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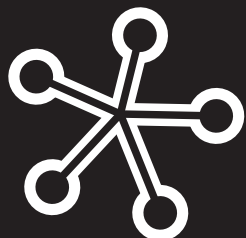
Solidarity in the 21<sup>st</sup> century

POPULATION AGEING, IMMIGRATION AND SOLIDARITY

# Conditions and motives for voluntary sharing

## Results of a solidarity game experiment

*Paul de Beer and Maarten Berg*



Working Paper 124

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# Conditions and motives for voluntary sharing

## Results of a solidarity game experiment

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**WP 124**



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## On the series ‘Solidarity in the 21<sup>st</sup> Century’

The research programme ‘Solidarity in the 21<sup>st</sup> Century’ of the Amsterdam Institute for Advanced Labour Studies focuses on the effects of changes in the composition of the population due to immigration and ageing on the public support for social solidarity. It is often claimed that increasing diversity of the population erodes solidarity, because people do not recognize other people who differ in some important characteristics from themselves, as members of their own community. However, there are only few studies that have attempted to test directly the relationship between diversity and solidarity.

This research program aims to analyse the effects of the changing composition of populations on both informal and formal solidarity. It examines which motives, conditions and circumstances are beneficial or detrimental for sustaining solidarity within and between different groups in society. The apparent discrepancies between immigrants and natives on the one hand, and the elderly and the young on the other hand, may seriously affect the willingness of citizens to support or help fellow citizens who belong to a different ethnic group or age category. Members of various groups may find it difficult to relate to each other, and fears that one group will benefit unequally from the other may grow.

By combining different research methods – qualitative case studies, statistical analyses of large scale surveys, laboratory experiments, media content analysis – this research project investigates the different conditions and motives for solidarity. The focus of the research is on solidarity between immigrants and natives, and between the elderly and the young. Solidarity is defined broadly as any act that purposefully benefits another person at a cost for the agent, without any guarantee of an equivalent return. Some examples of solidarity are alms-giving to a beggar, helping your neighbour, voluntary community work, donating money to a charity organization, paying an insurance premium and paying taxes.

The research programme ‘Solidarity in the 21<sup>st</sup> Century’ includes statistical analyses of cross-country surveys, qualitative field studies in several neighbourhoods that differ in composition, laboratory experiments of a solidarity game and a content analysis of the representation of different groups (old, young, allochthones) in mass media. The (provisional) results of most of these studies will be published in the AIAS Working Paper series.

The research programme is made possible by a grant from *Stichting Instituut Gak*.

For further information on the research programme ‘Solidarity in the 21<sup>st</sup> Century’ see the programme’s website [www.solidariteit.info](http://www.solidariteit.info).





# Abstract

This paper studies experimentally the conditions and motives for voluntary solidarity, following a game theoretical approach. The ‘solidarity game’ that is used in this study consists of groups of four players and is based on the solidarity game of Selten and Ockenfels (1998). In each group, two winners, which are either randomly selected or on the basis of their performance on a quiz, distribute 20 credits each (reflecting real money). We tested four hypotheses regarding the effect of various conditions on voluntary sharing, related to the motives for solidary behaviour, viz. self-interest, fairness, neediness and meritocracy. For most of our hypotheses the experiments provided support, although there are a few exceptions.

Players share more with others in the first round of the four shots game than in the one shot game, but their gifts decrease quickly as the game progresses, which confirms that they act largely out of self-interest. Players give more to a player from whom they have received money in the previous rounds (fairness, resulting in direct reciprocity). However, players do not give more to co-players who have been generous to others in the previous round, which would have been proof of indirect reciprocity. Players do not give more to a loser than to a winner in the current round, and, consequently, do not equalize the differences in revenue. However, they give more to players who have received relatively little in previous rounds, which suggests that neediness of the potential beneficiary is also a motive. Finally, winners give more in the random based conditions, when they do not really ‘deserve’ to be a winner, than in the performance based conditions, which offers support for the meritocracy hypothesis.

The motives that the subjects expressed themselves for their sharing behaviour in answering some post-hoc questions, mirrors their actual behaviour pretty well. Additionally, we also analyse the effect of some personal characteristics, and the party preferences and media use of the players.



# 1. Introduction

Voluntary solidarity and sharing behaviour are necessary elements of viable, well-functioning societies. Although voluntary solidarity exists in all known societies, it has been a theoretical puzzle for mainstream (neo-classical) economics, in which the rational self-interested *homo economicus* is one of the most fundamental assumptions. In the real world, human behaviour seems to be a mix of both self-interested and altruistic acts. In this paper, we study experimentally the conditions under which people are willing to voluntarily share money with people with whom they have played a game.

## 1.1. Game theory, a short overview

The current paper is embedded in the so-called game theory, the discipline of interactive decision theory (Aumann, 1987). A ‘game’ refers to a human interaction that is guided by certain rules that are known by the ‘players’. The players know how their decisions, the decisions of others and, sometimes, chance determines the outcome of the game. The interactive element of game theory implies a theoretical focus on cooperation and/or conflict. This can be seen, for example, in the famous prisoner’s dilemma (Poundstone, 1992) that showed that two people might not cooperate, even though it would be in the interest of both to do so.

Game theory has been used as a way of describing and modelling actual human behaviour in real populations. This approach has been increasingly subject to criticism, as the underlying ‘homo economicus perspective’ has come more and more under attack (e.g. Simon, 1947; Sen, 1977; Kahneman and Tversky, 1979; Frey, 1997; Sunstein and Thaler, 2008). Human behaviour appears to be not only motivated by maximizing individual returns (as is assumed by many of the earlier game theorists), but also by altruistic, other-regarding motives (e.g. Andreoni, 1989; Rabin, 1993; Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000). Recent research therefore focuses both on self-interest and on voluntary sharing and the conditions under which they are prevalent (Smith, 1989; Camerer, 1999). This marks a shift from theoretical game theory to an experimental approach of real human behaviour.

### The ultimatum game

The distinction between theory and empirics can be clearly seen in the example of the famous ultimatum game (Güth, Schmittberger and Schwarze, 1982). In this game, two players interact to decide how to divide a sum of money that is given to them. The first player proposes a division of the sum between the

two players, and the second player can either accept or reject this proposal. If the second player rejects, neither player receives anything. If the second player accepts, the money is split according to the proposal. The game is played only once, so that reciprocation cannot affect the decision of either player.

