilities are very common it is crucial to understand the currently under-explored implications and interactions of indivisibilities and asymmetries on bargaining. In particular, institutions have a much larger effect on bargaining behavior in the presence of indivisibilities. Therefore, indivisibilities offer a fruitful setting for contributing to the relatively sparse literature on the effect of institutional asymmetries on bargaining behavior. Additionally, once we understand how asymmetric institutions affect bargaining processes we can think about what bargaining rules different players or a social planner would prefer. Therefore, valuable insights can also be gained for the literature on institution formation.

To investigate the effect of asymmetries we consider asymmetric preferences as well as asymmetric institutions. First, we study the case where players derive different monetary payoffs from their most favorable outcome and, second, we consider the situation where the institutional rules are asymmetric in the sense that some players are more likely than others to be recognized to make a proposal. The general question we consider in both cases is how these asymmetries influence the strategic interaction of players in the bargaining process. In case of asymmetric payoffs, the question is whether players can capitalize on the higher payoff from their preferred outcome or if competition between the players negates this seeming advantage. In case of asymmetric institutions the question is how the probabilities of being recognized translate into outcomes. For instance, we study whether a higher recognition probability implies higher expected earnings.

The natural first step in investigating the effect of asymmetries is to set up a model that reveals how they shape bargaining strategies and outcomes. In their seminal contribution, Baron and Ferejohn (1989) study these phenomena in a perfectly divisible divide-the-dollar setting under majority voting. They consider asymmetries in institutions as asymmetries in agenda setting and propose to model these as asymmetric probabilities of being recognized as proposer. In their framework, there does not exist a Condorcet winner and parties are asymmetric in their recognition probabilities and in their role of either proposing or voting. Baron and Ferejohn show that the expected stationary equilibrium payoffs are insensitive to the distribution of recognition probabilities. Fréchette and al. (2005a) report empirical and theoretical results for an extension in which parties have asymmetric voting weights and recognition probabilities are either uniform or proportional to voting weights. *Ceteris paribus* of a representation in terms of unaffected minimal winning coalitions, they show that the expected equilibrium payoffs are insensitive to the distributions of recognition probabilities and voting weights. Fréchette and al. (2005a) also report empirical results from a laboratory experiment finding support for this insensitivity.

In general, the empirical and theoretical literature that studies bargaining situations under indivisibilities is relatively small. One plausible reason may be that such bargaining situations are much harder to analyze in the absence of a Condorcet winner. McKelvey (1991) and Herings and Houba (2016) consider a setting with three players, three indivisible alternatives, a Condorcet cycle under majority voting,[1] and utilities that need not arise from divide-the-dollar settings. This is the simplest setting in which proposers face a hard choice between proposing their most or second-most preferred alternative, i.e. being bold or cautious. McKelvey (1991) characterizes the unique stationary equilibrium for the case of symmetric recognition probabilities allowing for asymmetric valuations while Herings and Houba (2016) extend this characterization to a setting where both recognition probabilities and valuations are allowed to be asymmetric. The analyses in these two papers reveal that, in contrast to the divide-the-dollar case, equilibrium play and expected payoffs are sensitive to changes in recognition probabilities and valuations. At the same time these effects can be quite subtle and equilibrium outcomes can react in ways that at first glance might seem unintuitive.

This raises the question whether the theoretical predictions are borne out by the data. There are good reasons why we might expect this not to be the case: players are often only boundedly rational and have non-selfish preferences. Then the subsequent question is how the observed behavior will differ from theoretical predictions. To answer these questions, we conduct a controlled laboratory experiment that allows us to test the theoretically predicted effects of asymmetries and to identify potential systematic deviations.[2] We employ a setting with three players and three imperfectly divisible alternatives (as in McKelvey 1991; Herings and Houba 2016) since this shuts down fairness considerations to a large degree thereby making it easier to investigate whether subjects use their bargaining power as theoretically predicted and identify how they may deviate. In a two-by-two between-subject design we vary recognition probabilities and payoffs. Each dimension of our design has a symmetric and an asymmetric version. In the treatments with symmetric recognition probabilities each player has a chance of 1/3 to be the proposer while in the asymmetric treatments player 1 is the proposer with a probability of only 10% while players 2 and 3 each have a probability of 45% of being the proposer. These two sets of probabilities are the same as in Fréchette et al. (2005a, b) who in a divide-the-dollar setting investigate the effect of recognition probabilities. An important difference to our experiment is that in their setting equilibrium payoffs are invariant to differences in recognition probabilities which makes it difficult to judge whether subjects understand the effect of recognition probabilities on bargaining power. In the treatment with asymmetric payoffs we substantially increase the attractiveness of player 2's most preferred alternative. In treatments with

[1] With three alternatives called A, B and C, Condorcet cycles under majority voting feature either A beats B, B beats C and C beats A, or the opposite sequence. Condorcet cycles rule out Condorcet winners and preserve the essence of no Condorcet winner in perfectly divisible divide-the-dollar bargaining.

[2] See McKelvey (1991), Fréchette et al. (2003, 2005a, b), and Diermeier and Morton (2005) for other experiments on strategic bargaining. Palfrey (2015) discusses experiments on bargaining in general.

symmetric payoffs the monetary values of the most, second-most and least preferred alternatives for each player are permutations and therefore these treatments allow an interpretation as a divide-the-dollar setting. In contrast, in the asymmetric treatments where player 2 gets a substantially higher monetary payoff from her most preferred alternative than the other players get from their most preferred alternative such an interpretation is impossible since the game is no longer constant-sum. To our knowledge we are the first to report experimental evidence on bargaining behavior in such a setting.

From our four treatments two main hypotheses regarding the effect of asymmetries arise. First, payoff asymmetries have almost no effect on expected equilibrium payoffs. This implies that player 2 is unable to benefit from the higher payoff associated with her most preferred option. The reason is that the competition to be part of the winning coalition makes it impossible for her to sustain the advantage. Second, reducing player 1's recognition probability from 33 to 10% has no effect on her equilibrium payoffs, but substantially hurts player 3 even though her recognition probability increases from 33 to 45%. The reason is that due to her lower recognition probability player 1 is easier to convince to become part of the winning coalition and therefore she is less often left out of the agreement while for player 3 the opposite is the case. The intriguing question is whether the subjects in the experiment are able to recognize this effect of asymmetries.

The analysis of the experimental data reveals two main findings: first, subjects show cautious bargaining by proposing and accepting their second-best alternative too often. Therefore, they underexploit their bargaining power because even though their best alternative has a higher than predicted probability of being implemented they nevertheless are more cautious than predicted. This finding might be caused by subjects' risk aversion and, paradoxically, implies proposer power that is larger than predicted. This is contrary to the common observation of lower proposer power, see for instance Palfrey (2015) and the references therein, and this difference is most likely caused by indivisibilities that force each proposer to choose between a bold demand for her best alternative or a cautious demand for her second-preferred option. Our empirical findings are in line with results in McKelvey (1991) who reports on an experiment with symmetric recognition probabilities testing the theoretical point predictions.

