The impact of payoff interdependence on trust and trustworthiness

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Abstract

In one-shot investment game experiments where each player's payoff is a convex combination of own and other's profit, trust remains unaffected by the extent of interdependence whereas trustworthiness reacts positively to it.

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1 Introduction

The phenomenon of trust has been extensively explored by a variety of disciplines across the social sciences, including economics, social psychology, and political science. Economists usually define trust as believing in others' trustworthiness, and conceive it as a risky prospect (Coleman, 1990; Williamson, 1993; Ben-Ner and Putterman, 2001). To account for trust in this sense, one needs an account of what determines trustworthiness and how (if at all) trust reacts to variation in trustworthiness.

Here, we focus on shared interests as determinants of trust and trustworthiness. To this aim, we modify the investment game (Berg et al., 1995) by introducing a mutual payoff interdependence between players. In the investment game, a trustor can send any share of her endowment to a trustee. The amount sent is tripled before reaching the trustee, who can then return any share of what she received to the trustor. In our modified game, a player decides for a given role (trustor or trustee), whose main share of payoff she collects, but also receives a share of the payoff of the other role. The link between payoffs does not question the opportunistic benchmark solution with no exchange at all. Nevertheless, increasing the strength of payoff interdependence weakens the conflict between parties. We want to investigate whether and to what extent this affects behavior.

If shared interests prompt group identity, as advocated by some social psychologists (see, e.g., Brewer and Gardner, 1996), the stronger the interdependence, the higher the exchanged amounts. But, if people honor trust because they want to reward trustors for accepting a "true" risk (Rousseau et al., 1998; James, 2002), increasing payoff interdependence may crowd out trustworthiness.[1] Our design allows us to test how these two effects influence trustworthiness.

[1] See Frey (1997) for the hypothesis that monetary incentives endanger intrinsic motivations (here, of rewarding trust).

In a former experimental study focusing on ingroup/outgroup comparisons (Güth et al., 2005a), the effects of shared interests on trustworthiness were not clear-cut. Only for an intermediate level of outcome interdependence, trustworthiness (but not trust) inspired ingroup-favoring behavior. Here we want to investigate the effects of mutual payoff interdependence more thoroughly by a more focused design.

2 Experimental design

Let A and B be two interacting players, each endowed with 10 ECU (Experimental Currency Unit). Trustor A can send any integer amount a to trustee B, with $0 \leq a \leq 10$. The amount sent is tripled and received by B, who can return any integer amount b to A, with $0 \leq b \leq 3a$. The players' profits are $\pi_A = 10 - a + b$ for A, and $\pi_B = 10 + 3a - b$ for B. Our modification via mutual profit sharing is based on payoffs

$$U_i = (1 - \alpha)\pi_i + \alpha\pi_j,$$

with $i, j = A, B$, $i \neq j$, and $0 < \alpha < 1/2$.[2] Hence player i's final payoff is a convex combination of his own and his counterpart's profits. A description of our experimental game is provided in Figure 1.

Insert Figure 1 about here

To isolate the effects of shared interests from other confounding factors, we systematically manipulate α, but keep it lower than 0.25 to never question the opportunistic benchmark solution. We use $\alpha = \underline{\alpha} = 0.02$ and $\alpha = \bar{\alpha} = 0.18$ in our experimental treatments, and $\alpha = 0$ in our control treatment.[3] If parties are opportunistic, transfers should be zero in all three treatments, regardless of α. Nevertheless, a positive investment by the trustor becomes less risky when

[2] Situations where interaction is not limited to transaction but allows for positive externalities are social environments or stable organizations like firms or families.

[3] Setting $\underline{\alpha} = 0.02$ allows us to check whether minimal profit sharing suffices to trigger group identity. The instructions of the control treatment did not include any reference to α.

α increases. Thus, if trust is viewed as a risky prospect, the trustor may send more, the larger α is. A positive relation between a and α is also suggested by considering trust as a social decision: The more other's interests become one's own interests, the stronger group identity should be, and the more the trustor should send (cf., Bourhis et al., 1997; Haslam, 2001).[4] In this view, it should matter more whether α is positive than how large it is ($\underline{\alpha}$ or $\bar{\alpha}$).

How trustworthiness reacts to variations in α depends on what drives trustees' behavior. If people honor trust because they want to reward true risk-taking trustors, then an increase in α, reducing true risk, may crowd out trustworthiness. However, if a higher share in the other's profits enhances group identity and, by this means, the social and psychological trust-trustworthiness mechanism, a stronger interdependence may trigger larger returned amounts.

