Do Proposers Expect Groups to Play More "Rational" Than Individuals?

Evidence From an Ultimatum Game Experiment

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Abstract

Players in ultimatum games do not behave as game theory would predict, but rather prefer "fair" divisions of a certain amount of money. Prior experiments show that groups play more "rational" than individuals. However, we do not know if proposers expect responder groups to play more "rational" and therefore offer them lower amounts. In this experiment proposers did not anticipate such a behaviour by groups and offered them even higher amounts. Responder groups also did not behave in a more "rational" manner, instead they even played less "rational".

1 Introduction

In a society rent-sharing decisions between people are a daily occurrence, e.g. negotiations within the legislative or executive branch, negotiations in the business world or within families. People have to decide how to divide a certain amount of money or the like between different actors. These actors are often not only individuals acting on their own, but also groups of various individuals. The idea of my experiment is to study rent-sharing decisions between individuals and groups.

This paper describes an ultimatum game which was designed and conducted within the seminar "Experimental Economics". In order to study the behaviour of individuals and groups I decided to design an ultimatum game with groups as responders and a special focus on the expectations of the proposers vis-à-vis group versus individual responders. In the classical ultimatum game a proposer proposes the division of a certain amount of money between him and the responder. The responder then decides if he wants to accept or reject the proposed division. In case of acceptance, the proposer and the responder get payoffs according to the proposed division, while in case of rejection nobody gets any money. To the best of my knowledge such an experiment has never been conducted before.

2 Experimental Evidence

Game theory under the assumption of a "rational" person, only aiming to maximize his own profit, would predict an outcome strongly favouring the proposer. According to the subgame-perfect equilibrium the proposer would offer the smallest amount possible and the responder would accept the division because "something is better than nothing". But results from prior experiments show that people do not behave in line with these theoretical predictions: Instead, typical offers are about 40 to 50 percent of the total sum and a substantial proportion of non-zero offers is rejected (Camerer: 2003: 43). Bornstein and Yaniv show that three-person groups indeed play more "rational" than individuals, i.e. both offers as well as rejection rates are lower compared to the results with only individuals as players. A reason for this behaviour might be that groups have a better understanding of the game's strategic structure. Bornstein and Yaniv argue that further research has to be done to test if proposers are conscious of the fact that groups are the more “rational” players and offer different divisions to groups or individuals (Bornstein: 1998: 101ff.). Elbittar et al. find out that different voting rules within groups have an effect on the outcome in an ultimatum game, e.g. rejection rates under a majority rule are lower than under a unanimity rule. (Elbittar: 2005: 1ff.). Grosskopf tests whether competition among the responders in an ultimatum

game matters: Competition among responders drives up the proposers' demands after a certain learning period. (Grosskopf: 2003: 141ff.)

3 Design and Procedure

3.1 Experimental Model

The model of the present game was a standard ultimatum game with a proposer and a responder. There were two different treatments of the game with the type of responder as the changed variable. In treatment A the responder was a group consisting of three persons who communicated with each other by chat function. In treatment B the responder was a single person.

