

# The Relevance of Equal Splits in Ultimatum Games<sup>1</sup>

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In this note we present a slightly altered version of the mini ultimatum game of G. E. Bolton and R. Zwick (1995, *Games Econ. Behav.* **10**, 95–121). More specifically, we replaced exactly equal splits by nearly equal splits either (slightly) favoring the proposer or the responder. Such a minor change should not matter if behavior was robust. We find, however, a significant change in behavior: Fair offers occur less often when equal splits are replaced by nearly equal splits. *Journal of Economic Literature* Classification Numbers: C72, C78, C92. © 2001 Academic Press

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## 1. INTRODUCTION

The findings on the ultimatum game (see Roth, 1995, for a survey) belong to the most robust experimental results. Bolton and Zwick (1995),

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for example, have shown that essential behavioral regularities like responders' willingness to reject unfair offers and proposers' propensity to offer equal splits pertain in ultimatum games in which only two offers, a fair and an unfair one, are feasible. Here we investigate such "mini ultimatum games" in which the "fair offer" can be slightly unfair. If behavior were robust, such small payoff changes would not matter. But, in fact, they do. Replacing the equal split by a "nearly equal split" dramatically changes behavior. In particular, the fair outcome is chosen less frequently.

We investigated three mini ultimatum games, one similar to Bolton and Zwick and two others in which we replaced the equal split by offers once slightly favoring the proposer and once slightly favoring the responder. We find that proposers are less inclined to make a fair offer if the equal split is replaced by a nearly equal split (especially if the latter slightly favors the responder) while responders reject unfair offers less frequently if both offers favor the proposer. Although these patterns are highly significant they disappear in treatments economizing on subjects, e.g., if the so-called strategy method is used.

The remainder of the paper is organized as follows: In Section 2 we introduce the experimental design in more detail. In Section 3 we present the main behavioral regularities and Section 4 concludes.

## 2. EXPERIMENTAL DESIGN

The three mini ultimatum games are represented in Fig. 1. First player  $A$  chooses between  $l$  and  $r$  and then, depending on  $A$ 's choice, player  $B$  chooses between  $L_1$  and  $R_1$ , respectively, between  $L_2$  and  $R_2$ . The three games only differ in the payoffs for the path  $(r, L_2)$ . For the variant corresponding to Bolton and Zwick (1995) this path assigns equal payoffs to both players.<sup>5</sup> We refer to this game as Equal. In game Prop player  $A$ , the proposer, receives 11 and player  $B$ , the responder, gets 9, in case of  $(r, L_2)$ . In game Resp this is reversed. (We will refer to the games Prop and Resp also as the "inequality games" in contrast to the "equality game.") If players are only guided by monetary incentives, the solution of all three games is the unique subgame perfect equilibrium  $s^* = (l, (L_1, L_2))$ .

The experiments were conducted in summer 1997 and autumn 1999 at Humboldt University. A total of 207 subjects played the one-shot

<sup>5</sup>The payoff vector  $\binom{17}{3}$  corresponds to the payoff vector  $\binom{h_{4,1}}{h_{4,2}} = \binom{h_{9,1}}{h_{9,2}} = \binom{3,40}{0,60}$  of Bolton and Zwick (1995) since  $\binom{17}{3} = 5 \cdot \binom{3,40}{0,60}$ .



TABLE I  
Behavior in All Three Games

Game	Decisions					
	Proposers		Responders			
	$l$	$r$	$L_1$	$R_1$	$L_2$	$R_2$
Prop	16	20	12	4	17	1
Equal	10	24	4	6	21	2
Resp	24	12	11	11	12	—

Responder behavior is more difficult to summarize. Virtually all responders accept, of course, the fair offer  $r$ . But how do responders react to the unfair offer? Due to sequential play the number of observations here is much smaller than for proposers. Nevertheless, we observe that the rate of rejections is significantly lower in game Prop than in the other two games ( $p = 0.06$ ,  $\chi^2 = 3.43$ ).

We sum up our observations in two behavioral regularities.

*Regularity 1.* Proposers choose more often the unfair offer when the equal split is replaced by a nearly equal split. This effect is particularly strong when the nearly equal split favors the responder.

