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Intentions and Consequences

An Experimental Investigation of Trust and Reciprocity Determinants

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Abstract

We experimentally manipulate the efficiency of trust and reciprocity in a modified Investment Game. The aim of our manipulation is to test whether reciprocity is mainly affected by payoff consequences of trust or by intentions underlying it. We find that intentions matter and that consequences have an asymmetric impact: trustees reward trust more when trust is more efficient but do not adjust rewards to the efficiency of their own actions. As a result, profitability of trust is fostered by efficiency of trust as well as by efficiency of reciprocity. However, trustors do not fully exploit the high efficiency gains offered by investments and display only moderate trust.

Keywords: trust and reciprocity; other-regarding preferences; experiment

JEL classification: C72, C91

1 Introduction

Trust and reciprocity are main constituents of social capital and have been observed to improve the efficiency of economic systems (Arrow, 1974) and large organizations (La Porta *et al.*, 1997). According to Coleman (1990), a trust relationship involves two parties, the trustor and the trustee, and is characterized by four main aspects: i) trust opens up new opportunities for the trustee; ii) when the trustee reciprocates trust, the trustor is better off than when not trusting; iii) when the trustor trusts the trustee, the trustor's resources are accessible to the trustee at no cost; iv) a trust relation involves a time lag between the choices of the trustor and those of the trustee (sequentiality).[1] As an example, consider a typical hold-up problem: an employer invests in an employee training program but upon its completion possesses no mechanism to bind the employees to the firm. In this instance, the employees, having attained skills from the training, may opportunistically look for new job opportunities outside the firm. Thus, the employer anticipating this will offer the training program only if she believes that sufficiently many employees will reciprocate this trust-building action by staying with the firm.

In the standard economic approach, decisions involving trust are not distinguished from decisions under risk (Williamson, 1993). In this framework, the trustor would trust the trustee only if the expected gains from trusting were positive. Trust is thus rationalizable when the likelihood of the trustee reciprocating is sufficiently high. However, one has to distinguish the strategic aspect of trust from mere stochastic risk. Eckel and Wilson (2004) and Houser *et al.* (2010), for example, identify no significant correlation between choices involving risk and those involving trust. In an fMRI study, McCabe *et al.* (2001) show that the part of the brain involved when individuals face interactions with other humans beings in situations where trust is feasible differs from the part involved

[1] In our view, aspect iv) is debatable: when both parties decide independently, it is also possible for the trustee to exploit the trustor. More basically, it seems more important who can condition on what: e.g., the one who can condition on the other's choice may be the one who first commits to a choice.

when individuals face a risky task. Additionally, Kosfeld *et al.* (2005) show that trust is positively influenced by a neuropeptide called oxytocin, whereas risk taking is not.

Trust and reciprocity have been investigated in experimental settings adopting interaction schemes based on a sequential Prisoner's Dilemma. Within this class of games, the Investment Game (Berg *et al.*, 1995) has attracted a great deal of attention and several replications and variations can be found in the Experimental Economics literature (for a meta-analysis, see Johnson and Mislin, 2011). In the Investment Game (hereafter IG), the trustor chooses how much of a fixed endowment (usually a sum of money) to send to the trustee. This is then multiplied by a positive factor, usually equal to three, and forwarded to the trustee. The trustee decides how much of the received amount to send to the trustor.

The standard rational choice prediction for this game is that the trustee returns nothing to the trustor and that the trustor, anticipating this, does not send anything in the first place. Contrary to this prediction, Berg *et al.* (1995) find that trustors send positive amounts, i.e., on average about half of their endowment, and that trustees return on average slightly less than what is invested by the trustors. Among the studies on the IG reviewed by Johnson and Mislin (2011), the most relevant for our study manipulate the efficiency factor or multiplier, which is set equal to two or three. When reciprocity is measured as the proportion of investment returned to the trustor, a higher multiplier decreases the overall level of reciprocity.

We investigate behavior in a modified IG in which both amounts, one sent by the trustor and the other sent by the trustee, are multiplied by an efficiency factor. We experimentally manipulate both multipliers along two dimensions: the multipliers are either *high* or *low* and either *deterministic* or *probabilistic*. In the deterministic condition, multipliers are known by participants before choosing, while in the probabilistic condition participants only know that the former can be either high or low, with equal probability. Varying multipliers

can capture different technologies, generating different outputs for a given input. The aim of our variation is to check whether trust and reciprocity choices are mainly driven by either intentions or consequences of own and other's actions. In our setting, the intentions of trustors and trustees are measured by the amounts sent and, thus, by the costs of trusting and reciprocating, respectively. The costs are kept constant across experimental conditions, whereas consequences of actions differ across experimental conditions due to the varying multipliers.

Previous contributions in the literature have shown that both intentions and payoff consequences are likely to affect pro-social behavior. Rabin (1993), for example, analyzes fairness as originating from the intentions of others: if intentions of others are perceived as good (bad), this may trigger a positive (negative) reaction. Fehr and Schmidt (1999) measure fairness in terms of payoffs and suggest that only the material consequences of actions matter. Specifically, interacting individuals experience a psychological cost when they are either better or worse off than others in terms of payoff (i.e., inequity aversion). In an attempt to discriminate between the two explanations, McCabe *et al.* (2003) compare observed choices in two simple experimental settings. In the first setting, trustees can either choose a fair or a selfish move after a trust move by the trustor. In the second setting, trustees are given the same set of options, but the trustor is not given the opportunity to trust the trustee. Whereas the payoff consequences of the trustee's action do not change, the intentions of the trustor are accessible to the trustee only in the first setting. McCabe *et al.* show that fairness is observed in both settings but is much more frequent when good intentions can be inferred.