The second main finding that arises from the experiment is that for asymmetric recognition probabilities we observe systematic deviations from the model predictions. In particular, the player with the low recognition probability is much more cautious than predicted. In contrast, when recognition probabilities are symmetric, subjects' change in behavior when going from symmetric to asymmetric payoffs is more in line with the theory. The systematic deviations for asymmetric recognition probabilities do not only arise relative to the risk-neutral Nash equilibrium but also when a quantal response equilibrium—with risk-aversion and noise parameters estimated using experimental data—is used as a theoretical benchmark. Comparing observed behavior of the first and second half of the experiment did not show any evidence of learning. We therefore conclude that subjects have a harder time understanding the strategic implications of asymmetric recognition probabilities than of asymmetric payoffs. Humans are known to rely on heuristics, which would also explain the absence of learning. We propose the ‘recognition is power’ heuristic in order to explain behavior when probabilities are asymmetric: subjects equate recognition probabilities with bargaining power. This would explain why the player with the lower recognition probability is much more cautious than predicted because she would think that her bargaining power is lower than it actually is.

The remainder of this paper is structured as follows: in the next section we present the experimental design; then Sect. 3 describes the experimental results and compares these to Nash equilibrium predictions. Potential explanations for the observed deviations, in particular the quantal response equilibrium, are discussed in Sects. 4 and 5 presents the ‘recognition is power’ heuristic. Section 6 concludes with a summary of the results and a discussion of potential avenues for future research.

2 Experimental design

2.1 The game

The game consists of a group of three players that has to decide which of three available options to implement. Bargaining proceeds as follows: in each round, all three players simultaneously submit a proposal (being one of the three alternatives in Table 1) they want the other players to vote on. After every player has submitted a proposal one of the proposals is randomly chosen to be voted on.[3] Subsequently, the proposal of the selected player (the “proposer”) is then communicated to the other two players which then can vote to accept or reject this proposal. The voting procedure is sequential: first the player who earns a higher payoff from the proposal gets to cast his vote. Given that we assume majority voting and that the proposer is implicitly assumed to support his own proposal, the proposal is accepted if the first voter accepts the proposal and acceptance ends the voting (and the bargaining). However, if the first voter rejects the proposal the second voter gets to cast his vote. If he votes yes a majority supports the proposal and it is accepted. Note that the last voter is only asked to vote if the first vote was a ‘no’, i.e. if she is pivotal.[4] If a proposal is accepted the payoffs associated with the proposed alternative are implemented. If the proposal is rejected the game continues to the next period with probability $\delta \in (0, 1)$ while with probability $1 - \delta$ bargaining breaks down and everyone receives a payoff of zero. In the experiment, we implement $\delta = 0.9$, which corresponds to a risk of breakdown of 10% per round. The structure of payoffs (denoted in points) is shown in Table 1. Symmetric payoffs with

[3] This setup is strategically equivalent to selecting one player as the random proposer and also has several advantages. It keeps subjects engaged, all subjects have the same incentives in submitting their proposals as compared to a randomly selected proposer and more data on proposals are obtained.

[4] This implements the voting procedure in Herings and Houba (2016), who show that sequential voting eliminates the equilibrium in weakly-dominated strategies where both voters vote in favor of the proposal believing that the other will vote ‘yes’. This reduction in equilibrium multiplicity has to be traded-off against a loss of data since we do not observe how the second voter would have voted when being non-pivotal. However, it is not clear how informative a non-pivotal vote is since such a vote has no impact on the outcome. Furthermore, the fact that subjects almost never accepted their least preferred option suggests that subjects understood the incentives they faced.

Table 1 The payoff structure

	Alternative I	Alternative II	Alternative III
Payoff player 1	9	4	0
Payoff player 2	0	β	4
Payoff player 3	4	0	9

β denotes player 2's payoff associated with her most preferred alternative, where β is either 9 or 15

a total of 13 points to be divided allow an interpretation as divide-the-dollar, while asymmetric payoffs lack such interpretation.

At this point we should note that while the structure of the bargaining process is similar to most previous experiments on strategic bargaining our payoff structure is different. While we employ a setting with a small set of possible proposals representing indivisibilities most of the literature considers a continuous divide-the-dollar setting. As we argue in the introduction, indivisibilities are a common but underexplored occurrence and our design aims at increasing our knowledge of behavior in such situations. Furthermore, given the goal of testing the predicted effect of asymmetries on behavior our design has two more advantages compared to a divide-the-dollar setting. First, in a setting with continuous alternatives recognition probabilities have no effect on payoffs (Frechette et al. 2005a) which makes it more challenging to test whether subjects understand the impact of asymmetric probabilities. Second, indivisibilities should reduce fairness considerations therefore making it easier to test the theory. The reasoning is that given the binary nature of decisions it is quite expensive to be kind (i.e. to accept or propose one's middle option) while in a divide-the-dollar setting it is possible to be kind at relatively low costs to yourself.

2.2 Treatments

The experiment consists of four between-subject treatments that are constructed in the 2×2 configuration shown in Table 2. The first treatment dimension varies whether the alternatives are symmetric with respect to payoffs. In the symmetric case every player gets 9 (4, 0) points when her favorite (middle, worst) option is implemented, i.e. $\beta = 9$. When payoffs are asymmetric player 2 gets 15 points instead of 9 points when her favorite alternative is implemented, i.e. $\beta = 15$. The second treatment dimension varies the probability that a player will be the proposer in any given period. As in Fréchette et al. (2005a), we consider symmetric treatments in which each player has an equal probability to become proposer and asymmetric treatments in which player 1 is the proposer with a probability of 10% while players 2 and 3 each have a recognition probability of 45%.

2.3 Nash equilibrium

Table 3 shows the resulting stationary subgame perfect Nash equilibria assuming risk-neutrality (the equilibria are derived in Appendix A). We only report a player's

Table 2 Treatments

	Symmetric payoffs	Asymmetric payoffs
Symmetric recognition probabilities	SymPaySymRec	AsymPaySymRec
Asymmetric recognition probabilities	SymPayAsymRec	AsymPayAsymRec

Cell entries give the treatment acronym used throughout this paper

Table 3 Nash equilibrium

	SymPaySymRec	SymPayAsymRec	AsymPaySymRec	AsymPayAsymRec
Accept M	100%	48%	39%	21%
	100%	23%	58%	18%
	100%	100%	73%	100%
Propose M	0%	0%	0%	0%
	0%	0%	0%	0%
	0%	13%	0%	10%
Expected payoff	4.3	4.4	4.4	4.4
	4.3	4.4	4.4	4.4
	4.3	2.8	4.4	3.3

Cell entries give the Nash equilibrium probability of accepting (proposing) the middle option and the expected equilibrium payoffs by treatment and player role (the first/second/third entry in each cell corresponds to player 1/2/3) assuming risk-neutrality and continuation probability $\delta = 0.9$

probabilities of accepting and proposing her middle alternative since she will always accept her favorite alternative and neither propose nor accept her worst alternative. Therefore equilibria are completely described by the behavior regarding each player's middle option.