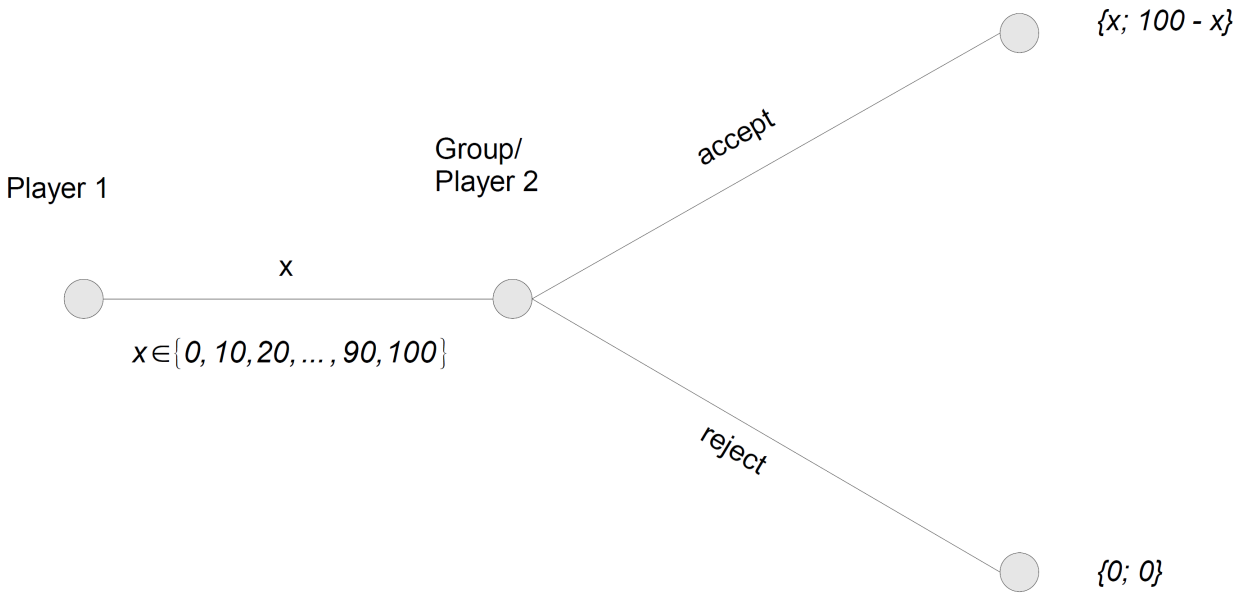

Fig. 1: Game Tree of the Ultimatum Game

The proposer had an initial endowment of 100 *Passau taler* which he could divide between himself and the responder in steps of ten (see Fig. 1). In order to keep the two treatments comparable I introduced two conversion ratios: One Passau taler for the proposer was always worth 10 Euro cents, one Passau taler for the responder was worth 10 cents in condition B and 30 cents in A because the responder consisted of three persons who had to share the common payoff. During the proposer's decision the responder group was answer a guessing question, which had no impact on the payoffs, to get used to the chat function of the game. After having chosen the division of money, the proposer was to answer the question which amount of money he considered to be the smallest

amount the responder would accept. By means of this question I wanted to determine the proposer's expectation of the responder's minimal acceptable offer (MAO) – the lowest amount of money he would barely accept. In condition B the division was submitted to the responder and the responder decided if to accept or reject the offer. In condition A the responder group was to discuss the proposed division for four minutes and afterwards every group member stated his decision. Except for the time limit of four minutes there was no further instruction how the group should reach a common decision. If the decisions within the group were not unanimous the decision of one group member was randomly chosen to represent the group as a whole. The payoffs resulted from the proposer's proposed division and the responder's decision. Due to the fact that the experimentator was a student, the payoffs were only paid hypothetically. At the end of the two experiments all participants filled in a computerized questionnaire[1] to gather statistical information about gender, age, field of study, knowledge in game theory etc. as well as their perceptions of the other player's choice.

3.2 Experimental Procedure

The experiment was computer based using *ztree*, the Zurich Toolbox for Readymade Economic Experiments by Urs Fischbacher (Fischbacher: 2007). It was held on 17 January 2011 at the University of Passau. All participants took part voluntarily. In order to recruit participants we organised announcements in several lectures and used flyers, personal contacts as well as social networks like facebook and studiVZ to reach as many people as possible. All in all 56 students took part in the experiment. The experiment was conducted together with another participant of the seminar. The games were played simultaneously in four sessions and took place in two computer pools in the Department of Economics via the intranet of the University.

Every participant of the experiment played both treatments, A and B (*within subject*). In order to eliminate any effects resulting from the order in which the participants played treatment A and B half of the participants played treatment B after treatment A and the other half vice versa. After the first treatment the participants were mixed again to ensure that the games remained single shot. A team of eight or four[2] persons respectively was chosen randomly. The participants did not know with whom they played. Every sessions was managed by two experimentators. My experiment was

1 Due to technical problems three participants filled in the same questionnaire on a pen-and-paper basis.

2 I programmed two versions of the game: In the first one a team of eight persons forms two quadruples (one proposer and three responders in one quadruple) for treatment A and four couples (each consisting of one proposer and one responder) for treatment B. They are matched in a way that everybody plays with totally different persons. In the second one a team of four persons forms one quadruple for treatment A and two couples for treatment B. Apart from this technical difference the versions were absolutely identical, including all the instructions, to be able to pool the two versions. With this technical difference I wanted to get less dependent on the number of participants.

always played prior to the other participant's experiment so that any effect due to the other experiment can be excluded. Only instructions concerning the organizational part of the experiment were given orally to all participants in front of the computer pools. All important instructions for the experiment were given in written form on the computer screen of each participant.

