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Power Asymmetry and Escalation in Bargaining *

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Abstract

Bargaining is prevalent in economic interactions. Under complete information, game theory predicts efficient bargaining outcomes (immediate acceptance of first offer) (see Rubinstein, 1982). However, continuous rejections of offers leading to inefficient delays (*escalation*) have regularly been found in previous bargaining experiments even under complete information (see Roth, 1995). I test experimentally (1) whether power asymmetry leads to more escalation in bargaining and (2) whether perspective-taking reduces escalation. I find that power asymmetry increases escalation, but that perspective-taking does not reduce escalation.

KEYWORDS: two-person bargaining experiment, asymmetric power, escalation, perspective-taking
JEL CLASSIFICATION: C78, D89

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1 Introduction

Bargaining is prevalent in economic interactions. It has been investigated theoretically at least since Edgeworth (1881). More recently, many economists have also analyzed bargaining situations experimentally (see, for example, Roth, 1995). According to Nash (1950), a bargaining situation is defined by three characteristerics: a potential to reach a mutually beneficial agreement, a conflict of interests about which agreement to choose, and both parties' approval as a requirement to reach any agreement. The first part of the definition – both bargaining parties could be made better off – seems rather beneficial than problematic. Nevertheless, the second two parts – reaching an agreement *with conflicting interests* – may be problematic.

"Bargaining power" is often said to influence which agreement will be reached. Trying to answer the question how exactly bargaining power determines the bargaining outcome, Rubinstein (1982) presented a formal solution to a highly structured alternating offers bargaining problem (see section 2 for details): The higher a player's bargaining power, the larger her share in the outcome. Besides, and more important for this study, under complete information, both bargaining parties are predicted to reach an agreement in the most efficient way possible, i.e., the first mover's offer is immediately accepted, the pie does not shrink and there are no inefficient delays, no matter how much bargaining power each bargaining party possesses.

Alternating offers bargaining experiments (see Roth, 1995) have indeed often found a high percentage of immediate and therefore efficient agreements. Nevertheless, a non-negligible frequency of offers not being accepted immediately has also been found regularly even under complete information. This fraction may not be too large, but it may cause substantial costs if offers and counteroffers are continuously being rejected. In this case, the remaining pie becomes smaller and smaller and efficiency might decrease considerably. I call this situation "escalation".

In general, escalation may either be defined as "an increase or development by successive stages" (OED, 2011); or it can be defined as "a shift to more extreme tactics during social conflict" (Pruitt et al., 1997, p. 252) or similarly as an "increase in the intensity of a conflict as a whole" (Rubin et al., 1994,

p. 69). Applying the first definition to alternating offers bargaining games means offers and counteroffers are continuously being rejected. If rejecting offers is costly as in Rubinstein's bargaining game (see Rubinstein, 1982), this definition of escalation is the same as inefficient delays and can be measured by the number of rounds that are needed until an agreement is reached. Applying the second definition to alternating offers bargaining games means offers and counteroffers are continuously being rejected *and* demands are getting more extreme. This is includes inefficient delays, but also captures a second aspect. In the following, I will use the first definition of escalation which does neither necessarily include nor rule out increasing demands.

If escalation has been observed experimentally even under complete information, there may be other factors not yet captured by Rubinstein (1982) that influence how efficient a bargaining outcome will be. One such potential factor is asymmetric power. It has already been shown that asymmetric power can lead to inefficient outcomes and escalation in public good games (see Cox et al., 2011; Nikiforakis and Noussair, 2011). However, asymmetric power does not always increase escalation. For example, Bolle et al. (2010) do not find an effect of asymmetric power on escalation in their "Vendetta Game". Thus, the first question of this study is whether power asymmetry leads to more escalation in bargaining.

If it really does, a natural second question would be whether it is possible to reduce this escalation. From an experimental study, Mummendey et al. (1984) conclude that divergent perspectives and thus divergent evaluations are responsible for aggressive behavior and escalation. Perspective-taking as a means to align divergent perspectives has been shown to reduce aggression (see Richardson et al., 1994). Thus, the second question of this study is whether perspective-taking reduces escalation in bargaining.

2 Rubinstein's bargaining game

In order to answer the two questions of this study, I will use Rubinstein's bargaining game (1982) as a workhorse. It captures the three characteristics of a negotiation mentioned in section 1 and, in contrast to simpler bargaining

games like the ultimatum game, Rubinstein's bargaining game moreover allows to examine the process of a negotiation and to measure efficiency more precisely.

Individual Rubinstein bargaining under complete information works as follows (see Rubinstein, 1982). There are two players: player 1 and player 2. Their task is to split a pie of size one between them. Player 1 starts in round 1 and makes an offer how to divide the pie. If player 2 accepts, the offer is implemented and the game ends. If player 2 rejects, round 2 starts and player 2 makes a counteroffer. If player 1 accepts this counteroffer, it is implemented and the game ends. If player 1 rejects, round 3 starts and player 1 makes a counteroffer. The game continues like this until an offer is accepted. The value of time or the players' patience is modeled using discount factors. Each player has a discount factor d_i between zero and one where $i \varepsilon \{1,2\}$. Whenever an offer is rejected and a new round begins, the pie shrinks according to a player's discount factor. The higher a player's discount factor, the more patient and thus stronger the player is. The stronger she is, the higher her share will be. Besides, there is a first-mover-advantage and a second-mover-disadvantage. More precisely, game theory predicts that player 1 offers $\frac{1-d_2}{1-d_1 d_2}$ for herself and $1 - \frac{1-d_2}{1-d_1 d_2}$ for player 2 in round 1 and that this offer will be immediately accepted by player 2.