The equilibrium strategies have a general structure that is common in many bargaining models. In all treatments, a voter's continuation equilibrium payoff, which is the discounted value of this player's equilibrium payoff (i.e. 90% of the corresponding value in Table 3), determines the threshold for acceptance. A voter accepts her middle alternative if its payoff (of 4) is larger than this threshold while randomized acceptance requires equality. The lower the threshold, the weaker a responder is and the less bargaining power she has. For all players and in all equilibria, thresholds have a ceiling of 4, meaning no one is strong enough to reject their middle alternative with certainty. Furthermore, each player proposes the alternative with the highest expected continuation equilibrium payoff. This proposal is either the player's middle alternative, which will be immediately accepted by the voter whose best alternative it is, or her best alternative with possibly random acceptance and uncertain continuation of the bargaining. For all players and in all equilibria, the continuation equilibrium payoffs of proposing their best alternative have a floor of 4, meaning everyone is strong enough to propose their best alternative with positive probability. If the proposer randomizes between her middle and best alternative, then she must face random acceptance of her best alternative, because otherwise it is strictly better to always propose her best alternative.

As we can see from Table 3, in all but the completely symmetric treatment equilibria are in mixed strategies. In general, Nash equilibria with randomization have an unintuitive feature: the equilibrium strategies of all other players must make a randomizing player indifferent between all actions that are played with positive probability. Otherwise, shifting positive probability from non-optimal actions to better actions increases a randomizing player's expected utility. In textbook games, such as Matching Pennies, equilibria involving randomization resolve the endless merry-go-round argument why pure strategy equilibria do not exist. Below, we first explain the intuition of the pure equilibrium in the SymPaySymRec treatment. Then, we use treatment AsymPaySymRec to illustrate the merry-go-round arguments why specific pure strategies are not an equilibrium and provide intuition why randomization in Nash equilibrium is needed to resolve this endless argument.[5]

The SymPaySymRec treatment predicts that all players fully exploit their bargaining power by submitting their best alternatives and anticipating acceptance if their proposal is selected. The intuition is that voters prefer accepting middle alternatives with a payoff of 4 to the present value of obtaining one of the three alternatives with equal probability in the next round, which yields each voter an expected payoff of $0.9 \cdot \frac{13}{3} < 4$. Each voter is therefore too weak to reject her middle alternative and concedes. This treatment shows that bargaining with indivisibilities and a Condorcet cycle may resolve disagreement efficiently without causing costly delay. Moreover, all players submit bold demands.

In AsymPaySymRec, the equilibrium in which all submit their best alternatives and all accept their middle alternatives breaks down because player 2 (given the higher payoff from her best alternative) now prefers to reject her middle option in the hope of getting her best option in the next period. Therefore, the next equilibrium candidate is a situation where everyone submits their best alternatives and only player 1 and 3 accept their middle alternatives. But this is not an equilibrium either, since in this situation players 2 and 3 will never agree and therefore player 1 will be part of any agreement. This gives her an incentive to reject her middle option and hope for getting her best outcome next period. Interestingly, this change in player 1's behavior induces player 2 to reconsider her strategy and return to accepting her middle option and therefore the next equilibrium candidate is a situation where everyone still submits their best alternatives and only players 2 and 3 accept their middle option. As it turns out by an argument parallel to the discussion of the previous case this situation is not an equilibrium either. And similarly, for the situation where it is player 3 rejecting her middle option is not an equilibrium. In equilibrium randomized acceptance resolves this merry-go-round argument; all players submit their best alternatives and all players randomly accept their middle alternative.

[5] The mechanism underlying the mixed strategies in SymPayAsymRec and AsymPayAsymRec is very similar and omitted.

2.4 Hypotheses

From the equilibrium predictions in Table 3 and our two-by-two design, we derive two sets of hypotheses.

1. Effect of recognition probabilities
   - (a) For players 1 and 2 asymmetries reduce the likelihood of accepting the middle option.
   - (b) For player 3 asymmetries increase the frequency of accepting the middle option when payoffs are asymmetric.
   - (c) Asymmetric recognition probabilities increase player 3's frequency of proposing the middle option and do not affect the other players' proposing behavior.
   - (d) Asymmetric recognition probabilities reduce player 3's payoff and have no substantial effect on the other players' payoff.
2. Effect of payoff structure
   - (a) For players 1 and 2 asymmetries reduce the likelihood of accepting the middle option.
   - (b) For player 3 asymmetries decrease the frequency of accepting the middle option when probabilities are symmetric.
   - (c) The payoff structure does not substantially affect proposing behavior.
   - (d) Payoff asymmetries have almost no effect on expected equilibrium payoffs and the only substantial change is to player 3's payoff when the probabilities are asymmetric.

While some of the strategy changes might at first glance seem unintuitive (for instance, why does player 1 reject her middle option more frequently when she has a lower recognition probability), in general these all rely on the effect a parameter change has on the 'cost' of making a player accept a proposal. Recognizing these changes requires equilibrium reasoning that is rather complex. It is precisely this complexity that motivated us to investigate the robustness of the theoretical predictions in the laboratory and it raises the question how subjects' observed behavior might systematically deviate from theoretical predictions. These complexities notwithstanding we can provide a clear intuition for the changes in expected payoffs which then in turn imply the changes to acceptance and proposing behavior.

In terms of asymmetric recognition probabilities, it is very unintuitive that player 3 is hurt most, while the other two players are not substantially affected. There are two simultaneous effects at work causing this result. First, player 3's best alternative needs player 2's approval, while player 2's best alternative needs player 1's approval. Since the increase in her recognition probability makes player 2 stronger and more eager to reject player 3's best alternative (see Table 3), player 3 is now less likely to get her favorite alternative. The second effect is that player 1, now being recognized with a lower probability, is the only one proposing to player 3 and therefore there is now a higher chance that player 3 will be excluded from the agreement. The combined effect implies that even though players 2 and 3 have the same recognition probability they will receive different equilibrium payoffs which highlights that recognition probabilities are not a sufficient statistic for bargaining power. The reason is that it does not only matter how often a player gets to propose but also to whom, and in this respect player 2 and 3 are asymmetric.

