The cost of fair divisions: An experimental investigation of Ultimatum Games with groups

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Abstract

I investigated the effect of the presence of a group of non-active subjects upon the behavior of active players in a Ultimatum bargaining game. In the experiment a subject with the role of P has to offer a share r of a sum S to a subject with the role of AR who belongs to a group and decides on behalf of his group's members (players R). If AR rejects the P's offer, both active and non-active players get zero, if AR accepts the offer then P gets $S - r$ while r is equally divided between AR and the members of his group. Every subject assumes all the three roles (P, AR and R) and the group size is manipulated keeping constant the share S/N (with N=number of subjects, either active or non active, involved in the game)

Data suggest that active players tend to behave as they were playing a standard two-person Ultimatum game. A clear insensitivity to changes in group size by subjects playing as P, emerging in the main experiment, is compatible with the hyphotesis that at the basis of their behavior there is a willingness to gain a payoff which satisfies an ex-ante fixed aspiration level, that for most of them corresponds to about half of S.

The interpretation of the decisions taken by subjects under the AR role is more complicated as, although most of them show a behavior which is compatible with the one observed in the standard Ultimatum Game, a non-negligible share of players fix very low acceptance thresholds that could be explainained in terms of a shift from the willingness to punish unfair behaviors to the responsibility for others' wellbeing.

The experimental analysis of norms of fairness and reciprocity has become one of most promising strand of economic and decision theory research. The results gathered in twenty years of experiments have contributed to uncover the limits of models of human agents as motivated only by the maximization of their own material payoff. At the same time a number of theories have been introduced aiming at explaining the experimental evidence by means of models based on the hypothesis that agents have a multiplicity of motivations, maximization of their own material payoff being only one

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among them(see for example Fehr & Schmidt (1999),Bolton & Ockenfels (2000),Falk & Fischbacher (2001)).

Although social norms play a crucial role in this theories, we still know little about the way in which they influence individual behaviour, and in particular many questions remain to be answered about the determinants of the salience of specific norms within specific contexts, the interplay between self-interest and norm-driven behaviour and the variables that influence the balance between these two classes of motives.

Recently, an increasing number of researchers are trying to isolate some of these variables introducing, for example, experiments in which the social distance among the players is manipulated by means of some form of communication or group identification.

In my work I focussed on this kind of research and I investigated the effects of the presence of a group upon the choices of individuals involved in Ultimatum bargaining games, with the objective of assessing the influence of both group identification and cost of compliance on the definition of what is considered to be fair in a specific context.

In the following section I will briefly introduce the basic Ultimatum Game and the literature about the role of groups in Ultimatum bargaining, then I will proceed with the description of the experiment.

1 Groups and Ultimatum bargaining

The standard Ultimatum Game is a two-player sequential game in which the first mover, the Proposer, has to decide how to divide a sum of money (S) between himself and a second mover, the Responder, who can either accept or refuse the Proposer's offer. If the Responder accepts the offer, then the sum is divided according the Proposer's will, if he refuses, both players get zero. According to game theory, being the players exclusively motivated by the maximization of their own material payoff, we should expect to observe a Proposer's offer corresponding to a minimal share of the sum, ε, always accepted by the Responder, that has to choose between ε, if he accepts, and zero, if he refuses.

As shown by the experimental evidence produced in the last two decades - with hundreds of replications of the basic experimental design (Güth et al. (1982)) in different countries and under different conditions (Roth (1995)) and Bearden (2001))what real people do is not consistent with the self-interest hypothesis at the basis of the standard rational choice theory, in fact Proposers offer on average a share between 30% and 50% of the sum (with 50% as modal offer) and Responders tend to refuse offers below 25% of the sum with a probability of 50%.

Most of the research about Ultimatum bargaining has been devoted to the study of two-person games and only in the last few years some scholars have shown interest in experiments based on games with more players.