In our experiment, the consequences of trust enhance reciprocity. In particular, when investments generate higher deterministic benefits for the trustee, it is more likely to observe reciprocity than when investments generate lower deterministic benefits. When the efficiency of trust is probabilistic, the overall levels of reciprocity are in line with those observed in the low deterministic condition. Furthermore, trustees do not condition their level of reciprocity on expected

consequences of their own actions. As a result, trust profitability is positively affected by multipliers in the game. Unfortunately, trustors seem to disregard the levels of both multipliers, i.e., their own and that applied to amounts sent by the trustor, and generally fail to grasp fruitful investment chances.

2 Method

2.1 Design

We experimentally investigate modified versions of the well-known Investment Game (Berg *et al.*, 1995). In our setting, Player X (i.e, the trustor) chooses an amount x that she sends to Player Y (i.e, the trustee) from among four possible options: 0, 3, 6, or 9 ECU.[2] Before being forwarded to Y, x is multiplied by an efficiency factor m. In turn, Y chooses an amount y that she sends to X from among the same four possible options: 0, 3, 6, or 9 ECU.

Y can condition on the choice of X, i.e. Y's choice of y is a function of x in the sense of $y(x)$. Thus, a strategy of Y assigns amount y to each possible x choice of X. Similarly, amount y sent by Y is multiplied by an efficiency factor n prior to being forwarded to X. The payoff of X (π_X) is given by $\pi_X = E - x + ny$, whereas the payoff of Y (π_Y) is given by $\pi_Y = E - y(x) + mx$. $E = 9$ is the initial endowment given to each participant at the start of a round.

The efficiency factor m is experimentally manipulated in a within-subject fashion: in a deterministic condition, it can be either equal to 4/3 (m_{LOW}) or 3 (m_{HIGH}); in a probabilistic condition, it can be equal to 4/3 or 3 with equal likelihood ($m_{LOW/HIGH}$). Accordingly, each X has to choose an amount to send for m_{LOW}, m_{HIGH} and $m_{LOW/HIGH}$, being aware that each condition has the same likelihood to be chosen but not yet knowing which of the three applies. When condition $m_{LOW/HIGH}$ is randomly selected, a lottery defines whether m will be equal to either 4/3 or 3.

Factor n is subjected to the same manipulation, but the variation is per-

[2] ECU stands for Experimental Currency Unit used in the experiment.

formed between subjects. Thus, participants in one session are exposed to a single value of n chosen as 4/3 (n_{LOW}), 3 (n_{HIGH}), and 4/3 or 3 with equal likelihood ($n_{LOW/HIGH}$).

Given our experimental design, X has to choose one of the four possible values of x for each realization of m, deterministic with 4/3 versus 3, or probabilistic. Thus, in each round, X is asked to report three distinct choices, knowing that only one of them is actually going to be implemented. Y chooses one of the four possible values of y for each level of m and for each possible amount sent by X for the given level of m. It follows that in each round, Y is asked to report $4 \times 3 = 12$ distinct choices of which, eventually, only one is implemented.[3]

After each round both participants are reminded of the multipliers m and n, respectively, and informed about their random realizations when they are stochastic. Additionally, they are informed about their own as well as the other's actual choice and about their payoff.

2.2 Behavioral Predictions

Our experimental design allows us to test alternative hypotheses about determinants of trust and reciprocity. Under the standard assumption of selfish rationality, both x and y should be zero. Similar to the standard IG, Y does not have an incentive to send back a positive amount to X, irrespective of the amount sent by the latter. Accordingly, X rationally chooses to send nothing to Y. However, when individuals place value on the social consequences of their actions, outcomes may emerge that deviate from the sub-game perfect equilibrium based on common opportunism outlined above.[4]

Previous studies have highlighted the role of trust and reciprocity in interaction settings similar to the one investigated here (for a survey, see Camerer, 2003). A reciprocity-minded Y is likely to send to the corresponding X an amount y that reacts monotonically to x. An X anticipating such conditioning

[3] For details on how choices were collected, see the instructions reported in Appendix A.

[4] What this requires in our setting is that X and Y only care for their own payoff and that X knows that Y is opportunistic in this sense.

may thus trust Y and send a positive amount x.

Reciprocity, as captured by the behavior of Y, may be intention based or consequence based. On the one hand, reciprocity of Y may be triggered by intentions underlying choices of X. In our setting, intentions are proxied by the opportunity cost faced by X when choosing x. For each unit of x, Player X suffers a unit opportunity cost, independent of the level of m or n. If only intentions matter, a controlled variation of m and n should thus not change $y(x)$. On the other hand, reciprocity may be positively affected by the consequences of behavior as captured by the levels of m and n. A unit sent to Y generates a benefit of either 4/3 or 3, according to the level of m. If Y reacts to the consequences of X's actions in a proportional fashion, the following order should generally be observed, for a given $\tilde{x}$: $y(\tilde{x})|m_{HIGH} > y(\tilde{x})|m_{LOW/HIGH} > y(\tilde{x})|m_{LOW}$.