4 Hypotheses

The design of my experiment does not change the strategic structure of the ultimatum game and therefore does not affect the game theoretically predicted outcome which can be deduced by backward induction: The proposer should offer the lowest amount possible (but greater than 0) and the responder should accept it. However, previous experiments show that people do not behave according to the theoretical predictions but prefer “fairer” divisions. According to Bornstein and Yaniv, groups behave more “rational” than individuals which gives rise to lower offers and lower rejection rates if both proposer and responder are groups. (Bornstein: 1998: 106) I wanted to test whether proposers knew that groups play more “rational” than individuals, i.e. that they offer lower offers to groups compared to individuals. As I wanted to test the expectations the proposer has vis-à-vis groups as responder and to make the result more comparable to the individual condition the proposer was always an individual.

Hypothesis 1

Proposers know that groups as responders play more “rational” than individuals.

H 1.1: Offers to groups are lower than offers to individuals.

H 1.2: Expected MAOs for groups are lower than expected MAOs for individuals.

Hypothesis 2

To verify whether groups really play more “rational” I examined the rejection rates.

H 2: Groups' rejection rates for lower offers are lower than individuals' rejection rates.

5 Experimental Results and Analysis

In treatment A we get one proposer observation per quadruple and as the responder consists of three persons who discuss a joint decision but choose their decision individually we get three responder observations. With 56 participants there are 42 proposer observations and 14 responder observations in treatment A. In treatment B we get one proposer observation and one responder observation per couple, so there are 28 observations for both proposer and responder.

5.1 Proposer Behaviour: Offers and MAOs

	A			B			
	mean offers	**mean MAOs**	**mean rejection rates**	**mean offers**	**mean MAOs**	**mean rejection rates**	**number of participants**
session 1: A-B	(N=3) 50.00	(N=3) 30.00	(N=9) 0.00	(N=6) 45.00	(N=6) 35.00	(N=6) 0.00	12
session 2: B-A	(N=3) 63.33	(N=3) 50.00	(N=9) 0.00	(N=6) 40.00	(N=6) 36.67	(N=6) 0.17	12
session 3: A-B	(N=4) 62.50	(N=4) 55.00	(N=12) 0.25	(N=8) 33.75	(N=8) 36.25	(N=8) 0.38	16
session 4: B-A	(N=4) 62.50	(N=4) 50.00	(N=12) 0.25	(N=8) 37.50	(N=8) 27.50	(N=8) 0.38	16
total	**(N=14) 60.00**	**(N=14) 47.14**	**(N=42) 0.14**	**(N=28) 38.57**	**(N=28) 33.57**	**(N=28) 0.25**	**56**

Fig. 2: Mean Offers, Mean MAOs and Mean Rejection Rates by Sessions

In Fig. 2[3] we can see that the mean offers in A are always greater than the mean offers in B with the total mean offer being 60.00 in A and 38.57 in B. Most of the time the mean MAOs in A are greater than the ones in B – total mean MAO in A is 47.14 and in B 33.57. The mean MAO in session 1 turns out to be the only exception. These data probably occurred because one proposer in A had a huge discrepancy of 40 taler between the proposal and the MAO which is quite extraordinary. Additionally, most of the time mean MAOs are lower than mean offers with session 3 condition B being the only exception. This might be due to the fact that one person demanded 100 % of the total sum for himself but stated an expected MAO of 30 for his responder. In nearly all other cases in session 3 the proposal equals the MAO. We can observe that the mean rejection rates in A are always lower than or equal to the mean rejection rates in B. Due to the fact that I alternated the order in which the participants played the two games (A-B or B-A respectively) it is possible to pool all the results.

offers	**total mean**	**mean by sex**	**mean by experience**
A (N=14)	(N=14) 60.00	women (N=5): 70.00 men (N=9): 54.44	yes (N=5): 66.00 no (N=9): 56.67
B (N=28)	(N=28) 38.57	women (N=16): 36.25 men (N=12): 41.67	yes (N=11): 34.54 no (N=17): 41.18

Fig. 3: Mean Offers Total, by Sex, by Experience

3 N designs the number of observations.

MAOs	total mean	mean by sex	mean by experience
A (N=14)	(N=14) 47.14	women (N=5): 56.00 men (N=9): 42.22	yes (N=5): 54.00 no (N=9): 43.33
B (N=28)	(N=28) 33.57	women (N=16): 35.62 men (N=12): 30.83	yes (N=11): 27.27 no (N=17): 37.65