Güth & van Damme (1998) designed an experiment based on a three-person Ultimatum Game in which the Proposer has to decide how to allocate a sum among himself, a Responder and a third player (dummy) who does not have an active role in the in-

teraction. As in the basic game, the Responder can choose, under different information conditions, whether to accept or refuse the offer, if he refuses all the players get zero. The main result of the study is that the Proposer exploits the information conditions choosing proposals that could be perceived by the active Responder as fair. In any case, neither the Proposer nor the Responder seem to care much about the dummy player's payoff. A similar result has been obtained with the manipulation of the consolation prize for the dummy player in Kagel & Wolfe (2001) experiment [1].

This kind of experiments is characterized by a framing of the game as an interaction amongst a triad of players and not between a Proposer and a group of Responders. In fact, they are not designed with the aim to explore the role of group membership upon individual decision making, but to test the explanation power of models of social preferences based on the "relative income" (Bolton & Ockenfels (2000)) or the "inequity aversion" (Fehr & Schmidt (1999)) hypotheses, and in particular to shed light on the role of intentionality in the definition of fairness as well as on the problem of the definition of the natural reference group, conceived as the set of subjects whose payoffs enter the utility function of the active players (Kagel & Wolfe (2001)).

The effect of group identification upon players' behaviour in Ultimatum bargaining games has been explicitly considered by researchers interested in testing the relevance of the so-called "minimal group effect" hypothesis (Tajfel & Turner (1979)). According to this hypothesis the simple definition of an individual as a member of a group would trigger a strong feeling of membership and the adoption of a cooperative attitude towards the members of his group and a competitive attitude toward outsiders. Although understanding this kind of mechanism can be very useful for the study of norm-driven behaviour, there is still a lack of consensus among psychologists about the appropriate explanation of it. The experiments conducted so far about the possible role of this effect in Ultimatum-like situations [2] have not provided conclusive evidence.

Finally, there is growing interest in the comparison between group and individual performances in bargaining experiments. The focus here is on team decision dynamics and their effects on the outcome of the allocation process. With regard to Ultimatum bargaining, some experiments have been conducted in which groups of people are called to collectively play either as a Proposer or as a Responder: The aim of the researchers is to understand why, as the experimental results seem to suggest, the group decision making process could lead to a more selfish, and consequently to a more rational, behaviour (Messick et al. (1997), Robert & Carnevale (1997), Bornstein & Yaniv (1998)).

In my study I assumed a point of view characterized by an explicit framing of the game as an interaction between a single individual and a group. In particular I was interested in the effects, upon both the Proposer and the Responder's behaviour, of the presence of a group on the side of the Responder. I did not considered the collective choice process, but I analyzed a game played by a single Proposer and a Responder who is part of a group and who decides also on behalf of the other members of his

[1] See also Riedl & Vyrastekova (2002) and Bolton & Ockenfels (1998)

[2] See for example Robert & Carnevale (1997) and Buchan et al. (2002)

group. What could one expect to observe in such a context? Does the presence of a group behind the Responder influence the Proposer offer? If yes, in which direction? And how does a Responder with such a particular role perceive the Proposer's offers?

In section 2 the experimental design and procedure are described; results are presented in section 3 and few conclusive remarks end the paper (section 4)

2 Experimental design and procedure

The experiment was based on a game in which a subject with the role of P plays as a Proposer in a Ultimatum Game, offering a division of a sum of money to a subject with the role of AR (Active Responder) who is part of a group and decides whether to accept or refuse the P's offer also on behalf of the members of his group (players R). The group membership was based on a random draw and there were neither interaction nor identification amongst the members of the groups.[3]

The experiment took place at the *Computable and Experimental Economics Laboratory (CEEL)* of the University of Trento in June 2004. It consisted of four sessions, and sixty students participated in it, with fifteen students per sessions. Each subject received a show-up fee of €5 for the participation. The whole experiment lasted two days (two sessions per day).

The entire experiment has been conducted under condition of absolute anonymity and through the use of personal computers.

Each session was divided in two phases: the $1vs4$ game and the $1vs2$ game.

In the $1vs4$ game, using a random draw, 3 player were assigned the role of P. The remaining 12 players were divided into 3 groups of four people and within each group a member was randomly selected as the AR player [4].