The $_{LOW/HIGH}$ condition allows us to investigate the impact of stochastic consequences. When more positive consequences are rewarded more, reciprocity in condition $m_{LOW/HIGH}$ is expected to be higher than that in m_{LOW} but lower than that in m_{HIGH}, independent of individual risk preferences.

As outlined above, the controlled variation of the efficiency factor m provides us with insights on how Y evaluates the actions of X. The controlled variation of n allows us to study how Y evaluates her own actions. Similar to the argument advanced for X, when Y values intentions underlying her actions, the same levels of y should be observed for all levels of n. Put differently, when consequences are taken into account, to generate the same reward for X, a stronger "effort" in terms of y is required for lower levels of n.[5] Accordingly, when only consequences matter, the following order should generally be observed: $y(\tilde{x})|n_{HIGH} < y(\tilde{x})|n_{LOW/HIGH} < y(\tilde{x})|n_{LOW}$.

In summary, if Y evaluates actions in terms of their underlying intentions, no significant differences in y should be observed across alternative specifications of the efficiency factors m and n, for a given x. On the other hand, if consequences

[5]For example, with the higher multiplier $n = 3$ an amount $y = 4$ would be required in order for X to receive 12, whereas with the lower multiplier $n = 4/3$ the higher amount $y = 9$ is required to achieve the same effect.

of actions drive reciprocity concerns, alternative levels of m and n are likely to affect the behavior of Y, for a given x. In particular, stronger reciprocity should be observed for higher levels of m and lower levels of n. We therefore expect to observe the highest levels of reciprocity, measured by y, in the m_{HIGH},n_{LOW} treatment and the lowest reciprocity levels of reciprocity in the m_{LOW},n_{HIGH} treatment.

2.3 Participants and Procedures

The experiment was run in Jena (Germany) using the laboratory of the Max Planck Institute of Economics. Participants were students of the Friedrich Schiller University Jena and were recruited using the ORSEE system (Greiner, 2004). The computerized experiment was programmed and conducted using the z-Tree software (Fischbacher, 2007). A total of 184 participants took part in six experimental sessions.[6]

Upon arrival at the laboratory, participants were randomly assigned to cubicles preventing interaction with other participants. Each participant received written instructions and was given a few minutes to read them privately. Then, a member of the experimental staff read aloud the instructions, and participants were offered a chance to privately ask clarifying questions.

The experiment consisted of four rounds. At the beginning of the experiment, participants were randomly assigned to either role X or Y and kept their assigned role for the remainder of the experiment. In each round, an X participant was randomly matched with a Y participant, and participants were made aware that they would not be matched with the same partner in subsequent rounds.

At the end of the experiment, one of the four rounds was randomly selected for payment. Experimental Currency Units (ECU) were used during the experiment, and participants were aware of the exchange rate of 2 ECU= €1 from

[6]In total, we conducted five sessions with 32 participants and one session with 24 participants.

the beginning. Final payment, which included experimental earnings and the show-up fee of €2.50, was paid in private to each participant prior to leaving the laboratory.[7]

3 Results

3.1 Descriptive Statistics

3.1.1 Choices of Players X

Figure 1 provides a summary description of the distribution of individual-level average x choices over the four experimental rounds, for each level of n and m.

[Figure 1 about here]

Most of the average choices of X are within the interval 3–6, with slightly higher values observed in conditions $n_{LOW/HIGH}$ and n_{HIGH} in comparison to condition n_{LOW}. However, a series of Wilcoxon Rank Sum tests does not highlight a statistically significant impact of the multipliers m and n on choices of X. In summary, X participants appear to not fully trust their partners and do not condition their behavior on m and n parameters.

Result 1 *Players X mainly reveal intermediate trust levels and are not responsive to alternative consequences of either their own or their partners' actions, as measured by multipliers m and n.*

Thus, like financial investors, trustors mostly engage in portfolio diversification by keeping part of their monetary endowment as a risk-free asset and also invest in risky trust. Here this risk is only strategic in case of deterministic multipliers and, additionally, stochastic when multipliers are stochastic.

[7] On average, participants earned €8.797. Earnings were, on average, higher for Y participants (€9.774) than for X participants (€7.819).

3.1.2 Choices of Players Y

For each level of n and m, Figure 2 provides a summary description of the distribution of individual-level average choices of Y conditional on potential choices of X.

[Figure 2 about here]

From Figure 2, we observe that Y participants condition their choice on the choice of their respective partners for each level of m and n. However, average and median values show that the reactions of Y participants do not perfectly match the choices of their respective partners. When comparing choices across alternative levels of n, it emerges that Y participants reward intentions of trustors and do not strictly link their actions to the consequences of trust. As an example, average y is always bigger, given a level of n, for $x = 9$ and m_{LOW} than for $x = 6$ and m_{HIGH}, even though the latter generates more positive consequences for X (12 vs 18, respectively).

Result 2 *Irrespective of conditions (i.e. m, n, and round), Players Y reward trust proportionally and condition their reward on intentions of trustors.*

Whether proportional reciprocity, when correctly anticipated by X, renders trust a profitable investment depends, of course, on the proportionality factor of the reaction but also on the multiplier n. The issue of trust profitability is addressed by the regression estimate reported below.

