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On competing rewards standards—an experimental study of ultimatum bargaining

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Abstract

In the tradition of earlier experimental studies, this paper introduces competing reward standards by letting parties bargain over the distribution of chips. The monetary equivalents of a chip for the bargaining parties can be equal (no competing rewards) or different (competing rewards). The ultimatum game is used as a tool to learn about reward standards in an asymmetric procedure. A major effect of different monetary chip equivalents is observed only when the proposer has a higher chip value. Results are compared to those reported in [Games Econ. Behav. 13 (1966) 100], who used a different experimental design.

Keywords: Reward standards; Ultimatum bargaining; Asymmetric procedure

1. Introduction

Rewards standards measure how people perceive their success when performing a certain task. In interactive situations, such reward standards usually rely on commonly accepted views on what constitutes a reward and how to measure individual rewards. In experiments, competing reward standards can be easily introduced by allowing parties to bargain over the distribution of chips whose monetary equivalent (that is, the value of a chip) varies for different individuals. (See Nydegger and Own, 1974, for an early application.) The two competing rewards are then

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the amount of chips that an individual receives, and the monetary earning implied by the chip's assignment.

The original motivation for using this experimental method was to test experimentally basic axioms of game theoretic solutions (see Nydegger and Own, 1974, and Roth and Murnighan, 1982, who were mainly interested in testing the independence of bargaining results with respect to affine utility transformations as required, for instance, by Nash, 1953). Changing the positive monetary chip value actually amounts to a positive affine utility transformation and should not affect the game theoretic prediction (relying on such axioms). In this research tradition, competing reward standards are a convenient experimental method to challenge the empirical validity of a certain rationality requirement.

According to the hierarchical structure of the chips earnings versus the monetary earnings, equity theory (see Homans, 1961, for an early reference) would predict equal chip assignments when the monetary value of chips for individuals are not common knowledge. On the other hand, it predicts that monetary earnings will be equalized when values are commonly known, i.e., when the superior reward standard of monetary earnings is applicable (see Guth, 1988, 1994). This has been demonstrated most clearly by Nydegger and Own (1974) and subsequently by Roth and Malouf (1979). See Roth (1995) for a more comprehensive survey.

Whereas the above-mentioned studies were concerned with symmetric bargaining, e.g., the demand game of Nash (1953), the experiment reported in this paper has used the extremely asymmetric ultimatum game. In the ultimatum game, player 1 (the "proposer") first proposes how to split the total amount of chips. Then player 2 (the "responder") decides whether to accept or reject this proposal. If the responder accepts, then the proposal is implemented; otherwise, both players receive nothing. For players motivated purely by monetary considerations, the game theoretic solution implies that the proposer receives almost all the money. This is not the observed outcome in experiments. The deviation is usually attributed to "fairness" considerations (Roth, 1995).

Testing fairness in asymmetric bargaining games should not be perceived as a test of equity theory, since it is not claimed that equity considerations dominate all other, e.g., strategic considerations. What we therefore try to explore experimentally is the trade-off between fairness and strategic considerations. Moreover, the structure of the ultimatum game is such that players may develop different fairness standards depending on their role. We can thus explore whether and how relative strategic advantages will influence the standard on which one relies.

We report here the results of three different treatments: in treatment (2,1), the value of a chip for player 1 was twice its value for player 2; in treatment (1,1), they had a common value; in treatment (1,2), the value of a chip for player 2 was twice its value for player 1.

In treatment (2,1), player 1 may consider an equal chip-split as "fair" since it gives him a higher reward. On the other hand, the responder may consider an equal money-split as "fair," and for that reason be likely to reject an equal chip-split which he conceives as unfair. In the regular ultimatum game, the proposer, on average, typically claims a bit more than 50% of the cake (again, see the survey by Roth, 1995). In our case, the proposers claim a bit less in terms of the chips, but a much larger share of the money. We conclude that the average proposal is more in line with the equal chip-split than the money-split in this case. In treatment (1,1), both the equal chip-split and the equal money-split coincide. Our results in this case are in line with what is usually observed. The proposers claim a bit more than 50% of the pie. In treatment (1,2), player 1 is expected to favor an equal money-split to an equal chip-split. However, our result does not support this. In fact, proposals are not significantly different from the proposals of treatment (1,1).