Each player P was coupled with one player AR and they were invted to play a Ultimatum game with the following structure: P is given a sum S (€25) and he can offer a share r (from 0 to 25) of that sum to AR. AR can either accept or refuse the offer. If he refuses then P gets 0, AR gets 0 and the member of the AR's group get 0; if he accepts, P gets $S - r$, AR and each member of his group get $r/4$.

In our setting, active players could make their choice selecting some (one for P and one or more for AR) of the possible division options ranging from {25,0} to {0,25}[5]which

[3]Two pilot experiment were run before the main one, using a less complicated procedure. Both the pilots were based on the same game used in the main experiment and the only difference between the two consisted in the introduction, in the second pilot, of the possibility of communcation among the members of the group in a pre-experimental phase, before knowing what would have happened in the following phases. The observation of the same interesting pattern of behavior shown both by the Proposers and the Responders, in both the preliminary studies, induced me to depeen the analysis of the active player's behavior, setting aside the study of the role of communication amongst the members of AR's group.

[4]A window with role and group number (for players AR and R) appeared on the computer screen of each subject.

[5]The first number is always the sum that P asks for himself. The options were fourteen ({25,0},{23,2}, {21,4}...{3,22}{1,24}{0,25})

appear on their computer screen. If the option chosen by P is included in the set of options selected by AR then the offer is accepted.[6]

After P and AR's choices, a new round started with a new selection of P players, groups and AR players. This procedure was repeated for five rounds.

The selection mechanism was so designed that each subject assumed the roles of P and AR once. In addition, as a P (AR) the single subject did never play the game with same AR (P) more than once. At the beginning of each round the subjects were not aware of the outcomes of the previous rounds. At the end of this five rounds players passed to the $1vs2$ game (second phase), consisting of three round.

In each round of the $1vs2$ game (second phase) five subjects were selected for the role of P, the remaining ten subjects were assigned to five groups of two members each, and within each group a member was selected for the role of AR.

As in the first phase each subject assumed once each of the active roles [7].

P and AR were involved in the same game as in the first phase, but now the Proposer had to divide a sum of €15 between himself and a group composed of one AR and one R, selecting one of the options from a list ranging from {15,0} to {0,15} with steps of €1.

At the end of the second phase the software drew one of the five rounds of the first phase and one of the three rounds of the second phase and the subjects were paid according to the outcomes of those rounds [8] . The outcomes were communicated, and the subjects were paid.

This procedure has been adopted with the aim to deepen the study of some aspects of the active players' behaviour. In particular, with regard to the P role, the objective was to find additional evidence about the relevance of quasi- fifty-fifty divisions in the $1vs4$ game, and, with the introduction of the $1vs2$ treatment, to look at the role of the cost of fair offers.

If we consider the two games that the subjects are called to play we can note that in the first one ($1vs4$) offering the fair share imply a cost of €20 (80% of S). In the second game ($1vs2$), where P has to divide the sum with a group composed of two player and where the fair share is the same, this cost becomes of €10 (66% of S). More generally offering one euro in the $1vs2$ game costs less then offering one euro in the $1vs4$ game.

[6]Such a procedure, which imply the use of the so called *strategy method* (Selten (1967)), has been adopted with the aim to collect as much information as possible about the Responder's preferences.

[7]Given the composition of the groups, in the first phase each subject assumed the role of R three times, in phase two he assumed this role only once.

[8]This is a form of the procedure known as "random lottery incentive system" (Starmer & Sugden (1991) and Cubitt et al. (1998)). Players play eight rounds knowing that and they will be paid according to the outcome of the two rounds that will be selected. In particular, at the beginning of the first game, subjects were informed about the fact that, even if they would have played five rounds of the $1vs4$ game, only one round would have been selected. Moving to the second phase, a new set of instruction were given to the subjects, with similar information about the $1vs2$ game.