3 Design, predictions and procedures

I design three experimental treatments (see table 1). They are called "Symmetric", "Asymmetric" and "Asymmetric & perspective" and will be abbreviated as "Sym", "Asym" and "AsymPersp" in the following. The first two are needed to answer the first research question: Does power asymmetry lead to more escalation in bargaining? The last two are needed to answer the second research question: If yes, does perspective-taking reduce escalation? In the experiment, I call player 1 "red" and player 2 "blue" to avoid that participants perceive an order of players according to the numbers 1 and 2. From now on, I will also switch to "player red" and "player blue" instead of "player 1" and "player 2" when referring to players in this study.

The power (a)symmetry does not refer to a player's discount factor per se, but rather to the subgame-perfect equilibrium prediction. This prediction

TABLE 1: The three treatments

Treatment	Player red's discount factor	Player blue's discount factor	Subgame-perfect equilibrium
Symmetric	0.60	0.70	(0.52, 0.48), round 1
Asymmetric	0.95	0.70	(0.90, 0.10), round 1
Asymmetric & perspective	0.95	0.70	(0.90, 0.10), round 1

includes the discount factors *and* the first mover advantage (see section 2 for the exact formula). The higher a player's discount factor, the higher his bargaining power. If a player moves first, he has an additional advantage. In "Sym", player red has a lower discount factor than player blue. However, since player red is the first to move, the power is approximately balanced (a share of 0.52 for player red and 0.48 for player blue according to the subgame-perfect equilibrium) and this treatment is called symmetric. In "Asym", player blue's discount factor remains the same, but player red's discount factor is increased to be higher than player blue's. Since player red is (as always) also the first to move, he has more bargaining power than blue and the treatment is called asymmetric (a share of 0.9 for player red and 0.1 for player blue is predicted by the subgame-perfect equilibrium). In "AsymPersp", both discount factors remain the same, but in addition, players are asked to take each other's perspective.

In "AsymPersp", the perspective-manipulation works as follows. Players are asked to take the other player's perspective before confirming *each decision*. For example, player red enters a proposal. Before he can confirm this proposal, he is asked to take player blue's perspective and to imagine as clearly as possible how he would react to this proposal in place of player blue. He then has to choose between two buttons "As blue: accept" and "As blue: reject". Afterwards, he has the possibility to change and confirm his proposal. Only this confirmed proposal is transmitted to player blue. Nevertheless, before player blue can see this confirmed proposal, he is asked to take player red's perspective, to enter a proposal that he would consider as player red and to imagine as clearly as possible how he would act in place of player red. After having done so, player blue can see red's proposal and either accept

or reject it. In case of rejection, blue is asked to enter a counterproposal. Before he can confirm this proposal, he is asked to take red's perspective and to imagine as clearly as possible how he would react to this proposal in place of player red. Like player red in round 1, he then has to choose between two buttons "As red: accept" and "As red: reject". Afterwards, he has the possibility to change and confirm his proposal. Only this last proposal is transmitted to player red. Along the same lines, player red is asked to take blue's perspective, to enter a proposal that he would consider as player blue and to imagine as clearly as possible how he would act in place of player blue before red can see blue's proposal. This manipulation continues until an agreement is reached.

The discount factors are chosen to be multiples of 0.05 to keep the numbers as simple as possible for participants while ensuring a large enough difference between player red and blue in "Asym" as well as "AsymPersp" and while getting as close as possible to the equal split in the subgame-perfect equilibrium prediction in "Sym". The subgame-perfect equilibrium predictions regarding the shares that players receive are already known not to serve as precise point predictors but can still be useful to predict directions of behavior (see Roth, 1995). This is enough for my purposes. More important for this study are the rounds in which agreement is reached. They are predicted to be 1 for all treatments irrespective of (a)symmetric bargaining power.

In June, July and August 2011, I conducted 16 sessions (5 per treatment and 1 additional for "AsymPersp" since there was still some money left) in the economics laboratory of the University of Jena, Germany. Depending on how many participants showed up, 12 to 18 persons took part in one session, adding up to a total of 244 subjects. Participants were invited using ORSEE (Greiner, 2004). According to post-experimental questionnaire data, my sample consisted mainly of students from Jena aging 24 years on average. I invited male participants only to exclude (different-)gender effects. I did not invite subjects that had (according to ORSEE) previously participated in Rubinstein bargaining experiments. Subjects participated in only one session of the experiment.

An experimental session proceeded as follows. Upon arrival, participants were randomly assigned a cubicle number. To ensure that participants understood the instructions, those that had not completed our German language

test before were asked to complete it. Instructions [1] were then distributed and subjects were given enough time to read them. Participants could ask questions and were answered privately in their cubicle if applicable. Communication between participants was strictly prohibited at all times. The experiment was programmed and conducted with the software z-Tree 3.3.8 (Fischbacher, 2007) [2]. Participants were asked to answer four control questions first. In case a control question was answered incorrectly, the right answer was explained to the subject in error. After the control questions, subjects were randomly assigned to be "red" or "blue" and maintained these roles during the whole experiment. I conducted one treatment per session.

