Helping the meaner, hurting the nicer: the contribution versus distribution game

May 14, 2003

Gianandrea Sta¢ero

Abstract

We present an experimental design which addresses the increasingly debated question over the comparative importance of inequality aversion, reciprocity and e¢ciency as behavioral motives leading to deviations from standard "homo economicus" predictions. After a standard public good game, one player is given the possibility to increase or decrease his opponent's payo¤. While our baseline treatment replicates the tendency to hurt richer lower contributors and help poorer higher contributors, by adding exogenous assignments by the experimenter we …nd substantial willingness to hurt the richer even if she had contributed more and to help the poorer even if she had contributed less. This result shows a greater focus on correcting inequality rather than on punishing or rewarding behavior. Moreover, we also …nd that subjects disregard e¢ciency consideration. In fact, while helping results in increasing the total payo¤s, and hurting in decreasing it, we …nd that the former activity is not signi…cantly present in situations where reciprocity and inequality considerations can be ruled out.

Overall, our data support inequality aversion as a more robust phenomenon than reciprocity and e¢ciency considerations.

Acknowledgement 1 I would like to thank Jordi Brandts for his continuing support to this project, Klaus Abbink and Rosemarie Nagel for useful advice, Marcela Arqueros, Raul Lopez and Pablo Guillen for assistance during the sessions of the experiment. The usual disclaimer applies.

1 Introduction

The aim of the present work is two-fold. On one hand, we are going to compare the forces of inequality aversion and reciprocity in a very natural context where both criteria provide intuitive guidance to behavior. On the other, we provide a contribution in the debate over the relative importance of equality versus e¢ciency in individual choices. While most studies in experimental economics treat the two comparisons separately, our design allows to address both questions

with data from the same pool of subjects. In this way we are able to investigate possible correlations between di¤erent behavioral motives; at the same time, we strive to isolate the e¤ects of three relevant "other-regarding" aspects of preferences which normally interact simultaneously in determining deviations from pure sel…shness in human behavior. We will see how both comparisons highlight inequality aversion as a robust phenomenon.

The …rst question arise from the data obtained in the experimental lab which show that in symmetric public good games agents are willing to punish free riders (see Fehr and Gaechter, 2000); other studies replicate these results and also present some, albeit less conclusive, evidence of the willingness to reward highly cooperative behavior (see Andreoni et al., 2002, Sefton et al., 2002). In particular, the in‡uential article by Fehr and Gaechter shows that high cooperators are willing to spend money to "punish" low cooperators. This, in turns, provokes positive e¤ects on cooperation across rounds in the repeated version of the game, due to the educational e¤ects on free riders who learn to contribute in order to avoid sanctions. This result stands in contrast to what is found in standard repeated public good games, where cooperation tends to fade away. The term "punishment" in the title appeal to a reciprocity motivation: it is the action of hurting somebody whose previous actions have hurt the punisher. However, in other frequently cited papers, Fehr himself and Schmidt (1999) and Bolton and Ockenfels (2000) present models of preferences based on inequality aversion, which are consistent with a large set of experimental results including the ones in Fehr and Gaechter (1999). That is due to the fact that free riders achieve higher payo¤s in the game, before punishment can occur. The "punishment technology", according to which the expense for the punisher is lower than the loss for the punished, is such that the action of punishing reduces (and possibly eliminates) the inequality caused by contribution di¤erentials. A natural question, then, concern the real motivation for decreasing free riders' payo¤s: is it negative reciprocity, i.e. the desire to "hurt who hurts you" as predicted, for instance, in Rabin (1993), or rather pure inequality aversion?

Some authors compare reciprocity and inequality aversion in an ex-ante asymmetric environment. Studies like Bolton et al. (2000), Abbink et al. (2000) and Falk et al. (2000) present sequentally played games in which second (and last) movers can evaluate the "kindness" of …rst movers' choices by comparing them with the available alternatives. While in general the determination of the latter may be complicated as beliefs and "beliefs of the beliefs" are to be taken into account, in the games quoted here the alternatives available for …rst movers can be easily ranked in terms of how favorable they are for second movers. Therefore "reciprocity motivated" second movers should choose to reward (punish) …rst movers when the latter's choice was bene…cial (damaging) to the former.

In Bolton et al. we …nd a strong result in favor of inequality aversion as the relevant tendency, rather than reciprocity motivations of "being nice (bad) towards who was nice (bad) to you". They …nd that when second movers face a given situation, de…ned in terms of a set of choices and immediate payo¤ consequences (as their move ends the game), on average they take approximately

the same choice - compatible with a mixture of sel…sh and inequality averse types in the population - independently of which alternative was available for the …rst mover. More speci…cally, in one treatment that situation corresponds to the node which was the only one available to the …rst mover in a treatment; in another one it was unambiguously the nicest (from the second mover's point of view) choice the …rst mover could take; in a further treatment it was unambiguously the least kind. The failure to …nd statistically signi…cant di¤erence in the second movers' choice in the three treatments when facing the same situation indicates that in the experiment no evidence of reciprocity motives is found.

On the other hand, results in Falk et al. (2000) stress the importance of intentions without, however, neglecting the importance of inequality aversion. In their experiment, one treatment has …rst movers choosing to give to, or take away from second movers. The latter can reward or punish …rst movers by spending some money to increase or decrease their payo¤. Falk et al. …nd that, unlike standard predictions, second movers are willing to spend in order to punish the mean and reward the kind, con…rming evidence in Abbink et al.; on the other hand, when the …rst move is randomly determined, the reactions are mild, although on average inequality reducing second moves are still found to be signi…cantly (in statistical terms).