Theoretically, we would expect the receiver to accept any positive offer. Because the proposer knows that the receiver is better off with any positive offer than with nothing, s/he can safely offer the smallest possible offer (with no fear of rejection) and thereby maximize his/her own individual profit in the game. Results from actual ultimate game experiments, however, show that most proposers choose to offer more than the minimum amount possible and that receivers often reject offers of less than 20% of the total sum of money (e.g. Henrich et al., 2004; Oosterbeek, Sloof and Van de Kuilen, 2004). Results from the ultimatum game are, unfortunately, difficult to interpret in terms of solidarity. We do not know if (more than minimal) sharing behaviour is motivated by genuine altruism or by strategic and selfish considerations of the proposer. Proposers might be afraid that a low offer angers the receivers and will be rejected.

## The dictator game

It is easier to interpret the experimental outcomes of the so-called ‘dictator game’ (e.g. Camerer and Colin, 2003). In the dictator game, the first player, the dictator or proposer, determines the division (split) of some endowment (such as a cash prize). The second player, the responder, simply receives the amount that is left by the proposer. The responder’s role is entirely passive and can in no way influence the outcome of the game.<sup>1</sup> Following a standard economic approach, we would expect that dictators would not share any money. Experimental results, however, show that many dictators offer substantial amounts (e.g. Bolton, Katok and Zwick, 1998). Although it can be questioned to which extent the gifts in the dictator game are truly voluntary (e.g. Hoffman et al., 1994; Haley and Fessler, 2005), these gifts are more easily explained in terms of solidarity than in the ultimatum game. The dictator game does, however, not inform us about the conditions and motives for sharing money with others.

## The solidarity game

The solidarity game, introduced by Selten and Ockenfels (1998), is more complex than the dictator game, but similar with respect to the aspect of voluntary sharing. In this game, in which three players partake, each player has a 2/3 chance of winning 10 Deutsch Mark (about 5 euro) and a 1/3 chance of winning nothing. As the outcomes for each player are independent, there are four possible outcomes to the game,

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<sup>1</sup> Consequently, the dictator game is not formally a proper game, as the term is used in game theory, since there is no interaction between the players.

viz. no winner, one winner, two winners and three winners. Each player has to state in advance how much (if anything) he is willing to share if he is the only winner and how much (if anything) he is willing to share if he is one of two winners. In the case of zero or three winners, the game stops. Defying the assumption of pure self-interest, the great majority of subjects are willing to make substantial (conditional) gifts. The variation in gifts, however, makes it difficult to interpret the results in a straightforward way. A lot of additional research is required to analyse the conditions of voluntary sharing.

## The current solidarity game

We conducted a laboratory experiment, which we call a solidarity game, too, which is a variant of the original solidarity game. This game allows us to study four types of conditions (mentioned below) which may affect voluntary solidarity. Our solidarity game is in several respects an extension of the Selten and Ockenfels game. First, the groups consist of four players rather than three, and there are always two winners and two losers. This enables us to study solidarity both from an intergroup perspective (solidarity between winners and losers) and an intragroup perspective (solidarity among winners). The behaviour of a winner cannot only be influenced by his/her own norms and by his/her perception of the losers, but also by the behaviour of the other winner. Secondly, the dictator role was not always randomly assigned, but in half of the experimental conditions the two players who performed the best on a general knowledge quiz were appointed as winners. This quiz functions as a way to model the role of performance (related to intelligence and earning capacity) in the real world. Thirdly, in half of the conditions, the game was played for four consecutive rounds (with the same players) rather than one. In this way, it can be tested whether recurrent interactions, as are common in the ‘real’ world, result in other behaviour than a once-only encounter.

## 1.2. Main research question and hypotheses

As mentioned above, this experiment was designed to study the conditions under which people are inclined to voluntarily share money with other individuals or to keep it to themselves. Several theories, perspectives and studies address this topic. In this section we very briefly discuss a few of these and formulate the hypotheses that we can test with our specific experiment.

First, according to the ‘homo economicus perspective’, which is dominant in mainstream economics, people are rational and narrowly self-interested actors who have the ability to make judgments to forward their subjectively defined ends (e.g. Rutström and Williams, 2000). Even rational self-interested individuals,

however, will sometimes be prepared to share, if they expect to be better off by sharing. This is the case when risks are spread, when voluntary sharing is an investment in greater (expected) future returns or when people expect to be praised for their behaviour.

Secondly, people may act on the basis of motives of fairness, which are determined by social values regarding a just society. Thus, people may prefer equal outcomes above unequal outcomes (e.g. Bolton and Ockenfels, 2000). Moreover, they may want to thank other people who have shared money with them in the past, by reciprocating their earlier gift (Trivers, 1971).

Thirdly, people may care about or be affected by the well-being of other persons. They may feel better themselves if others fare well. Consequently, they may be willing to share money with other people who are in need. This motive comes closest to what is usually called altruism (Batson, 2011).

Fourthly, it might be relevant whether contributors feel that they deserve their privileged position because they have earned it themselves (e.g. Chavanne, McCabe and Paganelli, 2009). As a consequence, they will share a larger part of their endowment with other people if it is the result of chance instead of their own good performance.

Lastly, sharing might be intrinsically rewarding, resulting in a ‘warm glow’ (Andreoni, 1990). In this case, people are willing to share with others, irrespective of the specific conditions.

This very brief overview shows, that people can have quite diverging motives for sharing money with other people. Therefore, our main research question is:

*Under which conditions and to what extent are people willing to act solidary by sharing money with other people?*

Based on the five perspectives on solidary behaviour, we can formulate four hypotheses on voluntary sharing behaviour that we will test in our experiment.

Our first hypothesis is that solidarity is based on *forward looking reciprocity* and, hence, may be explained by *self-interested motives*. In the four shots conditions self-interested people may share with others, expecting them to return this gift in later rounds. This may be explained by the fact that people are risk averse and, not knowing how well they will score in the next rounds of the game, want to minimize the risk that they will earn nothing in the remainder of the game. By sharing some of their current profit, they hope to reduce their risk in the next rounds, by eliciting reciprocity from their co-players. This prediction is in line with the work on the so-called ‘tit for tat strategy’ (e.g. Axelrod, 1984).

According to this hypothesis the players will, on average, share more in the four shots game than in the one shot game. However, we also hypothesize that this effect will be smaller as the end of the relationship draws near. Thus, we expect less sharing as the game progresses, especially in the last round (the so-called ‘end effect’).

