Attitudes toward Private and Collective Risks in Individual and Strategic Choice Situations

Geoffrey Brennan[a], Luis G. González[b], Werner Güth[b], M. Vittoria Levati[b,*]

[a] Research School of Social Sciences, Australian National University, Canberra

[b] Max Planck Institute of Economics, Strategic Interaction Group, Jena

Abstract

Idiosyncratic risk attitudes are usually assumed to be commonly known and restricted to own payoffs. However, the alternatives faced by a decision maker often involve risks for others' payoffs as well. Motivated by the importance of other-regarding preferences in social interactions, this paper explores idiosyncratic attitudes toward own and others' risks. We elicit risk attitudes in an experiment involving choices with and without strategic interaction.

Keywords: Other-regarding concerns; Random price mechanism; Public goods experiments

JEL classification: C90; D63; D81; H41

*Corresponding author. Max Planck Institute of Economics, Strategic Interaction Group, Kahlaische Strasse 10, D-07745 Jena, Germany. Tel.: +49/3641/686-629; fax: +49/3641/686-667. E-mail address: levati@econ.mpg.de

1 Introduction

When an individual's action affects both her own and other individuals' payoffs, the actor often exhibits other-regarding preferences. These are mostly discussed in the economic literature under the rubric of benevolence or altruism (Trivers, 1971; Brennan, 1975; Becker, 1976; Bester and Güth, 1998). There has though also been some analysis of cases where the payoffs of others enter negatively into the preferences of the actor, as in envy or spite (Brennan, 1973; Kirchsteiger, 1994; Dufwenberg and Güth, 2000). And sometimes the actor's other-regarding concerns are thought to be better construed as 'inequity aversion' (Bolton, 1991; Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000).

Previous studies have formulated other-regarding concerns simply in terms of the expected payoff levels of other individuals. What is distinctive in our study is that we attempt to take into account attitudes to risk not only with respect to own payoffs (which is common) but also with respect to others' payoffs. Specifically, we aim to engage the following research questions: How strong are other-regarding concerns in situations involving exogenous risks both for oneself and others? How do attitudes toward own and others' risks interact? Are such attitudes different when strategic uncertainty is introduced? To the best of our knowledge, attitudes to risks borne by others have not been introduced into economic theory, although one might think that, when agents are other-regarding, attitudes to own-risk should be replicated in attitudes to others' risks.

Part of the background to the interest in these questions lies in the philosophical literature on distributive justice, including most notably the work of John Rawls (1971). Rawls' notion of justice is derived from a conceptual experiment in which individuals choose among institutions (and the payoff vectors associated with them) without knowing which element in the relevant payoff vector will fall to themselves. Institutions are, in this sense, chosen from "behind a veil of ignorance". Rawls imagines that each individual, in making her decision, will choose with an eye to her own payoff, in an entirely selfish way. But if individuals exhibit risk-aversion or something rather like it, as he believes they do,[1] they will rationally choose egalitarian institutions – and the chosen institutions will be more egalitarian the more risk-averse the chooser is. If Rawls is right in this, one may conjecture that the more risk-averse an individual is, the more "benevolent" she will prove.

More generally, Rawls (in his rather formal way) and many other egalitarians (less formally) think of benevolence as a matter of each individual locating herself imaginatively in the shoes of others. This psychological foundation for benevolence seems plausible enough, but it has structural implications. In particular, it implies that benevolent individuals should have attitudes to risks faced by others similar to those they exhibit to risks faced by themselves.

Here, then, there is a straightforward empirical question. How do individuals who exhibit benevolence evaluate risks to others? Do those individuals who are indifferent to risks borne by others also exhibit weak concerns toward others more generally?

By means of a comprehensive experimental design we try to shed light on the relation between other-regarding concerns and risk preferences when one's own and/or another person's payoff is risky. Since individual dispositions toward others' risk and/or payoff may depend on the situation at hand, we consider choice problems with risky payoffs in the presence of strategic interaction and not.

In the setting with no strategic interaction, each decision maker is required to evaluate four different allocations, each of which assigns a payoff to herself and to another participant, either probabilistically or in a deterministic way. As elicitation procedure we use the incentive compatible random price mechanism (Becker, DeGroot and Marschak, 1964). This procedure is implemented both as a willingness-to-pay and as a willingness-to-accept decision task.

[1] Though Rawls explicitly resists the language of risk-aversion.

The setting with strategic interaction is a two-person public goods game which, under risk neutrality, yields interior opportunistic and efficient benchmark solutions. Here, preferences for risk are captured by letting participants decide in four different situations involving risks about one's own and/or other's marginal benefit from the public good.

In Section 2 the different decision problems are introduced. The experimental results are analyzed in Section 3, and Section 4 presents some concluding remarks. Although at this stage our conclusions are essentially descriptive, this paper represents a first step toward a theory of other-regarding risk attitudes.

2 Decision tasks involving social risks

2.1 Non-strategic settings

Do agents care for the well-being of another person when no strategic uncertainty is involved? And, if so, is there any relation between other-regarding concerns and risky outcomes? To address these questions we rely on the random price mechanism (Becker, DeGroot and Marschak, 1964) to elicit individual valuations of several risky prospects. Valuations are defined as reservation prices in the form of either willingness to pay in order to *acquire* the prospect (henceforth, WP-treatment) or willingness to accept a fixed amount of money to *forgo* the prospect (henceforth, WA-treatment). These two treatments are administered in a between-subjects design. Each prospect allocates payoffs both to the decision maker and to another participant. More specifically, each member of the pair receives either a sure payoff, u, or a lottery ticket, U, assigning $\underline{U}$ or $\overline{U}$ with 1/2 probability each. The relation between the different payoffs is given by $0 < \underline{U} < u < \overline{U}$ and $\mathrm{E}U = (\underline{U} + \overline{U})/2 = u$.

