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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 the investment game of Berg, Dickhaut, and McCabe (Trust, reciprocity, and social history, Games Econ. Behav. 10 (1995) 122) 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 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 $0 \leqslant r \leqslant 3c$ 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 pre-commitment 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]

However, Berg et al.'s analysis does not necessarily rule out the possibility of pure distributional concerns (fairness) as an alternative explanation for the observed behavior in the investment game. While their data confirm several predictions of the trust and reciprocity model, they are often also consistent

[1] Recent examples of models in which distributional concerns are important are Fehr and Kirchsteiger (1994) and Fehr and Schmidt (1999). For models of reciprocity, see, for example, Bolton and Ockenfels (2000) or Duwfenberg and Kirchsteiger (1998).

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

[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) and McKelvey and Palfrey (1992). The explicit focus of our paper is on the role of trust and reciprocity versus pure distributional concerns.

with a model in which individuals simply care about distributional aspects of realized gains. [4] In this paper, we modify the investment game in such a way that we can distinguish more easily 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 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 $C$ remained 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 using the same verbal framing as the other treatments. In contrast, if $\bar{r}$ is close to zero, the treatment of no possible repayment is approached, again using the same verbal framing. 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.

## 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

[4] For example, the result that 30 out of 32 room A people send money, while 11 of these 32 result in payback greater than the amount sent may be consistent with care for distributional aspects.

integer satisfying $0 \leqslant c \leqslant 10$. 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 $0 \leqslant r(2c) \leqslant \min(\bar{r}, 2c)$. The instruction and decision sheets, for $\bar{r} = 2$ are provided in Appendix A.

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

$$\bar{r} = 2 \qquad \text{(nearly no repayment)},$$

$$\bar{r} = 10 \qquad \text{(full repayment)},$$

$$\bar{r} = 18 \qquad \text{(nearly full sharing)}.$$

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, [5] 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 anonymity 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 $\bar{r}$ will be particularly important in this respect. The first hypothesis is that individuals care only about own payoffs, and behave rationally (with common knowledge of rationality). Individuals would then 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 $\bar{r}$ to what $R$ can repay. First, trust and reciprocity predicts that $C$ regards her contribution as an investment and therefore contributes a positive amount. In our set-up with bounds to repayment, this prediction is somewhat different: $C$ contributes a positive

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

amount but *not exceeding the upper bound* $\bar{r}$ *that R can repay*, so $0 \leqslant c < \bar{r}$. Correspondingly, one may expect low contributions $c$ if $\bar{r}$ is small, and larger contributions as $\bar{r}$ increases. Second, the trust and reciprocity model predicts that $R$ repays an amount $r(2c) > c$ if there is full reciprocity; $R$ would at least contribute some positive amount if there is partial reciprocity. Third, if trust is to emerge evolutionarily as a norm, then, for at least some amounts $c^*$, the average return is positive. If the average return were to be nonpositive for every $c$, then the investment strategy of positive contributions would become extinct. Fourth, a positive correlation between $c$ and $r(2c)$ may be expected. This is based on Rabin (1993), who assumes that, from an evolutionary perspective, a person with a predisposition to reciprocate may be more willing to do so when she believes that her counterpart shares a common regard for trust. See Berg et al. (pp. 126–127) for more details on the predictions of the trust and reciprocity model (without bounds to repayment).

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 $0 < c \leqslant 10$. Hence, it is possible that $c \geqslant \bar{r}$, in contrast to the trust and reciprocity hypothesis. Furthermore, contributions should no longer necessarily increase as $\bar{r}$ increases if $C$ behaves altruistically. Finally, $R$ may send 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 one 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 $c \geqslant 3.33$: $R$ 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, $0 \leqslant c \leqslant 10$ and $0 \leqslant r(2c) \leqslant \min\{\bar{r}, 2c\}$. The solution to this program is: $c = (10 + 2\bar{r})/3$ and $r(2c) = \bar{r}$ if $\bar{r} < 10$; and $c = r = 10$ if $\bar{r} \geqslant 10$.

Recently, Bolton and Ockenfels (2000) and Fehr and Schmidt (1999) have provided more sophisticated versions of distributional concerns. They consider inequality aversion in the sense of being allergic to own unfavorable inequality, i.e., being more allergic to one's own rather than others' ill treatment.