The computerized experiment was conducted at the laboratory of the Max Planck Institute in Jena, using the z-Tree software (Fischbacher, 1999). Participants were undergraduate students from different disciplines at the University of Jena. After being seated at a computer terminal, participants received written instructions.[5] Understanding of the rules was ensured by a control questionnaire that subjects had to answer before the experiment started.

In total, we ran three sessions, each involving 32 participants and employing one of the three treatments. Sessions took about 45 minutes. We implemented an exchange rate of 10 ECU = €5.00, and the average earning per subject was €14.90.

3 Experimental results

Figure 2 provides an overview of the experimental results. It graphically illustrates how returned amounts, b, depend on amounts a sent in each of the three

[4] See, however, Güth et al. (2005a) showing that trust may not be affected by purely artificial group identity.

[5] See Güth et al. (2005b)'s working paper for an English translation.

treatments. The dots represent the independent observations, and the straight line is the ideal linear fitting of the data. The $\bar{\alpha}$-treatment exhibits the steepest line, while the lines of the control- and the $\underline{\alpha}$-treatment appear quite similar. This suggests more trustworthiness in case of high profit-sharing.

Insert Figure 2 about here

Tables 1 and 2 provide descriptive statistics on investment decisions in each treatment. Table 1 refers to the trustors and reports on absolute amounts sent. Table 2 refers to the trustees and reports on the return ratio b/a.

Insert Tables 1 and 2 about here

In line with earlier findings (cf., Berg et al., 1995; Gneezy et al., 2000; Ortmann et al., 2000; Cox, 2004), the average amount sent is around half the endowment in all treatments. Quite surprisingly, it is the highest in the $\underline{\alpha}$-treatment. However, due to the large standard deviations, non-parametric tests fail to reject the hypothesis that the values come from the same distribution ($p > 0.3$ for all comparisons, two-sided Wilcoxon rank-sum tests). Trust decisions remain therefore unaffected by the creation of a link between one's own and the trustee's profits.

Turning to the trustees' behavior, Table 2 reveals that only in the $\bar{\alpha}$-treatment the average return ratio is greater than 1, while in the control- and the $\underline{\alpha}$-treatment positive investments by the trustors are not rewarded properly. Wilcoxon rank-sum tests (one-sided) confirm that trustees return significantly more when $\alpha = 0.18$ than when $\alpha = 0.02$ ($p = 0.045$). Therefore, even with conservative non-parametric tests, we find that stronger mutual sharing strengthens trustworthiness.

The effect of shared interests on amounts sent and returned is explored in more detail via generalized linear regressions, whose results are reported in Tables 3 and 4 for trustors and trustees, respectively. For the trustors we assume

a negative binomial, rather than Poisson, distribution due to over-dispersion in the data.

Insert Tables 3 and 4 about here

The regression for the trustors has sending decisions as dependent variable, and treatment dummies as independent variables (with $\alpha = 0$ as baseline). The dummy coefficients are not significant, meaning (in line with the results of the non-parametric tests) that sharing in the trustee's profits has no significant impact on sending decisions. Additionally, we cannot reject the hypothesis that all coefficients are jointly equal to zero.

In the regression for the trustees (cf., Table 4), the dependent variable is the amount returned. The independent variables are the amount sent by the trustors, and treatment dummies having the same interpretation as in Table 3. The regression has considerable explanatory power, and the hypothesis that the dummy coefficients are jointly equal to zero can be rejected. The amount sent has a significantly positive effect on the amount returned, implying that reciprocity is to some extent important. Furthermore, the coefficient of $\bar{\alpha}$ is significantly positive, meaning (as suggested by the non-parametric tests) that trustees tend to return more if their share of the trustor's profits is high. Finally, the effect of low share on trustworthiness is negative, but not significantly so. Hence, the regressions confirm the results emerging from the previous analysis: While trust is not significantly affected by the level of profit-sharing, trustworthiness is.

4 Conclusion

We provide experimental evidence for a different reaction of trust and trustworthiness to various levels of payoff interdependence. In particular, trust does not change significantly when different degrees of shared interests between trustors and trustees are exogenously established. In contrast, trustworthiness reacts

positively to the extent of interdependence. Thus, at least in our setting, trust seems to be driven by own intrinsic dispositions while trustworthiness is more affected by cognitive perceptions of the social domain in which interaction takes place. Deliberated trust, based on realistic beliefs about others' trustworthiness, is not supported by our data. This may result in missing profitable investment opportunities and in payoff losses for both parties.

