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Trust and Reciprocity under Asymmetric Information

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Abstract - We analyze the effects of introducing asymmetric information in an investment game (Berg et al., 1995), in which the division of an economic surplus between a trustor and a trustee is not contractible. Backward induction suggests that rational self-interested players would not voluntarily engage in any transaction, unless they expect trust and reciprocity to play a role in determining the behavior of their counterparts. In our experiment, only the trustee is aware of the size of the surplus obtained, so the trustor cannot tell if a low back-payment corresponds to a low or a high level of reciprocity. The introduction of asymmetric information in the investment game does not reduce the amounts sent and returned, when compared with previous experimental studies. Moreover, average payback levels increase with the average amount sent. Expectations about other's behavior and risk attitude are also elicited in the experiment. Our results show that the first movers' choices are functions of their expectations about the second movers' payback, and the second movers' choices depend on the difference between the amount the first movers have sent to them and their expectations about this amount.

Keywords: game theory, trust, reciprocity

JEL classification: C70, C91, D63, D64

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1 Introduction

An increasing body of literature in experimental economics has provided evidence of cooperative behavior in situations where non-cooperation is a dominant strategy, and no enforcing mechanisms such as reputation concerns, repeated interactions, contractual precommitments, or punishment threats support a cooperative equilibrium.

In a previous investigation of the investment game, Berg et al. (1995) argued that "trust can be viewed as a behavioral primitive," and that an agent's decision to reward trust may depend on this agent's subjective interpretation of the inherent motives of the trustor. In accordance with the social contract hypothesis one may, for instance, believe that economic agents are evolutionarily predisposed to produce cooperative outcomes, e.g., by their ability to "ratify one another's volitional states" (Hoffman et al., 1998).

Choosing different levels of "trust" can be seen as a way to signal some kind of "cooperative predisposition," which, in turn, increases reciprocal behavior. In the experiment reported here, our aim is to test whether trust and reciprocity survive as patterns of behavior even in a setting where individual decisions have very low informational content about any predisposition to be cooperative. This is achieved by using an asymmetric information structure in an investment game, in which only the player who is in charge of dividing the surplus is aware of its true size.

The investment game is a sequential two-person game. The first mover can send any amount of his or her initial endowment to an anonymous counterpart. The amount received by the second mover equals the amount sent multiplied by a factor greater than one. The second mover can return to the first mover any amount taken from his or her initial endowment plus the amount received. Backward induction suggests that opportunistic players would not voluntarily engage in any transaction, unless they expect trust and reciprocity to play a role in determining the behavior of their counterparts.

In our experiment only the trustee is aware of the size of the surplus obtained, so the trustor cannot tell if a low return corresponds to a low or high level of reciprocity. Additionally, we ask for subjects' expectations about the behavior of their counterparts. Since trust in reciprocity in an investment game is risky for the trustor, we also elicit risk preferences of the subjects.

The paper is organized as follows: in Section 2 we describe our behavioral hypotheses for the investment game with asymmetric information; Sections 3 and 4 describe the design and the procedures of our experiment; Section 5 reports the results and the analysis of the data; and Section 7 contains concluding remarks.

2 The investment game with asymmetric information: Behavioral hypotheses

We modify the investment game (Berg et al., 1995). In our design two players, A and B have equal initial endowment ω. The value of the initial endowment is common information. In the first stage of the game, player A (the "trustor") may send any amount $0 \leq a \leq \omega$ from his or her endowment to player B (the "trustee"). The amount sent is then multiplied by a stochastic factor m, which takes the value $m=2$ with probability p, or $m=4$ with probability $(1-p)$. Only player B learns the true value of the multiplier m.

In the second stage, after observing how much surplus has been generated, player B decides which amount of money b to send back to A.[1] The amount of money B may send to A is $0 \le b \le ma + \omega$. The theoretical solution of the game (perfect Bayesian Nash equilibrium) is: $a=0$ for the first mover, and $b(a)=0$ for the second mover. Thus, the original version of the investment game and the investment game with asymmetric information described here have the same equilibrium solutions. The first hypothesis of our analysis refers to the consistency of the subjects' behavior with the theoretical prediction. *Hypothesis 1*: $a=0$, and $b(a)=0$.

We extend the definition of trust given by Coleman (1990) and Berg, et al. (1995) imposing some considerations on the subjects' expectations about each other's actions. If the first mover sends a positive amount of money ($a>0$) and she expects to receive back at least the same amount (i.e., expectation of b $\ge$a), we say that she "trusts" the second mover. In response to a trusting behavior (and if the amount received is greater than the amount expected), the second mover may send back an amount greater than or equal to the amount received. This behavior could be based on reciprocity, altruism, and inequality aversion.[2] Thus, we propose, *Hypothesis 2*: when expectation of b $\ge$a, then a>0; and when (a - expectation of a) >0, then b$\ge$a.

The third hypothesis concerns the type of correlation between the amounts sent and returned. *Hypothesis 3*: a and b are positively correlated.

[1] The second stage of the game is equivalent to a dictator game; i.e. the player that has to move at this stage must decide how much to send to his/her counterpart. This decision will end the game, and the interaction between the two players.

[2] Our experimental design, eliciting expectations about other's behavior, allows us to define trust behavior of the first movers; but it does not allow us to discriminate the motives of the second movers' behavior.

The fourth hypothesis is exclusively related to our design, which allows trustees with multiplier m=4 to hide their opportunism by pretending that m=2. If so, the reward of trust should not depend on the value of the multiplier: *Hypothesis 4*: the reward b(a) of trust level a is the same for m=2 and m=4.