3.2 Regression Analysis

3.2.1 Determinants of Reciprocity

To test Y's reciprocity, we specify a multilevel logistic model. The dependent variable *yrecp* takes the value one if Y reciprocates (defined as sending back an amount equal to, or greater than, the amount x invested by X), and equals zero otherwise. The model is estimated by the maximum likelihood procedure

implemented in GLLAMM.[8] The main advantage of GLLAMM is that it allows for the inclusion of several nested random effects representing unobserved heterogeneity at different levels of a hierarchical dataset (Rabe-Hesketh *et al.*, 2005). In our experiment, both X and Y participants make repeated choices and are randomly assigned to matching groups at the start of each round, which is taken into account in our estimation.

The behavioral predictions discussed in subsection 2.2 set out a clear relationship between the multiplier combinations and the expected level of reciprocity in two of nine possible combinations. We expect to observe the highest level of reciprocity in the combination of m_{HIGH} and n_{LOW}. Conversely, we expect the lowest level of reciprocity in the combination of m_{LOW} and n_{HIGH}. The latter multiplier combination serves as the base case in our regression analysis.

Our set of explanatory variables includes the multipliers of X (m_{HIGH} and $m_{LOW/HIGH}$), the multipliers of Y, (n_{LOW} and $n_{LOW/HIGH}$), and the period variable. The underlying logistic model thus takes the form:

$$p_i = Pr(yrecp_i = 1) = f(\beta_0 + \beta' \mathbf{Z}_i) \tag{1}$$

where,

$\beta' \mathbf{Z}_i = \beta_1 n_{LOW_i} + \beta_2 n_{LOW/HIGH_i} + \beta_3 m_{HIGH_i} + \beta_4 m_{LOW/HIGH_i} + \beta_5 Period_i$.

We ran three regressions for the different amounts sent by X that may reasonably allow for reciprocity behavior of Y (i.e., $x = 3ECU$, $x = 6ECU$ and $x = 9ECU$). Table 1 summarizes the results of the regressions.[9]

[Table 1 about here]

The results show that in terms of X's multipliers, m_{HIGH} has a significant impact on the reciprocity of Y in relation to the baseline. In contrast,

[8] The acronym GLLAMM stands for Generalized Linear Latent and Mixed Models. For a review, go to http://www.gllamm.org/

[9] We run an extended regression model adding the four possible multiplier combinations that result from interacting the multipliers of X with those of Y as regressors. The results do not change substantially and, given that we do not aim to study specific interactions between multipliers, we keep the reduced model that includes the main effects.

$m_{LOW/HIGH}$ has no significant impact on the reciprocity of Y. In terms of Y's multipliers, no significant impact on reciprocal behavior is observed. Thus, higher deterministic consequences of trust result in higher levels of reciprocity for all trust levels, while the consequences of reciprocity have no significant effect on reciprocity.

Result 3 *In line with consequence-based reciprocity, Players Y reward trust more in case of* $m = 3$. *In contrast to consequence-based reciprocity, Players Y do not adjust their reaction to the efficiency of their own choice* y.

Probabilistic consequences of trust seem to displace reciprocity concerns, with reciprocity levels for $m_{LOW/HIGH}$ being not significantly different to those for m_{LOW}. However, reciprocity levels for $m_{LOW/HIGH}$ are lower than those for m_{HIGH} (see W-$st2$).

Result 4 *Probabilistic rewards seem to diminish reciprocity concerns, with overall reciprocity levels lower than those observed for* m_{HIGH} *and similar to those observed for* m_{LOW}.

3.2.2 Profitability of Trust

The profitability of trust depends on amount y returned by Y and on the level of multiplier n. The regression of Table 1 shows that Y participants positively react to higher amounts x but do not adjust their reactions to the consequences of their own actions. To better understand the determinants of the profitability of trust, we estimate a multilevel linear model.[10] The dependent variable *Rate of return (%)* measures the rate of return of the investment made by X and is given by $\left(\frac{ny}{x} - 1\right) * 100$.[11] As independent variables, we include in our model the multipliers of X (m_{HIGH} and $m_{LOW/HIGH}$), the multipliers of Y (n_{LOW}

[10] As for the regression in Table 1, the model is estimated by the maximum likelihood procedure implemented in GLLAMM and controls for repeated choices at the individual and the group level.

[11] For obvious reasons, the regression estimate refers only to strictly positive investments ($x > 0$). In condition $n_{LOW/HIGH}$, the expected value of ny is employed to compute the dependent variable *Rate of return (%)*.

and $n_{LOW/HIGH}$), the period variable ($Period$), and two dummy variables controlling for the level of trust displayed by X ($x = 6$ and $x = 9$).

Table 2 reports the outcomes of two distinct regressions, one restricted to strictly positive levels of y and one for all levels of y. Main attention is given to the former because estimations in the latter are likely to be biased by the high number of observations clustered at the lower bound of the distribution (about 45% of the observations are observed in correspondence to -100%). Moreover, the estimation restricted to $y > 0$ seems to be justified since we are not interested in how the explanatory variables impact on the decision to reciprocate but on how much to reciprocate.

[Table 2 about here]

The analysis restricted to reciprocators (with choices $y > 0$) shows that in the baseline condition n_{HIGH}, m_{LOW}, investments tend to generate high positive returns, with the amount received back being more than three times the amount invested. When the positive consequences of the investment are further improved by m_{HIGH}, the returns on the investment are even higher, as captured by the coefficient of m_{HIGH}. However, profitability of trust seems to largely depend on the multiplier of Y: for n_{LOW} returns of the investment sharply decline. The same holds for the probabilistic n, but the negative impact is weaker than that of n_{LOW} (see W-st1). For $m_{LOW/HIGH}$ no significant difference with respect to m_{LOW} is observed, but the impact in terms of profitability is significantly lower than that of m_{HIGH} (see W-st2).