2. Experimental procedure

Kagel et al. (1966) (hereafter KKM) have also used the ultimatum game as a tool to study these phenomena. Since the KKM study is closely related to ours we will first describe their procedure. In the KKM study, unequal chip equivalents could favor either the proposer or the responder ($0.10 or $0.30 per chip). The total amount of chips to be allocated was 100, and only unequal chip values were tested. Furthermore, they varied the information about the monetary chip value of the other party (own-chip values were always known). Participants in the KKM experiment played the ultimatum game in the same role (proposer or responder) 10 times with different partners, learning only about their own plays. One of the 10 successive plays was then finally selected by chance for actual payment.

Since we are interested in the hierarchy of reward standards, we focused on the “full information” condition. That is, the conversion rates were commonly known. We find some of the results obtained by KKM for this condition striking:

(i) High rejection rates (39% of all proposals in the case when the proposer has the higher value).
(ii) Proposers for the most part refrained from proposing equal earnings when they had the higher value per chip.
(iii) When proposers had the lower value per chip, their mean proposals were consistent with the equal-earnings prediction.

The rejection rates are quite high compared with other experiments (see Roth, 1995). Tendencies (ii) and (iii) imply that proposers apply the superior reward standard when this is in their own advantage.[1] The current experiment was conducted to test the robustness of these results with respect to the procedure.

2.1. Procedure

In each of the three treatments, participants in the role of proposers were asked to divide 100. In treatment (2,1), the value of a chip was 0.4 Guilders for the proposer and 0.2 Guilders for the responder. In treatment (1,1) the value of a chip was 0.2 Guilders for each player, and in treatment (1,2) it was 0.2 for the proposer and 0.4 Guilders for the responder. The values of the chips were commonly known in all treatments. The game was played only once.[2]

Compared with KKM, we have therefore used less dramatic differences in monetary chip equivalents and included a treatment with equal equivalents, which enables us to compare our results to other studies of ultimatum games. Moreover, our participants played only once in order to increase the monetary incentives.

Table 1
Pairwise comparisons of the distribution of chips and money for the different treatments

	(2,1) and (1,1)	(2,1) and (1,2)	(1,1) and (1,2)
Chip-split	.05*	.02*	.95
Money-split	.00*	.00*	.95

The numbers in the table are the *p*-values.
* Indicates significant differences.

The participants in the experiment were undergraduate students in economics at the University of Tilburg. Students were recruited in classes. Each treatment was conducted with a different group of participants. The instructions they were given are presented in Appendix A.

3. Results

The results of the plays (16, 14, and 15 in treatment (2,1), (1,1), and (1,2) respectively) are presented in Appendix B. We use the nonparametric Mann–Whitney *U*-test based on ranks to test the following two hypotheses:

Hypothesis 1. The distribution of *chips* is not affected by the different treatments.

Hypothesis 2. The distribution of *money* is not affected by the different treatments.

The results are presented in Table 1.

We cannot reject the hypothesis that the chip-split, as well as the money-split, in treatments (1,1) and (1,2) comes from the same distribution. Both these hypotheses are rejected, however, when we compare treatment (2,1) to the other two treatments: proposers in treatment (2,1) demanded significantly *fewer chips for themselves* than in the other treatments, but significantly *more money*. The comparisons of the *c.d.f.* are presented in Fig. 1(a) and (b).

Note that equal earnings would require

- the (33, 67) or (34, 66)-chip assignment for treatment (2,1)
- the (50, 50)-chip assignment for treatment (1,1)
- the (67, 33) or (66, 34)-chip assignment for treatment (1,2), Table 2.

Table 2
Hit rates of proposals in line with the basic and superior reward standard and of equity theory in general (a hit is given when the observations deviates by 5 chips or less from the prediction)

	Treatment			
	(2,1)	(1,1)	(1,2)	All
Hit rate of basic reward standard (chips)	0 of 16 (0%)	7 of 14 (50%)	6 of 15 (40%)	13 of 45 (29%)
Hit rate of superior reward standard (money)	4 of 16 (25%)	7 of 14 (50%)	6 of 15 (40%)	17 of 45 (38%)
Hit rate of equity theory in general	4 of 16 (25%)	7 of 14 (50%)	12 of 15 (80%)	23 of 45 (51%)