I also distributed one sheet of paper with a table per cubicle where subjects could enter the results of each bargaining period so that they had a record of the experiment's history. Subsequently, the bargaining periods started. Each treatment was played four periods. Cubicles were randomly rematched after each period; no subject interacted more than one period with the same partner. To approximate the infinite horizon of the game as closely as possible, I did not explicitly limit the time of a bargaining period. Similarly to Rapoport et al. (1990), I told subjects that I planned enough time and that they could take their time. If they needed, however, "unexpectedly long", the computer would interrupt the current period. In fact, the computer was programmed to interrupt a period if more than 10 minutes or round 28 or 29 had passed (the round was drawn as a random number). After the four bargaining periods, one period was chosen randomly for payment. The experiment ended with a questionnaire that is used for a seperate study and finally asked for field of study and age. Each participant was then paid in private and left. The room temperature was measured immediately after all participants had left (according to Geen (1990), temperature may influence aggressive behavior). A session lasted on average 1 hour and 10 minutes. Every participant received a 2.50 EUR show-up fee plus the amount agreed upon (or calculated by the computer in case of break off) in the bargaining process. On average, a participant earned 9.61 EUR during a session.

[1] The instructions can be found in appendix A.

[2] An example screenshot can be found in appendix B.

4 Analysis

4.1 Overview

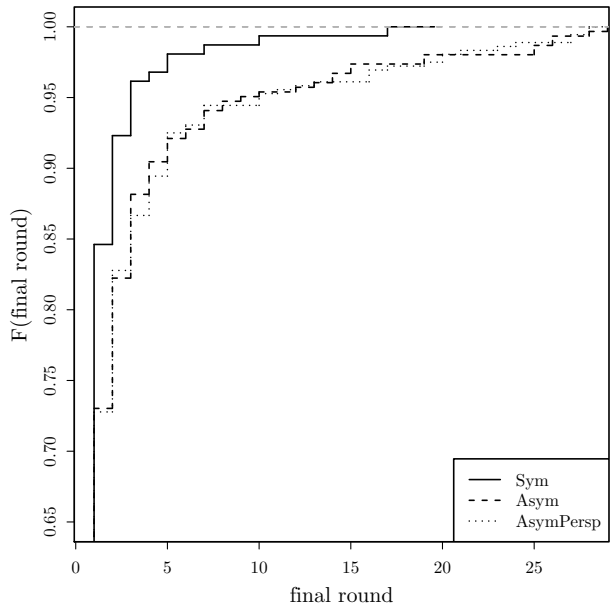
As mentioned in section 1, the number of rounds that are needed to reach an agreement, called "final round" in the following, is used to measure the degree of escalation. The more rounds are needed, the stronger the escalation. Figure 1 shows the empirical cumulative distribution function of the final round for each treatment. The solid line for "Sym" is always above the two other lines for "Asym" and "AsymPersp" which are very close together. This indicates that participants needed least rounds to reach an agreement in "Sym", but took similarly long in "Asym" and "AsymPersp". Besides, approximately 85 % of subjects in "Sym" behave according to the game-theoretic prediction (see table 1) and agree immediately in round 1. In contrast, only about 73 % of subjects agree immediately in round 1 in "Asym" and "AsymPersp". Table 2 summarizes the mean final round for each treatment. It confirms the observation that participants in "Sym" agreed on average earlier than in "Asym" and "AsymPersp".

Table 2: The mean final round for each treatment

Treatment	Sym	Asym	AsymPersp
Mean final round	1.423077	2.434211	2.461111

Another interesting observation are the first round demands because they may also influence the degree of escalation. Figure 2 shows the empirical cumulative distribution function of the first round demands in % for player red. Similar to figure 1, the solid line for "Sym" is almost always above the two other lines for "Asym" and "AsymPersp" which are very close together. This indicates that participants make lower first round demands in "Sym", but similarly high demands in "Asym" and "AsymPersp". Besides, approximately 60 % of the red players demand half the pie which is very close to the game-theoretic prediction (see table 1), whereas hardly anybody is close to the game-theoretic prediction in "Asym" and "AsymPersp". Nevertheless, there are clearly less subjects demanding half the pie in "Asym" and "AsymPersp"

FIGURE 1: The cumulative distribution function of the final round



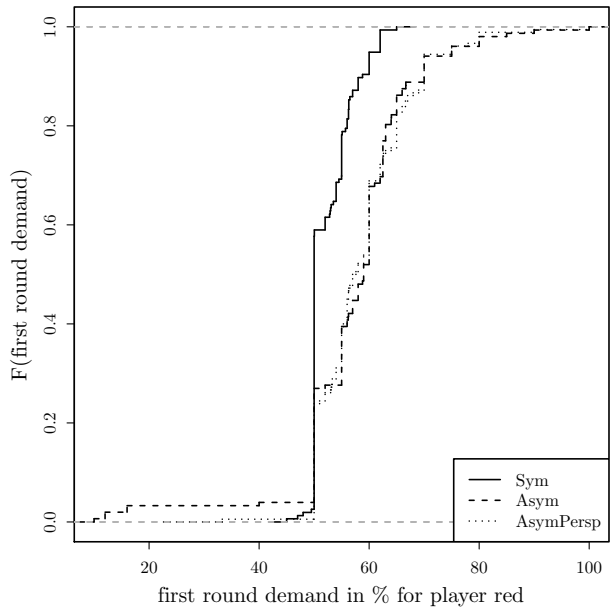
compared to "Sym". More than 70 % of red players deviate from this demand in the direction that is predicted by game theory. Table 3 summarizes the mean first round demand for each treatment. It confirms the observation that participants in "Sym" make lower first round demands than in "Asym" and "AsymPersp".