Note that with this design the round in which one assumes an active role (P or AR) can be selected with a probability of 2/5 in the first phase and 2/3 in the second phase. This probability is exactly the same of that of being selected as an active player in the one-shot games (2/5 in the $1vs4$ game and 2/3 in the $1vs2$ game)

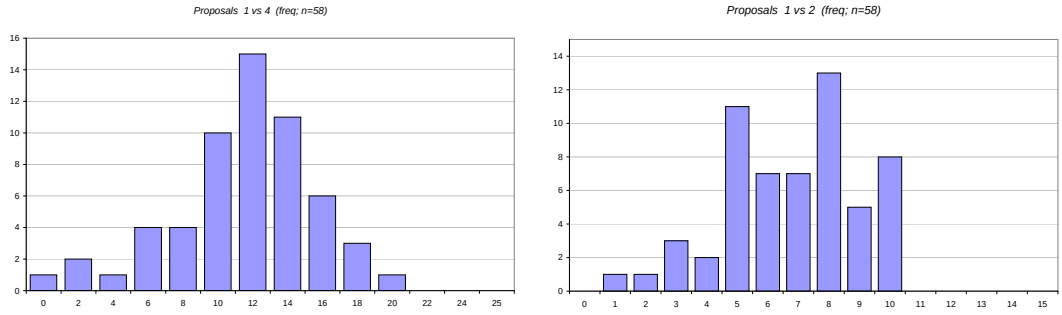

Figure 1: Choice under P role

Concerning the AR role, adopting this design should allow us to find additional evidence on the AR players' propensity to fix low acceptance thresholds and, at the same time, to evaluate the effect of group dimension on their behaviour.

2.1 Results

I collected a total of 58 observations for each phase [9].

Le me start by considering the choices of the subjects when they play the P role.

2.1.1 The behaviour of subjects under the P role

The distributions of offers in the two games are shown in figure 1.

When playing the P role in $1vs4$ game, subjects offered on average €11,52 to the whole group, corresponding to 46% of the sum and to 11,5% for each member of the group. The ratio between the payoff of each member of the group and the player P's payoff has been on average of 0,21. The modal offer was €12 (48% of S) and 75% of the offers were below € 14 (56% of S). There was only one fair share offer.

Thus, the offers are smaller then the ones observed in the pilot experiments, but the willingness to offer a share around the 50% to the whole group is confirmed.

The distribution of offers in game $1vs2$ has a higher variance, with a mean of € 6,81 (45,4% of S). On average, each member of the group is offered a share fo 22,7% of the total sum, corresponding 41% of player P's payoff. The modal offer is €8 (53,3% of S) and 75% of the offers are below €8.

Moving from $1vs4$ game to $1vs2$ game the number of the fair share offers increases up to 8. The higher frequency of fair share offers could be interpreted as a sign of the effect of the lower cost of norm compliance, but the observation of the presence of eleven €5 offers (33% of S) and of the relevance of offers close to the fifty-fifty division suggests the need for a deeper analysis of passage from the $1vs4$ to the $1vs2$ game.

At a first glance, players's attitude towards the representative of the group does not change much passing from the four-people group to the two-people groups. A Spearmen

[9] I excluded from the analysis the choices of two subjects who probably did not understand the game, choosing only one alternative when playing as AR.

correlation index of 0,71 between the offers in the $1vs4$ game and the ones in $1vs2$, t-test for paired sample (pvalue=0,65) and F-test(p-value=0,47) confirm this impression, but we can get more information by looking at the cost of the single offers, defined as the share of the sum that P gives away.

If we classify the subjects according to the cost of their offers (share of the sum that they decide to give away) in the $1vs4$ game we can see that, within each class, when moving to the $1vs2$ game players tend to choose an offer that on average have a cost which is very close to the cost of offer made in the $1vs4$ game. In addition, subjects who paid a low cost in the $1vs4$ tend to bear higher costs in the $1vs2$ game (see figure 2 and table 1).