Our second hypothesis is that the motive of fairness results in *backward looking reciprocity*. Players who give more to others in the current round, will receive more from others in the following rounds. We can distinguish here between direct and indirect reciprocity. *Direct reciprocity* means that a player will tend to give more to a player from whom s/he has received more in the previous round(s).

*Indirect or generalized reciprocity* means that the more a player shares with his/her co-players, the more s/he will receive from others in the following rounds, even if these players were non-beneficiaries in previous rounds.

Our third hypothesis is that people tend to help other people who are *in need*. This might either imply that they are inclined to allocate credits to the losers in this round, who do not earn any money, or to those players who earned relatively little in earlier rounds.

Our fourth hypothesis deals with deservingness and meritocracy. Following the logic of Chavanne, McCabe and Paganelli (2009), we hypothesize that subjects act more solidary if the assignment of the winner is random instead of performance based. When people know they did not earn their favourable position, they will have a greater concern for fairness in the sense of equal outcomes. Thus, we expect larger gifts in the random based conditions than in the performance based conditions. We also expect that players will keep more credits to themselves as their score on the quiz is better, because they feel they deserve it. This can be called a meritocratic motive.

To summarize, we will test the following hypotheses regarding the motives for solidary behaviour.

Hypothesis 1: self-interest, resulting in forward looking reciprocity.

- a) Players will give more in the four shots game than in the one shot game.
- b) In the four shots game, players will give less as the game progresses, especially in the last round.

Hypothesis 2: fairness, resulting in backward looking reciprocity.

- a) Players will give more to a player from whom they have received more in the previous round(s) (direct reciprocity).
- b) Players will give more to a player who has given more to others in the previous round(s) (indirect or generalized reciprocity).

Hypothesis 3: neediness, resulting in equalizing behaviour.

- a) Players give more to the losers in this round than to the (other) winner.
- b) Players give more to players who earned relatively little in earlier rounds.

Hypothesis 4: deservingness, resulting in meritocratic behaviour.

- a) Players will give more in the random based conditions than in the performance based conditions.
- b) The higher players score on the quiz, the less they give to other players.

We do not consider these hypotheses as mutually exclusive motives for solidarity. It is possible that subjects are motivated by various reasons at the same time. Nevertheless, some motives do not easily go hand in hand, such as giving to losers (Hypothesis 3) and rewarding one's own performance (Hypothesis 4).



## 2. Method

### 2.1. Participants

For this study university students were used as participants. 156 students of the University of Amsterdam participated, of whom 153 were below 30 years old (mean = 22.3 years). More men (n=94) than women (n=64) participated. Most students were natives (n=115), there was a minority of students from non-Western (n=32) and Western (n=9) foreign origin.

All participants received 7 euros as a show-up fee. On top of that, each group of four players earned 40 euros. The average player earned 17 euros (including the show-up fee), but actual earnings varied between players and depended on performance, chance and/or the sharing behaviour of the group members.

### 2.2. Procedure

The subjects assembled in a waiting room of the Center for Research in Experimental Economics and Political Decision Making (CREED) at the University of Amsterdam in groups with a maximum of 24 persons. They were instructed in the waiting room to be silent after entering the experimental room and not to communicate with other participants. The experimental room consisted of 24 separated cabins. Each cabin contained a computer, and also a pen and paper to make notes. Subjects were assigned randomly to a cabin by drawing a card. Groups of four players were created randomly by the experimenters. The subjects did not know with whom they were interacting during the experiment. After entering the experimental room and sitting behind their own computer, subjects received further instructions on the computer screen.

In the first phase of the game, the subjects were told that they would participate in a general knowledge quiz (about history, science, music, sports, etc.), consisting of ten multiple (four) choice questions.

In the second phase, subjects had to indicate how many correct answers (0-10) they expected to have. They were also asked to estimate the average number of correct answers of their three fellow players.

In the third phase, subjects had to indicate how much they would be willing to share of 20 credits if they would be one of the two winners, not yet knowing their scores on the quiz. In total, 40 credits could be shared, 20 credits by each winner. The subjects were told that any distribution was allowed. They could keep all 20 credits themselves, give everything away, discriminate between the other players or treat the other

players equally. They were also told that the credits reflected real money, and that they would receive the money as it was distributed immediately after the experiment.

In the fourth phase, the results of the quiz were made public. They were also told whether or not they belonged to the two winners.

In the fifth phase, only the two winners had to indicate, for the second time, how they would like to distribute the 20 credits. They were allowed to choose the same distribution as in phase 3 or to make a different choice. The two losers did not have to do anything in this phase.

In the sixth phase, it was randomly decided by the computer which distributions, either those of phase 3 or those of phase 5, would be executed. The total distribution of credits was calculated, adding up the relevant distributions of the two winners. Each player was informed about his/her earnings and about the players who had allotted these earnings.

With respect to the procedure to appoint the winners of the game in phase four, there were two different conditions. In the performance based conditions (approximately half of the games) the appointment of the two winners was based on the scores on the quiz. In the case of equal scores, the winners were chosen by lot. In the random based conditions, the winners were determined by lot, independent of their scores on the quiz. Thus, in this condition, the winners were not selected by performance, but purely at random. The players were informed about this procedure only in phase four.

In some conditions, the game consisted of four rounds or shots rather than one shot. In the case of four rounds, the same six phases were repeated three times, although instructions were only given in the first round. The winners could be either the same or different in each round. Consequently, each player could win zero, one, two, three or four rounds.

After the experiment itself, subjects were required to answer some exit questions about their sex, age, type of study, political preference (“What party did you vote for during the last election?”) and country of birth (of him/herself, and of his/her father and mother). They also were asked some questions about their attitudes (favourable or unfavourable) with respect to the welfare state and some questions about their use (frequent or infrequent) of several newspapers, internet-sites and television programmes.

The subjects were also asked to rank (from most important to least important) their motives while distributing the money. The four motives to choose from were: 1. Self-interest. 2. Reciprocity (returning gifts). 3. A preference for equality. 4. Meritocracy (rewarding achievements, i.e. a good performance on the quiz).

Finally, they were also invited to comment on the experiment and/or express any possible criticism.

