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PRESENTS OR INVESTMENTS? AN EXPERIMENTAL ANALYSIS

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Presents or Investments? An Experimental Analysis

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Abstract

Individuals frequently transfer commodities without an explicit contract or an implicit enforcement mechanism. We design an experiment to study whether such commodity transfers can be viewed as investments based on trust and reciprocity, or whether they rather resemble presents with distributional intentions. Our experiment essentially modifies Berg et al.'s investment game by introducing an upper bound to what a contributor can be repaid afterwards. By varying this upper bound, extreme situations such as unrestricted repayment and no repayment (dictator giving) can be approximated without altering the verbal instructions otherwise. Our results show that individuals contribute more when large repayments are feasible. This is consistent with the trust and reciprocity hypothesis. Although distributional concerns in some contributions can be traced, they are not nearly close to a preference for equal payoffs.

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1 Introduction

Due to transaction costs individuals are usually not able to specify all the details of an agreement in a legally binding contract. At best, the contract is incomplete and often transactions are not governed by any contract at all. This observation raises important issues about individual behavior. Do people use implicit enforcement mechanisms in their long term relationships? Or are people motivated by other goals than pure material self-interest? People may not only care about their own material payoffs, but also about the distribution of the payoffs between each other. In addition, people may take decisions based on trust and reciprocity. This means that they care about each other's *intentions* that give rise to their payoffs and distribution.[1]

In an influential recent experiment, Berg, Dickhaut and McCabe (1995) study an investment game. In this game, a contributor C owns an amount of money and can choose to contribute a certain amount c to a reciprocator R. This contribution is then tripled, and R can choose to repay any amount r with $0 \leq r \leq 3c$ to C. The subgame perfect equilibrium of this game is obvious: R will not send any money to C in the second stage. Realizing that, C will not give money to R in the first stage. Berg et al. focus on the role of trust and reciprocity in this investment setting. The game is well suited for this purpose: there are large potential gains from trade, yet contractual precommitment is not possible and implicit enforcement mechanisms that might arise from repeated game reputation effects or punishment threats are ruled out.[2] Berg et al.'s experimental data confirm a list of predictions implied by the trust and reciprocity model. For example, contributors generally send positive amounts of money, and reciprocators are often found to send back more than they received.[3]

[1] Recent examples of models in which distributional concerns are important are Fehr and Kirchsteiger (1994) and Fehr and Schmidt (1998).For models of reciprocity, see for example Bolton and Ockenfels (1997) or Dufwenberg and Kirchsteiger (1998).

[2] Reputation effects are ruled out because individuals can play the game only once. Punishment threats are avoided by guaranteeing full anonimity.

[3] Several other authors have conducted experimental studies in which aspects of trust, reciprocity and efficiency are key features. See, for example, Fehr, Kirchsteiger and Riedl (1993), Fehr, Gächter and Kirchsteiger (1997), Güth, Ockenfels and Wendel (1994), McKelvey and Palfrey (1992). The explicit focus in our paper is on the role of trust and reciprocity versus

However, Berg et al.'s analysis does not necessarily rule out the possibility of pure distributional concerns (fairness) as an alternative explanation for observed behavior in the investment game. While their data confirm several predictions of the trust and reciprocity model, they are generally also not inconsistent with a model in which individuals simply care about distributional aspects of realized gains. In this paper, we modify the investment game in such a way that we can study whether individuals really invest based on trust and reciprocity, or whether they merely provide presents to each other, based on a distributional concern for fairness.

A first way to study the role of distributional concerns as a possible explanation for Berg et al.'s findings is by comparing the investment game with a different game in which repayment by R is impossible. If payments by C would remain high in this different game, then one may view C's behavior mainly as a reflection of distributional concerns. One problem with such an experiment is that the two different games rely on different verbal instructions: repayments are not mentioned at all in the treatment where they are impossible. Consequently, the results of the two games are not really comparable, since the individuals may have been induced by the instructions to think in a certain way.

In the experiment of this paper we avoid differences in verbal instructions by introducing in the standard investment game an upper bound $\bar{r}$ for repayments from R to C. The upper bound $\bar{r}$ is our treatment variable. It can be varied systematically to study the potential distributional concerns in the investment game, while at the same time keeping the verbal framing the same. If the upper bound $\bar{r}$ is close to the maximum possible repayment, the original set-up of Berg et al. is approximated. In contrast, if $\bar{r}$ is close to zero, the treatment of no possible repayment is approached. From the extent to which contributions and repayments differ across the alternative treatments we can learn the role of trust and reciprocity versus distributional concerns in the investment setting.