The first mover's decision of trusting the second mover (sending him a positive amount of money) is risky. In terms of risk, a standard hypothesis is that risk-averse people should send a lower amount of money to the second mover compared to risk-lovers. In our comparison between risk attitude and actual decision, we test *Hypothesis 5*: risk-aversion is negatively correlated with the amount sent.

Hypotheses 1, 4, and 5 are standard in the sense that they claim opportunistic behavior. In contrast, Hypotheses 2, and 3 predict other-regarding preferences and strategic cooperation.

3 Experimental design

Subjects are randomly paired. We refer to any two interacting participants as A and B. The A participants are the first movers and the B participants the second movers in the investment game. Each participant receives an initial endowment of 100 Experimental Currency Units (ECU). The amount of initial endowment is common knowledge (see Instructions in Appendix A). Participant A can send any amount (multiple of 10 from 0 to 100) of his or her initial endowment to B. Participant B receives the amount sent by A, multiplied by a factor that we call the multiplier. The multiplier (m) can be either 2 or 4. Each of these two values are equally likely. Only participant B knows the value of m, whereas A knows the (binomial) distribution of m. B can send to A any amount (not necessarily a multiple of 10) taken from his or her initial endowment *plus* the amount received from A multiplied by 2 or 4. This ends the interaction.

We implement the strategy method introduced by Selten (1967). The decision form differs for participants A and B. Participant A has to state his or her expectation about the amount B will send back for any amount he or she might send; and his or her choice of the amount to be actually sent. Participant B has to state his or her expectation about the amount A will send, and his or her choice of an amount to return for every possible amount he or she might receive from A for the two possible multipliers. The subjects will get an extra pound if their expectation turns to be correct.[3] The monetary payments depend on the amount A has sent, the amount B has returned, and the multiplier. Participant A earns 100 ECUs *minus* the amount sent *plus* the amount returned by B. Participant B earns 100 ECUs *plus* the amount A has sent, multiplied by 2 or 4, *minus* the amount returned. The experimental earnings are converted at a rate of 25 ECU to 1 British pound. If a subject's expectation results are correct, the subject earns one extra pound.

4 Experimental procedures

Like Berg et al, we implemented a double blind procedure. Neither the experimenters nor the other participants could identify a decision maker.

[3] This information is provided in decision form.

The experiment proceeded as follows. First, the subjects entered a common room, and were randomly seated. They read the instructions and filled out a control questionnaire. The objective of the control questionnaire was to check whether the subjects understood the instructions before proceeding with the experiment. After everybody finished reading the questionnaire, participants were requested to draw a card from a bag that contained as many cards as the number of participants in the experiment. Each card was marked with a code number that they were required to keep secret. One of the cards was marked with the name "monitor." The monitor did not actively participate in the experiment. He or she just verified that the instructions were followed, distributed the decision forms, collected them, and then supervised the monetary payment procedure. The monitor earned an amount equal to the average earnings of all the other participants. This information was provided to the monitor privately.

The decision forms of A and B participants, once collected, were randomly paired, and the payments were determined according to the amount sent by A, the amount returned by B, and the multiplier, as described above. This was done by first choosing the multiplier randomly, and then checking for B's response to the choice made by the corresponding A. During the calculation of the subjects' earnings they were invited to fill out an anonymous questionnaire marked with the same code as the decision form (see questionnaire in Appendix A). In the questionnaire the subjects had to specify the minimum amount of money they would prefer to receive for sure, instead of a gamble. The questionnaires were collected and finally the subjects received an envelope marked with their codes and containing their final earnings. We conducted 3 sessions of the experiment with 11 subjects each (10 subjects plus a monitor). The subjects were undergraduate students at the University of York, UK. They were all first year students with no previous participation in economics experiments. Sessions lasted approximately one hour.

5 Results

The data collected consist of the amounts, `a` that `A` participants want to send, the amounts, `b(a)` that `B` participants want to return for each feasible value `a`, the `A` participants' expectations about the amount, `b(a)`, and the amount, `a` that `B` participants expect to receive from their counterparts. In addition, we collected data about subjects' risk preferences. The analysis of the results is divided into three parts: choice, expectations, and risk attitude.

5.1 Choice

The results of the experiment strongly rejected Hypothesis 1. Figure 1 shows that only one subject (in pair 15) sent zero to his or her counterpart, and only three subjects (in pairs 7, 12, and 14) returned zero to the first mover. The average amount sent was 38 ECUs (with a standard deviation of 24.84); the average amount returned was 47.33 ECUs (with a standard deviation of 42.14).

Figure 2 reports the box plots of the amounts sent by `A` and the paybacks by `B`. The two medians (represented in the box plot by the solid lines) are very close (two-sided Wilcoxon rank-sum test, r=-0.4795, p-value=0.6316, i.e., the two means are not significantly different from each other). There is more dispersion in the amount of payback than the amount sent. This is explained in part by the fact that B can send any amount, not only multiples of 10 to A, and in part by the increase of the feasible range due to the multiplier.