TABLE 3: The mean first round demand for each treatment

Treatment	Sym	Asym	AsymPersp
Mean first round demand	52.61635	57.69169	58.87756

Figure 1 and 2 as well as table 2 and 3 also include participants who were stopped in the bargaining process because they took more than the allowed time or number of rounds to reach an agreement (0 % in "Sym", 2.63 % in "Asym" and 5.56 % in "AsymPersp").

FIGURE 2: The cumulative distribution function of the first round demand



4.2 Does power asymmetry lead to more escalation?

This section focuses on the difference between "Sym" and "Asym" to answer the question whether asymmetric power leads to more escalation in bargaining. Figure 1 and table 2 already indicate that this seems to be the case. In addition, I will present two regression results in this section to show how significant this effect is.

As the final round data are discrete data, a generalized linear mixed effects model assuming the poisson distribution may appear to be an adequate model. Nevertheless, the p-values that one obtains when estimating such a model with the glmer-function available in R may not be reliable. It would be preferable to bootstrap p-values instead. To my knowledge, such a bootstrapping function has not yet been implemented in the statistical software R for generalized linear mixed effects models, but there is one for (non-generalized) linear mixed effects models: "pvals.fnc()". In order to be able to use it, I take the logarithm of my main variable of interest, the final round, and then estimate a (non-generalized) linear mixed effects model. Eventually, I bootstrap

confidence intervals and p-values, using 5000 bootstrap replications.

I estimate two simple models. Both models regress the final round or the natural logarithm of the final round, respectively, on the treatments. Moreover, they contain random effects for each session and each subject as subjects are rematched during a session and make their choices repeatedly, so I cannot assume observations within a session to be independent. The results of the generalized linear mixed effects model assuming the poisson distribution are reported in table 4, the results of the non-generalized linear mixed effects model are reported in table 5.

TABLE 4: Generalized linear mixed effects model assuming the poisson distribution

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.24385	0.11061	2.20464	0.02748
Asym	0.42789	0.15230	2.80951	0.00496

$$\textit{final round} \sim \textit{treatment} + (1|\textit{date}) + (1|\textit{subject\_id})$$

The estimate for the Asym coefficient captures the difference between the two treatments "Sym" and "Asym". It is significant in both models: at the 1 % level in the generalized model (see table 4) and at the 5 % level in the non-generalized model (see table 5). This is evidence for more escalation in the asymmetric treatment. Participants who were stopped in the bargaining process because they took more than the allowed time or number of rounds to reach an agreement are included in both regressions. This makes the result even stronger since no participants were stopped in "Sym", but 2.63 % were stopped in "Asym". So those participants that were stopped in "Asym" might have taken even longer to reach an agreement if they had not been stopped. I also included temperature as an explanatory variable but there was no significant effect in either model. To summarize, there is robust evidence that power asymmetry leads to more escalation.

TABLE 5: Linear mixed effects model with bootstapped p-values

	Estimate	HPD95lower	HPD95upper	pMCMC
(Intercept)	0.1705	0.029	0.3041	0.0172
Asym	0.2192	0.025	0.4132	0.0340

log(final round) ~ treatment + (1|date) + (1|subject_id)

4.3 Does perspective-taking reduce escalation?

This section focuses on the difference between "Asym" and "AsymPersp" to answer the question whether perspective-taking reduces escalation. Figure 1 and table 2 already indicate that participants behave very similar in "Asym" and "AsymPersp". In addition, I will present two regression results in this section to show that there is no significant treatment difference.

I estimate two models along the lines of the models in the previous section. The first one in table 6 is a generalized linear mixed effects model assuming the poisson distribution, the second one in table 7 is a (non-generalized) linear mixed effects model with bootstrapped p-values. The obvious difference is that I analyze the data for "Asym" and "AsymPersp" in this section as opposed to "Sym" and "Asym" in the previous section.

TABLE 6: Generalized linear mixed effects model assuming the poisson distribution

	Estimate	Std. Error	z value	Pr(>|z|)
(Intercept)	0.63731	0.12305	5.17913	0.00000
AsymPersp	0.02318	0.16694	0.13884	0.88958

final round ~ treatment + (1|date) + (1|subject_id)

The estimate for the AsymPersp coefficient captures the difference between the two treatments "Asym" and "AsymPersp". It is not significant in either model. Participants who were stopped in the bargaining process because they

took more than the allowed time or number of rounds to reach an agreement are included in both regressions. 2.63 % were stopped in "Asym", 5.56 % in "AsymPersp". This makes the result less clear. The higher percentage of stopped participants in "AsymPersp" may indicate that the perspective-taking manipulation might even have increased escalation if the participants had not been stopped. Yet, this is only speculation as I do not know what the participants would have done if they had not been stopped. Besides, I also included temperature as an explanatory variable but there was no significant effect in either model. To summarize, I have not found any evidence that perspective-taking reduces escalation.