In section 2 we describe our experimental procedures and formulate some hypotheses. Section 3 presents and discusses the results. Concluding remarks follow in section 4.

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pure distributional concerns.

2 Experimental procedure and hypotheses

The investment game is played as follows. Each contributor C has an initial endowment of 10 chips, and must decide how much to send to the reciprocator R. Denote the actual amount contributed by c, which can be any integer satisfying $0 \leq c \leq 10$. The amount contributed is then doubled to $2c$ and received by R, who must then decide whether and how much to repay to C. The repayment is denoted by $r(2c)$, and can be any integer amount such that $0 \leq r(2c) \leq \min\{\overline{r}, 2c\}$. The instruction and decision sheets, for $\overline{r} = 2$, are provided in the Appendix.

The experiment was performed in 1997 at Tilburg University. There are three treatments, in each of which 16 pairs of inidviduals participated. Hence, a total of 96 undergraduate participants were recruited. Our treatment variable is $\overline{r}$, which can take three possible values:

$\overline{r} = 2$ ("nearly no repayment"),
$\overline{r} = 10$ ("full repayment"),
$\overline{r} = 18$ ("nearly full sharing").

Of course, our terminology refers to the maximal repayment that is feasible, and not to what is actually done. The value per chip is 2 guilders[4], for both players C and R. The payoffs in chips are $10 - c + r$ for C and $2c - r$ for R. Note that implicit enforcement mechanisms are ruled out, by guaranteeing anonimity and not repeating the experiment. The possibility of learning is not considered.

It is possible to formulate several alternative hypotheses about the individuals' behavior. The treatment variable $\overline{r}$ will be particularly important in this respect. A first hypothesis is that individuals behave according to the traditional concept of subgame perfect equilibrium. If this is the case, then C contributes $c = 0$, and R repays $r(2c) = 0$ if $2c > 0$.

The next hypothesis is that individuals behave according to the predictions of the trust and reciprocity model. The basic model is discussed in detail in Berg et al. Some of the predictions need to be modified in our context, since there is an upper bound $\overline{r}$ to what R can repay. In particular, trust and

[4]At the time of our experiment, 1 dollar = 1.8 guilder.

reciprocity now predicts that C contributes a positive amount, but *not exceeding the upper bound $\overline{r}$ that R can repay*, so $0 \leq c \leq \overline{r}$. Correspondingly, one may expect low contributions c if $\overline{r}$ is small, and larger contributions as $\overline{r}$ increases. Furthermore, R may be expected to repay an amount $r(2c) \geq c$ if there is full reciprocity, or at least a positive amount if there is partial reciprocity. A positive correlation between c and $r(2c)$ may also be expected.

The final hypothesis is that individuals behave according to distributional considerations. This model is distinct from the trust and reciprocity model in several respects. It predicts that C contributes a positive amount $0 \leq c \leq 10$. Hence, it is possible that $c > \overline{r}$, in contrast to the trust and reciprocity hypothesis. Furthermore, contributions should no longer necessarily increase as $\overline{r}$ increases if C behaves altruistically. Finally, R sends back an amount $r(2c)$ to guarantee a more or less "fair" distribution of the final outcome, rather than to provide a reasonable rate of return on C's initial investment contribution.

Preferences for *equal payoffs* are perhaps the most natural example of concerns for distribution or fairness. To achieve equal payoffs one way or another, it is *necessary* that C contributes a minimum amount of $c \geq 3.33$: R can then repay a positive amount $r = (-10 + 3c)/2$ to yield equal payoffs for both. An interesting special case of preferences for equal payoffs obtains when individuals obtain a Pareto-efficient outcome under the equal payoff constraint. It can easily be verified that this amounts to maximizing the joint profits, $10 + c$, subject to the constraint that payoffs are equal, i.e. $10 - c + r(2c) = 2c - r(2c)$, or $2r(2c) = 3c - 10$, and the feasibility constraints, $0 \leq c \leq 10$ and $0 \leq r(2c) \leq \min\{\overline{r}, 2c\}$. The solution to this program is: $c = (10 + 2\overline{r})/3$ and $r(2c) = \overline{r}$ if $\overline{r} < 10$; and $c = r = 10$ if $\overline{r} \geq 10$.