Result 5 *The profitability of trust is positively affected by the multiplier m via an increase in the proportionality of reaction, and by the multiplier n that directly increases the returns for Players X of each unit sent by Players Y.*

Table 2 shows that the profitability of an investment decreases with the amount invested, showing a stronger negative effect for an investment of 9 than for an investment of 6. Thus, Players Y do not reward more risk borne by

Players X with higher returns on the investment. Furthermore, investments become less profitable as participants gain experience.

Result 6 *The profitability of an investment decreases when the amount invested increases and when subjects become more experienced.*

Finally, it should be noticed that, at least in qualitative terms, findings of the regression analysis on the subsample of reciprocators are also confirmed by the regression analysis on the entire population of trustees.

4 Discussion and Conclusions

By systematically varying the multipliers, i.e., the efficiency of trusting (choice x) and rewarding trust (reaction $y = y(x)$ to x), we test with the help of our data whether reciprocity is more strongly affected by payoff consequences or by intentions. We find that trustees react proportionally to intentions, as revealed by the trustor's choice of x, but are also influenced by efficiency. The latter effect is, however, one-sided: trustees reward trust more when m is high and trust is highly profitable for them but do not condition their reciprocity on how profitable their rewarding is for the trustor. As a result, the profitability of trust is positively affected by both multipliers. Whereas the multiplier m improves trust profitability by fostering the proportionality of the reaction for a given trust level, multiplier n improves trust profitability by inflating the consequences of the proportional reaction. With reference to this finding, it should be noticed that the impact of the probabilistic multiplier m is the same as that of the low deterministic multiplier m. Thus, a probabilistic multiplier of the trustor's choice seems to dampen reactions of the trustees disproportionately. Trust profitability decreases with the number of rounds played and, quite surprisingly, when the amount invested increases. The latter seems to be anticipated by trustors who generally display intermediate or low trust levels. At the same time, trustors are quite unresponsive to alternative levels of m and n and, thus,

do not seem to fully anticipate the impact of efficiency parameters on trust profitability.

In our view, these findings are surprising and provoking. As should be expected, they confirm that reciprocity is based partly on consequences and partly on intentions. However, whether and how these two reciprocity concerns matter is highly role dependent. Trustors seem to consider trust as a valuable investment alternative but are not heavily affected by alternative levels of efficiency in the game. Trustees reward intentions by reacting proportionally to trust but also react to how profitable such intention-based trust is for them. What trustees mainly match by reciprocation are the intentions of trustors, by proportionally reacting to x. What they do not try to achieve, however, is to linearly relate the consequences of trust (i.e., mx) to the consequences of reciprocity (i.e., ny).

In order to obtain these findings, we employed a rather complex experimental design, which confronts participants with several choice tasks. Whereas X participants had to consider different m, n constellations, Y participants were aware of the m, n constellations but did not yet know choice x to which they eventually had to react. This somewhat unusual design was employed to balance the complexity of the choice task of X and Y. Game theoretically, this does not matter, but emotionally it may have rendered our experimental scenario a rather "cold" one (for a discussion of "hot" play and "cold" strategy method, see Brandts and Charness, 2011). In our view, a "cold" environment should provide a first testbed, and one should later test whether main effects emerging in an environment of this kind will survive when it gets "hot." Of course, "hot" environments might trigger additional effects and, if this is case, one has to discuss when they matter. In case of an institutional design one may, for instance, be less concerned about purely "hot" effects since, by becoming more experienced, participants might become less emotional.

As shown in previous studies (e.g., Rabin, 1993), access to the intentions of the counterpart is essential to trigger reciprocity. We complement this evi-

dence by showing that consequences, as opposed to intentions, also impact on reciprocity: trustees reward better trust outcomes (mx), for a given trust level (x), but do not adjust rewards to match the efficiency of their own actions (n). We conclude that in a risky investment context, trust profitability may be heavily affected by the structural efficiency of the exchange: when a highly efficient technology is available, the likelihood of profiting from a trust-based risky investment is much higher than when a less efficient or risky technology is available.

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A Instructions (Translation from German)

You have been recruited to take part in a computer administered experiment. You receive a 2.5 Euro show up fee for taking part in the experiment. Please read the following instructions carefully.

Prior to the experiment, you will have to answer a few questions testing your comprehension of these instructions. Please note that the instructions are written in male gender only for convenience, but refer to both genders equally.

Please do not talk and raise your hand if there are any specific questions during the experiment. Some experimenter will come to assist you. Please remain silent and switch off your mobile phone. If you violate these rules, we will have to exclude you from the experiment and all payments.

You will be either a Participant X or a Participant Y. Participants will be randomly assigned to role X or to role Y and will keep that role for the rest of the experiment. The experiment extends over 4 rounds. New pairs of X and Y participants are randomly formed before each round. Each participant X will not be paired with the same participant Y more than once in the 4 rounds of the experiment. Participants will not be informed by us, during or after the experiment, whom they are matched with. In each round the participants with a given role face the same decision task. However, the decision tasks of Participants X and Y differ as will be detailed below.