## 2.3. Design

Based on the various conditions, the study uses a 2\*2-factorial design (Figure 1). The participants were randomly assigned to one of the four experimental conditions. As in many earlier game theoretical experiments, the subjects of our solidarity game played for real money, giving them a strong incentive to take the experiment seriously. When real money is at stake, sharing behaviour will in general be more informative and less gratuitous, than when subjects are asked about their willingness to act solidary in survey research.

Figure 1: The four conditions of the solidarity game

	One shot	Four shots
Performance based	Condition 1	Condition 3
Random based	Condition 2	Condition 4

Although the students signed up for a specific session, they did not know beforehand what experimental condition would apply to that session. This means that the quasi-random design can be interpreted as a real random design. The advantage of such a design is that, using a sufficiently large number of subjects, we can assume that the average subject is identical on any (potentially relevant) trait in every condition. Therefore, differences in the dependent variable, i.e. the degree of voluntary solidarity, can be causally related to the experimental condition. This kind of causal inferences is only possible using an experimental design.

In the one shot conditions an experimental credit equalled one euro, whereas a credit was worth 25 eurocent in the four shots conditions. So in all conditions the average earnings per player (including the show-up fee of 7 euros) amounted to 17 euros.

## 2.4. Dependent variable and method of analysis

The dependent variable is the degree of voluntary sharing, as operationalized by the number of credits that players (are willing to) give to other players. In our analyses, each actual or intended gift to another player is taken as a separate observation. Thus, a gift is a dyadic relation between a donor and a (potential) beneficiary. Accordingly, the number of observations for each player varies between three (a loser in a one-shot-game who can only once declare his or her intention to donate money to the other three players) and 24 (a person who is a winner in each round of a four-shot-game and, hence, can declare eight consecutive times what s/he intends to give to the other three players). The total number of observations is 1,728

(among 156 players).

Since the various gifts of one particular player are likely to be correlated, we use a multilevel approach to analyse the determinants of an (intended) gift. The separate gifts are nested within an individual player. Moreover, the gifts of the players of a particular game may also be correlated, for example because the players may react to the behaviour of their co-players in previous rounds. Consequently, the four players of a game are nested within a group. Thus, in the multilevel analysis we take account of possible correlations within individuals and within groups.

Actually, two additional levels can be distinguished for each individual player: the intended gifts are nested within a distribution (i.e., the first or second distribution of each round of a game) and these distributions are nested within the round of the game.

### 3. Results

This section examines the factors, in particular the conditions of the game, that affect the willingness of the student players in the laboratory experiment to share the credits they have won with their co-players.

Table 1 displays the average (intended) gift for each combination of conditions, rounds and distribution of the game. The average gift amounts to 1.37 credits, which means that the players are willing to donate on average 4.11 credits from their 20 credits (20.5%) to the other players.

Table 1. (Intended) gift by conditions of the game

Distribution		Total			Performance based			Random based			
		Mean	N	Std. deviation	Mean	N	Std. deviation	Mean	N	Std. deviation	
<b>Total</b>	<b>Total</b>	1.37	1728	2.09	1.19	864	2.05	1.55	864	2.13	
	<b>1</b>	1.49	1152	2.14	1.37	576	2.15	1.61	576	2.12	
	<b>2</b>	1.14	576	1.99	0.85	288	1.78	1.42	288	2.14	
<b>1 shot game</b>	<b>Total</b>	1.59	360	2.19	1.15	144	1.75	1.89	216	2.40	
	<b>1</b>	1.80	240	2.21	1.41	96	1.90	2.06	144	2.36	
	<b>2</b>	1.17	120	2.11	0.63	48	1.28	1.54	72	2.46	
<b>4 shots game</b>	<b>round 1</b>	<b>Total</b>	2.16	342	2.32	2.03	180	2.52	2.31	162	2.07
		<b>1</b>	2.32	228	2.32	2.37	120	2.52	2.26	108	2.08
		<b>2</b>	1.86	114	2.30	1.35	60	2.40	2.43	54	2.07
	<b>round 2</b>	<b>Total</b>	1.42	342	2.14	1.33	180	2.18	1.52	162	2.10
		<b>1</b>	1.54	228	2.20	1.45	120	2.29	1.64	108	2.11
		<b>2</b>	1.19	114	2.01	1.10	60	1.96	1.30	54	2.07
	<b>round 3</b>	<b>Total</b>	1.18	342	1.94	1.18	180	1.95	1.18	162	1.94
		<b>1</b>	1.16	228	1.95	1.27	120	2.05	1.05	108	1.83
		<b>2</b>	1.21	114	1.94	1.00	60	1.74	1.44	54	2.13
<b>round 4</b>	<b>Total</b>	0.48	342	1.38	0.28	180	1.12	0.71	162	1.58	
	<b>1</b>	0.60	228	1.52	0.35	120	1.27	0.88	108	1.73	
	<b>2</b>	0.25	114	0.98	0.13	60	0.75	0.37	54	1.19	

The differences between the various conditions of the game largely confirm our expectations. In the random based games, players tend to give more than in the performance based games (Hypothesis 4a). In the first round of the four shot game they give more than in the one shot game (Hypothesis 1a). The aver-

age gift declines strongly as the four shot game progresses (Hypothesis 1b). In the fourth and last round, players give only about a quarter of what they gave in the first round. In general, the winners give less in the second distribution, after they have been announced as a winner, than before they knew they were winners.

### 3.1. Analysis of the effects of the conditions of the game

In this section we examine whether the specific conditions of the game and the behaviour of other players affect the gifts of the players. The results of the multilevel analyses are shown in Table 2 and Table 4 (at the end of this paper).

We start with an empty model (A), which includes only a fixed intercept and random intercepts for groups, individuals, rounds and distributions. This model shows that gifts are significantly correlated ‘within’ individuals, but not within groups, rounds and distributions. This indicates that group characteristics do not matter for individual giving behaviour and that the gifts within one distribution in a particular round of the game are not significantly correlated with each other. Therefore, we exclude these latter levels (group, distribution and round) in the following analyses.

In the next models, we retain the individual level in the multilevel analysis and include some characteristics of the game as explanatory variables, to test the hypotheses.

First, we include a variable which indicates whether the game has one round or four rounds. Contrary to Hypothesis 1a, this variable is not significant, i.e. the average gift in the four shot game is not larger than in the one shot game (not shown in Table 2). However, a variable that indicates the round of the game and that also distinguishes between the one shot game and the first round of the four shots game, is highly significant (model B). In the first round of the four shots game, gifts are on average .53 higher than in the one shot game, which is in accordance with Hypothesis 1a. However in the next rounds of the four shots game the gifts are considerably smaller. In the last round, players donate each other 1.68 credits less than in the first round. This confirms Hypothesis 1b.