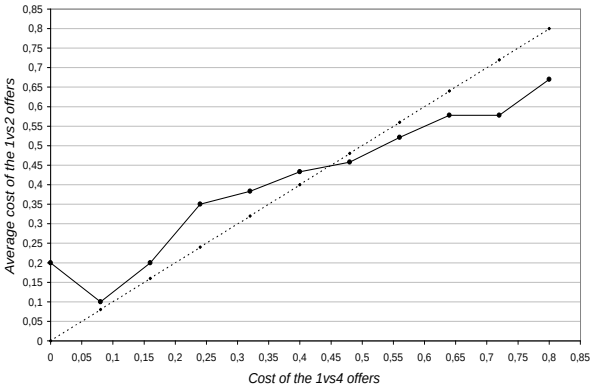

Figure 2: Cost of P'offers in the $1vs4$ game and average cost of P's offers in the $1vs2$ game

Table 1: Cost of P'offers in the $1vs4$ game and average cost of P's offers in the $1vs2$ game

1vs4 share	% of players	Individual share	Average 1v2 share	Individual share
0,00	1,72%	0,00	0,20	0,10
0,08	3,45%	0,02	0,10	0,05
0,16	1,72%	0,04	0,20	0,10
0,24	6,90%	0,06	0,35	0,18
0,32	6,90%	0,08	0,38	0,19
0,40	17,24%	0,10	0,43	0,22
0,48	25,86%	0,12	0,46	0,23
0,56	18,97%	0,14	0,52	0,26
0,64	10,34%	0,16	0,58	0,29
0,72	5,17%	0,18	0,58	0,29
0,80	1,72%	0,20	0,67	0,34

Looking at table 1 we can also observe that players who show the most significant changes in the share offered represent less than 30 % of the sample.

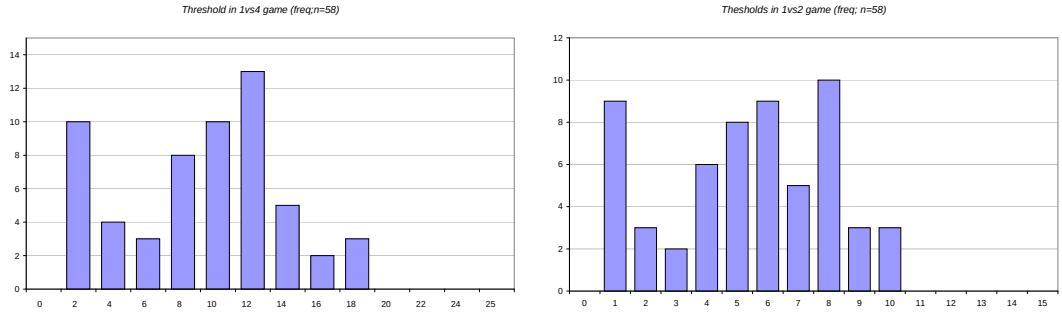

Figure 3: Choice under AR role

What seems to emerge is the heterogeneity of subjects with regard to the cost they are willing to bear when they have to decide how much to offer (or, in a complementary view, with regard to the share that they want to keep for themselves) with a majority of the subjects that are ready to give away among 40-50% of the sum.

The most puzzling fact is that this disposition seems not to be affected by the absolute amount of money and by the size of the group. In fact this behaviour is compatible with the evidence from the standard-two person ultimatum game and the triads experiments.

2.1.2 The behaviour of subjects under the AR role

As already emerged in the pilots, most of the subjects, when playing as AR, fixed a minimal acceptance threshold, choosing an ordered sequence of options [10] Nevertheless, some of them chose a set of options without considering as acceptable some of the most favourable allocation. We might think that they considere these allocation as little probable. [11]

The distribution of the acceptance thresholds in the two games is illustrated in figure 3.

The average acceptance threshold in the $1vs4$ game is €9,14 (36,5% of S), the mode is 12 (48% of S). The new data, then, confirm the evidence from pilots experiments.

In the $1vs2$ subjects chose on average a threshold of €5,46 (36,4% of S), with a modal offer of € 8 (53 % of S).