The experimental design introduced here, presented below in details, shares with the studies just mentioned the focus on second mover behavior, when bene…cial, neutral or hurtful choices towards opponents are available, and one-shot nature of the game. The latter allows to assume away strategic as well as "learning" aspects in the second movers' choices. Strategic aspects are often ruled out with "stranger" conditions, where players are re-matched at every round making sure the same opponents never meet again. However, the knowledge that the opponent is still going to play might have an in‡uence in players' mind; moreover, the expectation to repeat the game may provide incentive to try various strategies in order to "learn" which way best suit one's interests.

The ex-ante symmetry, usually present in repeated public good games, is a characteristic of the one-shot game played here. While in the sequential games in Abbink et al. (2000) and in Falk et al. (2000) players can tell whether the …rst move was nicer or not with respect to the alternatives, it is less clear-cut the de…nition of how kind (or mean) the choice was, in absolute terms. Some may …nd that the taken choice is not only the nicer but also an "obvious" choice that any "decent" individual should take; others may …nd it exceptionally kind. The fact that there may be no simple and objective way to evaluate how kind a choice was may be not problematic: a subject, i.e. the second movers, makes an evaluation and acts. The trouble is that the experimenter cannot really tell what the evaluation really was just by observing the reaction: a certain person may be strictly revengful and another one tolerate even large deviation from "decency".

Our design does not provide a clear answer as far as inner emotions are concerned, but allows us to observe, on top of the second mover's choice, what his choice as a …rst mover was, in a simultaneous public good game. In fact, no players know ex ante whether he will be a second mover: after contribution

choices are taken by both, the role of second mover is randomly assigned to only one of the two opponents. In this way, players are actually in the same position in the initial moment in which they choose how much to contribute to the public good. As parameters are set in a way which is compatible with the very de…nition of this type of game, the higher the contribution the more a player is being "nice" towards his opponent. The player who is picked as the unique second mover has the possibility to take his last decisions according to the possible opponent's contribution levels (as explained and motivated below, we employed the "strategy method"). A natural way to evaluate opponents' kindness at every possible decisional node is provided here: the second mover can compare his own and his opponent's contribution levels. While in general a possible manner to judge others' actions is to think of what one's own choice would have been in the same circumstances, here this comparison is made explicitly possible: second movers can tell whether in a given node their opponents were more, equally or less "nice" than themselves. The reciprocity concept used here is then - we argue - fairly plausible: you should take choices which are bene…cial to your opponent (or at least not damaging) if he contributed more than you; viceversa if he contributed less.

As we will see, results in the baseline "situation" essentially replicate results previously obtained in public good games with punishment and reward, where high (low) contributions are rewarded (punished). Other situations characterized by exogenous sources of inequality - di¤erence in additional "payo¤ points" distributed by the experimenter - permit to describe inequality aversion as a quite robust phenomenon, which emerges even in settings where reciprocity motives would prevent inequality reducing choices.

The way in which second mover's possibility are de…ned also provides insights in the increasingly active debate over the relative importance of equality versus e¢ciency motives. Experimental results in Charness and Rabin (2001) and Bolle and Kritikos (2001) indicate a general willingness to accept unfavorable inequality if the chosen alternative features high e¢ciency, de…ned in terms of total payo¤s distributed to the players. In our game, second movers are given the same "technology" in terms of "helping" and "hurting" activities, unlike, for instance, the case in Abbink et al. (2000), Falk et al. (2000) and Sefton et al. (2002) where "sanctioning" devices are more powerful than "rewarding" ones. Speci…cally, they have to spend F both if the want to increase and if they want to decrease their opponent's payo¤ by $3F$. So, a decreasing activity involves a total loss of $4F$ while an increasing activity provokes a net gain worth $2F$. If e¢ciency motives were strong vis-à-vis equality, they should drive towards more increasing than decreasing activity in general, and in particular towards a tendency to help …rst movers when reasons to reciprocate (positively or negatively) are absent. According to the de…nition of reciprocity used here, that is assumed to be the case when contribution levels were equal. As the latter point may be controversial, we also made the same subjects who acted as second movers play another treatment. In that "situation" the …rst phase is replaced by exogenous assignment of payo¤s by the experimenter, which can be modi…ed according to the same rules (spend F to increase or to decrease by

3F your opponent's payo¤). Overall, we …nd no evidence of e¢ciency motives; in particular, equal "partial payo¤s" are typically left unchanged, both when they come from exogenous assignments and when they are consequence of equal contributions. As argued below, our data stress the importance of inequalilty aversion especially in relation with other plausible motives such as reciprocity and e¢ciency.

The next section presents the experimental design, leaving protocol details for the appendix. Section 3 presents the di¤erent predictions which are derived according to di¤erent models of human behavior, starting from "homo economicus" standard assumptions to proceed into the realm of "other regarding" preferences. Section 4 clari…es the way in which the data are to be analysed in order to test the relative strenght of inequality aversion in the two comparisons we are interested in: versus reciprocity and versus e¢ciency motives. In section 5 results are presented; in section 6 they are summarized and discussed. Section 7 concludes.

2 Experimental design

The experiment was conducted at the Universitat Autonoma de Barcelona in …ve sessions which took place in January and February 2003, following a pilot which involved 14 students and suggested substantial modi…cations to the instructions and the necessity of a test. Overall, 64 students participated; earning varied fo 2 to 15 euro, with an average of 7.6 euros. In every session, students were divided in two groups located in separate rooms within the university. Every student in each room was coupled with one student in the other room. In both rooms instructions were read aloud and then a test was administered to ensure proper understanding of the game. During every session of the experiment in both rooms there was a person available to answer questions privately to any players with doubts.

