Voluntary Leadership in an Experimental Trust Game

Fabian Kleine°, Manfred Königstein, Balazs Rozsnyoi*

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Abstract

We present a lab experiment on an endogenous trust game in which one player (the principal) may decide to leave the investment choice to the agent or to take the investment decision himself/herself. In the latter case we refer to this as "voluntary leadership". We show that voluntary leadership increases investment and increases backtransfer of the second mover compared to the alternative sequencing in which the agent is investor. We also show that investment and backtransfer is higher under voluntary leadership than in the control treatment with exogenously determined sequencing. Furthermore, we show that risk preference and inequality aversion as modelled formally by Fehr and Schmidt (1999) influence behaviour in the endogenous trust game. Comparing effect sizes with standard results in trust games we find that voluntary leadership has a quite remarkable effect on behaviour.

°Fabian Kleine is affiliated with Universität Erfurt, Lehrstuhl für quatitative Methoden der empirischen Sozialforschung. * Manfred Königstein and Balazs Rozsnyoi are affiliated with Universität Erfurt, Professur für Angewandte Mikroökonomie, Nordhäuser Str. 63, D-99089 Erfurt. Manfred Königstein is also IZA research fellow and is corresponding author, E-mail: manfred.koenigstein@uni-erfurt.de.

1 Introduction

The trust game introduced by Berg et al. (1995) represents a basic two person conflict in which players may choose cooperative moves sequentially to achieve a mutually beneficial outcome. The first mover (trustor) chooses an investment which induces a return that accrues to the second mover (trustee). The second mover then can backtransfer money to the first mover but may also decide to keep the return for himself/herself. The first mover can not use a court to enforce a payback of the initial investment or a part of the surplus in addition to investment. He/she may, however, trust that the second mover will reciprocate the given "gift".

Without trust there will be no surplus in this game. But if there is trust, and if higher investment leads to higher backtransfer, we refer to this as the "Trust-And-Reciprocity" mechanism.[1] Such a positive correlation between investment and backtransfer has been shown in many experimental studies including the seminal study by Berg et al. (1995). It is also documented in a recent meta-analysis by Johnson and Mislin (2011). From a pure rationalistic viewpoint this result is surprising: An egoistic and rational second mover should not backtransfer any money, and therefore the first mover should not invest in the first place. But the result is not surprising from everyday experience, which tells us that sequential gift exchange is common in social interaction. Despite this everyday experience it is interesting to study the forces that strengthen or weaken the Trust-And-Reciprocity mechanism. Camerer (2003) describes how several structural and individual factors, like e.g. stake size and nationality, influence behaviour in trust games. Johnson and Mislin (2011)[2] investigate cultural differences in trust games. In addition to empirical studies theoretical models have been developed that might explain Trust-And-Reciprocity within a wider rationality framework framework (see e.g. the social preference models of Dufwenberg and Kirchsteiger(2004) and Falk and Fischbacher (2006)).

[1] Reciprocity in experimental labour markets is reported e.g. in Gächter and Fehr (2001).
[2] Furthermore see the related studies on gift exchange experiments by Charness et al. (2002), Falk et al. (1999);. Fehr et al. (1993), (1997) and (1998), and Gächter and Falk (2001).

Our study here contributes to the research on trust games by investigating the influence of voluntary leadership. Voluntary leadership means that one of the two players can decide whether to be first mover or second mover in the trust game. In natural relationships it is quite usual that the sequencing of moves is not predetermined. The mere fact that one player takes the "burden of the first move" in such a situation (we call this an "endogenous trust game") could make a difference compared to a situation, where the order of moves is predetermined. In an endogenous trust game the order of moves may be open in the sense that either player may volunteer to make the first move. But one may also think of situations where one player has the right to determine the order of moves. In a hierarchical relationship, like e.g. the principal-agent relationship of a manager and a worker, it might be the principal's choice whether to make the first move himself/herself or whether to pass this to the agent. It is such a situation which we had in mind in designing our experiment.

We present a lab experiment on an endogenous trust game in which one player (the principal) may decide to leave the investment choice to the agent or to take the investment decision himself/herself. In the latter case we refer to this as "voluntary leadership". We show that voluntary leadership increases investment and increases backtransfer of the second mover compared to the alternative sequencing in which the agent is investor. We also show that investment and backtransfer is higher under voluntary leadership than in the control treatment with exogenously determined sequencing. Furthermore, we show that risk preference and inequality aversion as modelled formally by Fehr and Schmidt (1999) influence behaviour in the endogenous trust game. Comparing effect sizes with standard results in trust games we find that voluntary leadership has a quite remarkable effect on behaviour.

In the next section we describe our experimental game and provide a theoretical analysis. In addition to a benchmark theoretical solution based on standard preferences we analyze the game assuming inequality aversion and risk preferences. The analyses lead to a set of empirical hypotheses. Section 3 describes experimental procedures, and section 4 provides data analyses and empirical results. Section 5 concludes.

2 Related Literature

To our knowledge this is the first study on endogenous sequencing in trust games. Gächter and Renner (2005), Güth et al. (2007), Kumru and Vesterlund (2005) are related studies which consider a leader's choice in public good experiments. They report increased contributions and efficiency gains compared to simultaneous public good games due to high first mover contribution. In these studies leadership is not voluntary but predetermined by the experimenter.

There are only a few studies on endogenous leadership in experimental literature[3]. Closest to our design are the studies of Abrak and Villeval (2007) and Rivas and Sutter (2009). Abrak and Villeval (2007) investigate a public good experiment with endogenous leadership. On the first stage one group member can contribute voluntarily while other group members contribute simultaneously after observing the contribution of the leader. A substantial number of subjects (about one out of four) is willing to act as leader. These first movers contribute significantly more to the public good compared to the contributions in simultaneous public good games. As a result second mover`s contributions are rising. First movers earn less than second movers but voluntary leadership induces efficiency gains. Rivas and Sutter (2009) study several forms of leadership in public good games and compare exogenously enforced leadership and endogenous (voluntary) leadership. They also find higher contributions to the public good under endogenous leadership.

In our trust game with endogenous leadership the leader's payoff hinges on the decision of a single player, the second mover. Compared to a public good game the leader might find this more risky. Furthermore the trust signal implied

[3] Fonseca et al. (2005), (2006) and Huck et al. (2002) study duopoly games with endogenous timing. Firms can choose their quantities in one of two periods. Potters et al. (2005) study a Public Good Game with endogenous sequencing when some donors do not know the value of the Public Good. Nosenzo and Sefton (2009) study a Public Good Game with endogenous move structure. Players can choose their contribution in one of two periods. Furthermore players receive different returns of the public good.

by voluntary leadership might have a different value in a two player trust game than in a public good game.