Figures 3 and 4 show the amount paid back by B as a function of the amount received from A when the multiplier was 2 or 4, respectively. These two figures exhibit the same trend, namely, an increase of payback with respect to an increase of amount received. The Kolmogorov-Smirnov goodness-of-fit tests (K-S) comparing the samples of less than or equal to 40 ECUs sent with the ones of more than 40 ECUs sent, rejects the hypothesis of same distribution (K-S =1, p-value=0.0079) for both levels of the multiplier ($m=2$, and $m=4$). There is significant difference in payback when trust is higher (the amounts sent and returned are positively correlated), which is in support of Hypothesis 3. On the other hand, there is no significant difference between the amount of payback for the two multipliers when the amount sent is less then or equal to 40 ECUs (K-S =0.4, p-value=0.873), but there is a significant difference between the amount of payback for the two levels of multipliers when the amount sent is higher than 40 ECUs (K-S =0.83, p-value=0.026). In the last case the paybacks for $m=4$ are higher than paybacks for $m=2$. These results illustrate the fact that the second movers do not take advantage of their information about the effective value of the multiplier (Hypothesis 4 is unconfirmed); and that the choice on payback is sensitive to the amount of trust and to the total return.

Table 1 presents two contingency tables, one for the amounts sent and one for the amounts returned. Both tables compare our result with those of Berg et al. (1995).[4] The results indicate no difference in the amount sent between our experiments and Berg et al. The Chi-square test cannot reject the hypothesis of independence between the rows (Berg et al.; Coricelli et al.) and the columns (category 1: $a=0$; category 2: $a>0$, where a is the amount sent). The second contingency table indicates a significant difference between our results and Berg et al.; in our experiments the second movers return more. The number of subjects that payback more than the amount that the first mover sent is significantly higher in our experiment. The Chi-square test rejects the hypothesis of independence between the rows (Berg et al., Coricelli et al.) and the columns (category 1: $a>0$ and $b \geq a$; category 2: $a>0$ and $b<a$; where b is the amount returned). In our experiment, only 5 of 24 second movers that received a positive amount paid back less than the amount sent to them by the first mover.

5.2 Expectations

Figure 5 indicates how the expectations of the second movers about the amount they would receive from the first movers were very close to the observed ones (two-sided Wilcoxon rank-sum test, r=0.86, p-value=0.938, i.e. we cannot reject the hypothesis of equal means). This result confirms the extraordinary human ability of predicting other people's behavior in situations involving reciprocal interactions (see Coricelli, McCabe, and Smith, 2000).

[4] We consider also in the tables the data of an analogous experiment that was conducted in Amsterdam during the ENDEAR Summerschool (2001).

As' expectations about the amount they would receive back for every possible amount they could choose and for both possible values of the multiplier are shown in Figure 6 (m=2) and Figure 7 (m=4). Their expected payback increases with the amount they might send to B. Indeed, the Kolmogorov-Smirnov goodness-of-fit tests comparing the samples of payback expectations for possible amounts sent less than or equal to 40 ECUs and more than 40 ECUs reject the hypothesis that both samples have the same distribution (K-S =1, p-value=0.0079) for both levels of the multiplier (m=2, and m=4).

There is no significant difference between the expectations of payback for the two multipliers. We cannot reject the hypothesis that the distributions for m=2 and m=4 are the same (K-S =0.455, p-value=0.211). Therefore, the first movers expect a defecting behavior from the second movers, meaning that they expect the second mover to exploit their private information on the effective value of the multiplier.

5.3 Risk attitude

Risk attitude was elicited through a post-experiment questionnaire. In the questionnaire (see Appendix A) we asked for 10 certainty equivalents. With the data of the questionnaire we can estimate a value function (Prelec, 2000) and a probability weighting function for each subject.[5] The psychological probability weight is the result of the

[5] We proceed as follows. We assume that the value function is a power function, $V(x)=x^{\alpha}$ and the weighting function is the compound invariant (S-shaped), $W(p)=\exp(-(-\ln p)^{\beta})$. If a person estimates that x is equivalent to a p-chance of y, then $x^{\alpha}=(y^{\alpha})\exp(-(-\ln p)^{\beta})$. Taking logarithms twice of both sides of this equation (and rearranging terms) gives a linear equation: $-\ln(-\ln(x/y)=\ln(\alpha)+\beta(-\ln(-\ln p))$. We can estimate this with linear regression, provided we have at least two certainty equivalent judgments. We just set up a linear regression, with the x-variable being values of $(-\ln(-\ln p))$ and y-variable the corresponding values of $-\ln(-\ln(x/y))$. The slope and intercept of the regression equation give us respectively, the value of β and the value of $\ln(\alpha)$. So then we have the weighting and the value

cognitive perception of objective probabilities. The psychological probability weight is represented by a nonlinear function. Therefore, this function is concave for probabilities close to zero and convex for probability values close to 1 (the other extreme). The convex region is larger than the concave region. This asymmetry of the function is shown also in the value of the inflection point; therefore, this value is estimated to be equal to a probability of .37 that is less than .5 (the symmetry case). The form of this function is determined by a series of cognitive factors. The nonlinearity of the probability weighting function is determined by the observed (experimentally and empirically) over-weighting of small probabilities (the function is concave) and under-weighting of large probabilities (the function is convex). The function expresses the phenomenon of sub-additivity (i.e. the value of a prospect changes more when we change the probability close to the two extremes). For this factor, the slope of the function increases near a probability equal to zero, and near the probability equal to one (certainty). Another cognitive factor that determines the shape of the function is the subproportionality (i.e. the same relative increase in the probability of winning is weighted more for higher probability). There are also differences in the form of the function for the domain of gains vs. the domain of losses. The concept of a psychological probability weight strictly depends on the way it is measured. The weighting function is determined by considering the prospect theory model of Kahneman and Tversky (1979) (and more recently the cumulative prospect theory model of Wakker and Tversky, 1993) as the background model. This implies that

functions fully specified. In terms of the questionnaire, we just need to ask for a couple of certainty equivalents for p-chances at y (changing both p and y). Thus 10 estimates are enough to give stable estimates of the slope-intercept.

the weights are constructed with the evidence of choices over prospects. In this way, we implement risk attitude behaviors. Therefore, risk attitude explains the shape and the characteristics of the weighting function. The use of both the value function and the weighting probability function gives us a better understanding of subjects' risk preferences.