Fig. 4: Mean MAOs Total, by Sex, by Experience

We can observe once more that the mean offers in A are always greater than the mean offers in B. This pattern does not change if we differentiate between several characteristics (see Fig. 3). Offers distinguished by sex show that in condition A the mean offers by women are greater than the mean offers by men (women: 70.00 vs men: 54.44) whereas in condition B the mean offers by men are greater than those by women (women: 36.25 vs men: 41.67). Grouping by experience in economic theory or experiments shows that in A the mean offer made by individuals with experience is greater (yes: 66.00 vs no: 56.67) than the mean offer by individuals without experience, whereas in B it is lower (yes: 34.54 vs no: 41.18) . See Fig. 4 for the comparison of the MAOs by sex and by experience. (Here we can observe that the women's MAOs are always greater than the men's MAOs whereas for the comparison of the MAOs by experience the same picture as for the mean offers in Fig. 3 holds true.)

Hypothesis 1 supposes that proposers know that groups as responders play more “rational” than individuals. H 1.1 states that offers in A are lower than offers in B. However, in Fig. 2 and Fig. 3 we can see that the exact opposite is true: mean offers in A are greater than mean offers in B. Therefore, we have to refuse H 1.1. Considering H 1.2 which tells us analogously to H 1.1 that the expected MAOs of the proposers are lower for groups than for individuals, the result once again is not the predicted one: MAOs for groups are in general greater than MAOs for individuals (see Fig. 2 and Fig. 4). H 1.2 only holds true for session 1, in all other cases it has to be refused.

General reasons for the deviation of the proposed divisions from the subgame-perfect equilibrium could be *social preferences* like an inequity aversion or altruism or the proposer's fear of negative reciprocity. The observed pattern is well-known from prior experimental evidence. Nevertheless these explanations do not suffice to explain the difference between treatment A and treatment B offers and MAOs because treatment B fits quite well into the line of prior experimental evidence, treatment A, however, does not. We could not assume especially altruistic participants e.g. because in treatment B 27 out of 28 proposers demanded 50 % or more for themselves in contrast to treatment A where nine out of 14 demanded less than 50 % of the total sum. But how can such a result be explained? Perhaps we have to take into consideration that group effects involve more

manifold aspects than a mere rational one. It would be possible that participants do not only maximize their own individual profit but are more oriented towards efficiency, i.e. that they try to maximize the collective payoff. This would explain why proposers offer much higher amounts of Passau taler to groups because with the multiplication of the group conversion ratio the collective output of the quadruple would be maximized. Another explanation one could bear in mind is that the proposer might feel a certain, perhaps undefined and subconscious threat vis-à-vis the group. The model of one individual player against a group of three persons might create a feeling of exclusion. The proposer believes that he has to put all members of the group in a conciliatory mood to accept his division.[4] In case of rejection he, as well as the group, would be left without any payoff. Chaserant states that the creation of artificial groups in experiments is quite possible. According to her studies members of the in-group are strongly acting in favour of their group members (Chaserant: 2006: 3). Perhaps this behaviour creates an undefined fear in the out-group, namely the individual player. Last but not least, we have to take into consideration that part of the participants did not understand the instructions in the intended manner. Although the design with two different conversion ratios is quite popular in experimental economics, people who have never concerned themselves with such a construction could find it hard to figure out the consequences immediately without the help of an example. Such an example was not given in the instructions to the game to prevent creating a focal point. If this explanation were correct, the divisions by the proposer in treatment A and treatment B would no longer be comparable. It could be that one person wanted to "go halves" with everybody. The correct way to achieve this would have been to choose a "50:50" division in treatment A. Participants who misunderstood the conversion ratio possibly considered "25:75" (which practically is not possible) to be the "fair division" and therefore might have chosen "30:70". A player in the role of the proposer could even have acted in the described manner when he understood the instructions correctly but suspected the other players to misunderstand them.

4 This effect might even be stronger due to the fact that the proposer did not know (from the instructions) that the group members communicated by a chat. Therefore he might have thought that he needed to convince every single group member.