3 Experimental Game and Theoretical Predictions

3.1 The Trust Game with Endogenous Leadership and Symmetric Endowments

Consider a principal-agent game between two players, player P (principal) and player A (agent), which are both initially endowed with 10 money units. The game comprises three stages:

Stage 1: P decides upon the sequencing of moves in the trust game that follows in stages 2 and 3. P has two options, sequence "*P-First*" or sequence "*A-First*", with the meaning that in case of *P-First* (see stages 2.a and 3.a) the trust game is played with P being investor (first mover) and A being trustee (second mover) and vice versa in case of *A-First* (see stages 2.b and 3.b).

If *P-First*:

Stage 2.a: P decides upon investment x_p with $x_p \in \{0,1,\dots,10\}$. Then A receives the amount $3 \cdot x_p$.

Stage 3.a: A decides upon backtransfer y_a with $y_a \in \{0,1,\dots,10\}$. Then P receives the amount $3 \cdot y_a$.

If *A-First*:

Stage 2.b: A decides upon investment x_a with $x_a \in \{0,1,\dots,10\}$. Then P receives the amount $3 \cdot x_a$.

Stage 3.b: P decides upon backtransfer y_p with $y_p \in \{0,1,\dots,10\}$. Then P receives the amount $3 \cdot y_p$.

Payoffs are determined as follows:

$$\pi_p = 10 - x_p + 3 \cdot y_a \quad \text{and} \quad \pi_a = 10 - y_a + 3 \cdot x_p$$
(if *P-First*)

or

$$\pi_p = 10 - y_p + 3 \cdot x_a \quad \text{and} \quad \pi_a = 10 - x_a + 3 \cdot y_p$$
(if *A-First*)

This concludes the description of the game. If *P* chooses *P-First* we refer to this as the principal's choice of "voluntary leadership". The game theoretic solution with egoistic and rational players – i.e., our benchmark solution – is straightforward. In stage 3 the trustee has no incentive to backtransfer money, therefore the backtransfer will be zero. Consequently, it does not pay to invest in the first place, so investment will be zero. Anticipating this outcome player *P* is indifferent with respect to the sequencing of moves. Thus, the game theoretic solution with rational, payoff-maximizing players predicts that each player keeps the 10 money units, foregoing a potential efficient payoff of 30 for each if investment and backtransfer were maximal.

Stages 2 and 3 of our game are similar but not exactly equal to the trust game of Berg et al. (1995). In our game investments and backtransfers are tripled whereas in Berg et al. only investments were tripled. Furthermore in our case the strategy space for backtransfers is fixed – the numbers 0 to 10 – whereas in Berg et al. it is endogenous – the numbers 0 up to three times the investment. Our design allowed us to describe the strategy spaces and their payoff consequences independent of the chosen sequence (*P-First* versus *A-First*). We thought this simplification is advantageous. Furthermore, our design allows the second mover to return more money than received which is excluded in standard trust games. We actually found that some participants do so.

We know from many experiments on these games that contrary to the benchmark solution players do cooperate: Players trust in the second mover (the trustee) by choosing positive investment levels, and trustees reciprocate by choosing positive backtransfers. If investment and backtransfer are positively correlated we interpret this as Trust-And-Reciprocity mechanism.

Our experiment is designed to investigate whether the Trust-And-Reciprocity mechanism is influenced by voluntary leadership, i.e., a player's choice of the first mover position in the trust game. We expect the following influences:

Hypothesis 1: If the principal chooses to be leader (voluntary leadership) investment (Hyp. 1.a) and backtransfer (Hyp. 1.b) are higher than if the principal forces the agent to be first mover in the trust game.

This is our main research hypothesis. It can be motivated as follows: If *P* chooses to be leader, he/she exposes himself/herself to higher risk, because being first mover in our trust game is a more risky position than being second mover. Therefore we consider this as a strong signal of trust in addition to the subsequent choice of investment. Player *A* reciprocates *P*'s trust by higher backtransfer; i.e., we predict higher backtransfer controlling for investment. To control for investment one may consider e.g. the backtransfer rate (backtransfer divided by investment) or backtransfer minus investment. If *P* anticipates a higher backtransfer rate due to voluntary leadership, incentives for investment are higher and consequently we predict higher investment. These arguments are intuitive but they are inconsistent with the benchmark solution of the game. In the next section we rely on more formal considerations of social preferences and risk aversion to motivate our hypotheses.

3.2 Social Preferences and Risk Preferences

While the standard model of egoistic and rational individuals cannot explain cooperation in trust games, this is possible under the assumption of other regarding (social) preferences. Different theoretical models of social preferences have been proposed[4]. We will rely on the inequality aversion model of FEHR and SCHMIDT (1999), since this is relatively easy to use. Accordingly an inequity

[4] See e.g. the intention-based models of DUFWENBERG and KIRCHSTEIGER (2004), and FALK and FISCHBACHER (2006) or the outcome-based models of BOLTON and OCKENFELS (2000) and FEHR and SCHMIDT (1999).

averse player maximizes the following utility function (we refer to this as FS-preferences):

$$U_j = \pi_j - \alpha_j \frac{1}{n-1} \sum_{i \neq j} \max\{\pi_i - \pi_j, 0\} - \beta_j \frac{1}{n-1} \max \sum_{i \neq j} \{\pi_j - \pi_i, 0\}$$

with restrictions $0 \leq \beta_j < 1$ and $\alpha_j \geq \beta_j$. The variables π_j and π_i represent monetary payoffs of players j and i while the parameter α_j (β_j) represents the degree of aversion against unfavourable (favourable) inequality. In the Appendix we provide a theoretical analysis of the trust game with endogenous leadership assuming FS-preferences and that the preference parameters are common knowledge. The following proposition can be shown to hold:

Proposition 1*: If the trustee (second mover in the trust game) is sufficiently inequality averse $\beta_j \geq 1/4$ there exist a subgame perfect equilibrium (SPE) with maximal investment and maximal backtransfer and with player P choosing sequence P-First (voluntary leadership).*

Intuitively, since the trustee can always avoid unfavourable inequality, the backtransfer depends only on preference parameter β_j. Depending on β_j the trustee will either reciprocate positive investment $x_i > 0$ by choosing $y_j = x_i$ or will choose $y_j = 0$. Then, if $y_j = x_i$ is anticipated by the investor (player i), maximal investment x_i is rational even for egoistic players ($\alpha_i = \beta_i = 0$). If the principal knows that the agent is sufficiently inequality averse he/she may choose to be investor. Alternatively, there also exists an SPE with maximal investment, maximal backtransfer and the sequence *A-First*. And the benchmark solution (zero investment, zero backtransfer, any sequence) is also an SPE if inequality aversion is sufficiently low. Thus, under complete information we can establish cooperative equilibria and voluntary leadership.