It is worth nothing the relevance of very low threshold as the €2 in the $1vs4$ and the €1 in the $1vs2$ game.

Thus, 75% of the subject are ready to accept offers corresponding to less then 48% in the first game and less then 53,3% in the second game, with a share for each member of the group of 12%(about half of the fair share) of S in the $1vs4$ game and of 26,6%

[10] Choosing all the option from {25-x, x } to {0,25}, where x can be considered as the acceptance threshold.

[11] An alternative explanation can be suggested by an experiment conduced in China , in which the reserachers observed subject who refuse both very low and very high offers, both considered as unfair (Hennig-Schmidt et al. (2002))

of S in the $1vs2$ game . Such individual shares imply a ratio between AR's payoff and P's payoff of about 0,23 in the $1vs4$ game and of 0,57 in the $1vs2$. With regard to the comparison of the $1vs4$ with the $1vs2$ choices, a Spearman correlation index of 0,80, t-test (p-value=0,61) and F-test (p-value=0,84) allow us to exclude the existence of significant differences between the two series.

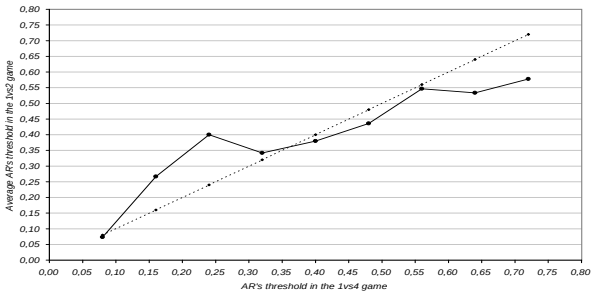

Figure 4: AR's threshold in the two games

Also in this case some additional information can be drawn from the classification of the subjects on the basis of the share they ask in the $1vs4$ game. What we can see, again, is that, within each class, when moving to the $1vs2$ game, players tend to fix thresholds that, in terms of share of S, are on average close to the shares in the $1vs4$ game (see figure 4 and table 2). Players who have shown the most significant changes in moving from 1v4 to $1vs2$ represent less than 17% of the sample.

Table 2: AR's threshold in the two games

1vs4 threshold	% of players	Individual share	Average 1vs2 threshold	Individual share
0,08	17,24%	0,02	0,07	0,04
0,16	6,90%	0,04	0,27	0,13
0,24	5,17%	0,06	0,40	0,20
0,32	13,79%	0,08	0,34	0,17
0,40	17,24%	0,10	0,38	0,19
0,48	22,41%	0,12	0,44	0,22
0,56	8,62%	0,14	0,55	0,27
0,64	3,45%	0,16	0,53	0,27
0,72	5,17%	0,18	0,58	0,29

The same share guarantees an individual payoff in the $1vs2$ that is double the one in the $1vs4$ game, but the focus seems to be more on the maximum share that should be left to the Proposer and consequently to the group as a whole and less on the individual payoffs of the members.

2.2 Moving from P role to AR role

We can conclude our review of the experimental results, considering the relation between the subject's decision as player P and his decision as player AR.

Following Güth et al. (1982)we can identify three classes of subjects by looking at the relation between their choice as P player and their choice as AR player. In the $1vs4$ game 12% of the subjects are characterized by conflictual decisions, in fact, having fixed, as AR, a threshold higher than the offer made as P, they would have rejected the offer they actually seggested as P. 24% behaved in a consistent way, with identical acceptance threshold and offer. Finally, 64% showed an anti-conflictual behaviour fixing a threshold below the offer made as P. In particular, they asked on average 63% of what they offered as P.

Moving to the $1vs2$ game, the composition of the classes does not change much, with 71% of anti-conflictual, 10% conflictual and 19% of consistent players. Anti-conflictual player ask, on average, 62% of what they offered as P.

The fact that the distribution of players classified according to this criteria does not differ between the two game represents a support of the evidence about the insensitivity to changes in the size of the group.