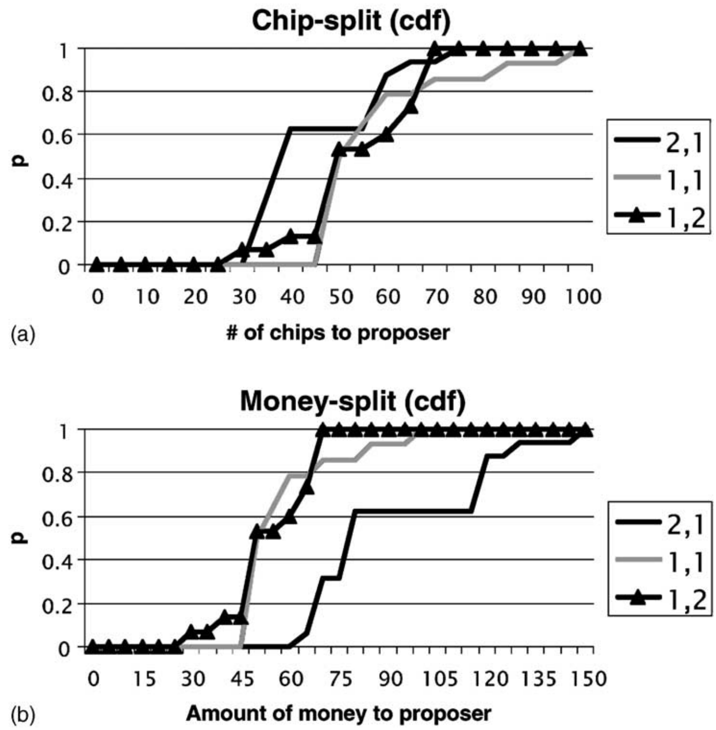

Fig. 1. Comparisons of chip-split and money-split (*c.d.f.*) according to treatments.

The hit rate of equal earnings is 25, 50, and 40% for treatment (2,1), (1,1), and (1,2), respectively. For the basic chip standard it is 0% for treatment (2,1) and 40% for treatment (1,2). Finally, only 51% of all observations can be justified by equity considerations.[3]

Remember that this does not question the validity of equity theory: in the asymmetric ultimatum game equity considerations and strategic aspects are, however, conflicting. It is interesting to observe whether behavior deviates from that implied by strategic aspects toward more equitable results (as is partly true for the KKM data).

Comparing our results with those of the KKM study, we observed a dramatically lower rejection rate (overall less than 9%). The equal earning result (iii) is also rejected by our data. The only consistent observation is their tendency (ii) stating that most proposers with larger chip equivalent refrain from granting equal earnings, but try to stay close to the 50:50-chip distribution. Counting earning differences smaller than or equal to 5 chips as equal, 5 of the 16 proposers in the (2,1)-treatment aimed at equal earnings, as compared to 7 out of 14 in the (1,1)-treatment and 5 out of 15 in the (1,2)-treatment. Thus, it is not so much the share of proposers aiming at equal earnings which differs, but more the direction and size of the deviations.

A double ultimatum hypothesis claiming that the proposer cannot only dictate the chip allocation, but also the reward standard would have predicted the 50:50 or a nearby chip allocation in the case of (2,1) and the 67:33 allocation in the (1,2) treatment as the equitable benchmark. Whereas in the second case the predictive success of this equitable benchmark (allowing for deviations smaller than or equal to 5 chips) is 40%, no 50:50 or nearby allocations has been

Table 3
Proposer's demand frequencies

Treatment	Proposer's demand		
	Less than 50	50	More than 50
(2,1)	10	0	6
(1,1)	1	8	5
(1,2)	2	6	7

observed for the (2,1) treatment: 6 proposers took considerably more and 10 considerably less than 50 chips.

Another way to describe the different results for the (2,1) and the (1,2) treatment is to distinguish between three groups of participants: those who ask for (at least 10 chips) more than 50 chips, those who ask for less than 50 chips, and those who allocate the chips evenly. According to Table 2, the group of 50:50 proposers is largest for treatment (1,1), still substantial in treatment (1,2), but non-existent for treatment (2,1). Thus, the more basic chip-standard is completely ruled out when it would favor the responder: if proposers care for fair rewards, they more often rely on the superior rewards of monetary earnings. If they do not, they try to exploit their ultimatum power by asking for even more than 50 chips (the right column in Table 3).