When considering asymmetries in payoffs we find that in case of symmetric recognition probabilities equilibrium payoffs do not differ substantially across treatments. The reason is the competition among the players to be included in the pair that eventually agrees. When recognition probabilities are asymmetric, payoff asymmetries do not balance each other and the effect of player 1's equilibrium strategy, who now accepts player 2's best alternative at a substantially lower rate, on player 3's payoffs is positive. The reason is that higher rates of disagreement between player 1 and 2, lead to an increased likelihood of future rounds in which player 3 may either propose or be proposed her middle alternative.

According to Table 3, the theoretical predictions that a player submits her middle alternative lie within the relative small interval of 0–13%, which may seem as weak quantitative predictions. Obviously, a design with parameters that generate larger differences in the theoretical predictions across treatments would be preferred. However, there is a stark tradeoff between generating variations in proposing versus accepting behavior because a positive probability of proposing one's middle option implies certain acceptance of one's middle option. The reasons is that if a player is willing to settle for her middle option in the advantageous position of being the proposer she will certainly settle for it when being proposed to. Therefore, we opted to aim for considerable variation in acceptance behavior which is easier to induce than a similar variation in proposing behavior. Furthermore, even the small interval of 10–13% implies some stark qualitative predictions. Player 1's reduction of her recognition probability will not induce this player to submit her middle option as a proposal. Similarly for player 2's increase of her recognition probability. It is only player 3 who should ever submit her middle option and only when recognition probabilities are asymmetric. Furthermore, we can also report that player 3's probability of submitting her middle option seems very sensitive to risk aversion. To be more precise, Tables A.1 and A.2 of Appendix A illustrate that player 3's probability of proposing her middle option rapidly increases in the risk aversion parameter $\alpha \leq 1$ when the players have identical CRRA utility functions of the form $u(x) = x^{\alpha}$. Therefore, the reported 10–13% of Table 3 should be seen as theoretical lower bounds on these probabilities that are most likely to be higher in practice due to risk aversion.

2.5 Experimental protocol

The experiment was conducted at the CREED laboratory at the University of Amsterdam in December 2013 and February 2014 and implemented using php/mysql.[6] Participants were recruited using CREED's subject database. In each of nine sessions, between 18 and 27 subjects participated. Most of the 225 subjects in the experiment

[6] For screenshots of the interface as well as the text of the instructions and the summary handout, see Appendix F.

were undergraduate students of various disciplines.[7] Earnings in the experiment are in 'points', which are converted to euros at the end of the experiment at an exchange rate of 10 points = 1€. The experiment lasted on average 80 min and the average earnings were 19€ (including a 7€ show-up fee).

After all subjects have arrived at the laboratory, they are randomly assigned to one of the computers. Once everyone is seated they are shown the instructions for the first part of the experiment on their screen.[8] After everyone has read these and the experimenter has privately answered all questions, a summary of the instructions is distributed. Then, all subjects have to answer quiz questions that test their understanding of the instructions. After everyone has successfully finished this quiz, the experiment starts. When everyone has finished part I the instructions for part II are shown on the screen and again a summary is distributed and a quiz has to be passed before part II begins. Finally, after everyone has finished part II the instructions for part III are shown on the screen and subjects make their decision for part III. At the end of the session, all subjects answer a short questionnaire and are privately paid their cumulative earnings from the three parts.

In order to induce subjects to think very carefully about their decision immediately for part I of the experiment the game was run as described above but with 10-times the payoffs.[9] Subjects were informed that in this part they would participate in a bargaining game, that they stay the same player throughout the first part and that they will never meet the two other group members in part II and part III of the experiment. The game started in period 1 with subjects learning their role (player 1, 2, or 3) and applied the strategy method, i.e., everyone decided on their proposal before one proposal was randomly chosen to be voted on. If the first voter (the non-proposing group member that likes the proposal better) votes 'yes' part I of the experiment ends and the payoffs according to the implemented alternative are realized. If the first voter votes 'no' the second voter has to decide. If she accepts the first part ends and payoffs are realized. If she rejects, then with probability 0.9 the game moves to the next period, which proceeds exactly the same as period 1. With the remaining probability bargaining breaks down, part I ends and all group members earn zero points.

Part II works in a way similar to part I, but the payoffs are not multiplied by ten and this part consists of 10 bargaining games. Each game works as described for part I but after each round groups are randomly re-matched and every subject is randomly assigned one of the three roles within the group. For econometric reasons this re-matching is not done using the complete group of subjects in the laboratory but is based on independent matching groups (i.e. subgroups) of size 6 or 9.[10] Table 4 shows the number of independent matching groups and subjects for each of the four treatments.[11]

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[7] 148 of the 225 participants were students in business or economics.

[8] They are informed that there will be three parts in the experiment but not what these parts will entail.

[9] This does not have any effect on the equilibrium predictions, provided the risk-neutrality also holds at this payoff level.

[10] Subjects were simply told that they would be rematched with other participants.

[11] The larger number of subjects in treatment SymPaySymRec is due to an oversight where one session that was supposed to be AsymPaySymRec was run as SymPaySymRec instead. This error was noticed immediately and was made up for by running a session of AsymPaySymRec the next day.

Table 4 Treatments

	Symmetric payoffs	Asymmetric payoffs
Symmetric recognition probabilities	N = 10 78 subjects	N = 5 45 subjects
Asymmetric recognition probabilities	N = 7 51 subjects	N = 7 51 subjects

Cell entries give the number of independent matching groups N and subjects for each treatment

In part III we measure risk-aversion using the task proposed by Eckel and Grossman (2008). Subjects have to choose one of seven lotteries with varying payoff for winning and losing but all with a winning probability of 50%.

3 Results

The theoretical predictions that a player always accepts her best option and that she neither proposed nor accepted her worst option are borne out by the data.[12] Therefore, we focus the analysis of the results on a player's acceptance and proposing behavior with respect to her middle option. Our discussion focuses on an in-depth analysis of behavior observed in part II of the experiment and for an analysis of part I which leads to similar conclusions we refer to Appendix E. In a first step we present a within-treatment analysis that investigates whether observed behavior corresponds to the equilibrium predictions. As a second step we analyze differences across treatments and investigate the effect of asymmetries on subjects' behavior.

3.1 Within-treatment analysis

For treatment SymPaySymRec, where all players are completely symmetric, Fig. 1 shows behavior that is quite close to the prediction of immediate agreement (i.e., players propose their best option and the other player for whom this is the middle option almost always accepts). Though all players sometimes reject the middle option, this only happens rarely and does not significantly vary by player (*p* value: 0.29).[13] Furthermore, sometimes a player proposes her middle option but this happens only occasionally and the frequency does not significantly vary across players (p value: 0.61).