TABLE 7: Linear mixed effects model with bootstapped p-values

	Estimate	HPD95lower	HPD95upper	pMCMC
(Intercept)	0.3897	0.2478	0.5468	0.0004
AsymPersp	0.0057	-0.1902	0.2183	0.9488

$$log(final\ round) \sim treatment + (1|date) + (1|subject\_id)$$

5 Discussion

5.1 Why does power asymmetry lead to more escalation?

As described in section 4.2, power asymmetry does lead to more escalation, in contrast to the subgame-perfect equilibrium that predicts immediate agreements. Yet, why is this the case? Although this experiment has not been designed to distinguish between different explanations, but serves rather as a first step to show that power asymmetry is one cause for escalation in bargaining, I would still like to discuss possible explanations in this section.

One explanation may be that coordination is more difficult in "Asym" than in "Sym" due to players' divergent perspectives (see Mummendey et al., 1984). Let us start with round 1. In both treatments, there is a positive relation

between the red players' first round demand and the degree of escalation: The higher a first round demand, the stronger the escalation (see figure 3). This correlation is significant at the 1 % level for both treatments (see table 8 in appendix C). In "Sym", where I assume bargaining power to be perceived approximately equal and players' perspectives to be aligned, around 60 % of the players demand half the pie for themselves in round 1. Around 40 % deviate from this focal point or norm in western cultures, but demand only little more (see figure 2). Offers at or slightly above the equal split are usually accepted immediately. The red players in "Sym" seem good at estimating which offers the blue ones will still accept. In "Asym", however, where I assume bargaining powers to be perceived more unequal and players' perspectives to be less aligned, the red players (the stronger ones) may feel justified to deviate more from the equal split when making their first round demands and actually do so (see table 3). This treatment difference is significant at the 5 % level when estimating a linear mixed effects model with bootstrapped p-values (see table 9 in appendix C). The blue players (the weaker ones), however, may not share this perspective. From their point of view, the red players' may not be entitled to take advantage of their power. In "Asym", the red players seem worse at estimating which offers the blue ones will still accept in round 1.

In addition to divergent perspectives in round 1 due to asymmetric bargaining power, a second source for divergent perspectives arises from round 2 on: two focal points or norms instead of only one. The example screenshot in appendix B shows that, during the bargaining process, players enter their proposal in percent of the pie. Once they click on the button "Display" ("Anzeigen" in German), the offer is shown in the diagram and the corresponding value in EUR is calculated. In round 1, offering 50 % is the equal split in terms of percentages *and* in terms of EUR. From round 2 on, however, offering 50 % is the equal split in percentages, but not anymore in EUR since the players' maximum amount available to be split is the same for both in round 1 but starts to be different from round 2 on as players' discount factors are different. So if players choose to adhere to the equal split, they have two choices: percent or EUR. The difference between players' discount factors is smaller in "Sym". Therefore, escalation due to two competing focal points or norms seems less likely as the equal split in % and in EUR are closer together.