## 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.

The predictions of the subgame perfect 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 roughly consistent with it. In particular, the average contribution $\emptyset c$ is significantly larger if $\bar{r} = 10$ or $\bar{r} = 18$ than if $\bar{r} = 2$. Hence, *contributors generally seem to care about what they can receive back*. Note that the average contribution under $\bar{r} = 10$ does not differ significantly from the one under $\bar{r} = 18$. This suggests that the contributors do not perceive the upper bound on repayment, $\bar{r} = 10$, as a binding constraint to $R$ (i.e., $R$ is not expected to pay back more than 10 anyway). [6] As far as plays are concerned, however, only six of the altogether 48 cases confirm the two basic aspects of the trust and reciprocity hypothesis, namely $c > 0$ and $r(2c) > c$. Note that we find a quite large number of plays (16 out of 48 cases) in which $R$ sends back an *equal* amount ($r(2c) = c$). We summarize:

**Regularity 1**: The two basic predictions of the trust and reciprocity hypothesis ($c > 0$ and $r(2c) > c$) are, in most cases, rejected. Many of the reciprocators (one third) send back the same as they receive ($r(2c) = c$).

Other evidence on the contributors' side against the trust and reciprocity hypothesis is found in the treatment $\bar{r} = 2$: only seven individuals send an amount that can yield a positive return. The other 11 individuals under treatment $\bar{r} = 2$ are inconsistent with the trust and reciprocity hypothesis: four individuals send an amount that can, at best, yield a zero return, whereas five contributors send *more* than they could possibly be repaid. For these individuals, other considerations than investment based on trust are present. Yet, notice that nearly all these "generous" offers generally do not exceed any of

[6] These claims are based on the Mann–Whitney U-test, which is a nonparametric test to compare the medians of pairs of distributions. We found $z$-statistics for significant differences in contributions of −4.52, −4.22 and 0.98 when comparing $\bar{r} = 2$ with $\bar{r} = 10$, $\bar{r} = 2$ with $\bar{r} = 18$, and $\bar{r} = 10$ with $\bar{r} = 18$, respectively. This corresponds to significance levels of 0.0001, 0.0001 and 0.3271.

Table 1
Contributions and repayments

| Repayment bound Subject | $\bar{r}=2$ | | $\bar{r}=10$ | | $\bar{r}=18$ | |
|---|---|---|---|---|---|---|
| | $c$ | $r$ | $c$ | $r$ | $c$ | $r$ |
| 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 |
| $\emptyset r/c$ | 0.879 | | 0.541 | | 0.981 | |

the contributions in the second and third treatments, where higher repayments are feasible. The only exception is one offer of 5 in the first treatment, which still lies below the average in the other two treatments. So we summarize:

> **Regularity 2**: Only seven contributors in treatment $\bar{r}=2$ send an amount that can yield a positive return. Quite many contributors in treatment $\bar{r}=2$ are guided by distributional generosity in the sense of $c > \bar{r}$.

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. Paying interest is thus rather rare: for $\bar{r}=2$, it occurs three times in seven feasible cases, for $\bar{r}=10$, never in 12 feasible cases, and for $\bar{r}=18$, only thrice in 16 cases. [7] Despite the relatively

[7] Berg et al. obtained more frequent cases of paying interest. One explanation is that upper bounds for repayment trigger different perceptions of the situation (e.g., framing effects as in Tversky & Kahneman, 1986). Another reason could be that their experimental design was made more favorable to high repayments in two respects. First, they assumed 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 endowed the reciprocator $R$ with an initial show-up fee.

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. We summarize:

**Regularity 3**: Except for $\bar{r} = 2$, resulting in the dictator game, higher contributions trigger higher repayments.

Note that, for treatments 1 and 3, we can find a value for the contribution, $c^*$, for which there is a positive return: namely $c^* = 1$ with an average return of 9/7 under treatment 1, and $c^* = 3$ with an average return of 16/12 under treatment 3. In both cases, this is the unique contribution yielding positive returns, and it happens to be a low contribution. Under treatment 2, no contribution $c^*$ with a positive average return has been found.