If the preference parameters are not commonly known as it is the case in an experiment, investment is risky. The investor does not know the trustee's parameter β_j and cannot be sure about the backtransfer. If $x_i = 10$ is chosen, the expected utility of a risk neutral investor is

$$E(U_i) = prob(\bar{\beta}_j) \cdot 30 + \left(1 - prob(\bar{\beta}_j)\right) \cdot (-\alpha_i \cdot 40)$$

with $prob(\bar{\beta}_j)$ representing the investors subjective belief about the trustee being sufficiently inequality averse to choose $y_j = 10$. Since $E(U_i)$ is increasing in $prob(\bar{\beta}_j)$ and decreasing in α_i investment is more likely if the investor is more optimistic about the trustee being inequality averse, and investment is less likely if the investor is more averse against unfavourable inequality. Consequently, the principal's willingness to take voluntary leadership should also increase in $prob(\bar{\beta}_j)$ and decrease in α_i.

In addition one may wonder about the investors attitude toward risk. If investment is zero, backtransfer will be zero as well, so the investor will keep the endowment of 10 for sure. With positive investment the payoff will be either larger or smaller than 10. Therefore a larger degree of risk aversion reduces incentives to invest and the principal's willingness to take voluntary leadership. With respect to the backtransfer one may argue that risk aversion does not matter, since the trustee is sure about the consequences of his choice. However, if the trustee acknowledges that the investor had to bear more financial risk, an inequality averse player may consider it fair to compensate the investor for taking the risk (see *Hypothesis 1*). Note that in this paragraph we argue only partially along the FS-model, since the FS-model does not incorporate risk aversion. Furthermore in our experiment we do not expect equilibrium behaviour to occur necessarily. However, we find it instructive to derive qualitative predictions for investment and backtransfer based on social preferences and concern for risk.

Following these theoretical arguments we formulate the following empirical hypotheses:

Hypothesis 2: Investment is smaller if the investor is more risk averse (Hyp. 2.a), if the investor exhibits a stronger aversion against unfavourable inequality (Hyp. 2.b), and if the investor has higher subjective belief of an inequlity averse trustee (Hyp. 2.c).

Hypothesis 3: Backtransfer is increasing in the trustee's degree of favourable inequality aversion.

3.3 Control Treatment: Trust Game with Exogenous Leadership

To investigate the influence of voluntary leadership (*Hypothesis 1*) we ran experimental sessions on the trust game with endogenous leadership and compare behaviour under both sequences (*P-First* versus *A-First*). As explained above we interpret the choice of voluntary leadership as a signal of trust that leads to stronger reciprocation (higher backtransfer rate) than if the principal does not take leadership (and thus assigns the agent to be first mover in the trust game). A subtle question arising here is whether it is the choice of voluntary leadership that is perceived as a signal of trust or whether it is the refusal of voluntary leadership that is perceived as a signal of distrust or non-cooperative attitude. In the latter case an agent who is mandated to make the first move might choose low investment leading to low backtransfer. To discriminate the possibility of such a distrust-effect from the proposed trust-effect we ran a control treatment on a trust game with exogenous leadership. It is equivalent to the stages 2.a and 3.a of the trust game with endogenous leadership as described above (again with an endowment of 10 and payoff functions as above). The trust-effect should increase investment and backtransfer compared to the control treatment, while the distrust-effect should lower investment and backtransfer compared to the control treatment.

4 Experimental Procedures

The experiment was run in the experimental economics lab at the University of Erfurt. It comprised 10 sessions with groups of 20 participants each, and it was computerized using the software z-Tree (see Fischbacher, 2007).The participants were students from different fields (social sciences and humanities) and recruited via Orsee (Greiner 2004). Each participant played only a single game, so the experiment was truly one-shot. Players received written instructions, were randomly paired and interacted anonymously (instructions are provided in the Appendix). The trust game with endogenous leadership was applied in 8 sessions, and the control treatment (exogenous leadership) was applied in 2 sessions. We ran more sessions on the endogenous treatment to collect enough observations on voluntary leadership. Namely, we anticipated correctly that voluntary leadership is more often refused rather than chosen.

After playing the trust game the participants played the lottery game of Holt and Laury (2002) to determine their degree of risk aversion and played the distribution game of Danneberg et al. (2007) to determine their FS-preference parameters α_i and β_i. The collection of both, the degree of risk aversion and the FS-parameters, were incentivized. We will use these measures to test *Hypotheses 2.a, 2.b* and *3*. Details on these procedures are provided in the Appendix. We also collected a measure of an individual's trust in other persons or society as a whole as it is collected by the World Value Survey (2005).[5] This measure may serve as a proxy for an investor's subjective belief of a reciprocal choice of the trustee and will serve to test *Hypothesis 2.c.* The participants also filled in the 16-PA-personality questionnaire of Brandstätter (1988) and provided some socio-demographic characteristics (age, gender, etc.) to allow for additional individual control measures. Thus, all in all we have a number of incentivized and non-incentivized measures. The experimental procedures are summarized in Table 1.

Table 1: Overview about experimental procedures

Treatment	Sequence of Games	Observations
Endogenous Leadership	1. Trust Game with Endogenous Leaderhip 2. Holt/Laury Game, Danneberg et. al. Game 3. Trust Question, 16-PA-Questionnaire, Socio-Demographic Questionnaire	8 Sessions 80 Pairs 160 Participants
Exogenous Leadership	1. Trust Game With Exogenous Leaderhip 2. Holt/Laury Game, Danneberg et. al. Game 3. Trust Question, 16-PA-Questionnaire, Socio-Demographic Questionnaire	2 Sessions 20 Pairs 40 Participants

[5] The question is: Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people? Participants may answer "yes" or "no".

Sessions took about 50 minutes, subjects were paid anonymously, and average earnings were about 10 EUR.[6]

5 Empirical Results

5.1 Descriptive Statistics and Simple Analyses

Table 2 provides summary statistics of experimental decisions. Accordingly, in the trust game with endogenous leadership most principals decide for the sequencing *A-First*. However, 16 out of 80 principals (20%) choose voluntary leadership (*P-First*).

Table 2.a.: Summary Statistics

Treatment		Investment x	Backtransfer y	Backtransfer Rate y/x	# Obs.
Endogenous Leadership	*P-First* (Vol. Leadership)	9.13 (1.50)	8.06 (2.70)	0.89 (0.26)	16
	A-First	6.83 (3.09)	5.19 (3.09)	0.88 (0.64)	64
Exogenous Leadership		5.40 (2.76)	4.10 (3.09)	0.94 (0.86)	20

Notes: Table 2.a. includes Means and standard deviations of investment, backtransfer and backtransfer rate by treatment.

Table 2.b.: Summary Statistics

Treatment		Investment x	Backtransfer y	Backtransfer Rate y/x	# Obs.
Endogenous Leadership	*P-First* (Vol. Leadership)	10.0 (2.0)	9.0 (3.0)	1.00 (0.17)	16
	A-First	7.5 (5.75)	5.0 (4.75)	1.00 (0.50)	64
Exogenous Leadership		5.0 (5.0)	3.0 (4.0)	0.67 (0.57)	20

Notes: Table 2.b. includes Medians and inter-quartil range of investment, backtransfer and backtransfer rate by treatment.