*Regularity 2.* Responders reject unfair offers less often when all agreements imply a payoff advantage for the proposer.

How can this sensitivity to slight alterations of a single payoff vector be explained? Looking at the two inequality games separately we get some clues: The data of game Resp suggest that envy dominates fairness concerns (proposers do not want to receive less than their opponent). In contrast, in game Prop proposers may have felt and also be viewed especially strong since all agreements favor them. Proposers may also simply have anticipated Regularity 2. It then makes perfect sense for them to be less afraid of rejections and to choose the greedy offer in game Prop.

The results are also in line with a focal-point explanation. One might argue that fairness considerations are only triggered if the focal equal split is *feasible*. Splitting equally plays an important role in our upbringing and, typically, our first bargaining experiences with siblings and friends are situations where sharing equally is quite common (often enforced by third parties like parents or teachers). If the familiar and focal equal split is removed, fairness concerns may not arise.

Next we briefly turn to a methodological question, namely whether one can observe the same behavioral patterns by economizing on subjects using the so-called strategy method which forces subjects to choose complete decision plans (strategies). Potentially, this procedure may reveal more information about the motives of a single subject. But there is a caveat as the effects of physical timing are removed<sup>9</sup> and as subjects might be less focussed.<sup>10</sup> A similar problem arises when subjects participate not only in one game but in many games.

We have studied the games at hand in a 2-by-2 factorial design (sequential play versus strategy method and one versus many games). Seventy-seven additional subjects played one of the games employing the strategy method.<sup>11</sup> In two further treatments, subjects played (at the same time) *all three* games, 20 participants in the sequential version and 19 in the simultaneous strategic-form version.<sup>12</sup>

The results are clear-cut: Only the “natural” design, in which subjects play one game sequentially, reveals the behavioral relevance of exactly equal splits. All other designs which economize on subjects fail to produce the same behavioral pattern.<sup>13</sup> This is summarized in

*Regularity 3.* Whereas there are significant differences in behavior across games when only one game is played sequentially there were no differences for all other methods of eliciting choices.

Regularity 3 provides further evidence that experimental observations depend crucially on the method of eliciting choices. This was also observed by Schotter *et al.* (1994)<sup>14</sup> who report a significant presenta-

<sup>9</sup>Evidence for the relevance of the timing of decisions is provided, for example, by Rapoport (1997) and Güth *et al.* (1998).

<sup>10</sup>Roth (1995, pp. 322–323) who provides a discussion of the pros and cons of the strategy method writes, “The obvious disadvantage is that it [the strategy method] removes from experimental observation the possible effects of the timing of decisions in the course of the game.” Furthermore, he points out that the strategy method “forces subjects to think about each information set in a different way than if they could primarily concentrate on those information sets that arise in the course of the game.” He concludes that applying the strategy method “amounts to a significant change in the game itself,” and argues that there is some need to explore “for which kinds of games there may be significant differences in observed behavior when the strategy method is used.”

<sup>11</sup>Prop 26, Equal 25, Resp 26.

<sup>12</sup>For instance, in the first of the two latter treatments, a proposer had to indicate his decisions for each of the three games before his choices were passed on to a responder who, then, had to decide in the corresponding information sets for all three games.

<sup>13</sup>The data of the additional treatments are presented in Appendix A.

<sup>14</sup>Using a between-subjects design, they confronted their subjects with either the normal form (matrix) or the extensive form of a simple game. (Problem 1 in their study is the game most similar to ours.) In either case each subject had exactly two alternative strategies.

tion effect for chainstore paradox-like games. For instance, the secure strategy of one player was less frequently chosen when subjects were confronted with the extensive rather than with the strategic form of the game.<sup>15</sup>

#### 4. DISCUSSION

We studied three mini ultimatum games varying only in one payoff vector following the acceptance of the (almost) fair offer. In one version an exactly equal split of the pie was feasible. In two other versions the exactly equal split was replaced by a nearly equal split, once slightly favoring the proposer and once slightly favoring the responder. Comparing the equality game with the inequality games we observed that behavior changed dramatically although the inequality games were generated by only slightly altering a single payoff vector. More precisely, proposers choose significantly more often unfair offers when the exactly equal split is not feasible and responders reject unfair offers less often when all offers imply a payoff advantage for the proposer.