3 Results

Table 1 provides all the data of our experiment. For each of the three treatments, 16 pairs of individuals have been matched. The actual contributions, c, and the corresponding repayment $r(2c)$, are listed in increasing order. At the bottom of each column, the average contribution $\emptyset c$, the average repayment $\emptyset r$ and the average repayment ratio $\emptyset r/c$ are given.

Table 1. Contributions and repayments

repayment bound	$\overline{r} = 2$		$\overline{r} = 10$		$\overline{r} = 18$	
subject	c	r	c	r	c	r
1	1	0	3	0	3	3
2	1	1	4	1	3	3
3	1	1	4	2	3	5
4	1	1	5	0	3	5
5	1	2	5	2	4	4
6	1	2	5	2	5	0
7	1	2	5	3	5	4
8	2	1	5	5	5	4
9	2	1	5	5	5	4
10	2	2	7	7	5	5
11	2	2	8	4	5	10
12	3	1	8	8	6	5
13	3	1	10	0	8	5
14	3	1	10	5	10	5
15	3	2	10	5	10	10
16	5	2	10	10	10	10
$\emptyset c, \emptyset r$	2.000	1.375	6.500	3.688	5.625	5.125
$\emptyset c/r$	0.879		0.541		0.981	

The predictions of the subgame perfection equilibrium are clearly rejected. As in Berg et al., both C and R usually send positive amounts. Are the results consistent with the predictions of the trust and reciprocity hypothesis? The evidence on the contributors' side seems indeed roughly consistent with it. In particular, the average contribution $\emptyset c$ is significantly larger if $\overline{r} = 10$ or $\overline{r} = 18$ than if $\overline{r} = 2$. Hence, *contributors generally seem to care about what they can receive back.* Note that the average contribution under $\overline{r} = 10$ does not differ significantly from the one under $\overline{r} = 18$. This suggests that the contributors do not perceive the upper bound on repayment, $\overline{r} = 10$, as a binding constraint to R (i.e. R is not expected to pay back more than 10 anyway).[5] The only pieces of

[5]These claims are based on the Mann-Whitney U test, which is a nonparametric test to

evidence on the contributors' side against the trust and reciprocity hypothesis is found in the treatment $\overline{r} = 2$: 5 out of 16 contributors sent *more* than they could possibly be repaid: for these individuals other considerations than investment based on trust are present. Yet notice that even these "generous" offers generally do not exceed any of the contributions in the second and third treatment, where higher repayments are feasible. The only exception is one offer of 5 in the first treatment, but even this offer is below the average in the other two treatments.

What support for the trust and reciprocity hypothesis can be found on the reciprocators' side? In all three treatments, the average amount repaid by R is less than what was actually received, though the difference is not significant in the first and the third treatment.[6] Paying interest is thus rather rare: for $\overline{r} = 2$ it occurs 3 times in 7 feasible cases, for $\overline{r} = 10$ never in 11 cases, and for $\overline{r} = 18$ only twice in 16 cases.[7] Despite the relatively low repayments, there is a significantly positive correlation between the contribution c and the repayment $r(2c)$ of 0.528 in the second treatment and of 0.558 in the third treatment (at significance levels of 0.0317 and 0.0288, respectively).[8] This suggests that there may be at least partial reciprocity in these treatments. In the first treatment we estimate a negative, but insignificant correlation between contribution and repayment of -0.3715 (significance level of 0.2084). This follows from a presumably binding upper bound on what R can repay in this treatment.

Finally, to which extent can the results be reconciled with the hypothesis

compare the medians of pairs of outcomes. We found z-statistics for significant differences in contributions of -4.52, -4.22 and 0.98, when comparing $\overline{r} = 2$ with $\overline{r} = 10$, $\overline{r} = 2$ with $\overline{r} = 18$, and $\overline{r} = 10$ with $\overline{r} = 18$, respectively. This corresponds to significance levels of 0.0001, 0.0001 and 0.3271.

[6]The z-statistics for the Man-Whitney U test for significant differences between contribution and repayment are 1.34, 2.53 and .55, in treatment $\overline{r} = 2$, $\overline{r} = 10$, and $\overline{r} = 18$, respectively. This corresponds to significance levels of 0.1632, 0.0116 and 0.5847.