3 Discussion and conclusion

The objective of my work was twofold; on the one side I wanted to evaluate the effect of the presence of a group of non-active players on the side of the Responder in a Ultimatum bargaining setting upon the decision of the active players (P and AR). At the same time we wanted to explore the relevance of changes in the group size, holding the same ratio between the sum to be divided and the total number of individuals involved, either as active or passive players, in the game.

With regard to the first issue, evidence shows a similarity between the behaviour of subjects playing as P and as AR and the behaviour of Proposers and Responders usually observed in the standard two-person Ultimatum Game [12] and, as confirmed by the answers to post-experimental questionnaires, subjects apparently neglect the distributive consequences of this behaviour.

Changes in the size of the groups, with the resulting decrease of the cost of fair share offers, do not seem to influence the subjects' decisions. In particular, when taking the role of P, in both the games, subjects seem to be motivated mostly by the willingness to hold for themselves a share of the sum compatible with a fixed aspiration level, that for most players is about 50%. This attidute is compatible with the "fixed total sacrifice" behavior observed by Selten & Ockenfels (1998) in the "solidarity game". In this game, subjects are assigned to groups of three persons and each member takes part

[12]There is a striking resemblance between our results and the ones observed by Güth et al. (1982) in their seminal article on Ultimatum bargaining. In the second version of the simple game (pages 377-380) in which, as in our experiment, the same subjects play both the roles, they observe an average offer by P of about 45% of the total sum and an average threshold fixed by responders of 36,7%.

to a lottery in which he can win 10 DM with probability of 2/3 or zero with probability of 1/3. Before the random draw is made, subjects have to decide how much of their possible win they are willing to give to the only loser, in the case of two winners, or to the two losers, in the case in which he was the only winner. What Selten & Ockenfels (1998) observed is that 36 % of their subjects decided to give the same amount in both the case of one loser and in the case of two losers. They concluded that subjects of this type behave as if they decide ex-ante the sum they are willing to give, independently on the number of individuals that have to share it.

The interpretation of the decisions taken by subjects when they play with the AR role is more complicated. At a first glance, it seems that assuming the role of AR does not imply changes in the motivations of the subjects who, behaving as they were playing a two-person Ultimatum Game, comply with the player P's decision and tend to accept offers which are far from the fair share payoff for the members of their group.

But the presence of a significant proportion of subjects who fix very low thresholds is noteworthy: one might interpret the behaviour of these subject as compatible with the standard game theory's assumption about individual motivations. But if we look at their decisions as P some doubts emerge about the selfish nature of these players, in fact, average offers of players who have chosen threshold less or equal to €2 in the $1vs4$ game and €1 in the 1vs2 game are of 32% and 28% of the sum respectively.

Assuming a different point of view, we can imagine that the behaviour of this class of subjects is a sign of the influence of the presence of the group. In particular, we might think that the adoption of AR role induces a shift of their attention from the willingness to punish an unfair behaviour to the responsibility for the payoff of the other players. This would be in line with the evidence gathered by Fershtman & Gneezy (2001)who ran a Ultimatum Game with a delegate who decides on behalf of either the Proposer or the Responder. As they have shown, when the delegate is hired by the Proposer with an observable agency contract, proposals tends to be lower with respect to that observed under the standard Ultimatum Game condition. A possible interpretation suggested by the authors is that the delegate might be viewed as a hostage who would be indirectly damaged by the Responder's willingness to punish an unfair offer. Thus, the Responder will accept lower offer and the Proposer, being aware this effect, will induce his delegate to make lower offers. To test this hyphotesis a condition has been introduced in which the role of hostage is made explicit: the third subject has not a specific function but gets a positive reward if the offer is accepted and gets zero if the offer is refused. The result is that the average offer in this last condition is even lower than the one observed in first condition.

Being the explanation of the AR 's choice crucial the study of factors which influence the interplay between moral and material motivations, future research should be devoted to a deeper analysis of the decisions of people playing this role.

Further research on the P decisions, especially on the motivational role of fixed aspiration levels, would be also of great interest for the understanding of the relevance of behaviour driven by simple-rules in bargaining games.

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