Investment and backtransfer is higher in *P-First* than in *A-First* giving a first indication of support for *Hypothesis 1*. Means of investment and backtransfer

[6] An average earning for a student job at the time of the experiment was about 8 EUR per hour.

are higher in the two endogenous leadership conditions than under exogenous leadership. Variances are relatively large, so we also look at medians. Table 2.b confirms that median investments and median backtransfers are higher under endogenous leadership than exogenous leadership. According to pairwise Mann-Whitney-U-tests the differences in investment are highly statistically significant for the comparison of *P-First* versus *A-First* and *P-First* versus exogenous leadership. Differences between *A-First* and exogenous leaderhip are only marginally significant.

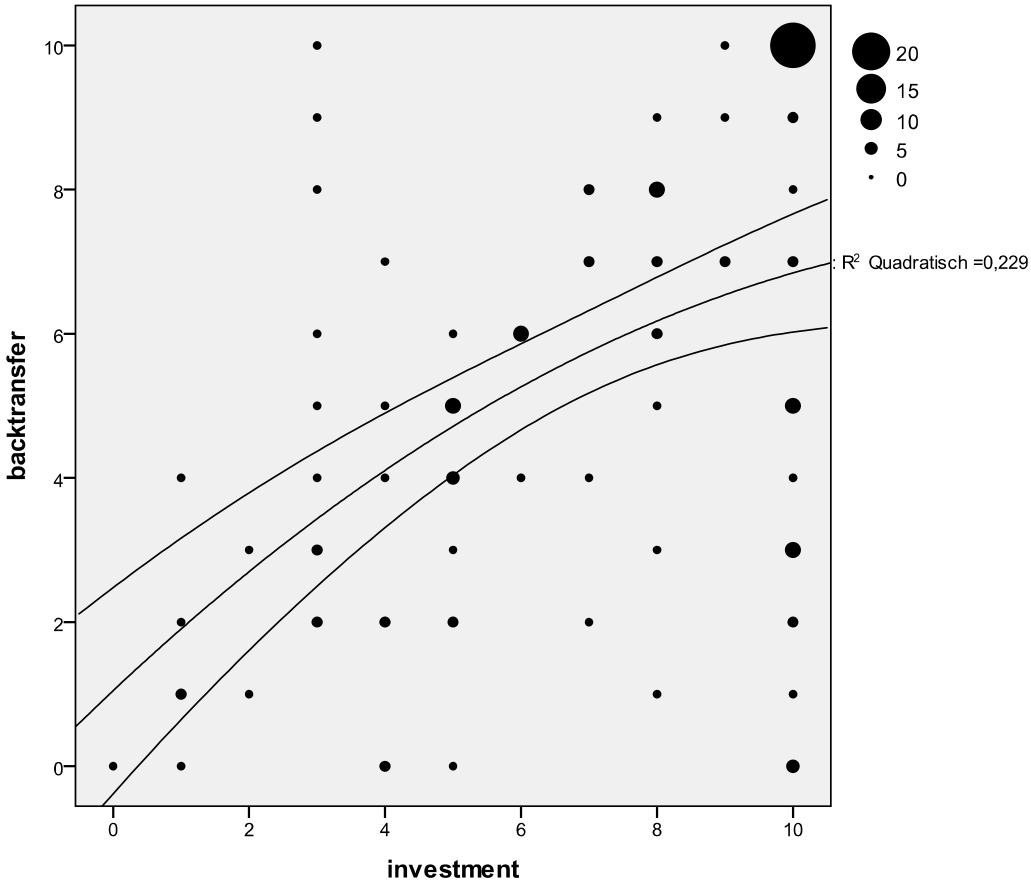
Table 3: Pairwise Mann-Whithney-U-tests of investment by treatments

Mann-Whitney-U-Tests of Investment	
P-First versus *A-First*	$p = 0.005$, $N = 80$
P-First versus Exogenous Leadership	$p < 0.001$, $N = 84$
A-First versus Exogenous Leadership	$p = 0.057$, $N = 36$

Notes: P-values are calculated for two-tailed tests.

Figure 1 is a scatterplot of backtransfer against investment. It illustrates the joint distribution of backtransfers and investments, and it clearly indicates a positive correlation. Different dot sizes represent clustering of observations. The reference lines represents a quadratic regression of backtransfer on investment with a 95%-confidence band. Obviously, agents behave reciprocally, responding larger backtransfer for larger investment. The Spearman rank correlation coefficient between backtransfer and investment is positive and highly statistically significant ($\rho = 0.449$, $p < 0.001$, $N = 100$) giving robust support for the Trust-And-Reciprocity mechanism.

Figure 1: Scatterplott of backtransfer against investment



Notes: Different dot sizes represent clustering of observations. Quadratic regression line included.

5.2 Regression Analyses of Investment

To investigate our hypotheses further we apply regression analyses controlling for the influence of social preferences, risk attitudes, personality characteristics, and other factors. Since Figure 1 also shows relatively large dispersion and that there is some clustering at the upper bound of the decision interval, we don't rely on OLS-regressions but apply median regressions and tobit regressions analyses. Table 4 shows the results of different model specifications for regressions of investment. Table 5 shows analogous analyses of the backtransfer. Details on explanatory variables are provided in Table A.1 in the Appendix.

Model (1) in Table 4 reports the result of a median regression of investment. Overall the model fits well showing a Pseudo R^2 of 0.310. *P-First* and *A-First* are 0-1-dummies for the two endogenous leadership conditions. Both coefficients are positive and significant confirming higher investment compared to the reference category (exogenous leadership). Testing the coefficient of *P-First* against the coefficient of *A-First* shows also a highly significant difference ($p < 0.001$) supporting *Hypothesis 1.a*.

Table 4: Regressions Results of Regressions on Investment

Dependent variable: ***Investment****, Base category is P-First-exogenous*				
	Model 1- Median Regression		*Model 2- Tobit Regression*	
Variable	*Coefficient*	*P-value (two-tailed)*	*Coefficient*	*P-value (two-tailed)*
A-First endogenous	1.531 (0.265)	0.000	1.215 (0.947)	0.203
P-First endogenous	4.107 (0.340)	0.000	6.533 (1.390)	0.000
FS-alpha	-2.249 (0.250)	0.000	-1.435 (0.888)	0.109
Alpha-missing	-0.836 (0.271)	0.003	-1.473 (0.966)	0.131
Risk aversion	-1.348 (0.227)	0.000	-2.385 (0.793)	0.003
Risk loving	2.548 (0.518)	0.000	4.085 (2.384)	0.090
Risk missing	-2.409 (0.347)	0.000	-2.578 (1.412)	0.071
Male	2.114 (0.224)	0.000	3.014 (0.848)	0.001
WV survey trust	0.440 (0.209)	0.038	1.223 (0.767)	0.114
Self control	0.126 (0.094)	0.185	0.258 (0.344)	0.455
Constant	5.410 (0.551)	0.000	4.753 (2.037)	0.022
Number of observations	100		100	
pseudo R2	0.310		0.117	

Notes: Table includes regression results for investment as dependent variable. Columns 2 and 3 contain coefficients and two-tailed p-values of the median regression. Column 4 and 5 contain coefficients and two-tailed p-values of the of tobit regression. Standard errors are included in parenthesis.