We can find (checking subjects' codes) the corresponding decision form for each questionnaire on risk attitude. In this way we can compare the decisions of the first and second movers with their risk attitude. Table 2 shows the subjects' risk attitudes in our experiment. Risk-averse subjects sent more than risk-lovers and risk neutral subjects (Hypothesis 5 is unconfirmed). Risk-lover subjects paid back more than risk-averse ones. Figure 8 shows the average payback expectations of risk-averse A subjects and risk-lover A subjects. This figure together with Table 3 show a significant difference in their payback expectations, i.e., risk lovers expected less payback. The gap between expectations and observed amount received is higher for the risk-lover second movers than for the risk-averse second movers, i.e. risk lovers were more pessimistic (see Figure 9 and Table 3).

6 Concluding remarks

The results of our experiment strongly rejected the "standard" hypotheses; i.e. our data are inconsistent with the self-regarding preference model. The introduction of asymmetric information in the investment game does not reduce the amounts sent and returned when compared with a previous experimental study of the investment game (under complete information). Moreover, average payback levels increase with the average amount sent. The second movers did not exploit their informational advantage about the value of the multiplier. The data on expectations show a remarkable ability of the subjects to predict other subjects' behaviors. The first movers expected an increasing amount of payback for an increasing amount of money sent. The second movers guessed (on average) correctly the amount they would receive. The comparison of risk attitude and decision yielded a counterintuitive result (if we only consider the comparison between risk and choice): risk averse people are the ones that send more, and risk lovers are the ones that return more. This observation is similar to the result in the experiment by Gunnthorsdottir, et al. (2002). Comparing the trust behavior of subjects that have scored high or low in the Christie and Geis's Machiavellianism scale (Mach-IV), they found that high Machs did not send (trust) significantly more than low Machs. The high Machs tend to be more risk lovers than low Machs (Allsopp et al., 1991); therefore, our results are similar to their results. Our interpretation of this finding refers to the fact that high Mach-risk lover individuals, due to their intrinsic nature, engage in more frequent and cynical interactions compared with low Mach-risk averse individuals. The experience and the attitude of risk lovers determine their expectations and beliefs about the others' behavior. Our analysis of expectations shows that risk-lover senders have lower expectations about payback, and risk-lover second movers have pessimistic expectations about the amount they will receive from the sender. This explains the first-mover risk-lover reluctance to send money to the second movers, and the second movers' over-generous behavior. Table 4 reports Probit estimates and marginal effects (evaluated at the mean) of the regression about the relation between amount sent and payback expectation. The dependent variable, “Send” takes a value of one when the first mover sends an amount greater than or equal to forty ECUs (High), and value of zero when the first mover sends less than forty ECUs (Low). In Table 5 the dependent variable, “Return” takes a value of one when the second mover returns an amount greater than or equal to the amount received, and value of zero when the second mover returns less than the amount received. The independent variable “a - expected a” represents the difference between the amount received from the first mover and the amount expected. In both tables the estimated parameters are positive and significantly greater than zero (Hypothesis 2 is confirmed). These results support our conclusions about the effect of expectations on choices.

Decisions and expectations in our experiment deviate from the standard model of self-regarding preference and rationality. Our experimental data are consistent with a model based on subjects’ beliefs about the intentionality of the other players’ actions (see Rabin, 1993). The first movers’ choices are functions of their expectations about the second movers’ payback. The second movers’ choices depend on the difference between the amount the first movers have sent to them and their expectations about this amount.

Our experimental setting allowed us to distinguish the amount of trust from the other motives of the first movers’ sending behavior. Indeed, we can determine the amount of trust as any positive amount the subject has sent expecting a greater amount in payback.

This procedure (eliciting payback expectation)[6] solved the critique pointed out by Cox (2001)[7] about the impossibility of distinguish between trust and altruism as determinants of the first movers' behavior in the investment game of Berg et al. We cannot distinguish between the motives that determine the reciprocal behavior of the second movers. We found that the positive amount of payback observed in our experiment could be explained by reciprocity, altruism, or inequality aversion. It is, indeed, the objective of our future research to change our experimental design in order to distinguish reciprocity from other motives for the second movers' cooperative behavior.

We show the necessary condition, for a better understanding of the subjects' behaviors, of eliciting expectations and risk attitudes in experiments involving reciprocal interactions.

[6] The first mover has to express his or her expectation about the amount the second mover will send back for any amount he or she might send.

[7] Cox (2001) introduces a "triadic" design in order to distinguish between different motives of reciprocal behavior.

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APPENDIX A: Experimental Instruction, Decision Forms, and Questionnaire

Instructions

You are about to participate in an experiment on decision making. In this experiment you will interact with another person, whose identity will remain unknown during and after the experiment. We kindly ask you not to talk or communicate with any other participant. If you have any question please raise your hand.

We refer to every two interacting participants as A and B. On the decision form you will be informed whether you are A or B.

In the experiment each participant will receive an initial endowment of 100 Experimental Currency Units (ECU). Participant A can send any amount (multiple of 10 from 0 to 100) of his/her initial endowment to B. Participant B will receive the amount sent by A multiplied by a factor we call the *multiplier*. The *multiplier* can be either 2 or 4, and each of these two values are equally likely. Only participant B will know whether the amount that he/she received has been multiplied by 2 or 4. B can send to A any amount (not necessarily a multiple of 10) taken from his/her initial endowment plus the amount received from A multiplied by 2 or 4. This ends the interaction.