Next, we test Hypothesis 2, which states that players are motivated by backward looking reciprocity. This can only be tested for the four shot game, where players can reciprocate gifts that have been given in previous rounds of the game (model C).

We can distinguish between direct reciprocity, meaning that a player gives more to a co-player who has given more to her/him in previous rounds (Hypothesis 2a), and indirect or generalised reciprocity, meaning that a player tends to give more to a co-player who has given more to others in previous rounds (Hypoth-

esis 2b). Since the impact of the gifts received in the previous round appears to be much stronger than the impact of the gifts from earlier rounds (not shown in the table), we only include the gifts from the previous rounds. Players do indeed tend to reciprocate gifts they have received in the previous round. For each credit they have received from another player in the previous round, they give on average .18 credits back. This confirms the assumption that players are motivated by direct reciprocity (Hypothesis 2a). However, players tend to give less to a player who has given more to his/her co-players in general, in the previous round. For each credit donated, the players give .04 credits less. This negative effect is difficult to explain, but as we will see later, this variable becomes insignificant if we include other explanatory variables. Thus, we find no evidence of indirect or generalized reciprocity (Hypothesis 2b).

Hypothesis 3 refers to the motive of neediness. In model D we test whether players tend to give more to the losers than to the winner(s) in the current round (Hypothesis 3a) and to co-players who have received relatively little in previous rounds (Hypothesis 3b). The average gift to a co-player is, contrary to Hypothesis 3a, not affected by whether or not the co-player is a winner. We do, however, find a significant effect of the gifts received in previous rounds. For each credit a co-player has received in previous rounds, a player tends to give him/her .09 credits less in this round. In this way, players equalize the gifts received by their co-players to some extent, which confirms Hypothesis 3b.

Next, we test whether players are motivated by meritocratic considerations, by including the distinction between the performance based and the random based conditions and the (expected) score on the quiz (model E). Since the players only know whether the game is performance based or random based at the time of the second distribution, we include the interaction term with the distribution in the model. As expected, in the first distribution, gifts do not differ significantly between the performance based and the random based conditions. But in the second distribution, gifts are on average .62 credits larger in the random based game than in the performance based game. This suggests that players are more willing to share their profit with other players if they realise that their profit is based on chance instead of on performance, confirming Hypothesis 4a.

To test the effect of the performance on the quiz, we included the number of questions that the player expects to have answered correctly, for the first distribution, and the actual score of the player, for the second distribution, respectively. The expected score on the quiz does significantly reduce the intended gift of a player at the first distribution. To illustrate, a player who expects that s/he has the maximum score of ten points donates on average 1.7 credits less to the other players than if s/he expects a zero score. This sug-

gests that players are less willing to share their profit with others if they believe they really deserve it because they have performed well, as stated in Hypothesis 4b. However, at the second distribution, when they know their score, the gifts that players donate do not depend on their score. Thus, the evidence for Hypothesis 4b is mixed.

Finally, we included all the variables discussed above simultaneously in the regression analysis (model F). Although most coefficients become somewhat smaller, this does not qualitatively alter the preceding results, with one exception. As mentioned above, the negative effect of the generosity of a co-player in the previous round on the gift given to him in the current round, becomes insignificant.

It would be interesting to compare the relative size of the various motives for sharing with others. However, it is not possible to calculate the size of the gifts for each motive separately, since these depend on particular circumstances, such as the quiz score and the gifts received from or by the potential beneficiary.

In order to get some feeling for the relative importance of the various motives nevertheless, we calculated the estimated gifts for some specific cases (see Table 3). It should be noted that the figures in Table 3 refer to the gift to one co-player only. As each player has three co-players, the total gifts of a player will, on average, be three times as large. As a reference point, we take the second distribution in the one shot performance based game, in which the player has answered 5 questions in the quiz correctly (this is the average for all players). The 1.05 credits that the player is willing to give to each of the other three players (thus, 3.15 out of 20 credits in total) can be considered as a basic act of solidarity, since this gift cannot be based on either forward or backward looking reciprocity or on the neediness of the co-players. Thus, the 16.85 credits that the player keeps for him/herself points to the overwhelming importance of pure self-interest as the main motivation for the subjects behaviour.



Table 3. Estimated gifts for some specific cases

conditions and results of the game	estimated gift	difference	motive related to difference
<b>reference: one shot, performance based, distribution 2, quiz score=5</b>	1.05		
<b>four shots, round 1</b>	1.66	.60 <sup>a</sup>	forward looking reciprocity
<b>four shots, round 4</b>	.13	-.92 <sup>a</sup>	simultaneous reciprocity
<b>random based</b>	1.62	.57 <sup>a</sup>	meritocracy (average)
<b>expected quiz score=10</b>	.99	.64 <sup>b</sup>	meritocracy (maximum)
<b>four shots, round 2, received previous round=0</b>	.92		
<b>four shots, round 2, received previous round=2</b>	1.31	.39 <sup>b</sup>	backward looking direct reciprocity
<b>four shots, round 2, total receipts beneficiary=8</b>	.70		
<b>four shots, round 2, total receipts beneficiary=0</b>	.92	.22 <sup>b</sup>	neediness

<sup>a</sup> Compared to reference case.

<sup>b</sup> Compared to previous case.

Source: calculated from model F (Table 2).

In the first round of the four shots game, the estimated gift is .60 credits larger than in the one shot game. This can be taken as the size of the gift based on forward looking reciprocity: players give more in the first round of the four shots game than in the one shot game, hoping to get something in return from other players in the next rounds.

However, in the fourth and last round the estimated gift is .92 credits less than in the one shot game. This suggests that the gift in the one shot game is not really unconditional, because then we would expect the same size of the gifts in the last round of the four shot game. Apparently, the gift in the one shot game is based on what we might call ‘simultaneous reciprocity’, i.e. that players expect that their co-players will also share with them. Thus, in the one shot game, giving may act as a kind of insurance against the risk that one loses the game. In the four shots game, players may expect their generosity to be returned in the next round. If co-players turn out to give less than expected, players may, however, reduce their gift in the following rounds, which ultimately results in a much smaller gift than in the one shot game. This difference of .92 credits can therefore be interpreted as the size of the gift motivated by simultaneous reciprocity. The gift of .13 credits in the last round is then the remaining ‘unconditional’ gift, possibly motivated by the feeling of a ‘warm glow’.