FIGURE 3: The relation between first round demands and final rounds

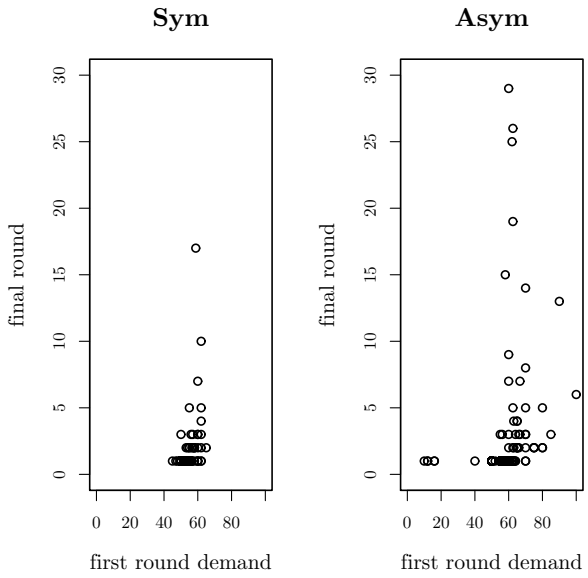


FIGURE 4: Four different bargaining processes

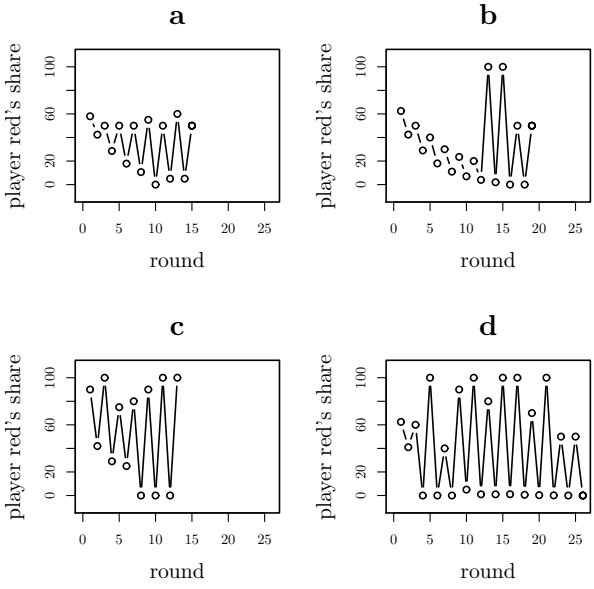


Figure 4 shows four different bargaining situations with a high degree of escalation from "Asym". Each round's offers are plotted in percent for player red, illustrating the negotiation process. Player red's proposals are those in the odd rounds, player blue's are those in the even rounds. In all four cases, players' perspectives seem not to be aligned, but to different degrees. In all four cases, player red starts with taking advantage of his bargaining position in round 1. The behavior from round 2 on is different in each case. In figure 4.a, player blue repeatedly proposes the equal split in absolute terms (in EUR). Player red more or less proposes the equal split in relative terms (in %). Each player seems to comply to one of two norms, more precisely, to the one that is more favorable to himself, leading them to an inefficient outcome. In figure 4.b, both players seem to comply to the same norm until round 12, namely the equal split in absolute terms, but still fail to reach an efficient agreement since they comply to this norm to different degrees. In figure 4.c, player red hardly seems to comply to any norm at all, but rather tries to take advantage of his bargaining position. Player blue offers the equal split in absolute terms until round 4, but stops following this norm completely from round 8 on. In figure 4.d, both players offer very little or nothing to their bargaining partner most of the time and seem not to follow any norm, except for very few rounds in the beginning and in the very end.

Apart from divergent perspectives, personality variables may also interact with the asymmetric power condition and thus influence escalation. I measured participants' procedural preferences with a questionnaire at the end of the experiment. These data will be analyzed in Chlaß and Vollstädt (2011).

5.2 Why does perspective-taking not reduce escalation?

As described in section 4.3, I have not found any evidence that perspective-taking reduces escalation. The contrary would have been nice and may have even served as policy advice. Nevertheless, I would still like to discuss different explanations of why perspective-taking did not reduce escalation in my setting.

One possibility is that the perspective-taking manipulation I employed simply did not make participants sufficiently aware that their perspective might

differ from their bargaining partner's perspective. The manipulation is described in detail in section 3. Compared to other perspective-taking manipulations, it simply asks participants to take their partner's perspective, without mentioning emotions or providing any special kind of incentive to do so. In contrast, Richardson et al. (1994), for example, inform subjects in the perspective-taking condition that people *seem to perform better* when taking the perspective of the other person and when trying to understand how the other person is *feeling*. Besides, there are other differences in their experimental setting. Richardson et al. (1994) use a competitive reaction-time task after which the "slower" participant (wins and losses are actually controlled by the experimenter) receives an electric shock. Aggression is measured by the level of the shock chosen by the respective participant. Of course, people might react differently to perspective-taking manipulations depending on whether they are focusing on physical pain as in Richardson et al. (1994) or on monetary incentives as in my study.

Another possibility is that the perspective-taking manipulation did make some participants aware that their perspective might differ from their bargaining partner's perspective, but that it did not always make them adjust their behavior in the same way. For example, consider the 33 cases in which a red player initially enters a first round demand of more than 50 % in "Asym-Persp" and states that he would *not* accept his own offer in place of player blue. 15 out of those eventually confirm lower demands, but 13 stick to and confirm their initial proposal and 5 even increase their demand. Thus, it could be that individuals react differently to the perspective-taking manipulation, and the overall effect is zero. Nevertheless, these data should be interpreted cautiously as neither the initially entered demands nor the "accept or reject as blue decision" are incentivized with money.

6 Conclusion

To summarize, the main findings of this study are the following. Power asymmetry due to different discount factors and first-mover-advantage vs. second-mover-disadvantage leads to more escalation in bargaining compared to a case in which bargaining parties are approximately equal in strength.

Overall, perspective-taking does not reduce escalation in such an asymmetric bargaining situation. Further research is needed to check how robust the effect of power asymmetry is to different kinds and to different degrees of power asymmetry, to different forms of interaction, for example, face-to-face, as well as to different cultures. Moreover, it would be interesting to investigate the effect of perspective-taking on individuals with different personality variables and to understand the underlying processes better.

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A Instructions [3]

Welcome to this experiment!

By participating, you support our research and you can earn money in return. It is important to read the following instructions very closely in order to understand how the experiment will proceed. Instructions are identical for all participants. All data will be treated in confidence and will be used exclusively for research.

General rules Please do not communicate with other participants and do turn off your mobile phones now. You will be excluded from the experiment if you break any of these rules. In this case, you will not be paid.

Procedure and payment The experiment consists of four periods. *Each period can consist of several sub-periods.* In the end, all participants will receive a show-up fee of 2.50 € irrespective of the decisions they will have made during the experiment. In addition, you can earn money during the experiment. The amount you will earn depends on your and on the other participants' decisions during the experiment and will be explained in the following paragraphs. None of the other participants will receive information on your payment.