The design make players interacting anonymously in couples, in a one-shot game composed of two phases. The …rst involves a standard public good game and the second the possibility for one player to modify the payo¤ combinations which could derive.

In the …rst phase, each one of them is given an endowment 4 and decides on his contribution g, (an integer between 0 and 4) to a public fund. The returns from the funds are then distributed so that, for player i with opponent k, the …rst phase payo¤ is:

$$¼_i = 4 ¡ g_i + 0:75(g_i + g_k)$$

and viceversa for k. Notice that this implies that the money in the fund is multiplied by 1:5 before distribution among the two players occurs. The payo¤ function can also be rewritten as:

$$¼_i = 4 ¡ 0:25g_i + 0:75g_k$$

(and again viceversa for k), which makes it clear that the more you put in the fund, the less you get and the more your opponent gets. Since the public good multiplier (0:75) is higher than $1=N$ ($N = 2$ being the number of "group

members") and lower than 1, we have the usual "dilemma type" situation which characterizes public good games: social e¢ciency requires maximal contribution levels to the public fund, while own payo¤ maximization dictates zero contribution as a dominant strategy and (0; 0) constitutes the unique Nash equilibrium of the game. The game just described determines the "…rst phase results".

In the second phase one player is randomly chosen to be "active", while the other has no more chioces to take. Notice that this randomization takes place after the end of the …rst phase, so that players have equal roles ex ante.

Four possible "situations" compose the second phase: A,B,C,D.

"Partial results" are determined as follows.

In situations A,B,C, they are the sum of the payo¤s resulting from the …rst phase plus the following amounts:

Situation A: active receives 4, inactive receives 4

Situation B: active receives 4, inactive receives 0

Situation C: active receives 4, inactive receives 8

In situation D, instead, "partial results" consist of 10 possible exogenous assignments, independent of …rst phase.

Every choice by the active player is an expense $F \in \{0; 0.5; 1; 1.5; 2; 2.5; 3; 3.5; 4\}$ to modify his opponent payo¤ by 3F or -3F, according to his preferences. For instance, a player who wants to bene…t his opponent may choose to spend 1 (or, say, 2.5) to increase her payo¤ by 3 (7.5); if he wants to hurt her he may spend, say, 0.5 (or, to hurt her more, 2) to decrease her payo¤ by 1.5 (6); also, he may decide not spend anything, choosing $F = 0$ and leaving her una¤ected.

Strategy method is used, so that the active player takes choices for every possible situation and, in A,B,C, for every possible …rst phase contribution by his opponent; in D, for every possible exogenous assignment. See Appendix 1 as an example of a decision sheet (translated form Spanish) used by an active player - whose …rst phase contribution was 2 - to write his second phase strategy and the possible payo¤ consequences (the calculation of all possible "…nal payo¤s" was not mandatory, and players typically made some of them to verify their correctness with the experiment assistant)[1].

After all contingent decisions by the active player have been collected, a random draw determines the actual situation. If it happens to be A,B, or C, then the actual …rst phase decision by the inactive player determines which decision by the active player takes e¤ect. For instance, if the opponent of the player whose choices are represented in Appendix 1 has chosen 3, and the draw selects situation B, then the relevant active player's decision is to spend 1 to increase her payo¤ by 3; as a consequence, the payo¤s distributed are 8.75 for the active and 7.75 for the inactive players. If instead the draw picks situation D, a further random draw determines which one of the ten exogenous assignments is selected. also here the correspondent decision by the active player determines the …nal outcome.

[1] This method provides great advantages in data collection. Whether it a¤ects substiantially behavior is an open question. Brandts and Charness (1998) …nd no e¤ects of this elicitation procedure with respect to the one in which opponents' choice are disclosed before second movers act.

Some aspects of the setup deserve comments. The choice to make only one player be active in the second phase is taken in order to ensure that for every possible payo¤ combination (and related way in which it was achieved) the subject tells us his choice about the …nal payo¤s. If both players were given the possibility to modify the partial payo¤s, we could not observe a choice of a …nal payo¤ combination, and not even a preference for a speci…c one: to assess it, we should know what a player believes his opponent is choosing. A viable way to obtain information from all players about second phase choices would be to ask for them with the condition that after that one player is selected to be active and only his choices are relevant. We preferred not to do so not only to avoid to increase the contingent nature of choices already inherent to the design, but especially to rule out a "coordination" aspect of the game: namely, if both players take increasing choice, they both have a higher expected payo¤ value. In general, we wanted to exclude any belief-related motivation in second phase decisions, in order to make sure that they really correspond to what players' preferences dictate in correspondence to every combination of contribution levels and exogenous giving (in A,B,C situations) or experimenter's assignments (situation D).

Situation D was added as a complement to the others in order to observe choices where reciprocity motivations can unambiguously be ruled out, as here …rst phase contributions do not matter (also recall that opponent's …rst phase choices are not disclosed during the second phase). In particular, choices in situation D when the situation is equal are compared with choices in situation A when contributions are equals; this allows to determine whether equal contributions actually stimulate no reciprocity or, instead, whether it is the absolute level of opponents' contribution which prompts positive or negative feelings. Overall, data from situation D point out the interplay of inequality aversion and e¢ciency motives and allow us to observe how the same subjects change their behavior once reasons to "reciprocate" are removed.