The general message of these results (which seem in line with a focal-point explanation) is that fairness concerns may be less pronounced in settings where splitting equally is impossible. In reality equal splits are quite often not feasible, e.g., because of different enforceable claims.<sup>16</sup>

Finally, our experimental data provide evidence that, in some games,<sup>17</sup> elicitation methods can significantly affect behavior.

<sup>15</sup>In our case it seems easy to explain the vanishing differences for the case of players who play all three games simultaneously. There the payoff differences implied by nearly equal splits wash out. (Offering in all three games (nearly) equal splits yields an exactly equal split overall.) With respect to the subjects who play only one game with the strategy method, it seems that we are less sensitive to small payoff differences when imagining their consequences than when actually experiencing them.

<sup>16</sup>Also, one might suspect that cooperative behavior, for example, in dilemma games or oligopolies becomes less frequent when the gains from cooperation are asymmetric. Evidence along this line can be found in Mason and Philips (1997) who study duopolies.

<sup>17</sup>Brandts and Charness (2000) present evidence on games in which behavior is robust to elicitation methods.

APPENDIX

A. Data of All Treatments

A.1. Synopsis

TABLE II  
Proposers' Behavior across Games

Game	Mode and moves							
	Seq. play one game		Seq. play all games		Sim. play one game		Sim. play all games	
	<i>l</i>	<i>r</i>	<i>l</i>	<i>r</i>	<i>l</i>	<i>r</i>	<i>l</i>	<i>r</i>
Prop	16	20	4	6	9	4	4	5
Equal	10	24	4	6	7	6	3	6
Resp	24	12	5	5	7	6	5	4
$\Sigma$	50	56	13	17	23	16	12	15

A.2. Detailed Results

TABLE III  
Responders' Behavior across Games

Game	Mode and moves															
	Seq. play one game				Seq. play all games				Sim. play one game				Sim. play all games			
	<i>L</i> <sub>1</sub>	<i>R</i> <sub>1</sub>	<i>L</i> <sub>2</sub>	<i>R</i> <sub>2</sub>	<i>L</i> <sub>1</sub>	<i>R</i> <sub>1</sub>	<i>L</i> <sub>2</sub>	<i>R</i> <sub>2</sub>	<i>L</i> <sub>1</sub>	<i>R</i> <sub>1</sub>	<i>L</i> <sub>2</sub>	<i>R</i> <sub>2</sub>	<i>L</i> <sub>1</sub>	<i>R</i> <sub>1</sub>	<i>L</i> <sub>2</sub>	<i>R</i> <sub>2</sub>
Prop	12	4	17	1	2	2	6	—	8	5	13	—	6	4	10	—
Equal	4	6	21	2	2	2	6	—	8	4	12	—	7	3	9	1
Resp	11	11	12	—	2	3	5	—	10	3	12	1	7	3	10	—

TABLE IV  
Results When Subjects Play One Game and Decide Simultaneously

Game	Proposer		Responder			
	<i>l</i>	<i>r</i>	( <i>L</i> <sub>1</sub> , <i>L</i> <sub>2</sub> )	( <i>L</i> <sub>1</sub> , <i>R</i> <sub>2</sub> )	( <i>R</i> <sub>1</sub> , <i>L</i> <sub>2</sub> )	( <i>R</i> <sub>1</sub> , <i>R</i> <sub>2</sub> )
Prop	9	4	7		5	
Equal	7	6	7		4	
Resp	7	6	9		2	1

TABLE V  
Results When Subjects Play All Three Games and  
Decide Sequentially (Prop, Equal, Resp)

Proposer	Responder
$\#(r, r, r) = 5$	$\rightarrow \#(L_2, L_2, L_2) = 5$
$\#(l, l, l) = 4$	$\rightarrow \#(R_1, R_1, R_1) = 2, \#(L_1, L_1, L_1) = 2$
$\#(r, r, l) = 1$	$\rightarrow \#(L_2, L_2, R_1) = 1$

TABLE VI  
Results When Subjects Play All Three Games and  
Decide Simultaneously (Prop, Equal, Resp)