In treatment SymPayAsymRec, where player 1 has a lower recognition probability, we find systematic deviations from Nash equilibrium. As we can see, player 1 is proposing her middle option regularly while in the predicted equilibrium she should

[12] Indeed, in line with theory players almost never proposed their worst option (14 out of 2697 decisions) and rarely accepted it (6 out of 173 decisions) and these frequencies do not vary much by treatment. Furthermore, a player almost never rejected her best option (1 out of 57 decisions).

[13] Unless mentioned otherwise all p values are taken from a logit regression with proposing (accepting) the middle option as dependent variable and standard errors clustered at the matching group level. All regression results are reported in Appendix C.

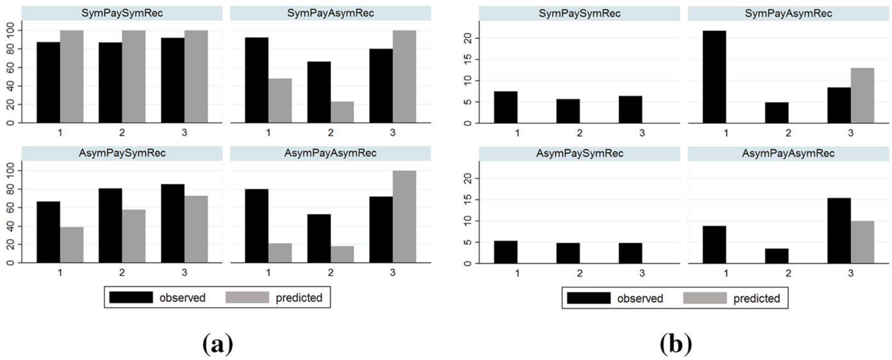

Fig. 1 Accepting and proposing one's middle option in Part II. **a** Fraction accepting middle option. **b** Fraction proposing middle option. The figure shows the average fraction of accepting and proposing one's middle option observed in part II of the experiment split by role and treatment and compares them to the Nash equilibrium predictions

only propose her favorite option. For player 3 we observe the opposite, she proposes her middle option less often than predicted. This results in player 1 being significantly more likely to propose her middle option than player 3 (p value < 0.01) who in turn is significantly more likely to propose her middle option than player 2 (p value: 0.04). With respect to the acceptance behavior in this treatment, we observe that behavior does not differ as much as predicted across players since players 1 and 2 accept their middle option more often than predicted. Furthermore, it is not the case that player 3 is most likely to accept her middle option. Instead player 1 has the highest acceptance rate[14] while player 3's behavior is statistically indistinguishable from player 2's behavior (p value: 0.30).

For the treatment with asymmetric payoffs and symmetric recognition probabilities (AsymPaySymRec) we find that the proposing behavior is in line with the predictions since everyone is almost always proposing their best alternative and there is no difference across players (p value: 0.88). For the accepting behavior we again find that the difference between players is smaller than predicted and that all players accept their middle options more often than predicted. We find that there is no significant difference between player 1 and 2 (p value: 0.09) or between player 2 and 3 (p value: 0.41) but player 3 accepts her middle option significantly more often than player 1 does (p value: 0.03). Overall, we find some support for the equilibrium predictions since proposing behavior and the ranking of acceptance rates is as predicted even though the differences in acceptance behavior are not as pronounced as predicted.

In the treatment were both payoffs and recognition probabilities are asymmetric (AsymPayAsymRec) we find that players 1 and 3 are proposing their middle option more frequently than predicted. This results in player 2 being significantly less likely to propose the middle option than player 1 (p value: 0.04) who in turn has an insignificantly lower probability of proposing her middle option than player 3 (p value: 0.09). For the acceptance behavior we find similar results to treatment SymPayAsymRec:

[14] The difference between players 1 and 2 is significant at the 1%-level while the difference 1–3 gives a p value of 0.08.

players 1 and 2 accept their middle option substantially more often than predicted. Given that this effect is stronger for player 1 we observe a significantly higher acceptance rate by player 1 compared to player 2 (p value: 0.02), which is not in line with the small predicted difference in acceptance rates. Furthermore, we do not find that player 3's acceptance rate is the highest but it is statistically indistinguishable from the other players' behavior (p values are 0.49 and 0.15 for player 1 and 2, respectively). Overall, we find only limited support for the equilibrium predictions since it is not only player 3 who proposes her middle option and the pattern of acceptance rates is not in line with the theory for risk neutral players.

Combining all these results, two main observations arise. First, we find mixed support for the equilibrium predictions. On the one hand, the perfectly symmetric treatment corresponds nicely to the predictions and while asymmetric payoffs by themselves have less of an effect on behavior than predicted, the general pattern is still in line with the predictions. On the other hand, for the treatments with asymmetric recognition probabilities we find almost no support for the equilibrium predictions since the patterns of both acceptance and proposing behavior are far from what is predicted. Second, we find that subjects do not fully exploit their bargaining power when making their acceptance decision since they too often accept their middle option. This is in line with findings reported by McKelvey (1991) in a related experiment and implies a higher than expected proposer power. The subjects seem to overlook that other subjects accept their middle option too often and therefore forego exploiting this when proposing. This finding is in contrast to previous work on bargaining experiments which finds smaller than predicted proposer power, see e.g. Fréchette et al. (2003, 2005a, b) and Diermeier and Morton (2005). We conjecture that the reason for these different findings is due to indivisibilities in our setting. These references consider perfect divisibility allowing for a smooth trade-off between kindness (i.e., giving up some of your own payoff in favor of others) and self-interest. In contrast, in our setting kindness is quite expensive, since it involves settling for your middle option. Therefore, with indivisibilities social preferences must be much stronger to have a noticeable impact on behavior. Given that social preferences are perceived to be the reason for the observation of lower than expected proposer power, this might explain our findings.

These observed deviations from the theory raise the question of how to explain them. In Sect. 4 we discuss potential explanations and present an equilibrium analysis that relaxes the rationality assumption and also allows for risk-averse agents. As we will see this alternative model can account quite well for behavior when recognition probabilities are symmetric but is unable to capture all aspects of behavior when probabilities are asymmetric. Therefore, in Sect. 5 we consider a heuristic where subjects equate recognition probabilities and bargaining power that we call the 'recognition is power' heuristic.