In line with *Hypotheses 2.b* a higher level of unfavourable inequality aversion (*Alpha_High*) decreases investment compared to the reference category (low inequality aversion).[7] The estimated coefficient is negative and highly significant. *Alpha_Missing* is a nuisance variable coded as 1 (and otherwise 0) if a participant did not provide a consistent measure of α (21 out of 100 cases). We included this in order not to confuse the reference category (low inequality aversion). Risk attitudes also influence investment in the predicted direction (*Hypothesis 2.a*): The coefficient of *Riskaverse_High* is negative, and the coefficient of *Riskloving* is positive.[8] The reference category is low riskaversion (including risk neutrality). *Riskaverse_Missing* is included to control for missing measures of risk aversion (8 observations). In line with *Hypothesis 2.c* participants who show more trust in others according to the world value survey measure (variable *Trusting*) choose higher investment as well.

Model (1) reports furthermore that male participants (variable *Male*) invest more than female. *Self-Control* is the only personality characteristic of those measured by the 16PA-questionnaire which we kept in the regression. The coefficient is positive but not significant.[9] We decided to keep one of the 16-PA factors in order to retain at least on intervalscaled variable in the regression. All other variables in model (1) are dummy variables. Backward elimination of insignificant regressors applied to the five 16-PA factors lead to *Self-Contol* as the best predictor out of the given five.

Model (2) is a Tobit regression using the same variables as model (1) and assuming for the dependent variable a lower bound of 0 and an upper bound of 10. It might be considered as a natural alternative for model specification, but it is less robust against outliers. The Tobit model qualitatively confirms model (1). All estimated coefficients show the same sign, but significance values differ. While the median regression model seems more adequate in our view, we will use the Tobit model later on for computing mean effect sizes.

[7] *Alpha_High* is a dummy coded as 1 if the value of α is in the upper quartile of the distribution (above 0.3), and it is coded as 0 otherwise.

[8] *Riskaversion_High* is 1 if the value of riskaversion as measured by the Holt/Laury procedure is above 0.7 (31 observations; about the upper 30%-percentile of the distribution). Otherwise it is 0. *Riskloving* is 1 if measured riskaversion is negative (otherwise 0). Only 3 participants were coded as riskloving.

[9] We decided to keep one of the 16-PA factors in order to retain at least on intervalscaled variable in the regression. All other variables in model (1) are dummy variables. Backward elimination of insignificant regressors applied to the five 16-PA factors lead to *Self-Contol* as the best predictor out of the given five.

5.3 Regression Analyses of Backtransfer

Model (3) in Table 5 is a median regression of backtransfer. The model fits well overall (Pseudo $R^2 = 0.284$). All partial effects are significant.

Table 5: Regression Results of Regressions on Backtransfer

*Dependent variable: **Investment**, Base category is P-First-exogenous*				
	Model 3- Median Regression		*Model 4 - Tobit Regression*	
Variable	*Coefficient*	*P-value (two-tailed)*	*Coefficient*	*P-value (two-tailed)*
Investment	0.742 (0.050)	0.000	0.604 (0.132)	0.000
A-First endogenous	1.067 (0.374)	0.005	0.211 (0.968)	0.828
P-First endogenous	2.468 (0.494)	0.000	2.719 (1.358)	0.048
FS-Beta	1.086 (0.310)	0.001	1.646 (0.830)	0.050
Bet- missing	0.686 (0.393)	0.084	1.172 (1.045)	0.265
Male	-0.596 (0.311)	0.058	-0.733 (0.847)	0.389
Emotional Stability	0.555 (0.111)	0.000	0.338 (0.288)	0.244
Tough-Mindedness	-0.390 (0.144)	0.008	-0.246 (0.378)	0.517
Constant	-1.719 (0.846)	0.045	-0.427 (2.291)	0.852
Number of observations	100		100	
pseudo R2	0.284		0.077	

Notes: Table includes regression results for backtransfer as dependent variable. Columns 2 and 3 contain coefficients and two-tailed p-values of the median regression. Column 4 and 5 contain coefficients and two-tailed p-values of the of tobit regression. Standard errors are included in parenthesis.

As predicted backtransfer is increasing in *Investment* and in the trustee's degree of favourable inequality aversion (*Beta*).[10] Furthermore, backtransfer is higher under voluntary leadership (*P-First*) than under exogenous leadership (the reference category). Testing the coefficient of *P-First* against the coefficient of *A-First* shows also a highly significant difference ($p = 0.005$). These estimation

[10] *Beta* is a dummy coded as 1 if the value of β is above 0.05 and is coded as 0 otherwise. The reference category includes observations of $0 \leq \beta \leq 0.05$. *Beta_Missing* represents observations with inconsistent measures of β.

results clearly support our hypotheses (*Hyp. 1.b* and *Hyp. 3*). Backtransfer is smaller for male participants, and for those who score high on the 16-PA factor *Emotional Stability*. The factor *Tough-Mindedness* enters negatively. The two (out of five) factors were retained after backward elimination of insignificant factors. Model (4) shows a Tobit regression with upper bounds 0 and 10 and using the same set of predictor variables. All effects show the same signs as in the median regression.

6 Discussion and Conclusions

Voluntary leadership increases investment and backtransfer in our trust game experiment. The influence is shown as highly statistically significant in median regression analyses. Computing mean effect sizes[11] we find that voluntary leaderhip (*P-First*) increases investment on average by 6.53 compared to the control group (exogenous leadership) and by 5.32 compared to *A-First*. An investment of e.g. 7 induces an average backtransfer of 7.88 under voluntary leadership compared to 5.15 and 5.36 under exogenous leadership and *A-First*, respectively.

In a meta-study on trust game experiments Johnson and Mislin (2011), henceforth JM, report an average investment of 49.7% of the available amount with a standard deviation of 14.3%. The average backtransfer is 36.8% of the available amount with a standard deviation of 11.5%. In the control treatment (exogenous leadership) of our experiment investments and backtransfer are somewhat higher than in JM, but within one standard deviation of the JM averages. One reason for this may be that backtransfers are tripled in our case so that there is an efficiency gain in both investment and backtransfer, whereas in JM backtransfer only serves to distribute earnings. More impressive, however, is the strong effect of voluntary leadership. Both average investment and average backtransfer are more than three standard deviations above the JM figures.

[11] Here we rely on the Tobit regression models (2) and (4).

Table 6: Average Investment and Backtransfer Rates

	Johnson, Mislin	Kleine, Königstein, Rozsnyoi	
		Exogenous Leadership	Voluntary Leadership
average investment rate	49.7% (14.3)	50%	100%
average backtransfer rate	36.8% (11.5)	67%	90%

Notes: Table includes comparison of Average investment rate in terms of the available amount for investment and average backtransfer rate in terms of the available amount for backtransfer in Johnson and Mislin (2011) and Kleine, Königstein and Rozsnyoi.