5.2 Responder Behaviour: Rejection Rates

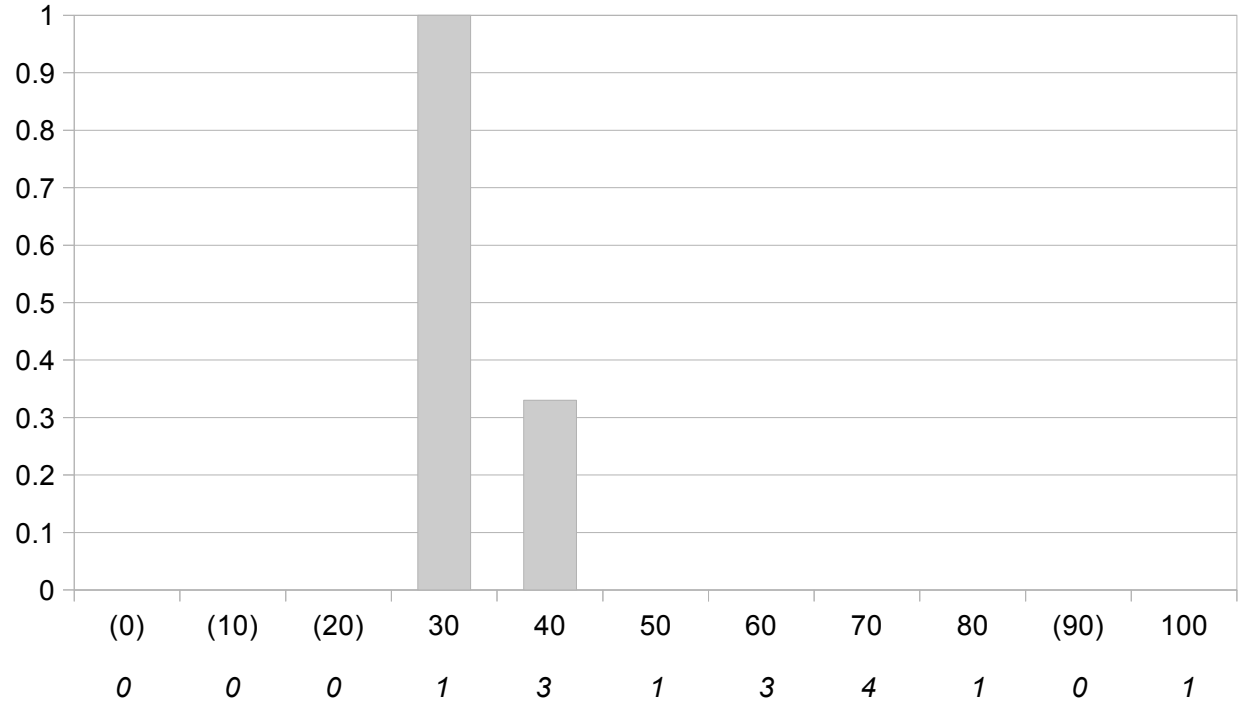

Fig. 5: Treatment A: Rejection Rates in % by Offer Size

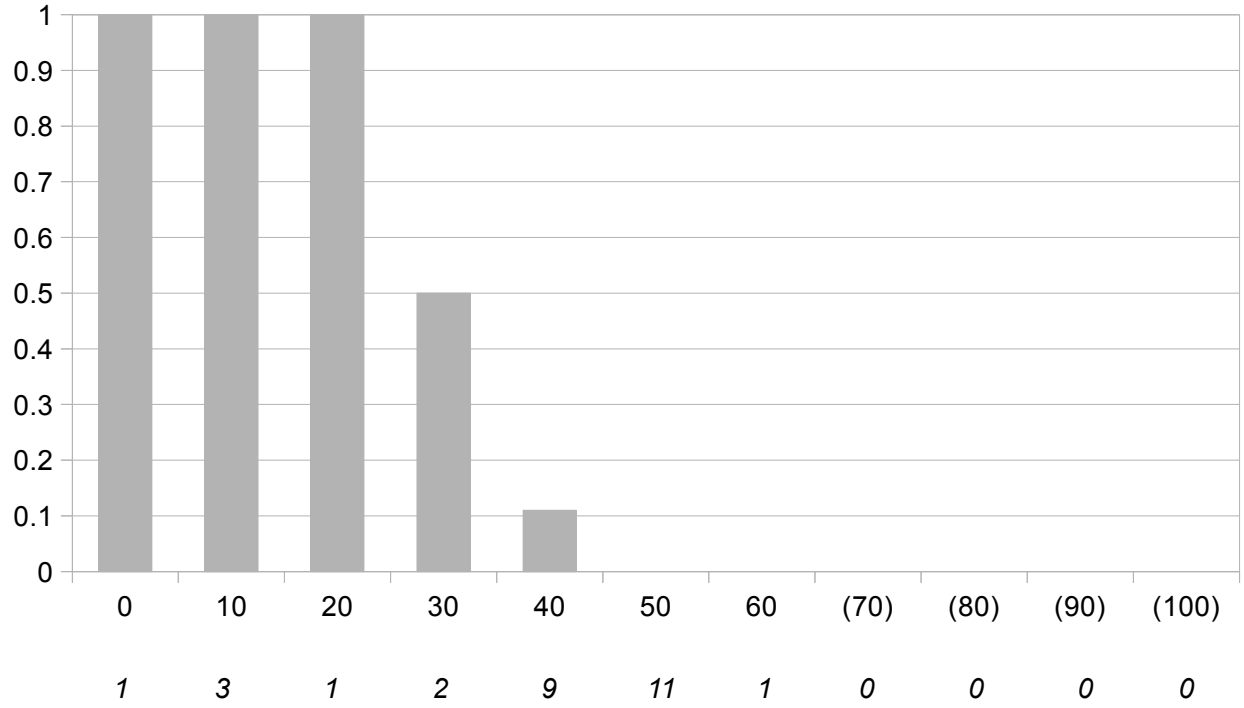

Fig. 6: Treatment B: Rejection Rates in % by Offer Size

As we have seen in Fig. 2 the mean rejection rates in A in total are always lower than or equal to the mean rejection rates in B. Fig. 5 shows the rejection rates by offers. The offers in brackets did not occur at all. The line in italics below the x-axis shows how often the individual offer size occurred. We can observe sinking rejection rates from 100 % to 0 % which we would consider as a “normal” pattern but the offer size that occurred are striking: Most proposers offered more than half of the amount to the group. In Fig. 6 we see the same figure as Fig. 5 for treatment B. Offer rates fall from 100 % to 0 %, but most offers are lower than or equal to 50 % of the total sum which we had expected from prior experiments.

If we want to test hypothesis 2 which wanted to check if groups really play more “rational” than individuals, i.e. if groups' rejection rates are lower than or equal to individuals' rejection rates, we have to consider the conditional rejection rates depending on the offer size. As the offer size differs enormously there is only a little range where we can compare the rejection rates in A and B: only between offers from 30 to 60 taler. In this range the rejection rates in A are always greater than (for the size 30 and 40 taler) or equal to (for the size 50 and 60 taler) the rejection rates in B. Given these results, hypothesis 2 has to be rejected.

Explanations for the responders' behaviour are more or less the same as for the proposers'. In general social preferences avoid that responders accept every positive offer by the proposers. Group behaviour might contain more aspects favouring a maximization of the collective payoff and not only of their own payoff. For the responders as well we have to consider the possibility that some of the group members did not understand the implications of the conversion ratios.

6 Limitations and Conclusion