3.2 Between-treatment analysis

First, we consider the effects of going from symmetric to asymmetric recognition probabilities. As Fig. 2 shows, for both payoff configurations this asymmetry is pre-

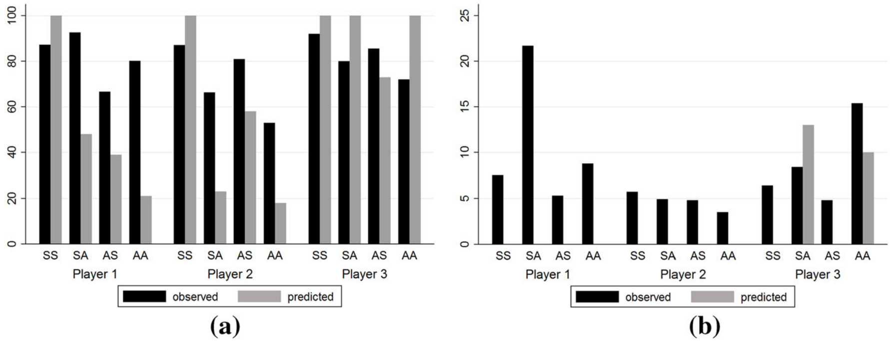

Fig. 2 Accepting and proposing one's middle option in part II. **a** Fraction accepting middle option. **b** Fraction proposing middle option. The figure contrasts for each role and treatment the average observed fraction of accepting and proposing their middle option with the Nash equilibrium predictions. SS (SA, AS, AA) denotes the treatment with symmetric (symmetric, asymmetric, asymmetric) payoffs and symmetric (asymmetric, symmetric, asymmetric) recognition probabilities

dicted to lead to a decrease in the acceptance rates of players 1 and 2 (Hypothesis 1a) while player 3's acceptance behavior should only be affected when payoffs are asymmetric (Hypothesis 1b).

For player 2 we find support for Hypothesis 1a since she significantly reduces her probability of accepting the middle option (for symmetric payoffs, p value < 0.01; for asymmetric payoffs, p value: 0.03) when recognition probabilities become asymmetric. For player 1 on the other hand, Hypothesis 1a is not supported since she (insignificantly) increases her acceptance rate instead of decreasing it (for symmetric payoffs p value: 0.35 and for asymmetric payoffs 0.24). Additionally, Hypothesis 1b finds only mixed support since independent of the payoff structure recognition probabilities do not significantly affect player 3's acceptance rate. While the insignificant effect (p value: 0.10) was predicted for symmetric payoffs, for asymmetric payoffs we do not find the predicted increase in player 3's acceptance rate but an insignificant decreases (p value: 0.14).

The deviations from the theoretically predicted effect of asymmetric recognition probabilities are even more pronounced with respect to proposing behavior and overall our data do not provide much support for Hypothesis 1c. While, as predicted, the middle option is only regularly proposed when probabilities are asymmetric, the predicted increase in player 3's frequency of proposing her middle option is only significant when payoffs are asymmetric (p values are 0.50 for symmetric and 0.00 for asymmetric payoffs). Furthermore, for symmetric payoffs we observe a significant increase in player 1's probability of proposing her middle option (p value < 0.01).

The observed deviations from theory in accepting and proposing the middle option also result in payoff consequences of asymmetric recognition probabilities that differ from the predicted effect. Hypothesis 1d states that asymmetric probabilities reduce player 3's average payoff while both player 1's and 2's payoff remain unchanged. This implies that having a lower recognition probability should not hurt player 1. The data presented in Table 5 show that player 3 indeed suffers a significant reduction in payoffs but we also see that player 2 increases her payoff at the expense of player 1 (all changes are significant at the 1%-level).

Table 5 Observed and predicted payoffs in part II

	SymPaySymRec	SymPayAsymRec	AsymPaySymRec	AsymPayAsymRec
Observed	4.6	3.1	4.7	3.8
	4.0	6.3	5.3	8.4
	4.4	3.6	4.6	3.7
Predicted	4.3	4.4	4.4	4.4
	4.3	4.4	4.4	4.4
	4.3	2.8	4.4	3.3

Cell entries give the observed and predicted payoffs by treatment and player role (the first/second/third entry in each cell corresponds to player 1/2/3) assuming risk-neutrality and continuation probability $\delta = 0.9$

We now turn to the effects of going from symmetric to asymmetric payoffs. For accepting behavior we expect that asymmetric payoffs reduce player 1's and 2's propensity to accept their middle option (Hypothesis 2a) while only affecting player 3's behavior when recognition probabilities are symmetric (Hypothesis 2b). The observed behavior is broadly in line with these predictions but the decrease in the probability of accepting the middle option is only significant for player 1 (p value: 0.05 for both symmetric and asymmetric probabilities) but not for player 2 (p value 0.45 for symmetric and 0.20 for asymmetric). Furthermore, player 3 shows a lower probability of accepting the middle option when payoffs are asymmetric but this effect is not significant (p value: 0.23 when probabilities are symmetric and 0.49 for the asymmetric case).

With respect to proposing behavior we expect payoff asymmetry to play no role (Hypothesis 2c). While this is what we observe when recognition probabilities are symmetric (p values are 0.39, 0.73 and 0.42 for players 1, 2 and 3) this prediction is not supported when recognition probabilities are asymmetric. Now payoff asymmetries significantly reduce player 1's probability of proposing her middle option (p value < 0.01) and significantly increases the frequency of player 3 proposing her middle option (p value: 0.04). In sum, Hypothesis 2c is only supported for symmetric recognition probabilities.

For the average payoffs shown in Table 5 we expect to find no effect of asymmetric payoffs for players 1 and 2 and an increase for player 3 when the recognition probabilities are asymmetric (Hypothesis 2d). The predictions that player 2 is unable to exploit the increased payoff associated with her favorite option is not observed in the laboratory since player 2 can significantly increase her payoff (p value < 0.01 for both recognition probabilities). For asymmetric recognition probabilities, it is not player 3 that significantly increases her payoffs but player 1 (p value: 0.02 for player 1 and 0.78 for player 3).

Overall, from the between-treatment comparison a similar picture to the one found in the within-treatment analysis arises: subjects do not react to asymmetries as predicted by theory and the deviations are more pronounced with asymmetric recognition probabilities than with asymmetric payoffs, indicating that subjects have more difficulties understanding the strategic effects of asymmetric recognition probabilities.

4 Discussion

The previous section begs the question as to the causes of these deviations from equilibrium. In the following we first discuss some well-known behavioral patterns and argue that they cannot explain the set of observed deviations. We then present an equilibrium analysis that considers two possible channels that might be at work -risk-aversion and noisy decision-making- and show that this analysis can explain some but not all the observed deviations.

4.1 Behavioral patterns

It is by now well-know that a large number of behavioral patterns can explain deviations from the ideal of a selfish and rational *homo oeconomicus*. Chief among them are social preferences but as we have argued repeatedly throughout the paper we think that due to the indivisibilities they are only of limited importance for explaining our results. Furthermore, the ‘taste for efficiency’ (a preference for joint payoff maximization, Engelmann and Strobel 2004) as a special form of social preferences cannot explain our findings either. This preference would predict that when payoffs are asymmetric alternative 2 gets implemented more often but this is not the case. When recognition probabilities are symmetric, the percentage of the time that alternative 2 gets implemented drops from 31 to 27 when payoffs change from symmetric to asymmetric. Similarly when recognition probabilities are asymmetric, the percentage drops from 56 to 50.