Next, the table shows the difference between the estimated gift in the random based game and in the performance based game. This difference of .57 credits can be interpreted as the average size of the meritocratic motive, since it is based on the average expected quiz score. However, if we take a player who expects to have scored the full ten points on the quiz instead of five, the difference is somewhat larger, viz. .64 credits.

The weight of the backward looking reciprocity motive can be assessed by comparing the gift to a co-player who has given nothing to the first player in the previous round of the game versus a co-player who has given 2 credits in the previous round (the average gift received is .96 credits,  $SD=1.67$ ). This difference of .39 credits is considerably smaller than the estimated size of forward looking reciprocity.

Finally, the size of the neediness motive is estimated by comparing the gift in the second round to a co-player who has received nothing in the first round with the gift to a co-player who has received 8 credits (the average receipts in the first round are 4.26 credits,  $SD=4.1$ ). The difference of .22 credits is relatively small compared to the other motives.

To summarize, the prime motive for the behaviour of the players in the solidarity game seems to be pure self-interests. As far as the players are willing to share some money with co-players, simultaneous reciprocity seems to be the most important motive. Next, forward looking reciprocity, which is also based on self-interest, and fairness, the willingness to share if one does not really deserve to be a winner (meritocracy), appear to be the most important motives for gift-giving. Backward looking reciprocity, returning a gift that one has received from a co-player, is somewhat less important. Neediness (giving to a co-player who has earned little) and the unconditional 'warm glow' motive appear to be the least important motives.

However, one should note that the relative sizes of the various motives are based on the variation in the specific conditions of this solidarity game, so that they may differ if other conditions would apply.

Moreover, one should note that the fact that we find support for various motives underlying solidary behaviour, does not prove that the behaviour of most individuals can be explained by a combination of motives. It is possible that different persons act according to different motives, and, as a consequence, *average* behaviour is influenced by various motives.

## 3.2. Background characteristics

In addition to the characteristics and the outcomes of the game, we control for some personal characteristics of the player, viz. sex, age and the study s/he takes (model G, Table 4). Both sex and study are highly insignificant, but age has a significant effect. For each year a player grows older, s/he gives on average .09 credits more. Consequently, since the age of the players ranges from 19 to 29 years, with the exception of three older students, the oldest students give on average .9 credits more than the youngest students.

It is noteworthy that the discipline of the students does not affect their gifts, contrary to some previous laboratory experiments that demonstrated that economics students tend to be less generous than students from other disciplines (e.g. Marwell and Ames, 1981; Kahneman, Knetsch and Thaler, 1986; Carter and Irons, 1991). Although the differences are not significant, science and humanities students tend to be the most generous and psychology students the least generous, with economics, sociology and law students in between.

Table 4. Multilevel analysis of the gift to an individual co-player, effect of individual characteristics and motives

independent variables	model G		model H		model I		model J	
	B	SE	B	SE	B	SE	B	SE
<b>Fixed effects (individual variables)</b>								
Intercept	-,941	,870	-,495	,784	-,619	,788	-,666	,792
<b>Round</b>								
one shot game	,781	,279	,439	,283	,474	,285	,550	,287
1st round, 4 shots game	1,511	,160	1,299	,171	1,309	,172	1,388	,173
2nd round, 4 shots game	,782	,136	,626	,152	,615	,150	,629	,150
3rd round, 4 shots game	,566	,131	,422	,151	,439	,150	,448	,149
4th round, 4 shots game								
<b>Received from co-player in previous round</b>	,196	,035	,546	,094	,531	,108	,532	,115
<b>Given by co-player in previous round</b>	-,011	,015	-,010	,015	,003	,016	,004	,016
<b>Co-player is loser</b>	-,083	,082	-,111	,082	-,099	,081	-,096	,080
<b>Total received by co-player in previous round</b>	-,028	,011	,018	,021	,058	,032	,085	,034
<b>Condition and distribution</b>								
performance based, distribution 1	,753	,381	,850	,362	,913	,360	,912	,360
performance based, distribution 2	-,561	,275	-,434	,250	-,388	,250	-,364	,252
random based, distribution 1	,970	,296	,915	,293	,948	,290	,922	,289
random based, distribution 2	,000		,000		,000		,000	
<b>(Expected) quiz score and distribution</b>								
Expected quiz score, distribution 1	-,185	,040	-,144	,066	-,154	,066	-,149	,066
Quiz score, distribution 2	-,017	,045	,016	,068	,012	,068	,013	,068
<b>Sex (man)</b>	-,215	,251	-,280	,221	-,286	,223	-,259	,224
<b>Age</b>	,089	,037	,061	,033	,063	,034	,061	,034
<b>Study</b>								
Science	,563	,454	,062	,409	-,024	,411	,005	,414
Economics	-,076	,299	-,142	,267	-,094	,268	-,112	,270
Social sciences	-,375	,421	-,172	,372	-,266	,375	-,239	,378
Psychology and pedagogics	-,596	,570	-,283	,505	-,294	,507	-,229	,511
Humanities	,499	,620	-,108	,565	-,140	,568	-,119	,571
Law	-,377	,540	-,499	,475	-,504	,478	-,627	,483
Other	,000		,000		,000		,000	
<b>Main motive and condition</b>								
Self-interest * round								
One shot game			-,1924	,373	-,1957	,374	-,1965	,376