During the experiment you are going to make your choices by using experimental currency units (ECU). All participants are given an initial endowment of 9 ECU. At the end of the experiment, ECU will be converted into Euros at an exchange rate of 2 ECU = 1 Euro. As an example, if you have 16 ECU, this is equivalent to 8 Euros. Only one of the four rounds is randomly drawn for payment at the end of the experiment.

The decisions that you make during the experiment will affect your final payoff.

Interaction Structure

PARTICIPANT X

Participant X chooses how much to send to Participant Y. Participant X can send only one of the following amounts: 0, 3, 6, 9 ECU.

The amount that Participant X sends to Participant Y will then be multiplied by a multiplier **m**. The multiplier m is either 4/3 or 3 or ?. In case of m=?, the multiplier **m** is either 4/3 or 3 with equal likelihood.

The following table shows the ECU received by Participant Y for each amount of ECU sent by Participant X and for each value of m. In case of m=?, both payoffs of Y are equally probable.

ECU		**Y receives**		
		m=4/3	**m=3**	**m=?**
X sends	**0**	0	0	0
	3	4	9	4 or 9
	6	8	18	8 or 18
	9	12	27	12 or 27

PARTICIPANT Y

Participant Y can react to what Participant X has sent her/him and chooses how much to send to Participant X. Participant Y can send only the following amounts: 0, 3, 6, 9 ECU.

The amount that Participant Y sends to Participant X will then be multiplied by a multiplier **n**. The multiplier **n** is *3 (4/3; ?, which means that the multiplier m is either 4/3 or 3 with equal likelihood).* [`Only the multiplier relevant for the implemented treatment is shown to participants`].

The following table shows the ECU received by Participant X for each amount of ECU sent by Participant.

ECU		***X receives***		
		n=4/3	***n=3***	***n=?***
Y sends	***0***	*0*	*0*	*0*
	3	*4*	*9*	*4 or 9*
	6	*8*	*18*	*8 or 18*
	9	*12*	*27*	*12 or 27*

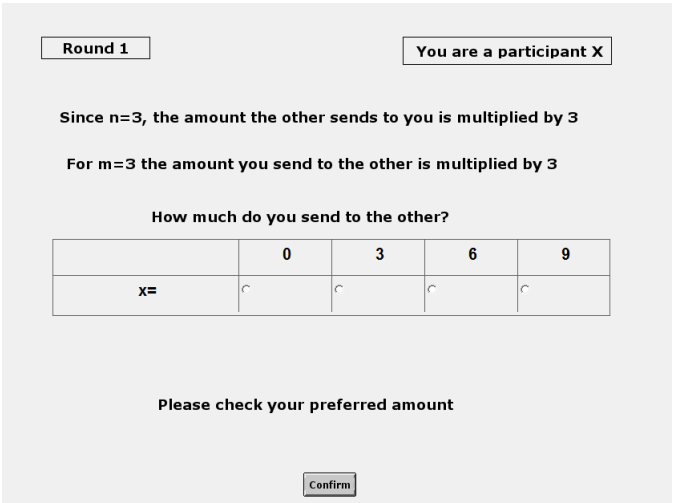
[`Only the column relevant for the implemented treatment is shown to participants`]

Decision Tasks

PARTICIPANT X

Participant X will be asked to report the amount he/she intends to send to Participant Y by filling up some tables similar to the one in Figure 1. The amount sent can be equal to 0, 3, 6, or 9 ECU

Participant X has to decide before knowing the actual value of her/his multiplier **m**. This implies that for each possible value of **m**, he/she has to submit a choice. The choices are submitted on three distinct screens that differ only for the value of **m**.



[`reproduction of the screenshot of condition n=3 and m=3`]

Figure 1: Participant X's screen

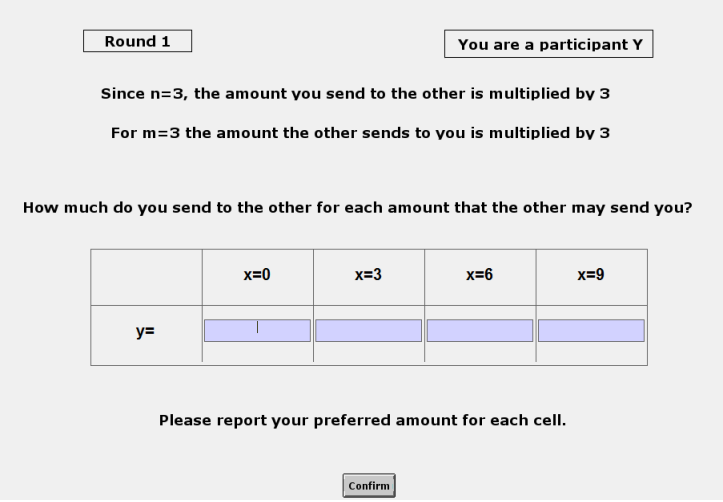
Figure 1 refers to m=3, however similar decisions have to be made by X for the other possible m values, m=4/3 and m=?.

Note that Participant X must choose without being able to condition on the choice y by Participant Y whereas Participant Y can react differently to different decisions x by Participant X.