Another behavioral force that is frequently discussed in the context of bargaining is entitlement (see, for instance, Gächter and Riedl 2005) which in our setting would predict that proposers feel entitled to their preferred outcome since they are in a privileged position. Furthermore, if other players respect this entitlement they would be more likely to accept their middle option. For two reasons it is unlikely that entitlement effects can explain our findings. First, given the strategy method players have not yet ‘won’ the right to be the proposer when submitting their choice which means that entitlement is at best anticipated which should reduce its salience. Second, entitlement would predict that players should very rarely propose their middle option which is not in line with the finding that, in particular, player 1 proposes her middle option more often than predicted in AsymRec.

While there are other behavioral mechanisms, like the inability of executing backward induction or competitive preferences, that are relevant when studying bargaining behavior we refrain from discussing all possible behavioral mechanisms and instead turn to another possible reasons for the observed deviations: bounded rationality.

4.2 Quantal response analysis

It is well established that humans may not be able to solve for the best-response as necessary for playing Nash equilibrium[15] but are often observed to find a ‘better-response’,

[15] In Appendix D, we investigate to what degree subjects’ behavior can be explained by them best-responding to the other players’ observed behavior in each independent matching group. The conclusions from this analysis are similar to the discussion in this section.

Table 6 Quantal response equilibrium

	SymPaySymRec	SymPayAsymRec	AsymPaySymRec	AsymPayAsymRec
Accept M	86%	86%	75%	76%
	86%	69%	75%	59%
	86%	88%	85%	91%
Propose M	18%	11%	12%	10%
	18%	10%	3%	3%
	18%	24%	18%	36%
Expected payoff	4.3	3.7	4.7	4.5
	4.3	5.2	6.2	7.4
	4.3	3.9	3.8	3.3

Cell entries give the probability of accepting (proposing) one's middle option and the expected equilibrium payoffs by treatment and player role (the first/second/third entry in each cell corresponds to player 1/2/3) for the quantal response equilibrium with $\alpha = 0.47$ and $\lambda = 2.9$

i.e. they tend to choose better options more often than worse options. This idea is captured by quantal response equilibrium (McKelvey and Palfrey 1995, 1998; Goeree et al. 2016), which assumes that the probability of choosing an action increases in the associated payoff. Previous experimental work (for instance, Goeree and Holt 2005) has shown that this equilibrium concept outperforms Nash equilibrium predictions in explaining experimental data. It also has been successfully applied to experiments on strategic bargaining (Battaglini and Palfrey 2012; Nunnari and Zapal 2016).[16]

In order to disentangle the role of bounded rationality and misspecified preferences we also allow for risk aversion when analyzing the quantal response equilibrium. Risk aversion might be relevant since the finding that players overall are more accommodating in their acceptance behavior than predicted would be in line with players being risk-averse since risk-averse players are less willing to take the gamble of rejecting their middle option in the hope of getting their favorite option in a future period.[17]

We operationalize these two channels by using the experimental data to estimate, first, the parameter α of the CRRA utility function x^{α} and, second, the noise parameter λ of the quantal response equilibrium. The results in estimates of $\alpha = 0.47$ and $\lambda = 2.9$.[18] The former is in line with previous work that estimated α's in the range of 0.3–0.6 (see Battaglini and Palfrey 2012 and references therein). Table 6 shows the estimated quantal response equilibria.

Figure 3 shows the choice probabilities predicted by the quantal response equilibrium for the estimated parameters. Considering the acceptance decisions, we see that observed behavior is quite close to the quantal response predictions. Turning to the proposing decision, we see that when recognition probabilities are symmetric the fitted model does predict higher rates of proposing one's middle option than observed,

[16] We also considered level-k (Nagel 1995; Stahl and Wilson 1995) as a way of modelling bounded rationality but level-k is unable to explain observed behavior.

[17] An analysis of decision-making at the individual level shows no systematic or substantial influence of risk-aversion and gender on behavior. Detailed results of this analysis are presented in Appendix C.

[18] In Appendix B we present the underlying model specification.

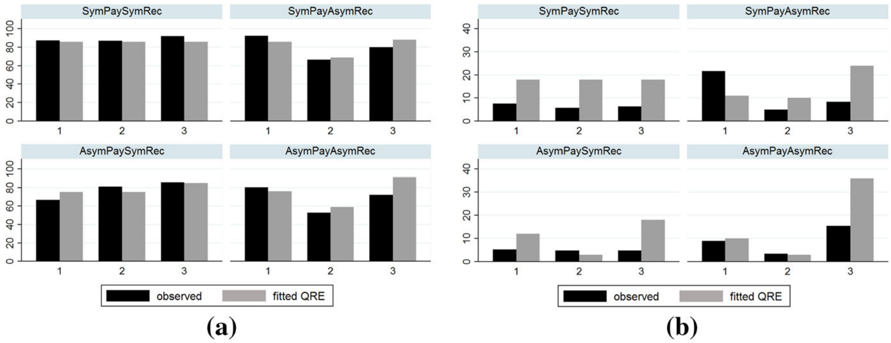

Fig. 3 QRE for accepting and proposing one's middle option in part II. **a** Fraction accepting middle option. **b** Fraction proposing middle option. The figure shows the average fraction of accepting and proposing one's middle option observed in part II of the experiment split by role and treatment and compares them to the quantal response equilibrium for the estimated noise-parameter $\lambda = 2.9$ and risk-aversion parameter $\alpha = 0.47$

which is opposite to the Nash equilibrium predictions. Furthermore, for asymmetric probabilities the fitted model is less accurate in capturing proposals. As when using Nash equilibrium as a solution concept, with symmetric payoffs player 1 is proposing her middle option more often than predicted. For player 3 we obtain a systematic deviation of doing so less often than predicted for both payoff structures, which differs from the deviations (one more often and one less often) from Nash equilibrium in Fig. 1b. Our estimated quantal response equilibrium indicates that subjects deviate from the rationality assumptions of Nash equilibrium and that errors in decision making are one important part of this deviation.

Table 7 compares the observed payoffs with the Nash equilibrium payoffs and the expected payoffs of the estimated quantal response equilibrium. Overall, the payoffs implied by QRE are closer to the observed payoffs than Nash equilibrium. In particular, QRE picks up that player 2 is the major beneficiary of the asymmetries, but when recognition probabilities are asymmetric the predicted effects are still substantially lower than observed. Furthermore, QRE picks up that player 1 is hurt by her lower recognition probability but the observed effect is substantially larger than predicted.

Overall, we can conclude that while noisy decision-making and risk-averse subjects can explain most of the deviations from Nash equilibrium when probabilities are symmetric, the adjusted model still falls short in explaining all of the effects of asymmetric recognition probabilities.