The above results indicate various observations that are inconsistent with the predictions of the trust and reciprocity hypothesis. To which extent can the results be reconciled with the hypothesis that distributional considerations are present? Recall from Regularity 2 that there are five out of 16 contributions in treatment $\bar{r} = 2$ that violate the trust and reciprocity model, and that are not inconsistent with distributional considerations. However, as noted above, these five 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 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 preference for an equal payoff outcome. We have:

**Regularity 4**: In a significant fraction of cases, there is no preference for equal payoff from the contributor's perspective.

[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.

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 the impossibility of exactly equal payoffs, 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 one out of five feasible cases in the first treatment; in six out of 16 feasible cases in the second treatment; and in two out of 16 cases in the third treatment. Hence, there is little support for equity seeking of the reciprocators.

**Regularity 5**: Of the 37 reciprocators who could have induced "almost equal payoffs" only nine accomplished such a contribution.

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

**Regularity 6**: Efficient equality is often prevented by the contributors (40 out of 48). When feasible, half of the reciprocators accomplish almost equal efficient payoffs.

Recently, more sophisticated versions of distributional concerns (Bolton & Ockenfels, 2000; Burnell, Evans & Yao, 1999; Fehr & Schmidt, 1999; Kirchsteiger, 1994) claim inequality aversion in the sense that one is allergic to own unfavourable inequality, i.e., more allergic to one's own than others' ill-treatment. We have considered several possible aspects of distributional concerns and inequality aversion. We use the absolute value of the difference in $C$'s and $R$'s payoffs as a measure of inequality. We looked at both $C$'s contributions and $R$'s repayments.

First, note that all contributions $c$ greater than or equal to 7 create the temporary effect that the initial inequality gap of 10 units becomes even larger (in favor of $R$). There are 11 such cases: zero in treatment 1, seven in treatment 2, and four in treatment 3. Yet, of these 11 cases, only four cases actually result in a widening of the inequality, due to a too low repayment by $R$ (observations 13, 14 and 15 of treatment 2 and observation 14 of treatment 3). This indicates that, while contributors sometimes take the risk of increasing the inequality (in favor of $R$), this event rarely materializes. Second, of the 37 contributions less than 7, which temporarily reduce the inequality, there are only six cases in which $R$ repays such a high amount that the inequality is eventually increased (in favor of $C$). Hence, generally speaking, most of the results can be explained by (heterogeneity in) the desire to reduce inequality:

> **Regularity 7**: Although several (11) contributions open the risk of a widening of inequality in favor of $R$, this event rarely materializes due to sufficient repayments by $R$. Of the 37 contributions that do not open this risk, only a small amount of cases result in a widening of inequality in favor of $C$.

In the tradition of "psychological game theory" (Geanakoplos, Pearce & Stacchetti, 1989), one can try to explain behavior by attempts to avoid not meeting the expectations of others (Rabin, 1993). If one assumes that contributions expect at least to be repaid ($r(2c) \geqslant c$), the overall repayment rates of 0.879, 0.541 and 0.981 for $\bar{r} = 2, 10, 18$, respectively, speak strongly against such attempts. Especially, the three of the seven fully trusting contributors who received only 5 in return could be expected to be very frustrated. In our view, this suggests that, for the trust game as introduced by Berg et al. (1995), inequality aversion seems to be more in line with experimental behavior.

## 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. From a methodological point of view, this becomes crucially important when comparing results of differently structured experiments and drawing general conclusions from such comparisons.

Our results demonstrate that individuals contribute more when large repayments are feasible than when nearly no repayment is feasible. While this seems to be at least consistent with the trust and reciprocity hypothesis, very few plays actually confirm the two basic predictions of trust ($c > 0$) and reciprocity ($r(2c) > c$). Although equity considerations in some contributions can be traced, the main kind of distributional concerns seem usually to come as a form of inequality aversion.

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## Appendix A

### *A.1. Instructions (for person A)*

In the experiment, we will match you with another student at random. You are person A and the other student is person 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.

### *A.2. Instructions (for person B)*

In the experiment, we will match you with another student at random. You are person B and the other student is person A. Person A will receive 10 points, which you will not receive. We ask 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 if you 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 you).

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

**For person 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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