The monetary payments depend on the amount A has sent, the amount B has returned and the *multiplier*, as follows:

A earns: 100 *minus* the amount sent *plus* the amount returned by B

B earns: 100 *plus* the amount A has sent multiplied by 2 or 4 *minus* the amount returned

We will proceed as follows:

1. You will be requested to answer a simple control questionnaire.
2. You will be asked to draw a card from a bag. The bag contains as many cards as the number of participants to the experiment. The card is marked with a code number that you must keep with you. One of the cards is marked with the name "monitor". The monitor will verify that the instructions have been followed as they appear here.
3. Everybody except the monitor will receive an envelope, containing the decision form, marked with your code number. The decision form, which varies according to whether you are participant A or B, has to be completely filled out. Participant A has to express his/her expectation about the amount B will send back for any amount he/she might send; and his/her choice of the amount he/she will send. Participant B has to express his/her expectation about the amount A will send, and his/her choice of an amount to return for every possible amount he/she might receive from A for the two possible *multipliers*.
4. The monitor will collect the decision forms.
5. The decision forms of participants A and B will be randomly paired, and the payments will be determined according to the values of the amount sent by A, the amount returned by B, and the *multiplier*, as described above. This is done by first choosing the *multiplier* randomly, and then checking for B's response to the choice made by the corresponding A.
6. The experimenters will calculate the payoffs for every participant without knowing your identities. You will receive an envelope marked with your code

containing your final earnings. Your total experimental earnings will be converted to GBP at a rate of 25 ECU to 1 pound.

Control Questionnaire:

Note that the following values of the amount sent by A and the amount sent by B are completely arbitrary. We only want to check that you have understood the instructions before proceeding with the experiment.

1. Assume that A has chosen to send 30 ECU, that the *multiplier* is 2, and B has chosen to send 70 ECU. Earnings of A and B will be:

   A earns ______ ECU; B earns ______ ECU.

2. Assume that A has chosen to send 70 ECU, that the *multiplier* is 4, and B has chosen to send 30 ECU. Earnings of A and B will be:

   A earns ______ ECU; B earns ______ ECU.

3. Assume that A has chosen to send 20 ECU, that the *multiplier* is 2, and B has chosen to send 46 ECU. Earnings of A and B will be:

   A earns ______ ECU; B earns ______ ECU.

4. Assume that A has chosen to send 50 ECU, that the *multiplier* is 4, and B has chosen to send 18 ECU. Earnings of A and B will be:

   A earns ______ ECU; B earns ______ ECU.

CODE [ ]

Decision Form

You are an "A" participant.
Please remember your code and keep it secret.

Expectations
(Please note that your answers in this part will not affect your final earnings, but if your expectation turns to be correct, you will get an extra pound.)

Please express your expectation about the amount you will receive back for every possible amount that you could choose and for both possible values of the multiplier. (You are asked to fill in 22 feasible numbers in the 22 boxes.)

	if you send an amount of	0	10	20	30	40	50	60	70	80	90	100
Multiplier 2	you expect to receive back an amount =											
	(feasible range)	[0-100]	[0-120]	[0-140]	[0-160]	[0-180]	[0-200]	[0-220]	[0-240]	[0-260]	[0-280]	[0-300]
Multiplier 4	you expect to receive back an amount =											
	(feasible range)	[0-100]	[0-140]	[0-180]	[0-220]	[0-260]	[0-300]	[0-340]	[0-380]	[0-420]	[0-460]	[0-500]

Choice
(Only your answer in this part will influence your final earnings.)

Please choose the amount of ECU you want to send to B: [ ]

(Feasible range: multiples of 10 between 0 and 100)

Please put your decision form in your envelope and keep your code with you.

CODE

Decision Form

You are a "B" participant.
Please remember your code and keep it secret.

Expectations
(Please note that your answer in this part will not affect your final earnings, but if your expectation turns to be correct, you will get an extra pound.)

Please express your expectation about the amount A will send:
(Feasible range: multiples of 10 between 0 and 100)

Choice
(Only your answer in this part will influence your final earnings.)

Please choose an amount of ECU you will send for every possible amount you will receive from A and for both multipliers.
(You are asked to fill in 22 feasible numbers in the 22 boxes.)

	if A sent you an amount =	0	10	20	30	40	50	60	70	80	90	100
Multiplier 2	you will send an amount of =											
	(feasible range)	[0-100]	[0-120]	[0-140]	[0-160]	[0-180]	[0-200]	[0-220]	[0-240]	[0-260]	[0-280]	[0-300]
Multiplier 4	you will send an amount of =											
	(feasible range)	[0-100]	[0-140]	[0-180]	[0-220]	[0-260]	[0-300]	[0-340]	[0-380]	[0-420]	[0-460]	[0-500]

Note that A's choice determines the column which finally applies, whereas the row multiplier 2 or multiplier 4 is randomly selected after collecting the decision forms.

Please put your decision form in your envelope and keep your code with you.

Questionnaire

CODE

Please specify in the dotted spaces below the minimum amount of money that you would prefer to receive for sure, instead of each of the following gambles:

………. instead of 10,000 pounds with 50 percent chances or 0 pound with 50 percent chances.

………. instead of 1,000 pounds with 1 percent chances or 0 pound with 99 percent chances.

………. instead of 10,000 pounds with 20 percent chances or 0 pound with 80 percent chances.

………. instead of 100 pounds with 90 percent chances or 0 pound with 10 percent chances.