[7]Berg et al. obtained more frequent cases of paying interest. This is because their experimental design was made more favourable to high repayments in two respects. First, they assume a tripling instead of a doubling of the contribution. We preferred to make the productivity of investment not too high, since a low contribution may then just be perceived as wasteful behavior. Furthermore, they endow the reciprocator R with an initial show-up fee.

[8]We use the Spearman rank correlation coefficient to test for the existence of correlation between c and $r(2c)$, using the observations of each treatment separately.

that distributional considerations are present? Recall that there are 5 out of 16 contributions in treatment $\overline{r} = 2$ that violate the trust and reciprocity model, and that are not inconsistent with distributional considerations. But, as noted above, even these 5 cases are not that "generous", when they are compared to the contributions of the second and third treatments. To learn more about the possibility of distributional considerations, let us focus on outcomes in which C and R obtain equal payoffs. As explained in the previous section, equal payoffs are made feasible only if C contributes a minimum amount of 3.33. This occurs in only one case in the first treatment, in 15 cases in the second treatment, and in 12 cases in the third treatment. So in 20 out of 48 cases the contributor clearly has no preferences for an equal payoff outcome.

Are equal payoffs in fact frequently achieved, relative to the total number of cases in which it has been made feasible by C? To allow for "mistakes" or other aspects of behavior, let us consider *"almost equal payoffs"*, defined as payoffs that differ by at most one chip. For a given contribution c, sometimes two repayments r can yield almost equal payoffs, e.g. for $c = 7$ both repayments $r = 5$ and $r = 6$ would induce "almost equal payoffs". Note that "almost equal payoffs" are feasible whenever C has contributed a minimum amount of 3. It can be verified that "almost equal payoffs" occur in only 1 out of 5 feasible cases in the first treatment; in 6 out of 16 feasible cases in the second treatment; and in 2 out of 16 cases in the third treatment. Hence, there is little support for a preference of (almost) equal payoffs by the reciprocators.

Using the formula of the previous section, Pareto-efficient equal payoffs require that C contributes $c = 5$ (rounded) for $\overline{r} = 2$, and $c = 10$ for $\overline{r} = 10$ and $\overline{r} = 18$. Only one contributor in the first treatment behaved this way, compared to respectively four and three contributors in the second and third treatment. Half of the reciprocators responded by repaying the "almost equal payoff" amount; the others repaid less.

4 Final Remarks

We have designed an experiment to study whether commodity transfers can be viewed as investments based on trust and reciprocity, or whether they rather resemble presents with distributional concerns. By varying the upper bound to what a contributor can be repaid afterwards, extreme situations such as unrestricted repayment and no repayment can be approximated without altering the verbal instructions otherwise. Our results demonstrate that individuals contribute more when large repayments are feasible than when nearly no repayment is feasible. This is consistent with the trust and reciprocity hypothesis. Although distributional concerns in some contributions can be traced, they are not nearly close to a preference for equal payoffs.

5 Appendix

INSTRUCTIONS (For person A)

In the experiment we will match you with another student at random. You are student A and the other student is student B. You (person A) will receive 10 points, which person B does not receive. We ask you to decide if you want to give some of the 10 points to the person you are matched with, and if so, to write the amount at the bottom of this page. We will collect your form, double the amount you wrote, and give the form to the person you are matched with.

Then person B with whom you are matched, will decide if he/she wants to give something back to you (this amount will not be doubled). Person B can give you back at most 2 points (and of course no more than twice the amount you gave).

We will then collect all forms and pay each of you accordingly.

INSTRUCTIONS (For person B)

In the experiment we will match you with another student at random. You are student B and the other student is student A. Person A will receive 10 points which you will not receive. We asked person A if he/she wants to give some of the 10 points to you, and if so, to write down the amount at the bottom of the page. We will collect the form, double the amount person A wrote, and give it to you.

Then, you will decide ify ou want to give something back to the person A with whom you are matched (this amount will not be doubled). You can give back at most 2 points (and of course no more then twice the amount person A gave to you).

We will then collect all the forms, and pay each of you accordingly.

For student A

Your registration number: ______ .

The number of points you give to person B with whom you are matched: _______ .

For person B

Your registration number: _________ .

The number of points you give to person A with whom you are matched (no more than twice the number of points person A gave, and no more than 2): ______ .

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