4. Discussion

Our results are quite different from those reported in KKM. First, we observe dramatically lower rejection rates. Second, we cannot confirm their observation that proposers aim at equal earnings when their monetary chip equivalent is smaller than the one of the responders.

What details in the experimental procedure could have caused these differences?[4] Unlike their counterparts in the KKM study, the participants in the current experiment played only once; learning effects may thus be different. However, hardly any learning effects are visible in the KKM data (see their Fig. 1 on p. 104).

The two aspects that we believe make the difference are, first, the less extreme asymmetry in chip equivalents, and second, the salience of monetary incentives ($18 instead of $2 per game). For example, if the responder's chip equivalent is only one third of the proposer's value, and only 1 out of 10 games is paid, it may seem "less costly" and thus "more attractive" for the responder to reject a 50:50 chip allocation which denies the superior reward standard, than would be the case in our procedure. The KKM results must therefore be considered with caution. We hope that their results and our observations *together* provide a more complete picture to understand the role of reward standards in asymmetric bargaining situations.

Notes

1. Such a behavioral tendency is in contrast to the politeness ritual, observed in reward allocation experiments (Shapiro, 1975).
2. Firstly, KKM did not detect learning effects. Secondly, we were interested in testing whether results (ii) and (iii) are robust for higher monetary incentives. To guarantee this,

participants played only once (see footnote 4 of KKM, which acknowledges this problem). The value of the pie was about $18 in our experiment, compared with $20/10 = $2 in the KKM experiment.

3. A standard test of equity theory is not obvious, since, without allowing for any error or noise, any violation would reject it. One possibility would be to specify alternative hypotheses, e.g., the one of uniformly distributed proposals over some range, and to test their relative success. Here we do not engage in such an attempt.
4. We would like to emphasize that KKM were interested in the role of information, which influenced their choice of procedure.

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Appendix A. Instructions/decision forms

A.1. Instructions for the proposer

Welcome to this experiment in decision making. Soon you will be randomly matched with another student. In the experiment, 100 points are to be divided between yourself and the other student. You are called the proposer and he/she is called the responder.

We will ask you to make a proposal about how to divide the 100 points between yourself and the responder. Then we will ask the responder to decide whether to "accept" or "reject" your proposal.

(a) If the responder accepts the proposal, then each of you will earn points according to the proposal you made.
(b) If the responder rejects the proposal, then neither of you will earn any points at all.

At the end of the experiment you (the proposer) will receive 20 cents for each point you have. The responder will receive 40 cents for each point he/she has. That is, he/she will receive twice the amount of money for each point held.

If you have no questions, please write down your ANR number and your proposal.

Your ANR number:______________

Your Proposal:

# of points for the Proposer (you):	# of points for the Responder:
[ ]	[ ]

Please note that the numbers in the two boxes should add up to 100.

A.2. Instructions for the responder

Welcome to this experiment in decision making. Soon you will be randomly matched with another student. In the experiment, 100 points are to be divided between yourself and the other student. You are called the responder and he/she is called the proposer.

We asked the proposer to make a proposal about how to divide the 100 points between him/herself and you. Now we ask you to decide whether to "accept" or "reject" his/her proposal.

(a) If you accept the proposal, then each of you will earn points according to the proposal made.
(b) If you reject the proposal, then neither of you will earn any points at all.

The proposer received similar instructions to yours. At the end of the experiment the proposer will receive 20 cents for each point he/she has. You will receive 40 cents for each point you have. That is, you will receive twice the amount of money for each point held.

If you have no questions, please write down your ANR number and whether you accept or reject the proposal written below.

Your ANR number:_____________

The Proposal made by the Proposer:

# of points for the Proposer:	#of points for the Responder (you):
[ ]	[ ]

Your decision (please write accept or reject):______________

Appendix B. Proposer's demand

	(2,1) Proposals	(1,1) Proposals	(1,2) Proposals
1	75(*)	99(*)	70(*)
2	65	85	67
3	60(*)	66	66
4	60	60	66
5	60	60	65
6	60	55	65
7	40	51	60
8	40	50	50
9	40	50	50
10	40	50	50
11	40	50	50
12	35	50	50

Appendix B (*Continued*)

	(2,1) Proposals	(1,1) Proposals	(1,2) Proposals
13	33.3	50	50
14	33.3	50	40
15	33.3		30
16	32		
Average	46.7	58.3	55.3

Proposer's demand (in chips). (*) indicates proposals that were rejected.

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