3 Predictions

In this section we derive predictions arising from di¤erent assumptions on players' preferences. Among them, we consider the standard "own-payo¤ maximization" but also inequality aversion, reciprocity and e¢ciency orientation. The fact that such alternative assumptions, which are characterized by di¤erent ways of incorporating opponents' payo¤s into players' utility functions, could help in predicting and interpreting behavior is not only intuitively plausible but also argued to be empirically supported by substantial experimental evidence. This section, therefore, is focused in particular on pointing out the di¤erent consequences each one of these aspects would determine.

3.1 ”Standard”subgame pe

F = 0, which implies spending nothing and leaving the opponent’payo¤ unaltered, for every possible situation and every possible opponent’s contribution. Obviously, a positive F in a possible contingency implies that, in case that contingency is realized, the active player’s payo¤ is lower than in case of choosing F = 0 always. If sel…shness is common knowledge, this way of playing in the second phase implies that both players in the …rst phase (the second phase role yet unknown) contribute zero, as in normal dilemma games. It is in fact easy to see, also with the help of a payo¤ table each player has on his table, that for any contribution choice by the opponent, zero contribution is the best reply in terms of maximizing the …rst phase payo¤, but also the …nal payo¤ following the assumptions on second phase behavior just presented. In particular, a zero contribution by a player, randomly selected to be inactive in the second phase, would not be ”punished”, nor a high contribution would be ”rewarded”.

3.1.1 Inequality aversion

According to the model by Bolton and Ockenfels (BO), for a given level of your payo¤, you are happier the closer it is to the payo¤ average. For t

u_i = ¼ ¡ ®maxf¼ ¡ ¼;0g ¡ ¯maxf¼ ¡ ¼;0g

Notice that ® measures how averse you are to be ”behind”, ¯ to be ”ahead”.

If inequality aversion models are good predictors for this game, we should observe frequent non-zero choices of F when partial results are unequal; active players would multiply by 3 when the opponent is behind, by -3 when he or she is ahead, independently of why this occurs, be it for contribution di¤erentials or situation e¤ects. More speci…cally, increasing the inactive’s payo¤ when lower than the active’s decreases inequality since the active’s payo¤ is lowered: both movements reduce inequality, at least as long as the sign of inequality is not reversed (it is in fact possible in some cases that for some particularly high F a larger, opposite signed inequality level is reached). Decreasing the inactive’s payo¤ when higher than the active’s decreases inequality since the loss for the inactive is 3 times the loss for the active. Again, inequality is reduced for sure as long as the inequality signed is not reversed, while if reversal happens inequality could end up larger.

3.2 Reciprocity

Players who are reciprocity motivated tend to reward (punish) high (low) contributions by their opponents. This is conpatible with the logic of ”intention oriented” models such as Rabin (1993) and Dufwenberg and Kirchsteiger (2002).

The standard proposed here as a de…nition of "high" or "low" contribution level is the comparison with one's own contribution. As argued in the introduction, while in ex ante asymmetric settings second movers might speculate over how they would have acted in …rst movers' shoes, here they can immediately compare their own contribution levels with the di¤erent hypothetical choices by their opponents. It seems therefore natural that a reciprocity oriented player should consider "nicer" than himself an opponent who has contributed more, and "meaner" an opponent who has contributed less, and therefore spend something to increase her payo¤ in the former case, and to decrease it in the latter.

While this informal de…nition of reciprocity does not allow more precision in deriving quantitative predictions, we can conclude that a "categorical imperative" in kantian sense that a reciprocity minded agent should ful…l can be expressed as follows: "never hurt anybody who contributed more than yourself, never help anybody who contributed less than yourself". That is, decreasing a higher contributor's payo¤ and increasing a lower contributor's constitute unambiguous violations of reciprocity imperatives.

3.3 Social welfare and "e¢ciency": normal and "reciprocity augmented"

We present the recent formulation in Charness and Rabin (2002), arguably the clearest example of "e¢ciency minded" preferences.

The idea is simple: besides your own payo¤, you also care about the following social welfare function:

$$W_i(\pi_1;\ldots;\pi_i;\ldots;\pi_N) = \theta \min\{\pi_1;\ldots;\pi_i;\ldots;\pi_N\} + (1-\theta)\sum_j \pi_j$$

The social welfare function for two players gets reduced to the weighted average of the sum of the two results (the e¢ciency component) and the lowest of the two (the Rawlsian component).

A player putting weight ρ_i on this social component maximizes:

$$u_i = (1-\rho_i)\pi_i + \rho_i W_i(\pi_1;\ldots;\pi_i;\ldots;\pi_N)$$

A prediction arising from this model is the absence of any payo¤ reduction activity: if you spend to reduce your opponent's payo¤, both your payo¤ and the social welfare part get lower. What we could observe, instead, are actions of giving, since you spend F to give 3F, so that e¢ciency increases. In particular, giving to the opponent when she is behind in the partial results should be frequent. Of course, to derive clear-cut predictions over the chosen expense quantity one needs to know the exact value of the parameters involved.

In the "reciprocity augmented" version, this model is integrated with an evaluation of how social minded the opponent is, i.e. how big is her own ρ, according to her behavior. In our design, t

t increasing activities towards higher contributors. If positive and negative reciprocity are assumed to be similar in intensity, then the tendency to increase inactive's payo¤s should still be stronger than its opposite.

3.4 Summary of predictions

Inequality aversion: non-negative modi…cations of inactive's payo¤s when lower than active's; non-positive modi…cations of inactive's payo¤s when higher than active's.