In line with other trust game experiments backtransfer increases strongly and significantly in investment. Voluntary leadership strengthens this Trust-And-Reciprocity mechanism. We interpret voluntary leadership as a trust signal of the principal to the agent. Surprisingly, investment and backtransfer are also higher under *A-First* compared to the control treatment (exogenous leadership). Thus, if the principal mandates the agent to make the first move in the trust game, this is not perceived by the agent as a signal of distrust or a non-cooperative attitude of the principal. In turn this supports our conlusion of voluntary leadership inducing a trust-effect rather than that the refusal of voluntary leadership is inducing a distrust-effect.

Risk preferences and social preferences modify behaviour in manners predicted by our rational choice considerations (*Hypotheses 2.a, 2.b,* and *3*). Investment is lower for high levels of risk aversion and high levels of unfavourable inequality aversion (α). Backtransfer is larger for high levels of favourable inequality aversion (β). The Fehr and Schmidt (1999) model of inequality aversion proved useful in deriving empirical predictions. Investment and backtranfer are furthermore modified by individual characteristics like gender, the degree of trust in others and 16-PA personality factors.

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Appendix A – Proofs of Propositions

Chapter 1

Proposition 1: *If the trustee (second mover in the trust game) is sufficiently inequality averse $\beta_{j.} \geq 1/4$ there exist a subgame perfect equilibrium (SPE) with maximal investment and maximal backtransfer and with player P choosing sequence P-First (voluntary leadership).*

Proof:

Suppose players preferences are described by the utility function (Fehr and Schmidt, 1999):

$$U_j = \pi_j - \alpha_j \frac{1}{n-1} \sum_{i \neq j} \max\{\pi_i - \pi_j, 0\} - \beta_j \frac{1}{n-1} \max \sum_{i \neq j} \{\pi_j - \pi_i, 0\}$$

with restrictions $0 \leq \beta_j < 1$, $\alpha_j \geq \beta_j$ and that the parameters are commonly known. Since trustee`s (player *j*) utility is decreasing for $\pi_j < \pi_i$ backtransfer will never exceed investment.

Furthermore due to linearity of the utility function the trustee (player *j*) maximizes his utility by a corner solution. He will either reciprocate positive investment $x_i > 0$ by choosing $y_j = x_i$ or will choose $y_j = 0$. For reciprocating positive investment trustee`s utility is given by

$$U_j = 10 + 3x_i - y_j$$

For keeping the whole endowment and received investment too trustee`s utility is given by

$$U_j = 10 + 3x_i - \beta_j\left((10 + 3x_i) - (10 - x_i)\right)$$

Thereby trustee will reciprocate positive investment if

$$10 + 3x_i - y_{j.} \geq 10 + 3x_i - \beta_j\left((10 + 3x_i) - (10 - x_i)\right)$$

Since $y_j = x_i$ if backtransfer is positive we can substitute y_j by x_i. Thus trustee will reciprocate positive investment if

$$10 + 3x_i - x_{i.} \geq 10 + 3x_i - \beta_j\left((10 + 3x_i) - (10 - x_i)\right)$$

$$\beta_{j.} \geq 1/4$$

Given $\beta_{j.} \geq 1/4$ backtransfer is high as investment and players receive equal payoffs. Thereby, for $\beta_{j.} \geq 1/4$ first mover`s (player *i*) utility is given by $U_i = 10 + 2x_i$ which will be maximized by choosing maximum investment x_i. Choosing the sequence P-first with maximal investment and maximal backtransfer is thereby a SPE if the utility function of player A fulfils the condition $\beta_{j.} \geq 1/4$.

q.e.d.

Appendix B – Instructions

Instructions for the Experiment (translated from German)

General Instructions

You are participating in various decision experiments. At the end you will be paid according to your performance. Thus it is important, that you fully understand the following instructions. In the following you read the instruction to experiment 1. The instructions for the other experiments take place on the computer screen.
Depending on your decisions you can earn money within the experiments. Earnings will be added to your account while loses will be subtracted. In the end of the experiment your earnings will be paid cash. Earnings are denoted by points. The convesion into Euro will be announced in each experiment.

Please note that during the experiment communication is not allowed. If you have any question, please raise your hand out of the cubicle. All decisions are made anonymously. No other participant will experience your name and your monetary payoff.

Best of luck!

Exogenous Treatment

<u>Experiment 1</u>

The participants will be divided into groups with two persons each group. They are called player A and B. Players are randomly assigned to their groups and types and your type is displayed on your screen. Points are converted into Euros according to the following rule:

<u>10 points = 3 Euro</u>

1. Each participant receives an endowment.
   - <u>Participant A receives 10 points</u>
   - <u>Participant B receives 10 points</u>

2 Participant B transfers an amount x ($0 \leq x \leq 10$) to participant A.

3 Participant A gains 3x i. e. participant A receives three times the amount transferred by B.

4 Participant A transfers an amount y ($0 \leq y \leq 10$) to participant B.

5 Participant B gains 3y i. e. participant B receives three times the transferred amount.

6 The experiment is done.

Endogenous Treatment

Experiment 1

The participants will be divided into groups with two persons each group. They are called player A and B. Players are randomly assigned to their groups and types and your type is displayed on your screen. Points are converted into Euros according to the following rule:

10 points = 3 Euro

2. Each participant receives an endowment.
   - Participant A receives 10 points
   - Participant B receives 10 points

3. Participant B decides about the sequence to choices. There are two feasible sequences. B-A or A-B. If B-A is chosen the experiment continues as described in 3.a to 7.a.. If A-B is chosen the experiment continues as described in 3.b to 7.b.

Sequence B-A

3a. Participant B transfers an amount x ($0\leq x \leq 10$) to participant A.

4a. Participant A gains 3x i. e. participant A receives three times the amount transferred by B.

5a. Participant A transfers an amount y ($0\leq y \leq 10$) to participant B.

6a. Participant B gains 3y i. e. participant B receives three times the transferred amount.

7a. The experiment is done.

Sequence A-B

3a. Participant A transfers an amount x ($0\leq x \leq 10$) to participant B.

4a. Participant B gains 3x i. e. participant B receives three times the amount transferred by participant A

5a. Participant B transfers an amount y ($0\leq y \leq 10$) to participant A.