Periods 1 to 4 There are two roles: player red and player blue. First, the computer will determine randomly which participants will become red and which will become blue. You will keep these roles during the entire experiment. That means, if you were player red in the first period, you will stay player red in the following periods and if you were player blue in the first period, you will stay player blue in the following periods. In each period, every two participants play together: one red and one blue player. At the beginning of each period, the computer matches

[3] This is a translated version of the instructions for "AsymPersp". In the experiment, they were used in German. The instructions for "Sym" and "Asym" were identical except that the sentence "During the entire experiment, please also try to take the player's perspective with whom you are going to split the amount of money." almost at the end of the instructions was missing. Moreover, the discount factors were different in "Sym".

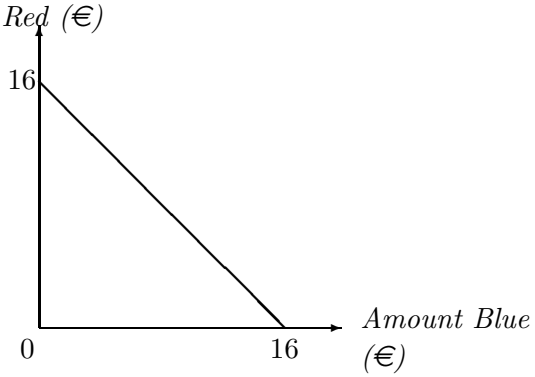
you anonymously and randomly with another participant. *You will not interact with any participant more than one period.* Your task is to divide an amount of (initially) 16 € between you and another participant. In order to divide the amount of money, player red and player blue alternate in making offers. Every time an offer is rejected, the amount of money is reduced by a constant factor: by 5 % for player red and by 30 % for player blue.

The first period starts with sub-period 1 and player red proposes a proportion how to divide the 16 € between himself and player blue, that means x % of the maximum amount of 16 € for himself and (100 - x) % of the maximum amount of 16 € for player blue. *These proposals in % always add up to 100 %.* It is not mandatory to propose integer numbers, also fractions can be divided. Player blue can now accept or reject the proposal. If he accepts, the 16 € will be divided accordingly and the first period will end in sub-period 1.

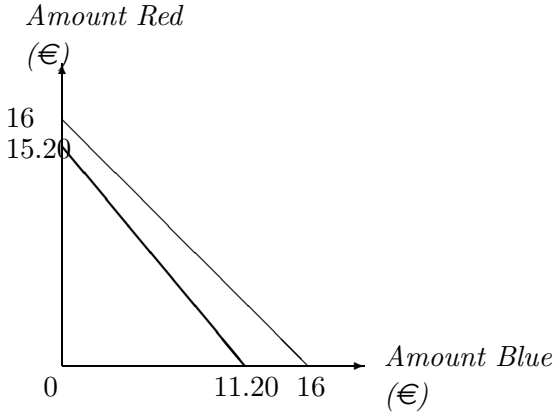
However, if player blue rejects the proposal, a new sub-period starts. At the beginning of each new sub-period, the maximum amount available for a player is reduced. In sub-period 1, the maximum amounts available for player red and for player blue are still the same, namely 16 €. In the following sub-periods, this will change.

In sub-period 2, the maximum amount available for player red is reduced by 5 %, for player blue by 30 %. Hence, the maximum amount available is 15.20 € for player red and 11.20 € for player blue (see the following two graphs as an illustration). Player *blue* now makes a counterproposal according to which proportion the remaining money is to be divided, i.e. y % of the *new* maximum amount for player blue (11.20 €) for himself and (100 - y) % of the *new* maximum amount for player red (15.20 €) for player red. As previously, the proposals in % add up to 100 %. The maximum amounts that the percentages apply to are, however, different for red and blue. Subsequently, player red can accept or reject the proposal. If he accepts, the money is divided accordingly and the first period ends in sub-period 2.

Possible divisions in sub-period 1



Possible divisions in sub-period 2



The graphs illustrate the possible divisions in sub-period 1 and in sub-period 2. In sub-period 1, the maximum amount available is 16 € for player red as well as for player blue. In sub-period 2, the maximum amount available is 15.20 € for player red and 11.20 € for player blue. The points *on* the bold lines represent all possible divisions. Example: In sub-period 2, player red could receive 100 % of his maximum amount of 15.20 €, consequently, player blue would receive 0 % of his maximum amount of 11.20 €. Or player red could receive 0 % of his maximum amount of 15.20 €, consequently, player blue would receive 100 % of his maximum amount of 11.20 €. All divisions in between that add up to 100 % are also possible.

If player red rejects player blue's proposal, sub-period 3 starts and the maximum amounts of money are reduced like in the previous sub-period: by further 5 % for player red, by further 30 % for player blue. Player *red* then makes a counterproposal according to which proportion to divide the remaining money. Subsequently, player blue can accept or reject this proposal like in sub-period 1 and so on. The maximum amounts of money available are reduced by 5 % for player red and by 30 % for player blue at the beginning of each new sub-period, i.e. every time a proposal is rejected. A period will end only if a proposal is accepted.

We have planned enough time for each period and you can take your time to reach an agreement with the other player. However, if you take unexpectedly long to reach an agreement, the computer will break off the current period. In this case, your remaining amount of money in this sub-period will be reduced by 5 %, respectively 30 %, as many

times as the other participants have needed on average to reach an agreement. From this reduced amount of money you will receive the *proportion* that the other participants red, respectively blue, received on average. In case all other participants should also not yet have reached an agreement, the computer will determine a proportion.