Appendix: Experimental instructions

This appendix reports the instructions (originally in German) we used for the $\bar{\alpha}$-treatment. The instructions for the other treatments were adapted accordingly and are available upon request.

Instructions in the $\bar{\alpha}$-treatment

Welcome and thanks for participating in this experiment. Please read the following instructions carefully. From now on any communication with other participants is forbidden. If you have any questions or concerns, please raise your hand. We will answer your questions individually. It is very important that you follow this rule, otherwise we will exclude you from the experiment and from all payments.

The experiment allows you to earn money. Your experimental income will be calculated in ECU (Experimental Currency Unit), where 1 ECU = €0.50. At the end of the experiment, the ECU-income you have earned will be converted to Euro and paid to you in cash.

Detailed information on the experiment

In this experiment, participants are randomly divided into pairs. This means that you will be interacting with one other participant, whose identity will not be revealed to you at any time.

At the beginning of the experiment, the two members of a pair will be randomly assigned one of two roles: either A or B. Each A-person and each B-person will receive an endowment of 10 ECU, and must take only one decision.

- *A-participants' task*

As an A-person, you must decide how much of your endowment you want to give to B. You can choose only an integer amount; i.e., 0, 1, 2, $\cdots$, 9 or 10 ECU.

For any amount you decide to give, B will receive the triple. For instance, if you give 1 ECU, B will receive 3 ECU; if you give 3 ECU, (s)he will receive 9 ECU; if you give 5 ECU, (s)he will receive 15 ECU.

- *B participants' task*

As a B-person, you are informed about the amount you receive, which is three times what A has given to you. You must then decide how much of the received amount you

want to give back to A. For example, if A has given you 5 ECU and thus you have received 15 ECU, you must decide how many of these 15 ECU you want to return to A. Only integer amounts (i.e., 0, 1, 2, $\cdots$, 3×amount given by A) can be sent back.

The return of A and B is therefore given by:

A's return	=	10 − [what (s)he gives to B] + [what (s)he receives from B]
B's return	=	10 + [3 × what (s)he has been given by A] − [what (s)he returns to A]

Your role (either A or B) will be told to you before the experiment starts.

Your **experimental earnings** depend on your own return as well as on the return of the person whom are matched with. In particular, you keep 98% of your own return and share the 2% of the return of the other person. Hence:

- If you are an A-person your period earnings are:

A's earnings	=	**0.98** × (A's return) + **0.02** × (B's return)

- If you are a B-person your period earnings are:

B's earnings	=	**0.98** × (B's return) + **0.02** × (A's return)

EXAMPLE

Suppose that you are an A-person, that your return is 12 ECU, and that B's return is 14 ECU. Then, your experimental earnings are: $0.98 \times 12 + 0.02 \times 14 = 11.76 + 0.28 = 12.04$.

After all participants have made their choice, you will receive information about your own's return, the other's return and your experimental earnings. If you are an A-person, you will also be informed about the number of ECU you received from B.

Before the experiment starts, you will have to answer some control questions to verify your understanding of the experiment.

Please remain quiet until the experiment starts. If you have any questions, please raise your hand now.

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Table 1: Average absolute amount sent by trustors in each treatment

Treatment	n^a	Mean	Median	Std. deviation
Control	16	4.44	4.5	3.73
$\underline{\alpha}$	16	5.87	5.5	3.18
$\bar{\alpha}$	16	4.69	4.5	3.46

[a] Number of observations.

Table 2: Average relative amount returned by trustees in each treatment

Treatment	n^a	Mean	Median	Std. deviation
Control	16	0.98	1.1	0.830
$\underline{\alpha}$	15	0.75	1.0	0.578
$\bar{\alpha}$	13	1.15	1.2	0.643

[a] Number of observations; missing values due to $a = 0$.

Table 3: Negative binomial regression on trustors' amounts sent

Independent variable	Coefficient	Std. error
Constant	1.490^{***}	0.201
$\bar{\alpha}$	0.055	0.283
$\underline{\alpha}$	0.281	0.279
Number of obs = 48		LR $\chi^2(3) = 1.15$
Prob $> \chi^2 = 0.5636$		Pseudo $R^2 = 0.0045$

Significance levels: $* * * \leq 0.01$

Table 4: Poisson regression on trustees' returned amounts

Independent variable	Coefficient	Std. error
Constant	0.180	0.221
a	0.236^{***}	0.024
$\bar{\alpha}$	0.302^{**}	0.153
$\underline{\alpha}$	-0.191	0.162
Number of obs = 40		LR $\chi^2(3) = 13.56$
Prob $> \chi^2 = 0.00$		Pseudo $R^2 = 0.330$