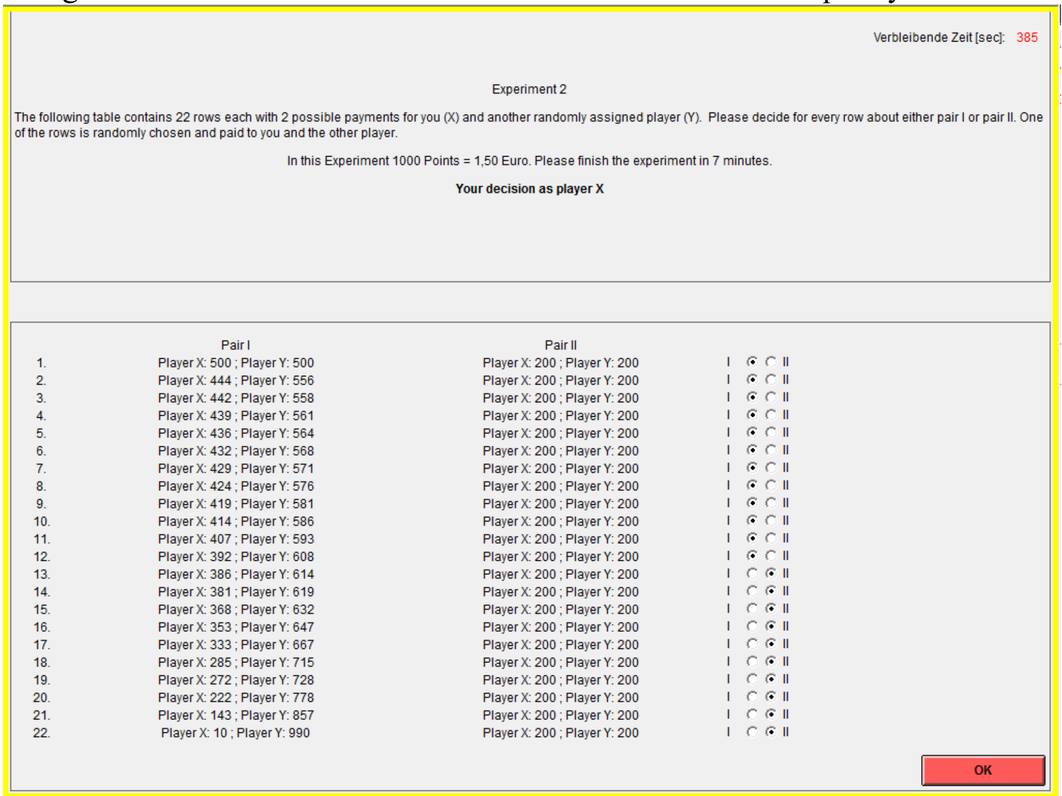
6a. Participant A gains 3y i. e. participant A receives three times the amount transferred by participant B.

7a. The experiment is done.

Instructions for the additional Experiments (translated from German)

<u>Experiment 2</u>

Figure C1: Z-tree screenshot of Elicitation of unfavoured inequality aversion



Verbleibende Zeit [sec]: 385

Experiment 2

The following table contains 22 rows each with 2 possible payments for you (X) and another randomly assigned player (Y). Please decide for every row about either pair I or pair II. One of the rows is randomly chosen and paid to you and the other player.

In this Experiment 1000 Points = 1,50 Euro. Please finish the experiment in 7 minutes.

Your decision as player X

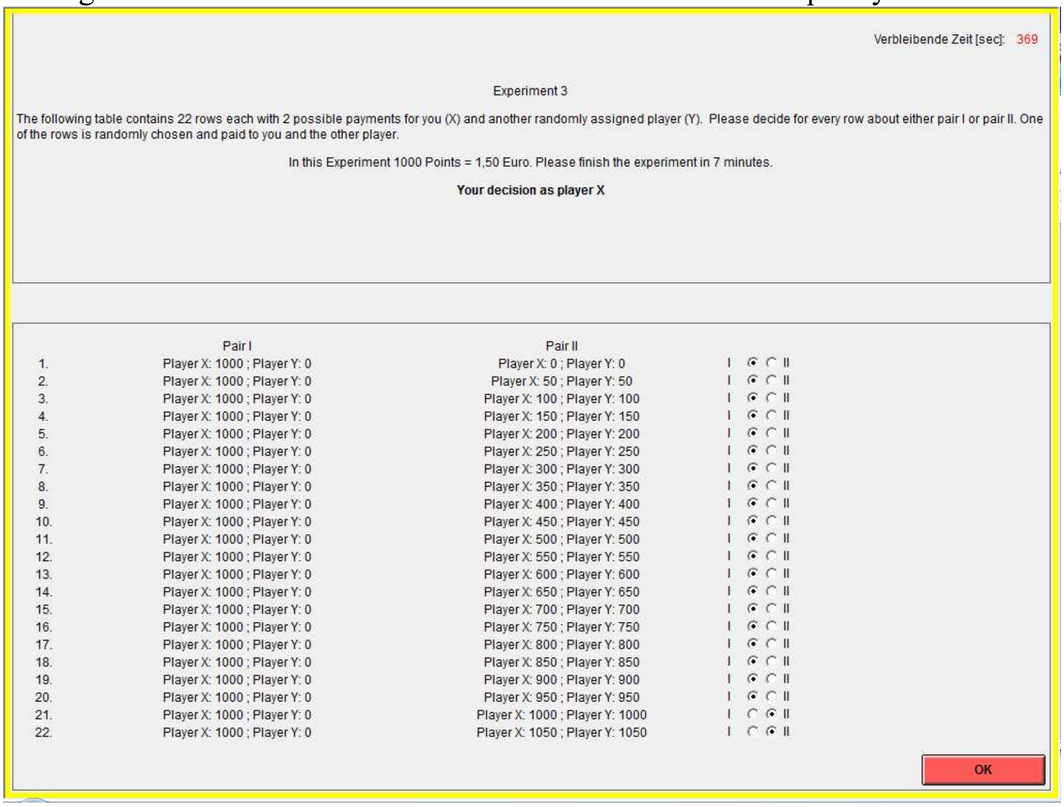
	Pair I	Pair II	
1.	Player X: 500 ; Player Y: 500	Player X: 200 ; Player Y: 200	I (•) ( ) II
2.	Player X: 444 ; Player Y: 556	Player X: 200 ; Player Y: 200	I (•) ( ) II
3.	Player X: 442 ; Player Y: 558	Player X: 200 ; Player Y: 200	I (•) ( ) II
4.	Player X: 439 ; Player Y: 561	Player X: 200 ; Player Y: 200	I (•) ( ) II
5.	Player X: 436 ; Player Y: 564	Player X: 200 ; Player Y: 200	I (•) ( ) II
6.	Player X: 432 ; Player Y: 568	Player X: 200 ; Player Y: 200	I (•) ( ) II
7.	Player X: 429 ; Player Y: 571	Player X: 200 ; Player Y: 200	I (•) ( ) II
8.	Player X: 424 ; Player Y: 576	Player X: 200 ; Player Y: 200	I (•) ( ) II
9.	Player X: 419 ; Player Y: 581	Player X: 200 ; Player Y: 200	I (•) ( ) II
10.	Player X: 414 ; Player Y: 586	Player X: 200 ; Player Y: 200	I (•) ( ) II
11.	Player X: 407 ; Player Y: 593	Player X: 200 ; Player Y: 200	I (•) ( ) II
12.	Player X: 392 ; Player Y: 608	Player X: 200 ; Player Y: 200	I (•) ( ) II
13.	Player X: 386 ; Player Y: 614	Player X: 200 ; Player Y: 200	I ( ) (•) II
14.	Player X: 381 ; Player Y: 619	Player X: 200 ; Player Y: 200	I ( ) (•) II
15.	Player X: 368 ; Player Y: 632	Player X: 200 ; Player Y: 200	I ( ) (•) II
16.	Player X: 353 ; Player Y: 647	Player X: 200 ; Player Y: 200	I ( ) (•) II
17.	Player X: 333 ; Player Y: 667	Player X: 200 ; Player Y: 200	I ( ) (•) II
18.	Player X: 285 ; Player Y: 715	Player X: 200 ; Player Y: 200	I ( ) (•) II
19.	Player X: 272 ; Player Y: 728	Player X: 200 ; Player Y: 200	I ( ) (•) II
20.	Player X: 222 ; Player Y: 778	Player X: 200 ; Player Y: 200	I ( ) (•) II
21.	Player X: 143 ; Player Y: 857	Player X: 200 ; Player Y: 200	I ( ) (•) II
22.	Player X: 10 ; Player Y: 990	Player X: 200 ; Player Y: 200	I ( ) (•) II