PARTICIPANT X

Participant Y will be asked to report the amount he/she intends to send to Participant X by filling up some tables similar to the one in Figure 2. The amount sent can be equal to 0, 3, 6, or 9 ECU

Participant Y has to decide before knowing the actual choice of the other, and the actual value of the multiplier **m** of the other. This implies that for each possible **m**, he/she has to submit four choices, one for each potential choice of the other. The choices are submitted on three distinct screens that differ only for the value of **m**.



[reproduction of the screenshot of condition n=3 and m=3]

Figure 2: Participant Y's screen

Figure 2 refers to m=3, however similar decision tables have to be filled out for the other possible m values, m=4/3 and m=?.

Round Payoffs

Once Participants X and Participants Y have made their choices, payoffs in the round are computed.

The payoff of Participant X is defined by subtracting from the initial endowment of 9 Euros the amount x sent to Participant Y and by adding the amount y received from Participant Y multiplied by the multiplier n (ny). Thus, the payoff of Participant X is equal to 9-x+ny ECU.

The payoff of Participant Y is defined by subtracting from the initial endowment of 9 Euros the amount y sent to Participant X and by adding the amount x received from Participant X multiplied by the multiplier m (mx).Thus, the payoff of Participant X is equal to 9-y+mx ECU.

In more details, the following procedure defines the round payoffs

- The multiplier **m** is randomly chosen for each pair of participants
- The choices made for the chosen multiplier m are employed to compute the payoffs of the participants as specified above.

At the end of each round, both participants are informed about the randomly drawn multiplier m, about the choices made by the other participant, and about their own payoff.

Final Payments

The experiment is composed of 4 independent rounds, but only one of the four rounds is randomly chosen for payment. The payoff in the randomly drawn round is going to define the final payment in the experiment. The amount of ECU obtained in the round are exchanged with Euros at the conversion rate of 2 ECU = 1 Euro. As an example, if in the randomly drawn round the payoff is of 9 ECU, the final payment in the experiment is equal to Euros 4.5 (obtained as 9/2). The show-up fee of 2.5 Euros and the final payment in the experiment will be paid out privately in cash at the end of the experiment.

B Figures

Figure 1: Choices of Player X (average at the individual level)

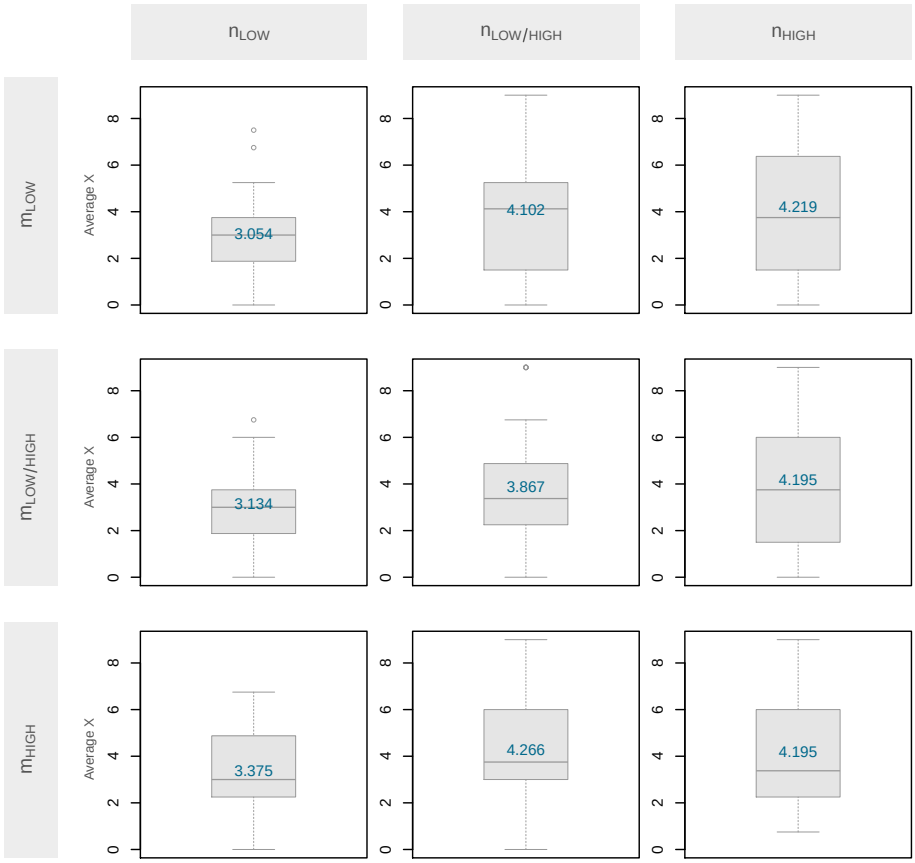
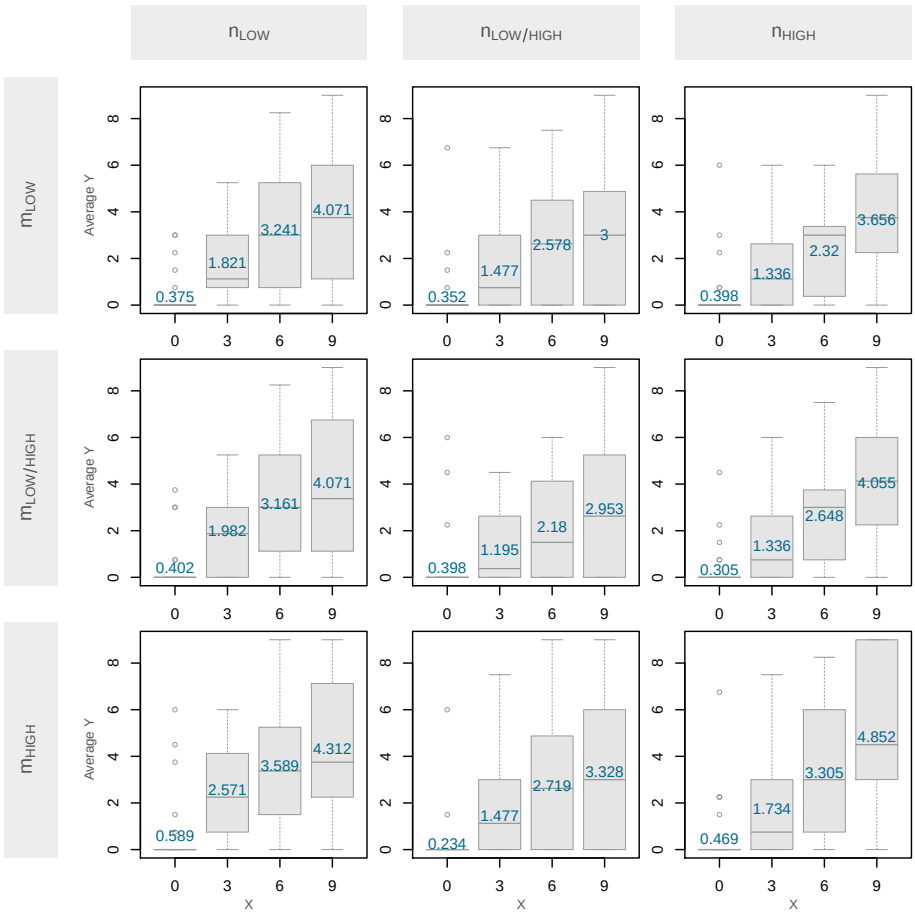