Significance levels: $** \leq 0.05$; $*** \leq 0.01$

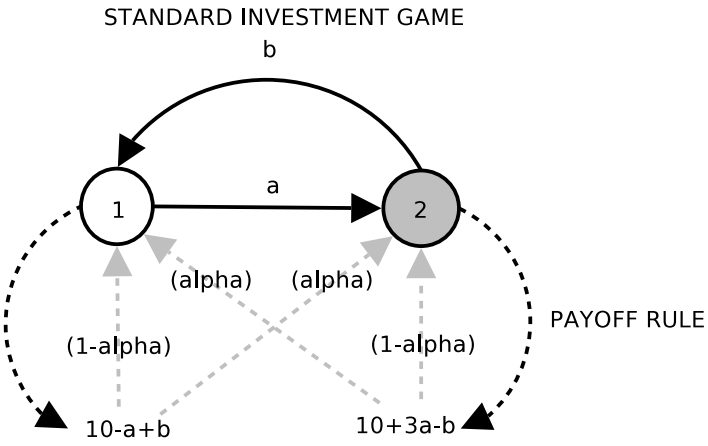

Figure 1: The experimental investment game

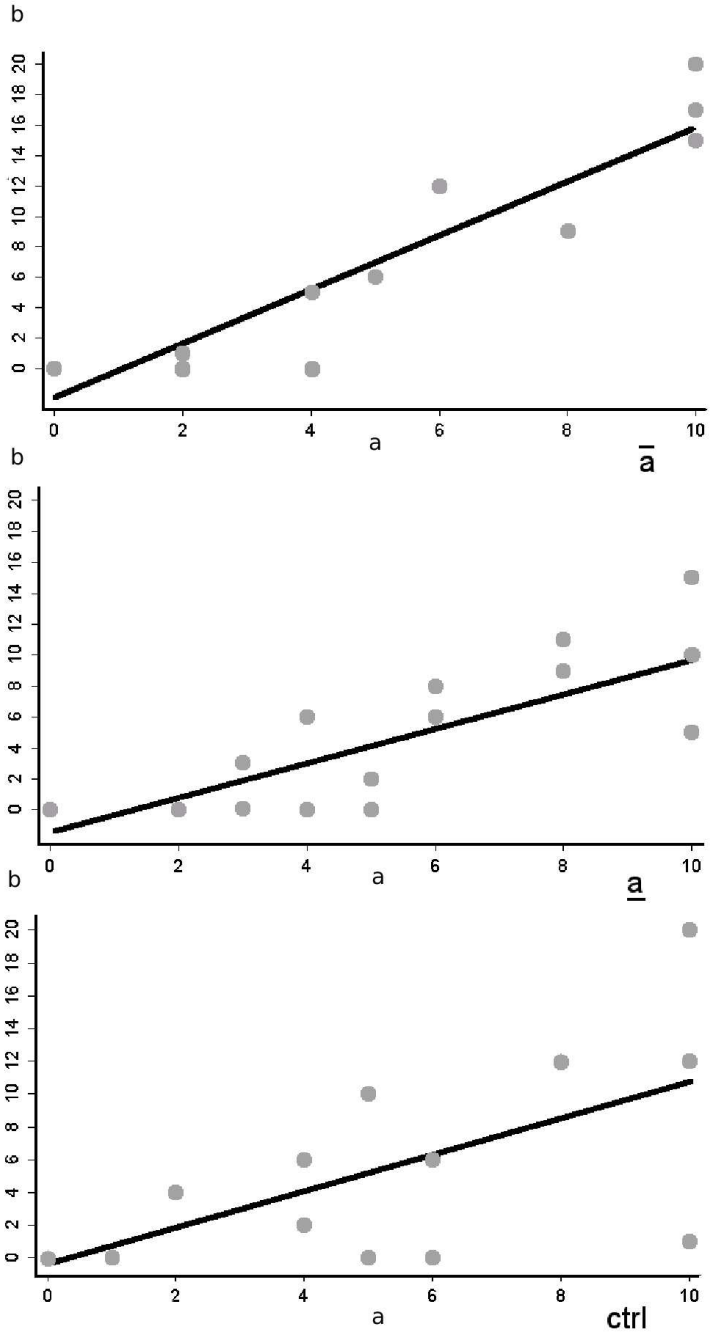

Figure 2: Distribution of the independent group observations and linear fitting of the data in each treatment