There are a few limitations to the experimental results. The first limitation is the absence of real money. Due to the fact that the experiment was conducted within the framework of a university seminar and due to the fact that the experimentator was a student, payoffs were only paid hypothetically. This circumstance may lead to a distortion: perhaps participants would have played more profit-maximizing if real money had been paid. Furthermore, the experiment was conducted with students from the University of Passau only. It is questionable if this selection of participants is representative for the whole population and additionally there could be a certain type of self-selection because the students participated voluntarily in the experiment.

At large the experiment did not show the predicted outcome. I wanted to examine if proposers know that groups as responders play “more” rational compared to individuals. The hypotheses have to be

refused because of the data. Hypothesis 1 is refused because offers to individuals are lower than to groups. Hypothesis 2 – rather a hypothesis to test if group responders are the more "rational" players in this experiment – is refused as well because the conditional rejection rates (in the range where they could be compared at all) are even higher in the group condition.

These results might be due to several reasons I have already explained in context of the data analysis, like confusion with the two different conversion ratios for groups and individuals, group effects beyond rationality or a certain feeling of intimidation. It would also be plausible to argue that proposers did understand the conversion rations correctly, but suspected their responders to misunderstand the ratios and therefore offered higher offers than necessary. Another explanation would be that participants did not know that groups (normally, e.g. in prior experiments) played more "rational". Perhaps after a certain period of learning, the participants would have learned the "correct" behaviour. Elbittar et al. conducted an experiment and stated that "[f]urthermore, there does seem to be evidence that agents learn the 'correct' behavior over time." (Elbittar: 2005: 43).