Reciprocity: non-negative modi…cations of inactive's payo¤s when his or her contribution was higher than active's; non-positive modi…cations of inactive's payo¤s when his or her contribution was lower than active's.

Social welfare model: no decreasing activity, tendency to increase especially when inactive's payo¤ is lower.

Reciprocity augmented social welfare model: higher intensity of increasing than decreasing activity; decreasing activity limited to lower contributors, tendency to increase especially towards higher contributors.

Notice that we are presenting qualitative, rather than quantitative predictions, in the sense that we are especially interested in the direction of the change of opponent's payo¤. In fact, we will especially focus on those cases where predictions drive in opposite directionsm, with the goal in mind of sorting out the relative strenght of di¤erent motivations.

4 Comparisons

4.0.1 Inequality aversion versus reciprocity

In previous public good games where a second phase was added, it usually happens that reciprocity and inequality aversion push behavior towards the same direction. Namely, as the lowest contributors are the richest, a decision to "punish" actually reduces inequality, as long as the negative e¤ect on the payo¤ of the "punished" is larger than the expense incurred by the "punisher"; rewards favoring the highest contributors also reduce inequality as these players are poorer than their opponents.

In our design, there are in fact decision nodes in which this compatibility occurs, in particular that is always the case in "situation A", where the exogenous assignments following the …rst phase are equal (4 to each player) and therefore if a player is richer (poorer) than his opponent his contribution was lower (higher). In these circumstances it is not possible to determine which tendency is stronger, between inequality aversion and reciprocity, in case behavior deviates (as typically does) from standard "sel…shness" assumptions. Situations B and C were therefore devised in order to "impose" the sign of inequality: in situation B, the active player's payo¤ is always at least as high as the inactive's, viceversa in situation C.

A simple way to analyse whether inequality aversion matters is to observe whether behavior changes across the three situation in front of the same choice by the opponent. For instance, if the choice by both players is the same, does is stimulate the same reaction in situations A, B and C? Does this hold for a given choice, say 2? Or for contributions one unit lower, or one unit higher? If

so, we could conclude that payo¤ di¤erentials exogenously determined do not matter, and the response to a given choice is purely "reciprocal".

also, using reciprocity in the way we de…ned it, in which the standard of comparison used by active players to evaluate opponents' contribution is precisely their own contribution, we are going to focus in particular on the following decision nodes, where unlike in the previous examples in the literature the directions in which reciprocity and inequality aversion recommend to modify opponents' payo¤s are opposite.

Inactive player's payo¤ is lower despite the fact that her contribution was lower. This can happen only in situation B. In particular, decreasing her payo¤ is incompatible with inequality aversion but compatible with reciprocity; viceversa, increasing her payo¤ is compatible with inequality aversion but incompatible with reciprocity.

Inactive player's payo¤ is higher despite the fact that her contribution was higher. This can happen only in situation C. In particular, decreasing her payo¤ is compatible with inequality aversion but incompatible with reciprocity; viceversa, increasing her payo¤ is incompatible with inequality aversion but compatible with reciprocity.

4.0.2 Inequality aversion versus e¢ciency

As already argued, if a "drive to e¢ciency" motive exists, it should foster helping behavior in the second phase of the game, which increases the total size of the "pie" as the bene…t for the inactive player is three times as large as the sacri…ce by the active, and prevent hurting behavior, which obviously reduce the total "pie" as both players' payo¤ is lowered. Of course in our design there are circumstances where e¢ciency interact with both other rendencies we are considering, inequality aversion and reciprocity. With the goal in mind to compare the relative strenght of equality and e¢ciency as attractive concepts in players' mind, we want to focus on decision nodes where reciprocity motives are not prompted.

We are going to observe behavior in situation A, with particular focus on choices towards equal contributors, i.e. agents who put the same contribution level in the …rst phase. If e¢ciency motives are at work, prevalence of increasing activity should emerge, while equality motives reinforce 0 as the best choice (which of course also coincide with the "sel…sh" choice). The rationale for this observation is straightforward, based on the assumption that equal contribution should not stimulate nice nor bad feelings. A natural objection to this approach could be that high contributions could prompt rewarding behavior also by players who had taken the same choice, and a the opposite for low contributions. This possibility is actually controlled for in situation D, where …rst phase behavior does not enter into the determination of "partial payo¤s" and therefore reciprocity motives are absent by de…nition (recall that the opponent's choice is not disclosed).

In situation D, we are going to observe whether behavior when exogenous assignments are equal (both 10 and both 8) is signi…cantly payo¤-increasing;

the alternative hypothesis, zero choices, is compatible with inequality aversion, although also with sel…shness, as pointed out above. An obvious way to sort out the two possible reasons to choose zero is observing what happens in the other choices in situation D, where exogenous assignments are unequal. There, decreasing when behind and increasing when ahead in exogenous assignment is of course incompatible with pure sel…shness, while it is consistent with inequality aversion. Therefore, this kind of behavior would preclude a "pure sel…shness" explanation as justi…cation for zero choices in equal assignments in situation D, and after equal contributions in situation A.

5 Results

In this section we are going to present the aspects in our data that we are interested in. The organization of "group of results" is left for a following section, where interpretations are proposed in terms of the behavioral tendencies we are investigating. As the reader will notice, in many cases data are arranged into "results" in a qualitative, rather than quantitative fashion. This choice is due to the fact that in those cases we are interested especially in whether a certain choice, such as increasing or decreasing the potential payo¤ of the opponent) is taken or not, rather than in its "intensity". In other words, in this work we want to …nd out how many people share a given tendency leaving aside the - albeit important - question of how much this tendency a¤ects their choices. We call M the modi…cation of opponent's payo¤s chose by the active players, and $\overline{M}$ its average.