………. instead of 100,000 pounds with 0.1 percent chances or 0 pound with 99.9 percent chances.

………. instead of 1,000 pounds with 30 percent chances or 0 pound with 70 percent chances.

………. instead of 10,000 pounds with 80 percent chances or 0 pound with 20 percent chances.

………. instead of 100,000 pounds with 5 percent chances or 0 pound with 95 percent chances.

………. instead of 1,000,000 pounds with 99 percent chances or 0 with 1 percent chances.

………. instead of 1,000 pounds with 70 percent chances or 0 with 30 percent chances.

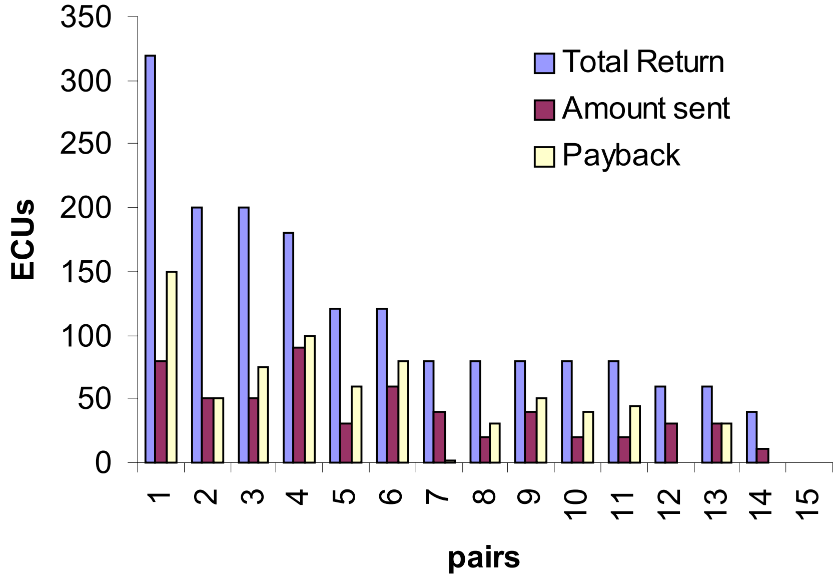

Figure 1: Observation sorted by the total return

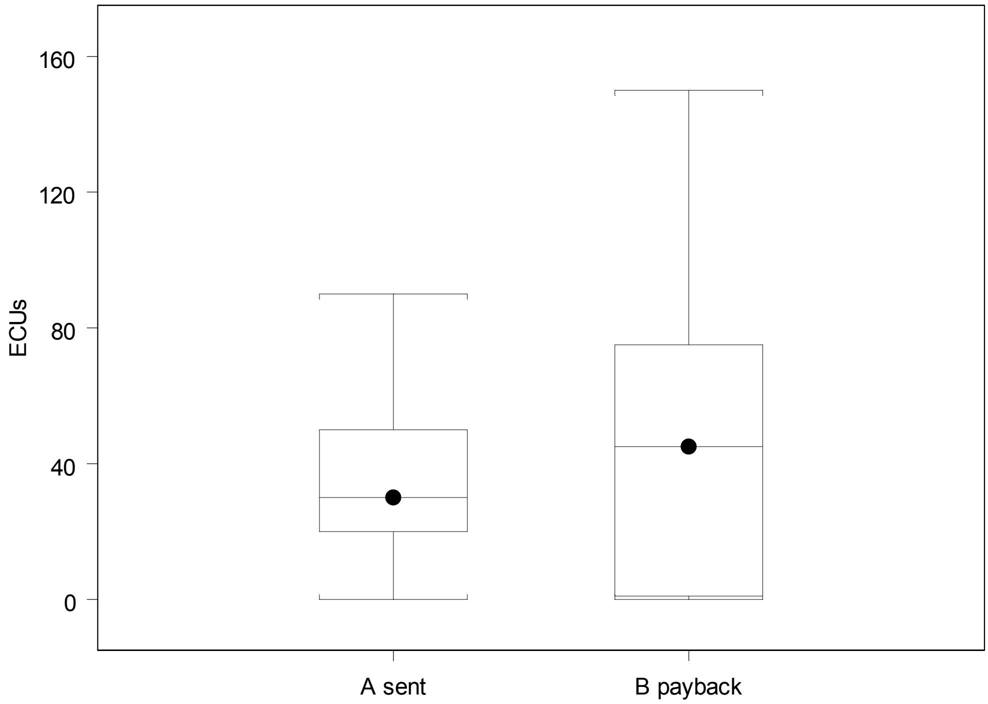

Figure 2: Observed amount sent and payback

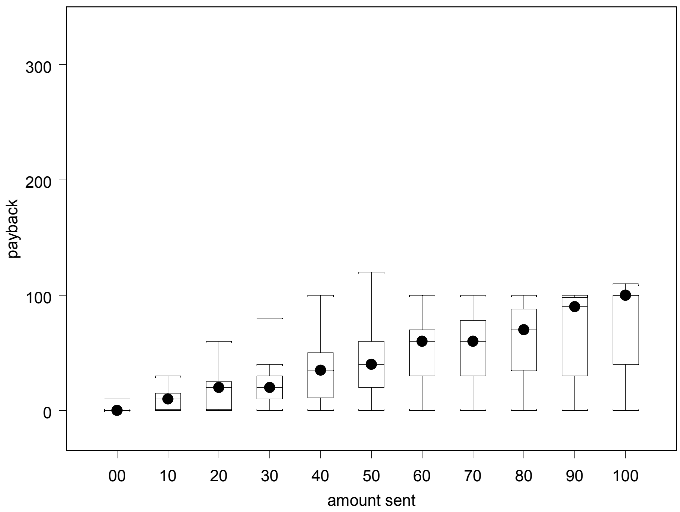

Figure 3: B's payback as a function of amount sent (m=2)