To explore why the results are the way they are and to test the hypotheses once again, it would be helpful to have several examples explaining the different conversion ratios and an additional question in the questionnaire concerning the division which the participant would consider to be "fifty-fifty".

References

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Appendix

Treatment A: Welcoming text for all players:[5]

Willkommen! Sie sind Teilnehmer eines Computer-basierten Experiments. Im Folgenden wird Ihnen das Spiel erklärt. Bitte lesen Sie die Anleitungen sorgfältig durch. Sie können nicht zu vorherigen Seiten zurückkehren. Sollten nach nochmaligem Durchlesen weiterhin Fragen bestehen, so heben Sie bitte die Hand: Der Experimentleiter kommt dann zu Ihnen und erklärt Ihnen die unklaren Punkte.

Bitte verhalten Sie sich während des ganzen Experiments ruhig und sprechen Sie nicht mit Ihren Nachbarn. Bitte beachten Sie, dass wir Ihren erspielten Gewinn leider nicht auszahlen können. Verhalten Sie sich während des Spiels bitte trotzdem so, als ob Sie tatsächtlich Geld gewinnen könnten.

Treatment A: Instructions for the individual player:[6]

Das nachfolgende Spiel besteht aus 4 Teilnehmern: einem einzelnen Spieler und einer Gruppe, bestehend aus 3 Einzelpersonen. Die Zusammensetzung der Teilnehmer ist zufällig.

Sie sind der Spieler.

Sie sollen einen Betrag von 100 Passau-Talern zwischen sich und der Gruppe aufteilen. Die Gruppe darf dann entscheiden, ob sie Ihre Aufteilung annimmt oder ablehnt. Nimmt die Gruppe die Aufteilung an, so erhalten Sie 10 Cent je Passau-Taler. Da die Gruppe aus 3 Personen besteht, erhält jedes Gruppenmitglied ein Drittel der Gruppenauszahlung. Um die Drittelung auszugleichen, zählt jeder Passau-Taler eines Gruppenmitglieds 30 Cent. Lehnt die Gruppe die Aufteilung ab, so erhalten alle nichts.

5 All instructions for treatment B are principally the same as for treatment A only lacking the two different conversions ratios and the chat function.

6 Due to the fact that the experiment was conducted at a German university, all the instructions are in German.

Treatment A: Instructions for the group members:

Das nachfolgende Spiel besteht aus 4 Teilnehmern: einem einzelnen Spieler und einer Gruppe, bestehend aus 3 Einzelpersonen. Die Zusammensetzung der Teilnehmer ist zufällig.

Sie sind Mitglied der Gruppe.

Der Spieler soll einen Betrag von 100 Passau-Talern zwischen sich und Ihrer Gruppe, bestehend aus Ihnen und 2 weiteren Einzelpersonen, aufteilen. Sie entscheiden gemeinsam mit den anderen beiden Gruppenmitgliedern, ob Sie die Aufteilung annehmen oder ablehnen. Nimmt Ihre Gruppe die Aufteilung an, so erhält der Spieler 10 Cent je Passau-Taler. Da Ihre Gruppe aus 3 Personen besteht, erhält jedes Gruppenmitglied ein Drittel der Gruppenauszahlung. Um die Drittelung auszugleichen, zählt jeder Passau-Taler eines Gruppenmitglieds 30 Cent. Lehnt Ihre Gruppe die Aufteilung ab, so erhalten alle nichts.

Die Kommunikation mit den anderen Gruppenmitgliedern erfolgt über einen Chat. Die folgenden Anleitungen für den Chat werden neben dem Chat-Fenster auf der nächsten Seite wiederholt. Im blau unterlegten Fenster links unten können Sie Ihre Mitteilung an die anderen Gruppenteilnehmer schreiben und mit der "Enter"-Taste absenden. Die geschriebenen Mitteilungen aller Gruppenteilnehmer erscheinen im grau unterlegten Fenster links oben. Mitteilungen von Ihnen werden mit dem Buchstaben X/Y/Z gekennzeichnet. Wichtig für den Chat: Das Experiment basiert auf Anonymität. Sie sind völlig frei, indem was Sie schreiben. Um die Anonymität zwischen den Teilnehmern sicherzustellen, geben Sie bitte Ihre Identität nicht bekannt. Ihre Daten können sonst nicht in die Auswertung einfließen.