5 The 'recognition is power' heuristic

The QRE analysis presented in the previous section suggests that the deviations from theory observed for asymmetric recognition probabilities are not only caused by risk aversion and mistakes in decision-making but that subjects exhibit a systematic bias when dealing with asymmetric recognition probabilities. One plausible source for this bias can be founded in the fact that humans often use heuristics in making deci-

Table 7 Observed, Nash equilibrium and quantal response equilibrium payoffs in part II

	SymPaySymRec	SymPayAsymRec	AsymPaySymRec	AsymPayAsymRec
Observed	4.6	3.1	4.7	3.8
	4.0	6.3	5.3	8.4
	4.4	3.6	4.6	3.7
Nash	4.3	4.4	4.4	4.4
	4.3	4.4	4.4	4.4
	4.3	2.8	4.4	3.3
Quantal	4.3	3.7	4.7	4.5
	4.3	5.2	6.2	7.4
	4.3	3.9	3.8	3.3

Cell entries give the observed and estimated quantal response equilibrium payoffs by treatment and player role (the first/second/third entry in each cell corresponds to player 1/2/3) assuming continuation probability $\delta = 0.9$

sions (Tversky and Kahneman 1974; Gigerenzer and Gaissmaier 2011) and therefore behavior might not be completely driven by expected payoffs. The use of a heuristic would also be consistent with the absence of learning throughout the experiment since a heuristic is a stable decision rule. We therefore propose the 'recognition is power' heuristic as a way to explain behavior with asymmetric recognition probabilities.

'Recognition is power' heuristic: *Players equate recognition probabilities with bargaining power and therefore players with a high (low) recognition probability are bold (cautious) in their bargaining behavior.*

This heuristic can explain the deviations from both Nash equilibrium and QRE. Compared to the Nash equilibrium we find that player 1 is accepting and proposing her middle option too often which is consistent with her believing that due to the low recognition probability she has only little bargaining power. For QRE the main deviation observed for asymmetric recognition probabilities is that player 3 proposes her middle option too little which is consistent with her believing that due to the high recognition probability she is in a strong bargaining position which makes her more aggressive in her bargaining behavior.

6 Conclusions

Committees are often confronted with indivisibilities in bargaining. This is an important topic that is currently understudied. Our study is a first attempt to fill this void and suggests a promising and important direction for future research. We implement four treatments in a situation where three committee members bargain over three imperfectly divisible alternatives. To investigate the effect of asymmetries on bargaining behavior we vary the preferences (comparing symmetric payoffs to a situation where one player is advantaged) and institution (comparing symmetric recognition probabilities to a situation where one player has a lower probability of being recognized).

While subjects' behavior corresponds nicely to the equilibrium predictions when the game is perfectly symmetric, deviations from theory begin to appear when asymmetries are introduced. The two main deviations we observe are: first, subjects are more accommodating than expected and regularly accept their middle option; our analysis attributes this to risk-aversion. Second, subjects do not react to asymmetries in the way predicted by theory. While introducing asymmetric payoffs when recognition probabilities are symmetric leads to a change in the predicted direction (albeit less pronounced than expected), with asymmetric recognition probabilities substantial and systematic deviations from theory arise. The most pronounced aspect of these deviations is that the player with the low recognition probability is much more accommodating than predicted, since she accepts and proposes the middle option more often than theory prescribes. Furthermore, we did not find any evidence of learning. Our findings can partly be supported by a theoretical benchmark consisting of a quantal response equilibrium with risk-aversion and noise parameters estimated using our experimental data. Nevertheless, even this model with parameters estimated to fit observed behavior cannot fully explain the behavior in treatments with asymmetric recognition probabilities. A possible explanation for the results in treatments with asymmetric probabilities is that subjects use the 'recognition is power' heuristic which equates recognition probabilities and bargaining power. This would lead the 'weak' player with the low recognition probability to be more accommodating than predicted in Nash equilibrium and to one of the 'strong' players with a high recognition probability to be less accommodating than in the quantal response equilibrium that we fitted to the data.

As with all experiments one crucial question concerns the external validity of the results: what do our results imply beyond the specific set of asymmetries we have considered? While it is ultimately an empirical question what would happen for different parameter choices our results can offer some guidance. First, outcomes with asymmetric payoffs should be well explained by the theoretical model. This assessment is based on the observation that subjects in the experiment reacted to asymmetric payoffs as predicted. Second, in situations with asymmetric recognition probabilities players will rely on a heuristic equating nominal bargaining power (i.e. recognition probabilities) with real bargaining power and therefore (relative to theoretical predictions) outcomes will be biased against players with low recognition probabilities to the benefit of players with high recognition probabilities.

Another crucial dimension of external validity is whether the 'recognition is power' heuristic has applications beyond the bargaining game considered in this paper. We are aware of at least one important empirical regularity that could be explained with our heuristic: Gamson's Law (1961). Gamson's Law describes the robust empirical finding that coalition governments tend to allocate government portfolios proportional to the seat shares parties are contributing to the government (for a survey of the empirical literature see Warwick and Druckman 2006). The fact that nominal bargaining power instead of real bargaining power (i.e. pivotality when forming a winning coalition) matters for bargaining behavior is similar in flavor to the focus our subjects put on recognition probabilities. In particular, the order of who gets to attempt to form a government often proceeds in order of seat shares which implies a close relationship between proposer power and recognition probabilities.

Ultimately, the external validity of our results can only be tested by future work exploring bargaining with asymmetries. For instance, it would be very interesting to consider more complex bargaining settings, be it by increasing the number of players or by increasing the asymmetry across players. In such a stress test both the predictive power of the rational choice benchmark and our proposed heuristic could be further scrutinized. Another interesting design could rely on the theoretical work by Herings and Houba (2016) which demonstrates the absence of a straightforward mapping from the parameters of the game to equilibrium behavior. This makes it possible to set up treatments that share the same theoretical predictions but vary in their asymmetry which would be another way to test the effect of asymmetries. Finally, we think a very promising continuation of our study of asymmetric institutions would be to consider whether players are aware of the 'recognition is power' heuristic and try to exploit it when designing institutions. For instance, one could think about an experiment where in an initial stage players choose between different allocations of bargaining power. The question would then be whether players pick the theoretically optimal allocation, i.e. the one that gives them the largest real bargaining power, or whether they focus more on nominal bargaining power, i.e. recognition probabilities.

In conclusion, this paper offers a first step towards understanding the effect of asymmetric recognition probabilities and asymmetric institutions in general on bargaining behavior in the presence of indivisibilities. Given the importance and prevalence of strategic bargaining in determining political and economic outcomes we are looking forward to further work exploring the role of institutions and indivisibilities. Our results suggest that there is still much to learn.

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