OK

Notes: Players have to decide upon one of each column in every row. The procedure is as proposed by Danneberg et al. 2007.

Experiment 3

Figure C2: Z-tree screenshot of Elicitation of favoured inequality aversion


Verbleibende Zeit [sec]: 369

Experiment 3

The following table contains 22 rows each with 2 possible payments for you (X) and another randomly assigned player (Y). Please decide for every row about either pair I or pair II. One of the rows is randomly chosen and paid to you and the other player.

In this Experiment 1000 Points = 1,50 Euro. Please finish the experiment in 7 minutes.

Your decision as player X

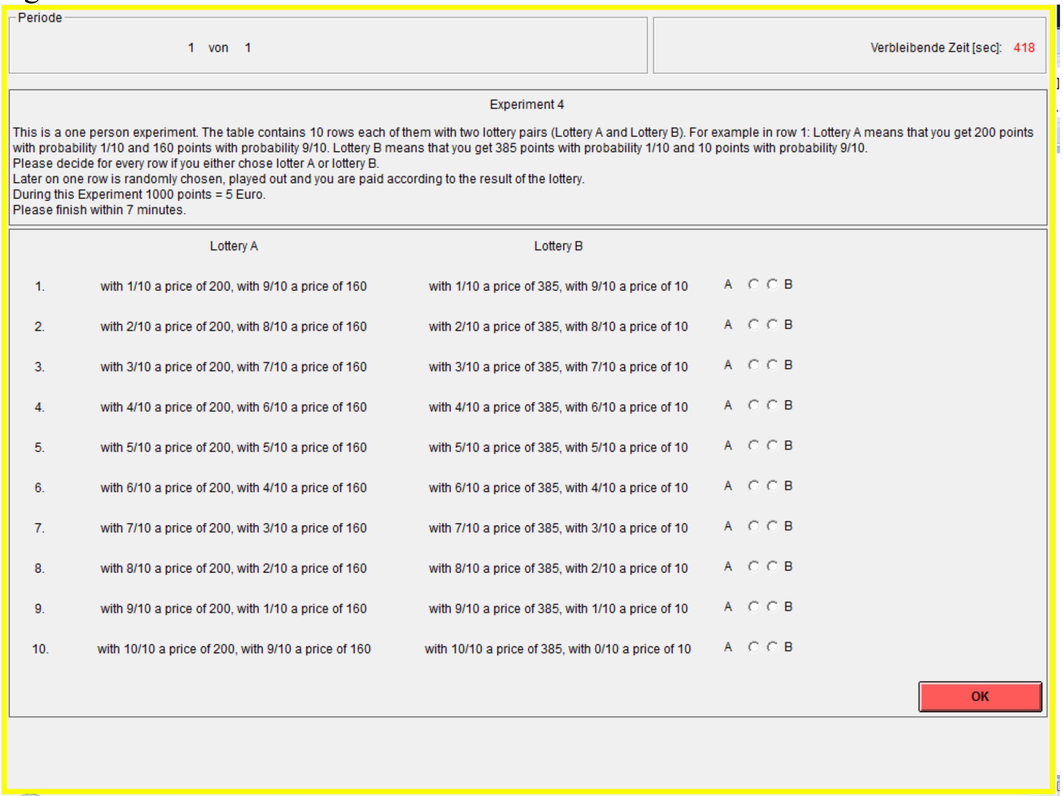
	Pair I	Pair II	
1.	Player X: 1000 ; Player Y: 0	Player X: 0 ; Player Y: 0	I II
2.	Player X: 1000 ; Player Y: 0	Player X: 50 ; Player Y: 50	I II
3.	Player X: 1000 ; Player Y: 0	Player X: 100 ; Player Y: 100	I II
4.	Player X: 1000 ; Player Y: 0	Player X: 150 ; Player Y: 150	I II
5.	Player X: 1000 ; Player Y: 0	Player X: 200 ; Player Y: 200	I II
6.	Player X: 1000 ; Player Y: 0	Player X: 250 ; Player Y: 250	I II
7.	Player X: 1000 ; Player Y: 0	Player X: 300 ; Player Y: 300	I II
8.	Player X: 1000 ; Player Y: 0	Player X: 350 ; Player Y: 350	I II
9.	Player X: 1000 ; Player Y: 0	Player X: 400 ; Player Y: 400	I II
10.	Player X: 1000 ; Player Y: 0	Player X: 450 ; Player Y: 450	I II
11.	Player X: 1000 ; Player Y: 0	Player X: 500 ; Player Y: 500	I II
12.	Player X: 1000 ; Player Y: 0	Player X: 550 ; Player Y: 550	I II
13.	Player X: 1000 ; Player Y: 0	Player X: 600 ; Player Y: 600	I II
14.	Player X: 1000 ; Player Y: 0	Player X: 650 ; Player Y: 650	I II
15.	Player X: 1000 ; Player Y: 0	Player X: 700 ; Player Y: 700	I II
16.	Player X: 1000 ; Player Y: 0	Player X: 750 ; Player Y: 750	I II
17.	Player X: 1000 ; Player Y: 0	Player X: 800 ; Player Y: 800	I II
18.	Player X: 1000 ; Player Y: 0	Player X: 850 ; Player Y: 850	I II
19.	Player X: 1000 ; Player Y: 0	Player X: 900 ; Player Y: 900	I II
20.	Player X: 1000 ; Player Y: 0	Player X: 950 ; Player Y: 950	I II
21.	Player X: 1000 ; Player Y: 0	Player X: 1000 ; Player Y: 1000	I II
22.	Player X: 1000 ; Player Y: 0	Player X: 1050 ; Player Y: 1050	I II

OK

Notes: Players have to decide upon one of each column in every row. The procedure is as proposed by Danneberg et al. 2007.

Experiment 4

Figure C3: Z-tree screenshot of Elicitation of Risk Preferences



Notes: Players have to decide upon one of two lotteries in every row. The procedure is as proposed by Holt and Laury (2002).