5.1 Situation A

Result A1: average choices towards lower contributors are always strictly negative (i.e. decreasing), with the only exception of 4-contributors choice towards 3-contributors. On the other hand, averages towards higher contributors are always strictly positive, with the exception of 0-contributors towards 1-contributors (all choices were 0).

——Figure A1 about here ——-

Result A2: equal contributions prompt zero choices. This is con…rmed both by a two-tailed test, with the use of normality assumption as the population exceed 30 (all 32 active players had such a decision node), where we cannot reject the null hypothesis that $\overline{M} = 0$ at any conventional signi…cance levels, and by a binomial test. In fact, 25 players chose zero, 4 positive and 3 negative; the hypothesis that players take non-zero choices with 50% probability is rejected at 0.01 level of signi…cance.

——Figure A2 about here ——-

Result A3: contribution one unit lower increased negative responses (with respect to the equal contribution case) to 10, which indicates a probability of positive choices signi…cantly higher than 3 at 5% level of signi…cance; 2 choices were positive, 14 zero.

Result A4: contribution one unit higher increased positive responses (with respect to the equal contribution case) to 8 (1 choice was negative, 21 zeros). If we compare with the equal distrituiton case removing the choices taken by 4-contributors (as they are not represented here), we …nd that in that case only 2 players took positive decision. Then, using again binomial distribution tables, we can conclude that the probability that one unit higher contribution stimulates positive responses is higher than in the equal contribution case at 5% level of signi…cance.

Result A5: 7 players chose an "all zero" schedule; all the others 25 took at least one positive choice towards higher contributors and/or at least one negative choice towards lower contributors; 1 also took a negative choice towards a higher contributor, and 1 also took a positive choice towards a lower contributor. If we take a binomial test over players type, the frequency of "punishing lower and/or rewarding higher", 23, is signi…cantly higher than the frequency of other types, 9 at 1% signi…cance level (z=2.42).

Result A6: towards lower contributors, 17 players took at least one negative and no positive choices, 1 took at least one negative, 1 both, and 7 took only zero choices.

Result A7: towards higher contributors, 17 chose always zero, 12 at least one positive and no negative, 1 at least one negative, no positive choices.

Result A8: if we compare choices towards who contributed 1 unit more and towards who contributed 1 unit less (of course we need to exclude the 8 active players who had contributed 0 or 4), we …nd that 12 players spent more to punish the higher contributor than to reward the lower, and 5 players spent more to reward than to punish; if we take a paired sample sign test, we …nd that the former behavior is more frequent than the latter at 5% signi…cance level.

Result A9: towards 2 contributors, modi…cations by higher contributors were less favorable than the ones by lower contributors, at 5% level of signi…cance according to a Mann-Whitney test.

5.2 Situation B

Result B1: all averages are positive except for choices by 4-contributors towards 1-contributors (zero) and 0-contributors (negative) and by 1-contributors towards 0-contibutors (negative).

——Figure B1 about here ——-

Result B2: In case of equal choice, 11 chose to help, 3 to hurt and 18 zero. The hypothesis of 50% probability of non-zero choices cannot be rejected at any conventional levels; the 50% probability of positive choice is actually rejected at 5%. Conditioning on non-zero choices, positive choices are signi…cantly more frequent than negative ones at 5% level of signi…cance.

——Figure B2 about here ——-

Result B3: towards lower contributors, 9 players chose to help at least once, never to hurt, 6 viceversa, 10 all zero and 1 at least one positive and at least one negative.

——Figure B3 and B4 about here ——-

Result B4: towards one unit lower contributors, 10 took positive choices, 3 negative, 13 zero. The probability 50% of positive choices cannot be rejected. Conditioning on non-zero choices, the probability of a positive choice is higher than the probability of a negative one at 5% level of signi…cance.

5.3 Situation C

Result C1: all averages are negative except for positive values towards 4-contributors by 1 and 4-contributors.

——Figure C1 about here ——-

Result C2: towards equal contributors, 2 chose to help, 12 to hurt, 18 zero. The hypothesis of 50% probability of non-zero choice cannot be rejected at any conventional signi…cance level, and the same holds for the probability of strictly negative choices. Conditioning on non-zero choices, negative choices are signi…cantly more frequent than positive at 5% level of signi…cance.

——Figure C2 about here ——-

Result C3: towards higher contributors, 5 chose to help at least once, and never to hurt, 9 viceversa, 14 zero and 1 both.

——Figure C3 and C4 about here ——-

Result C4: towards one unit higher contributors, 3 took positive, 11 negative and 16 zero choices. The probability 50% of negative choices cannot be rejected. Conditioning on non-zero choices, the probability of a negative choice is higher than the probability of a positive one at 5% level of signi…cance.

5.4 Cross-situational results

Result AB1: choices towards equal contributors are signi…cantly more helpful in situation B than in A. In particular, the frequency of helpful choices is higher in B at 5% level of signi…cance.

Result AB2: the probability of a positive choice towards a one-unit lower contributor is higher in B than in A at 5% level of signi…cance.

Result AC1: choices towards equal contributors are signi…cantly more hurtful in situation B than in A. In particular, the frequency of hurtful choices is higher in B at 5% level of signi…cance.

Result AC2: the probability of a negative choice towards a one-unit higher contributor is higher in C than in A at 1% level of signi…cance.