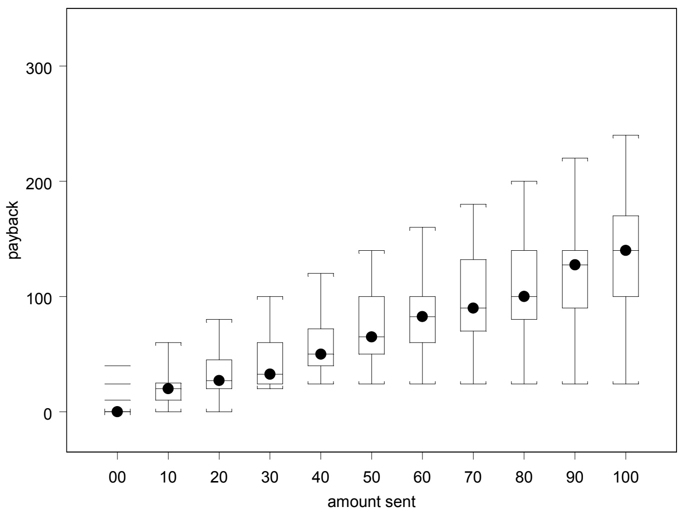

Figure 4: B's payback as a function of amount sent (m=4)

	Contingency table 1 Send Data		**Contingency table 2** Return Data	
	$a=0$	$a>0$	$a>0, b \geq a$	$a>0, b<a$
Berg et al.	2	30	14	16
Coricelli et al	3	24	19	5
Chi-square test	0.45 p-value=0.50		5.93 p-value<0.01	

Table 1: Contingency tables: send and return data, Berg et al vs. Coricelli et al.

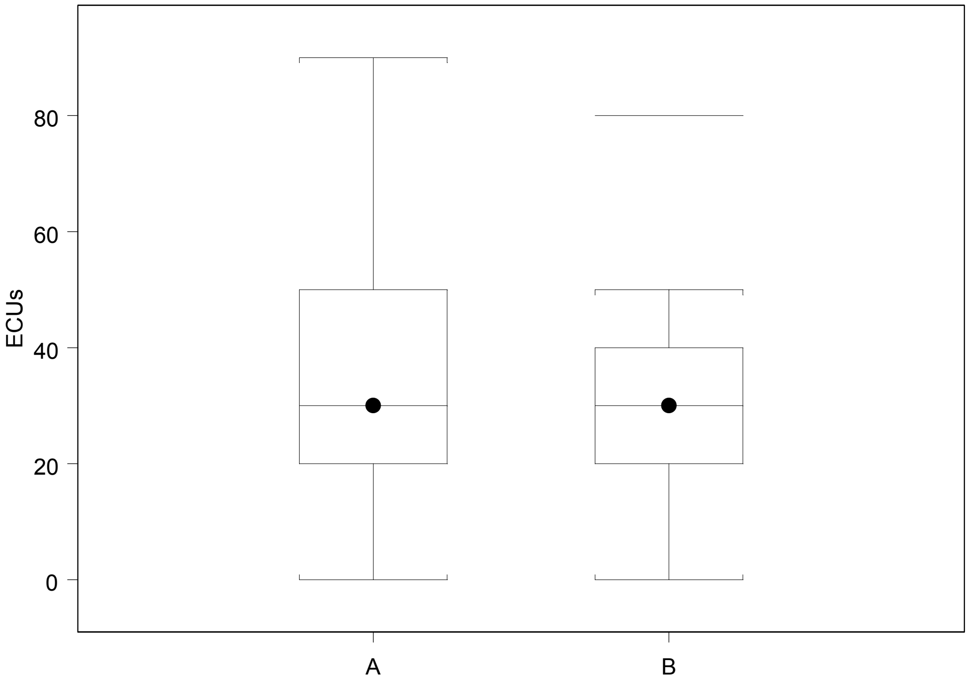

Figure 5: A’s decisions and B’s expectations regarding the amount sent

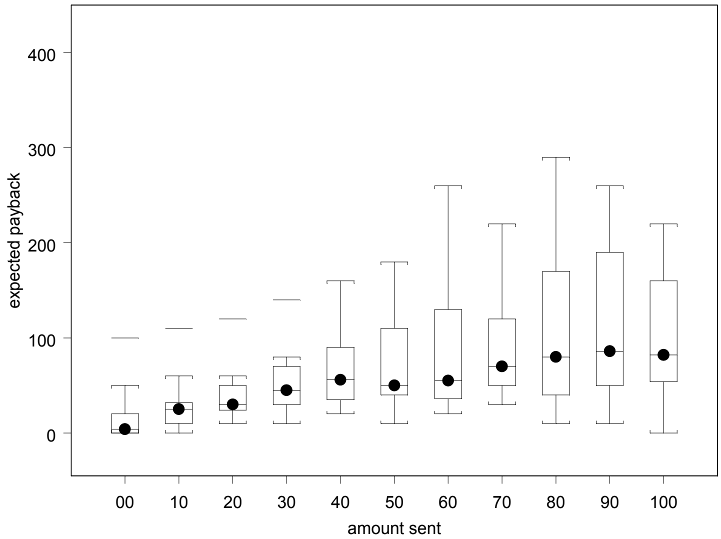

Figure 6: A's expectations about B's payback (m=2)