Round 1, 4 shot game	-1,446	,366	,000	-1,487	,368	,000	-1,491	,370	,000
Round 2, 4 shot game	-1,133	,374	,003	-1,133	,377	,003	-1,196	,380	,002
Round 3, 4 shot game	-1,067	,383	,006	-1,011	,386	,010	-1,084	,389	,006
Round 4, 4 shot game	-,260	,393	,508	-,226	,397	,569	-,307	,400	,444
Equality * total received by co-players in previous round	,047	,022	,031	,053	,025	,033	,046	,025	,063
Reciprocity * received from co-plaer in previous round	,390	,098	,000	,464	,101	,000	,407	,104	,000
Meritocracy * expected quiz scoore	,029	,058	,613	,018	,058	,759	,020	,058	,735
Party preference * received from co-player in previous round									
PVV, VVD			,001	,064	,099	,516	,111	,102	,277
CDA, CU				-,025	,170	,883	,044	,171	,798
D66				-,086	,100	,388	-,070	,100	,482
PvdA				,094	,109	,391	,087	,109	,429
GL, SP, PvdID				,345	,108	,001	,365	,108	,001
did not vote, no answer				,000			,000		
Party preference * total received by co-player in previous round									
PVV, VVD			,004	-,004	,028	,889	,015	,029	,019
CDA, CU				-,025	,044	,569	-,035	,044	,430
D66				-,077	,030	,010	-,053	,030	,084
PvdA				-,086	,030	,005	-,062	,031	,049
GL, SP, PvdID				-,010	,028	,713	,007	,029	,801
did not vote, no answer				,000			,000		
Media use									
Telegraaf reader * received from co-player in previous round							,258	,083	,002
Hart van Nederland viewer * received from co-player in previous round							-,179	,080	,026
Hart van Nederland viewer * total received by co-player in previous round							,059	,022	,007
Random effects (covariance variables)									
group	1,787	,267	,000	1,320	,210	,000	1,347	,213	,000
individual									
round									
distribution									
observations	1728			1728			1728		
individuals	156			156			156		
-2 restricted log likelihood	6553,244			6496,445			6492,464		

### 3.3. Motives for gift-giving

After the game, the students were asked a number of questions about their motives for sharing their profits and regarding their (political) attitudes. It is interesting to test whether their declared motives and attitudes are related to their actual behaviour.

The players were asked to rank the following motives for distributing the credits in order of importance (in parentheses the percentage of the respondents who ranked the particular motive first<sup>2</sup>):

- Equality of revenues for the players. (15%)
- Repayment of players who (might) have allocated money to me. (9%)
- High revenues for myself. (71%)
- High revenues for other players who have scored well on the quiz. (14%)

The four options roughly coincide with the four hypotheses formulated in section 1.2 and can be considered as expressions of the motives of equality (Hypothesis 3), reciprocity (Hypothesis 2), self-interest (Hypothesis 1) and meritocracy (Hypothesis 4), respectively. If we include the main motive for each player in our model, all motives turn out to have a negative effect on the gift, compared to those who did not mention one particular motive as their main motive (not shown in Table 4). Apparently, players who do not state one particular motive are more generous than players who do have a clear motive. An explanation for this might be, that those players who did not state one of these four motives as the main motive, actually liked the act of giving itself (the ‘warm glow’ motive).

That the players who selected ‘high revenues for myself’ as the main motive did donate relatively little is not surprising. They give on average 2.3 credits less to others than those who do not mention self-interest as their prime motive. For the other motives, it is not self-evident what effect they should have on average gifts. However, it is likely that the different motives affect the influence of other characteristics on gift giving. These effects can be tested by including interaction terms between the different motives and some of the conditions or outcomes of the game (model H).

If self-interest is the main motive, we would expect to see the largest (negative) effects in the one shot game and in the final round of the four shots game. The difference between the average gift by self-interested players and the gift of other players is indeed the largest (1.9 credits) in the one shot game. However, in the four shots game, the difference between the gifts of self-interested players and the gifts of other players becomes smaller as the game proceeds. In the first round, the difference is 1.4 credits, in the last round only

<sup>2</sup> Since some respondents ranked more than one motive first, the percentages add up to more than 100.

.3 credits. Apparently, players who do not state that they are primarily motivated by self-interest, reduce their gifts more strongly as the game draws to its end than the self-interested players.

If equality is the main motive, one would expect players to give more to co-players who have received relatively little in the previous game. However, we find the opposite effect: the interaction term between the motive of equality and the total gifts received by the potential beneficiary, has a significant positive effect, which means that players who endorse the equality motive give more to co-players who have received more in the previous rounds. This result is hard to explain.

For those subjects for whom reciprocity is the main motive, one would expect a higher gift to be bestowed on those players who have given to the first player in previous rounds. This, is confirmed by including an interaction term between the motive of reciprocity and the gift received from the potential beneficiary in the previous round, which has a significant positive effect.

If meritocracy is the motive, one would expect a lower gift if the player him/herself has scored relatively high on the quiz. However, the interaction term between the motive of meritocracy and the (expected) quiz score is not significant.

To conclude, the considerations that the players indicate that motivated their behaviour only partly coincide with their actual behaviour. The stated motives of self-interest and reciprocity are reflected in the behaviour of the players, but this is not the case with the equality and the meritocratic motive. The reason for this might be either that individuals want to hide their true motives and give a socially desirable answer, or that they do not realise that their behaviour is in conflict with their motives (irrational behaviour).

### 3.4. Party affiliation and media usage

The students were also asked for which political party they had voted at the last elections. This variable has no significant effect on the (intended) gift (not shown in Table 4). To test whether the party preference affects the influence of various outcomes of the game, we included interactions terms with most of the variables mentioned above. (To reduce the number of variables, we took some of the political parties together.) Of these, only the gift received from the potential beneficiary in the previous round and the total (cumulative) receipts of the potential beneficiary in the previous round have a significant effect. Players who voted for one of the left wing parties SP, GroenLinks (GL) or Partij voor de Dieren (PvdD) tend to reciprocate the gift received the most, while voters for the social liberal party D66 and the Christian parties CDA and ChristenUnie (CU) reciprocated the least. Voters for the labour party (PvdA) and the social liberal D66

give the most to players who received relatively little up till now, while voters for the right wing parties VVD (liberal) and PVV (populist) and those who did not vote or refused to tell their vote give less to the players who received little. Thus, the PvdA and D66 voters seem to be most motivated by neediness.

Finally, we test whether the media use of students affects their gift-giving. The students were asked how often they read or watch one of two popular newspapers (*De Telegraaf* and *de Volkskrant*), two news items on tv (*NOS Journaal* and *Hart van Nederland*), an Internet news site (*nu.nl*) or other media. None of these variables has a significant effect on the average gift (not shown in Table 4). However, if we include interaction terms with the same variables as with political preferences, we find some significant effects. Regular and irregular readers of *De Telegraaf* tend to reciprocate gifts received in the previous round more strongly than those who never read *De Telegraaf*. For viewers of *Hart van Nederland*, the opposite applies, they reciprocate less than non-viewers. Moreover, *Hart van Nederland* viewers also give less to players who have received little in previous rounds compared to non-viewers. Thus, for *Hart van Nederland* viewers neither direct reciprocity nor neediness appear to be important motives.