Proposer	Responder
$\#(r, r, r) = 3$	$\#((L_1, L_2), (L_1, L_2), (L_1, L_2)) = 5$
$\#(l, l, l) = 2$	$\#((R_1, L_2), (R_1, L_2), (R_1, L_2)) = 2$
$\#(r, r, l) = 2$	$\#((R_1, L_2), (L_1, L_2), (R_1, L_2)) = 1$
$\#(l, r, r) = 1$	$\#((R_1, L_2), (R_1, L_2), (L_1, L_2)) = 1$
$\#(l, r, l) = 1$	$\#((L_1, L_2), (L_1, R_2), (L_1, L_2)) = 1$
$\#(r, l, l) = 1$	

## B. Translated Instructions

*Please read the following instructions carefully! In case of questions raise your hand! We will answer all questions privately.*

Welcome to our experiment! As you will see in a moment you can earn some money. How much depends on what you will do and on what somebody else with whom you will be randomly matched will do. The rules are quite simple. Look at the following decision tree(s).

[Figure(s) of relevant game tree(s).]

(In all three situations) First A decides whether to choose “r” or “l.” After A has made his choice, B has to decide. Depending on A’s choice, B either has to choose between “L1” and “R1” or between “L2” and “R2.” Four cases are possible:

A chooses “l,” B chooses “L1”: In this case A receives DM 17 and B receives DM 3 (all situations).

A chooses “l,” B chooses “R1”: In this case both receive nothing (all situations).

A chooses “r,” B chooses “L2”: In this case A receives DM [amount according to game] and B DM [amount according to game]. [In the treatments in which subjects had to decide for all three games, this sentence was repeated for all situations.]

A chooses “r,” B chooses “R2”: In this case both receive nothing (all situations).

In case you are A, please make your choice between “l” and “r” by drawing a small circle around the letter. (Do this for all three situations.)

[Next paragraph only for simultaneous treatments:] In case you are B, please make your choice between “L1” and “R1” for the case A chooses “l” and make your choice between “L2” and “R2” for the case A chooses “r.” Do this by drawing two (six) circles indicating your decisions. This means that every A has to draw one (three) circle(s) and every B has to draw two (six) circles.

[Next paragraph only for sequential treatments:] A's decisions sheet will then be passed to a randomly chosen B. Knowing A's decision B has to make his choice, i.e., if A has chosen “l,” B has to choose between “L1” and “R1”; and if A has chosen “r,” B has to choose between “L2” and “R2.” As a B do this by drawing a small circle around the label of your choice. (Do this for all three situations!)

[Next paragraph only for simultaneous treatments:] After having collected all decision sheets we will pair A's and B's randomly to determine your payoffs.

To ensure your anonymity you receive a code number on a separate card. Please write your code number in the appropriate box on your decision sheet and keep your code card. You will receive your payoff only when showing this card. This procedure ensures your anonymity concerning us and the participant you are matched with.

You have role [A/B].

## REFERENCES

- Bolton, G. E., and Zwick, R. (1995). “Anonymity versus Punishment in Ultimatum Bargaining,” *Games Econ. Behav.* **10**, 95–121, doi:10.1006/game.1995.1026.
- Brandts, J., and Charness, G. (2000). “Hot vs. Cold: Sequential Responses and Preference Stability in Experimental Games,” *Experimental Econ.* **2**, 227–238.
- Güth, W., Huck, S., and Rapoport, A. (1998). “The Limitations of the Positional Order Effect,” *J. Econ. Behav. Org.* **34**, 313–325.
- Mason, C. F., and Phillips, O. R. (1997). “Information and Cost Asymmetry in Experimental Duopoly Markets,” *Rev. Econ. Stat.* **79**, 290–299.
- Roth, A. E. (1995). “Bargaining Experiments,” in *Handbook of Experimental Economics* (J. H. Kagel and A. E. Roth, Eds.), pp. 253–348. Princeton, NJ: Princeton Univ. Press.
- Rapoport, A. (1997). “Order of Play in Strategically Equivalent Games in Extensive Form,” *Int. J. Game Theory* **26**, 113–136.
- Schotter, A., Weigelt, K., and Wilson, C. (1994). “A Laboratory Investigation of Multiperson Rationality and Presentation Effects,” *Games Econ. Behav.* **6**, 445–468, doi:10.1006/game.1994.1026.