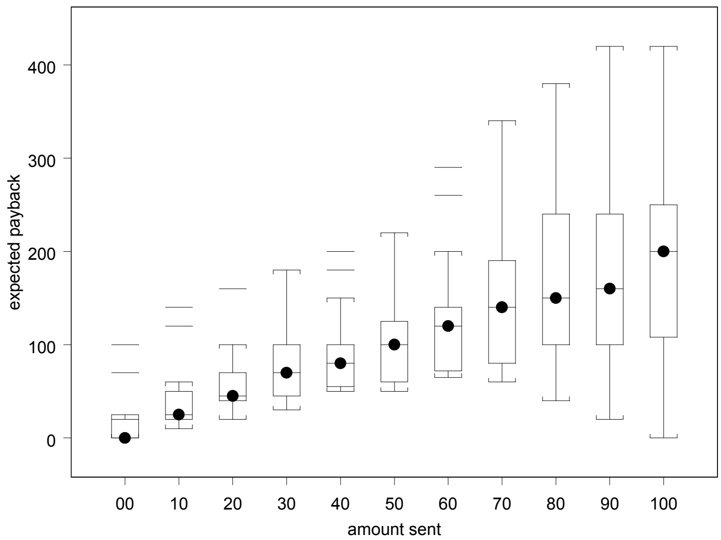

Figure 7: A's expectations about B's payback (m=4)

Risk attitude	Amount sent		Payback	
	$< 40ECUS$	$\geq 40ECUs$	$\leq 50ECUs$	$> 50ECUs$
Risk averse	0.375	0.6	0.5	0.4
Risk neutral	0.125	0	0.1	0
Risk lover	0.5	0.4	0.4	0.6

Table 2: Proportion of risk attitude for ranges of amount sent and payback

Samples	Risk Averse μ_x	Risk Lovers μ_y	μ_x - μ_y	t -stat	p-value
b expected	70.857	28	42.857	2.052	0.033
a – expected a	-6	16.667	-22.667	-2.946	0.016

Table 3: Fisher Exact test for differences between samples means of risk averse and risk lovers subjects payback “b” expectations and differences between amount received and amount expected

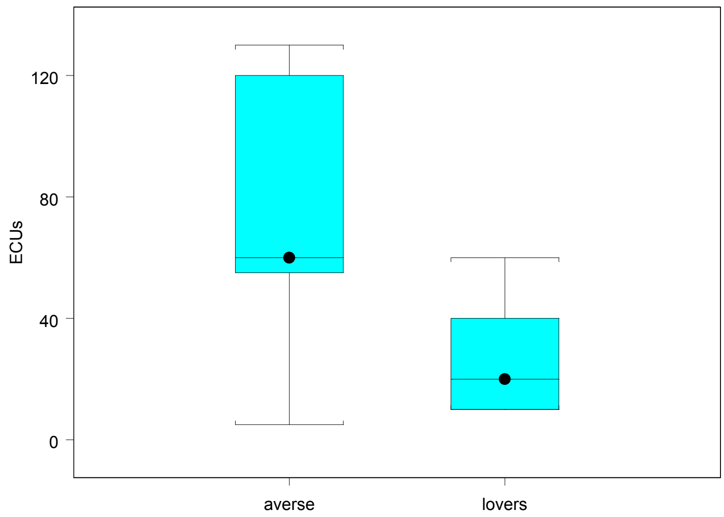

Figure 8: Payback expectations. `As` risk averse vs. `As` risk lovers subjects

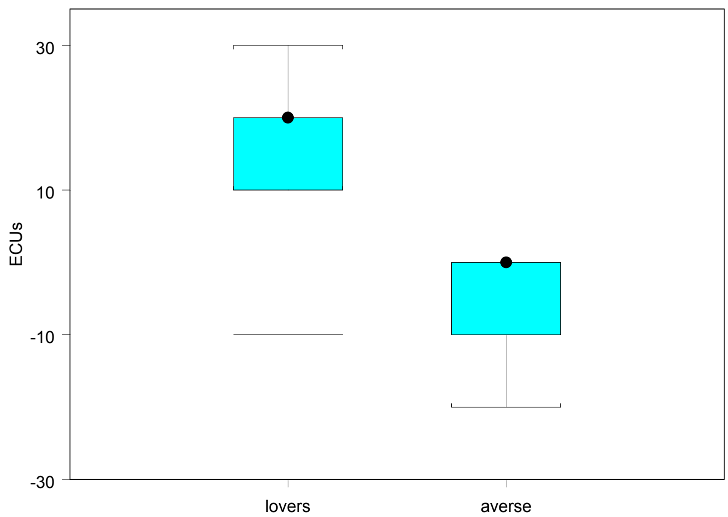

Figure 9: Differences between amount received and amount expected. `Bs` risk lovers vs. `Bs` risk averse subjects

Regression Analysis
Dependent variable: "Send"
PROBIT estimation

VARIABLE NAME	COEFFICIENT	MARGINAL VALUE
Constant	-4.04 (1.99)*	-0.14 (0.06)*
Expected Payback	0.69 (0.31)**	0.23 (0.08)**

Table 4: Regression Analysis

Regression Analysis
Dependent variable: "Return"
PROBIT estimation

VARIABLE NAME	COEFFICIENT	MARGINAL VALUE
Constant	-14.48 (0.13)**	-0.23 (0.004) **
a -expected a	0.72 (0.34)*	0.12 (0.06)*

Table 5: Regression Analysis

Numbers in parentheses are Standard Errors.

* Significant at 10% confidence
** Significant at 5% confidence