## 4. Conclusion and discussion

In order to test the conditions and motives for solidary behaviour, we conducted a laboratory experiment of a solidarity game, using university students as subjects.

We tested four hypotheses regarding the effect of various conditions on voluntary sharing, related to specific motives for solidary behaviour. For most of our hypotheses the experiments provided support, although there are a few exceptions.

Hypothesis 1 refers to self-interest as the main motive, resulting in forward looking reciprocity. As expected, the players share more with others in the first round of the four shots game than in the one shot game (Hypothesis 1a). But, as expected in Hypothesis 1b, their gifts deteriorate quickly as the game progresses.

Hypothesis 2 states that fairness is an important motive, resulting in backward looking reciprocity. Players do indeed give more to a player from whom they have received money in the previous rounds (direct reciprocity, Hypothesis 2a). However, we did not find any support for indirect or generalised reciprocity (Hypothesis 2b), which would imply that a player would also give more to co-players who were generous in previous rounds, regardless of whether the first player had benefited from this him/herself.

According to Hypothesis 3, neediness is a motive for sharing with others, resulting in equalizing behaviour. The evidence for this hypothesis is mixed. Contrary to Hypothesis 3a, players do not give more to a loser than to a winner in the current round. However, they do give more to players who have received relatively little in previous rounds, confirming Hypothesis 3b.

Hypothesis 4 refers to deservingness as measured by the performance of the player, which may result in meritocratic behaviour. As expected, winners give more in the random based conditions, when they do not really ‘deserve’ to be a winner, than in the performance based conditions (Hypothesis 4a). The evidence for Hypothesis 4b, which relates the quiz score to gift-giving, is mixed. At the first distribution, before they know their actual score, players who expect a high score tend to give less to others. However, at the second distribution, when they know their quiz score, the gifts by winners do not depend on their score.

In general, the results of this study are in line with previous studies based on experimental game theory. The students showed both other-regarding and self-regarding behaviour, with a strong emphasis on the latter. Self-regarding motives can, however, result in solidary behaviour if there is a repeated interaction

between subjects. Our main interest was the relative importance of various motives for solidary behaviour, which can be measured by varying the experimental conditions. More sharing with others occurred when the winners were randomly assigned than when they earned their position by their own performance. Solidarity is also larger if players know that they will continue their relationship for some rounds. When this relationship approaches its end, solidarity declines. Players reward other players for their gifts to them in previous rounds (direct reciprocity), but not for gifts to other players (generalised reciprocity). Finally, there is some evidence that subjects want to avoid inequality of outcomes by giving more to players who have received relatively little yet.

The fact that we found evidence for all these motives, with the exception of generalised reciprocity, suggests that people are driven by various motives to act solidary, simultaneously. All the same, various kinds of reciprocity (forward looking, backward looking and simultaneous reciprocity) appear to be the most important motives, although the meritocratic motive also plays an important role. Other-regarding motives, such as neediness and the warm glow of giving, are less important, but still play a role.

Of course, testing the motives for solidary behaviour by conducting a laboratory experiment has its limitations. The motives that one is able to find are fully dependent on the different conditions of the game. If we had added other conditions to the experiment (for example, the option to punish a co-player), we might have found other motives (such as altruistic punishment). Nevertheless, the conditions of the game were explicitly chosen to test the main motives for solidary behaviour that are discussed in the literature.

Moreover, the relative size of different motives may depend on the specific conditions of the game. Thus, it is an open question whether the relative size of the various motives that have been found in this study can be generalised to other situations.

Finally, running an experiment with university students who are used to participating in laboratory experiments, may elicit different behavioural reactions than if the experiment would have been conducted with 'ordinary' people. For this reason, we replicated the experiment with visitors of the Dapper market in Amsterdam. The results of this experiment are reported in another AIAS Working Paper (Solidarity in a multicultural neighbourhood: Results of a field experiment).

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Table 2. Multilevel analysis of the gift to an individual co-player

Independent variables	model A		model B		model C		model D		model E		model F	
	B	SE sign.	B	SE sign.	B	SE sign.	B	SE sign.	B	SE sign.	B	SE sign.
<b>Fixed effects (individual variables)</b>												
Intercept	1,314	,359 ,010	,469	,176 ,008	1,439	,117 ,000	1,749	,134 ,000	1,321	,298 ,000	,772	,344 ,025
<b>Round</b>												
one shot game			1,148	,246 ,000							,919	,272 ,001
1st round, 4 shots game			1,677	,126 ,000							1,523	,160 ,000
2nd round, 4 shots game			1,016	,126 ,000							,784	,136 ,000
3rd round, 4 shots game			,675	,126 ,000							,569	,131 ,000
4th round, 4 shots game			,000								,000	
<b>Received from co-players in previous round</b>					,178	,037 ,000					,196	,035 ,000
<b>Given by co-player in previous round</b>					-,040	,016 ,013					-,011	,015 ,490
<b>Co-player is loser</b>							-,124	,085 ,145			-,088	,082 ,282
<b>Total received by co-player in previous round</b>							-,087	,009 ,000			-,027	,011 ,019
<b>Condition and distribution performance based, distribution 1</b>												
<b>performance based, distribution 2</b>									,889	,384 ,021	,739	,380 ,052
<b>random based, distribution 1</b>									-,622	,270 ,022	-,572	,274 ,038
<b>random based, distribution 2</b>									1,141	,308 ,000	,970	,296 ,001
<b>(Expected) quiz score and distribution</b>									,000		,000	
<b>Expected quiz score, distribution 1</b>									-,173	,041 ,000	-,179	,039 ,000
<b>Quiz score, distribution 2</b>									,030	,047 ,527	-,013	,045 ,772
<b>Random effects (covariance variables)</b>												
group	,149	,161 ,354										
individual	1,583	,273 ,000	1,742	,251 ,000	1,687	,249 ,000	2,020	,283 ,000	1,688	,252 ,000	1,819	,264 ,000
round	,382	,277 ,168										

Continued: Table 2. Multilevel analysis of the gift to an individual co-player

independent variables	model A			model B			model C			model D			model E			model F			
	B	SE	sign.	B	SE	sign.	B	SE	sign.	B	SE	sign.	B	SE	sign.	B	SE	sign.	
distribution	,064	,096	,504																
observations	1728			1728			1728			1728			1728			1728			1728
individuals	156			156			156			156			156			156			156
-2 restricted log likelihood	6892,4			6898,3			6901,5			6687,7			7040,1			6559,5			

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