Result BC1: 18 players chose either to help lower contributors in B or to hurt higher contributors in C or both; 11 chose either to hurt lower contributors in B or to help higher contributors in C or both; 11 displayed only the former kind of choice, 4 only the latter and 7 both. The probability of the former ”player type” is found to be higher than the probability of the latter at 5% level of signi…cance.

——Figure BC1 about here ——-

5.5 Situation D

Result D1: equality in partial payo¤s prompts zero modi…cations; 28 out of 32 players chose zero both in (10:10) and in (8:8) exogenous assignments. The choice of zero is found to be more frequent than 50% at 1% level of signi…cance.

Result D2: inequality prompts choices which typically reduce it. In particular, averages are positive when the opponent' partial payo¤ is lower, and negative when it is higher, in all cases with at least 5% level of signi…cance. In absolute terms, the negative modi…cations for a given level of assignment for the active player and a given level of inequailty are always bigger than the correspondent positive modi…cation. For instance, the negative modi…cation for the assignment (10:12) is larger in average than the positive modi…cation for (10:8).

——Figure D1 about here ——–

Result D2: one quarter (8/32) of players choose an all-zero schedule; 7 players never hurt and 6 players never help; 11 do both things at least once for each.

——Figure D2 about here ——–

Result D3: the frequency of players choosing an "all-zero" schedule is lower than 50% at 1% level of signi…cance.

Result D4: the frequency of players choosing a schedule including at least one positve and no negative choices is lower than 50% at 1% level of signi…cance.

6 Proposed interpretation of the results

6.1 Non-sel…sh preferences

The overall picture from situation A constitute a replication of the tendency found in previous papers where a reward/punishment phase is added to a standard public good game: there is a substantial demand for modi…cation of opponents' payo¤s when contribution levels - and therefore "partial results" - are di¤erent. In particular result A3 indicate that only 7 out of 32 players choose the "all zero" schedule which maximizes their expected payo¤, and among the others the vast majority (25) takes at least one decision in the direction which is consistent both with inequality aversion and with reciprocity.

Evidence from situation D shows that even removing the e¤ects of the …rst phase and, especially, the possibility to condition decisions on opponent's contributions substantial "inequality reducing" activity is displayed by active players. These results - also to be used later - reinforce the observation that most players behave in a way which is not compatible with predictions arising from standard assumptions.

6.2 Inequality aversion versus e¢ciency orientation

In order to observe whether e¢ciency matters in players' behavior, in particular when put in contrast with equality, we need to see whether or not increasing

activity is substantially more frequent than decreasing, especially in those circumstances where reciprocity motives are assumed to be absent. That happens, according to the simple reciprocity concept we are using here, when the two contribution levels are the same. In that case, result A1 tells us that players typically choose not to modify opponents' payo¤s. That indicates that e¢ciency does not drive behavior and players would only spend when inequality aversion and/or reciprocity motives are stimulated.

However, this reciprocity concept may be debatable; in particular, high contributions could stimulate nice feelings per se, and low contribution desire to hurt even by equally low contributors. Anecdotical evidence by 4-contributors suggests such a thing; however, that is not the case for 3-contributors where an average choice by seven players was negative. In order to have more conclusive data on what happens in - less debatable - absence of reciprocity motives we refer to results from situation D. There we …nd that equal assignments stimulate no expense (result D0); moreover, average reductions of opponents' payo¤s are, in absolute value, bigger than increases in the correspondent payo¤ di¤erences.

Finally, if we take as observations single players, we …nd (D2, D3, D4) that only a minority take only e¢ciency oriented decisions, i.e. present at least one and no negative choices, while most players do display a tendency to "correct" inequality.

Overall, we …nd that e¢ciency considerations did not play any role in players' behavior, which makes it easier to focus on the next conparison.

6.3 Inequality aversion versus reciprocity

Results A1, B1 and C1, and the related cross-situational AB1 and AC1, show that equal contributors are treated di¤erently in the three situations, in particular it appears that active players tend to dislike unfavorable inequality. Similar tendencies appear in behavior towards "one-unit lower" and "one-unit higher" contributors. This, together with the already mentioned evidence from situation D, indicates that inequality aversion do matter.

Perhaps more interesting is what we …nd when this motive is put in contrast with reciprocity. Result B2 tells us that there are more players who behave towards poorer lower contributors in the way recommended by inequality aversion (i.e. helping them) than in the way prompted by negative reciprocity (i.e. hurting them). Result C2 tells that that inequality aversion also drives more players than positive reciprocity, when opponents are richer higher contributors. When we take the overall B&C schedule, we …nd that 11 players are inequality averse and 3 reciprocity oriented[2] when we observe the overall circustances described (behavior towards poorer lower contributors and towards richer higher contributors), while 6 took at least one choice in both directions.

[2] They become 4 if we also take into account a hurtful choice by a 4-contributor towards a 0-contributor in situation B. However, in that circumstance the 0-contributor was not poorer, but had an equal partial payo¤. This equality was broken by the hurtful choice. Increasing to 4 the "reciprocity oriented" does not destroy the 5% level of signi…cance of the binomial comparison.

Data indicate that inequality averse players were more frequent than reciprocity oriented. We should point out that - unlike in the case for e¢ciency - this comparison does not indicate the absence of reciprocity motives. 10 out of 32 players (see the previous footnote), in fact, took at least one decision that can only be explained by reciprocity motives. The case for inequality aversion is stronger, as a slight majority (17 out of 32) players took at least one choice that can only be explained by inequality aversion, and as the frequency of inequality averse and not reciprocity oriented players is signi…cantly higher than the frequency of reciprocity oriented and not inequality averse.