Figure 2: Choices of Player Y (average at the individual level)



C Tables

Table 1: Determinants of Reciprocity (GLLAMM: logistic)

	Coeff (Std. Err.)		
Reciprocity∼	x=3	x=6	x=9
(Intercept)	0.804 (1.135)	-2.515 (1.193)*	-3.612 (1.370)**
n_{LOW}	1.009 (1.287)	1.569 (1.644)	0.775 (1.859)
$n_{LOW/HIGH}$	-0.412 (1.243)	0.099 (1.767)	-0.698 (1.923)
m_{HIGH}	0.591 (0.252)*	1.367 (0.272)***	1.545 (0.302)***
$m_{LOW/HIGH}$	-0.222 (0.252)	0.072 (0.269)	0.227 (0.302)
Period	-0.562 (0.097)***	-0.461 (0.100)***	-0.292 (0.107)**
$W\text{-}st1$	2.440	0.670	0.560
$W\text{-}st2$	10.190**	22.890***	20.190***
Log likelihood	-414.013	-375.601	-321.977
No. of level 1 (2) [3] units:	1104 (92) [24]	1104 (92) [24]	1104 (92) [24]
Level 2 random effects variance$^{\diamond}$	18.615	12.743	14.057
Level 3 random effects variance$^{\diamond\diamond}$	2.184	2.682	3.232

$W\text{-}st1$: Wald statistic for the hypothesis that $n_{LOW} = n_{LOW/HIGH}$
$W\text{-}st2$: Wald statistic for the hypothesis that $m_{HIGH} = m_{LOW/HIGH}$
$^{\diamond}$subjects; $^{\diamond\diamond}$matching groups
$^{***}(0.001)$;** (0.01);* (0.05); $^{\circ}(0.1)$; significance level

Table 2: Profitability of Trust (GLLAMM: linear)

	Coeff (Std. Err.)	
Rate of return (%)∼	Reciprocators ($y > 0$)	All ($y \geq 0$)
(Intercept)	226.622 (18.952)***	102.500 (22.417)***
n_{LOW}	-146.437 (21.709)***	-68.921 (27.739)*
$n_{LOW/HIGH}$	-65.454 (21.649)**	-61.994 (27.390)*
m_{HIGH}	31.647 (9.452)**	25.885 (9.663)**
$m_{LOW/HIGH}$	9.839 (9.618)	-0.372 (9.729)
$x = 6$	-93.230 (11.025)***	-27.194 (10.298)**
$x = 9$	-125.670 (15.773)***	-26.955 (13.461)*
Period	-9.712 (3.656)**	-23.001 (3.644)***
$W\text{-}st1$	12.85***	0.06
$W\text{-}st2$	5.18*	7.45**(0.01)
Log likelihood	-2615.8	-5028.5
No. of level 1 (2) [3] units:	443 (78) [24]	812 (89) [24]
Level 2 random effects variance$^{\diamond}$	2106.9	1334.0
Level 3 random effects variance$^{\diamond\diamond}$	729.8	2263.4

$W\text{-}st1$: Wald statistic for the hypothesis that $n_{LOW} = n_{LOW/HIGH}$
$W\text{-}st2$: Wald statistic for the hypothesis that $m_{HIGH} = m_{LOW/HIGH}$
$^{\diamond}$subjects; $^{\diamond\diamond}$matching groups
$^{***}(0.001)$;** (0.01);* (0.05); $^{\circ}(0.1)$; significance level