When the first period will have ended, the second period will start. Subsequently, period 3 and period 4 will follow. The task will be the same for each period, namely to divide (initially) 16 € between you and another player.

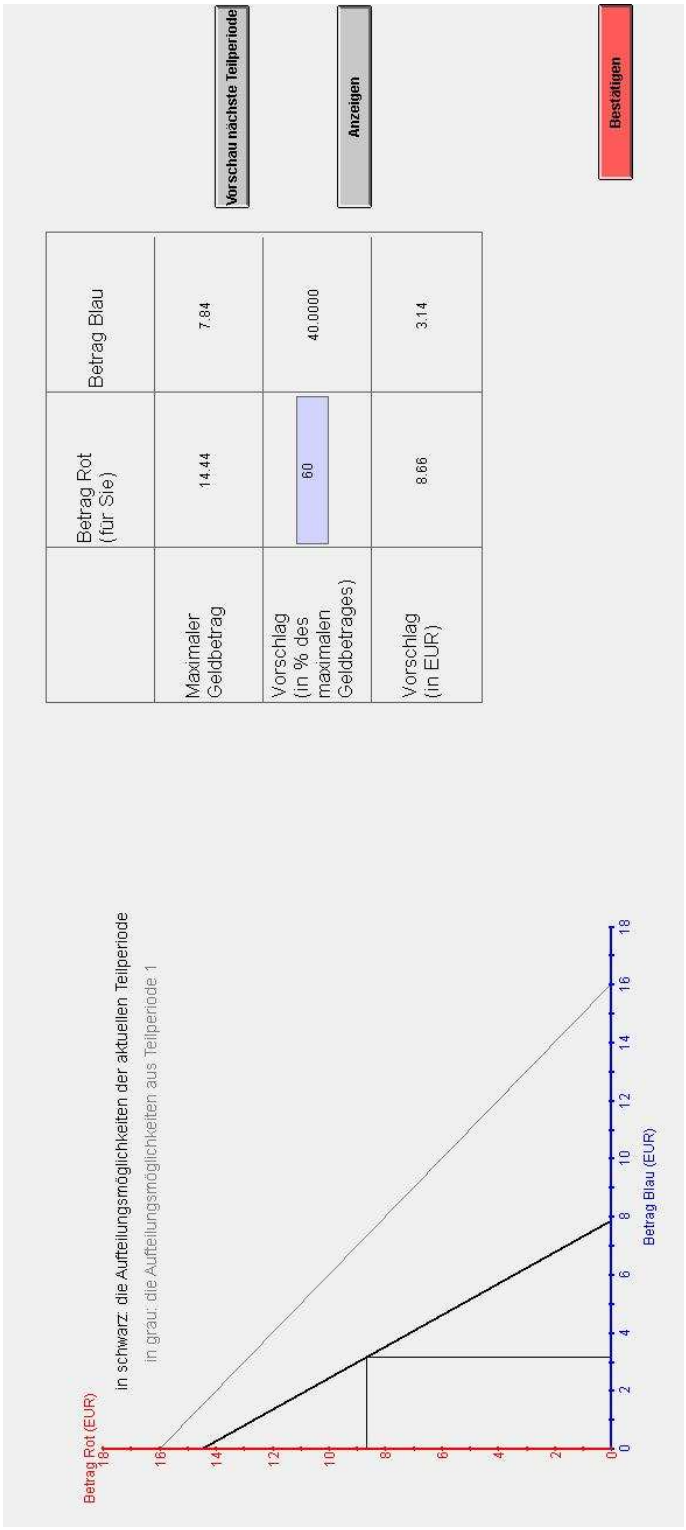
During the entire experiment, please also try to take the player's perspective with whom you are going to split the amount of money.

Payoff-relevant period When all four periods are over, the computer will determine randomly one of the four periods which will be payoff-relevant for all participants. The other periods will not be considered when paying you. At the end of the experiment, each participant will receive the show-up fee of 2.50 € as well as the amount of money that he agreed upon with the other player in the payoff-relevant period. Example: Player red has agreed on x € for himself and y € for player blue. In the end, player red will receive 2.50 € + x €; player blue will receive 2.50 € + y €. If applicable, the amounts will be rounded up to a multiple of 0.10 € *at the end* of the experiment.

Questions Should you have questions, please press the "Pause Break" key (top right on your keyboard). We will come to you and answer. The experiment will start on the computer as soon as all participants will have finished reading the instructions and all questions are answered.

Good luck!

B Example screenshot



C Additional regressions

TABLE 8: Linear mixed effects model with bootstrapped p-values

	Estimate	HPD95lower	HPD95upper	pMCMC
Sym:firstRoundDemand	0.0036	0.0013	0.0072	0.0048
Asym:firstRoundDemand	0.0077	0.0056	0.0119	0.0002

log(final round) ~ treatment:firstRoundDemand - 1 + (1|date) + (1|subject_id)

TABLE 9: Linear mixed effects model with bootstrapped p-values

	Estimate	HPD95lower	HPD95upper	pMCMC
(Intercept)	52.629	49.9469	55.536	0.0002
Asym	5.089	0.9974	8.851	0.0132

firstRoundDemand ~ treatment + (1|date) + (1|subject_id)

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