7 Conclusions

Our experimental design provides a test for robustness of inequality aversion as a drive for human behavior in a two-person game. In fact, the design is made in a way which potentially allows to discover not only egalitarian tendencies, but also the drive for "e¢ciency", in terms of total payo¤ or "social surplus" arising from possible choices, and reciprocity, called upon in -we argue - a natural way, such as the comparison between one's own and one's opponent contribution choices.

The potential "social surplus" can be easily perceived by observing that for every payo¤ unit spent to "help" your opponent, she receives three times as much. The proportion by which you can "hurt" your opponent is the same, but in such a case both players lose, albeit the opponent's loss is three times larger. It is therefore evident the "wasteful" nature of hurting decisions, and the "social payo¤ augmenting" nature of helping choices.

Our results clearly speak against any e¤ects of e¢ciency considerations, in decisions where these present a trade-o¤ with respect to equality. in this aspect they con…rm evidence found, among the others, in Gueth et al. (forthcoming), but contradict results found in Charness and Rabin (2001) and Bolle and Kritikos (2002). A main feature which distinguish their experimental designs and the one presented here is the binary choice the former present to subjects. For instance, most subjects in Charness and Rabin's article prefer (400,700) (own payo¤ …rst) to (400,400). Here subjects are presented with a number of possible payo¤ combinations and each one of them have various possibilities. A possible e¤ect of this di¤erence could be a status quo bias, in the sense that one possibility is presented as the temporary one that a subject could modify. However, the main di¤ernces in results, in terms of the direction of the change, cannot be explained in terms of status quo bias, which would simply make agents less inclined to a¤ect opponents' payo¤s.

The other main result highlights the robustness of inequality aversion as a social phenomenon. We …nd that a substantial number of subjects are willing to take inequality reducing decisions even if these move against what reciprocity would suggest, once we take a natural standard of evaluating the kindness of one's peers: the comparison between their with one's own behavior. However, our results also indicate that reciprocity, both negative and positive, do play

a role in driving average population behavior. As a matter of fact we do …nd instances, although less frequent, of choices which increase inequality in order to reward (punish) nicer (meaner) agents. Our results in terms of comparative e¤ects of inequality aversion and reciprocity are more in line with respect to what is found in Bolton et al. (2000) than in Falk et al. (2000). However, in common with the latter we …nd that both aspects matter, although here we …nd a clear dominance of equality principles; therefore our results can be seen as a less extreme evidence with respect to the one in Bolton et al. where, in fact, reciprocity aspects were found to be inexistent.

Summing up, results in a game where subjects play in ex ante symmetric roles highlight inequality aversion is a robust ph

w clari…cations but at the same time call for further investigation. In our view, future research should shed more light on which reference group is taken by individuals sharing particular behavioral motives, such as inequality aversion, and then on how incentive and control schemes a¤ect the evolution of cooperation in groups, once results of studies on individual preferences get consolidated.

8 Bibliography

Abbink, K., Irlenbusch, B. and Renner, E. (2000): "The Moonlighting Game - An Experimental Study on Reciprocity and Retribution" Journal of Economic Behavior and Organization, 42, 265-277, 2000

Andreoni, J., Harbaugh, W. and Vesterlund, L. (2002): "The Carrot and the Stick: Rewards, Punishments and Cooperation", ???

Bolle, F., and Kritikos, A. (2001): "Distributional Concerns: Equity or E¢-ciency Oriented?" Economics Letters 73, 333-338 (2001)

Bolton, G.E., Brandts, J. and Ockenfels, A. (2000): "Measuring Motivations for the Reciprocal Responses Observed in a Simple Dilemma Game", Experimental Economics 3, 207-221

Bolton, G.E., and Ockenfels, A. (2000): "A Theory of Equity, Reciprocity and Competition", American Economic Review 100, 166-193

Brandts, J. and Charness, G. (2000): "Hot and Cold Decisions and Reciprocity in Experiments with Sequential Games", Experimental Economics, 2, 3, 2000, 227-238

Charness, G. and Rabin, M. (2002): "Understanding Social Preferences with Simple Tests", Quarterly Journal of Economics, 117, 817-869

Dufwenberg, M. and Kirchsteiger, G. (1998): "A Theory of Sequential Reciprocity " CentER Discussion paper No. 9837

Falk, A., Fehr, E. and Fischbacher, U. (2000): "Testing Theories of Fairness - Intentions Matter", Working Paper No. 63, University of Zurich

Fehr, E. and Gaechter, S. (2000): "Cooperation and Punishment in Public Goods Experiments", American Economic Review, 90, 4, p. 980-994

Fehr, E. and Schmidt, K.M. (1999): "A Theory of Fairness, Competition and Cooperation", Quartely Journal of Economics 114, 817-868

Güth, W., Kliemt, H. and Ockenfels, A. (2003): "Fairness versus E¢ciency: An Experimental Study of (Mutual) Gift Giving", Journal of Economic Behavior and Organization, forthcoming

O¤erman, T., (2002): 'Hurting Hurts More Than Helping Helps', European Economic Review 46, 1423-1437

Rabin, M. (1993): "Incorporating Fairness into Game Theory and Economics", American Economic Review, 83(5), 1281-1302

Sefton, M., Shupp, R. and Walker, J. (2002): "The E¤ect of Rewards and Sanctions in Provision of Public Goods", CEDEX Research Paper