We denote by P_{ij} the prospect assigning i to the decision maker and j to her passive partner. Thus, in both the WP- and the WA-treatments, we allow for the following four prospects:

P_{uu} : both the decision maker and her passive partner get u,

P_{uU} : the decision maker gets u and her partner gets U,

P_{Uu} : the decision maker gets U and her partner gets u,

P_{UU} : both the decision maker and her partner get U.

In the WA-treatment, the decision maker is asked to submit a minimum selling price for each prospect, $b(P_{ij})$, where $0 < \underline{b} \leq b(P_{ij}) \leq \bar{b}$. Then a random draw from a uniform distribution determines an offer $p \in [\underline{p}, \bar{p}]$ with $0 \leq \underline{p} < \bar{p}$. If the random offer is at least as large as the decision maker's reservation price, i.e., if $p \geq b(P_{ij})$, then the decision maker sells the prospect and keeps the offer price p, while her partner receives nothing. Instead, if $p < b(P_{ij})$, the decision maker keeps the prospect, and she as well as her partner obtain a realization of the payoffs specified by the prospect.[2] To preserve the riskiness of the final payoff, we set $\underline{p} < \underline{b} < \bar{b} < \bar{p}$. In such a way, notwithstanding $b(P_{ij}) = \underline{b}$ (or $b(P_{ij}) = \bar{b}$) the decision maker can never be sure whether she will own the prospect or not.

In the WP-treatment, the decision maker is asked to report the highest integer value for which she would be willing to buy each prospect, where, as before, $b(P_{ij}) \in [\underline{b}, \bar{b}]$. If the random value $p \in [\underline{p}, \bar{p}]$ exceeds the bid, $b(P_{ij})$, the decision maker does not buy the prospect. In this case, she keeps her endowment, $\bar{b}$, and her partner obtains nothing. Otherwise, the decision maker buys the prospect at the price p. Hence, she earns her endowment minus p, and in addition she as well as her partner earn what the prospect prescribes.

In both treatments, a risk-neutral decision maker who cares only for her own payoff should submit $b(P_{ij}) = u = \mathrm{E}U$ in each of the four prospects. Nevertheless, if the decision maker cares for her partner and, thus, wants to increase the chances of not selling or buying the prospect in the WA- or WP-treatment, she should report $b(P_{ij}) > u$. Comparing bids across prospects in

[2]This way of capturing other-regarding concerns can be compared to the one by dictator experiments.

each treatment allows us to disentangle attitudes toward one's own risk from attitudes toward another person's risk.

2.2 Strategic settings

We also investigate how other-regarding concerns relate to risk attitudes in environments with strategic uncertainty. To this aim, we rely on a public goods scenario where the two members of a group, indexed by $i = 1, 2$, choose their respective contributions, c_1 and c_2, thus determining individual payoffs according to

$$u_i = \alpha_i(c_1 + c_2) - c_i^2 \qquad \text{for } i = 1, 2.$$

The above specification allows us to study if and how behavior depends on whether the players' marginal benefits from the public good, α_1 and α_2, are stochastic or not. In particular, in the experiment, player i's marginal benefits, α_i, can assume either a fixed value, a, or one of the two (equiprobable) values $\underline{A}$ and $\overline{A}$, where $0 < \underline{A} < a < \overline{A}$. More specifically, participants are confronted with the following four different situations:

Q_{aa} : the marginal benefits of both i and j (with $i \neq j$) are fixed at a,

Q_{aA} : i's marginal benefit is fixed at a, but j's marginal benefit can be either $\underline{A}$ or $\overline{A}$ (with probability 1/2 each),

Q_{Aa} : i's marginal benefit can be either $\underline{A}$ or $\overline{A}$ (with probability 1/2 each), and j's marginal benefit is fixed at a,

Q_{AA} : both i's and j's marginal benefit can be either $\underline{A}$ or $\overline{A}$ (with probability 1/2 each)

In the absence of other-regarding preferences, if player i knows that $\alpha_i = a$, her optimal contribution should be $c_i^*(Q_{a\cdot}) = a/2$ regardless of her partner's marginal productivity. Efficiency, on the other hand, would require $c_i^+(Q_{aa}) = a$ if α_j is certain, and $c_i^+(Q_{aA}) = (2a+\underline{A}+\bar{A})/4$ if α_j is stochastic. If a risk-neutral player i does not know whether her marginal productivity is $\underline{A}$ or $\overline{A}$, she should contribute $c_i^*(Q_{A\cdot}) = (\underline{A} + \bar{A})/4$ if she is rational and strictly self-interested. If, instead, she is efficiency-minded, she would choose $c_i^+(Q_{Aa}) = (2a + \underline{A} + \bar{A})/4$ and $c_i^+(Q_{AA}) = (\underline{A} + \bar{A})/2$.

As in the individual decision settings, we elicit choice behavior for all four possible situations $Q_{a,a}$, $Q_{a,A}$, $Q_{A,a}$, and $Q_{A,A}$.

3 Experimental results

The computerized experiment was conducted at the laboratory of the Max Planck Institute in Jena (Germany) in August 2004. The experiment was programmed 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.[3] Understanding of the rules was checked by a control questionnaire that subjects had to answer before the experiment started.

In total, three experimental sessions were run, each involving 30 participants (matched in 15 pairs), and implementing one of the three treatments. Sessions lasted about 45 minutes. The experimental money was the ECU (Experimental Currency Unit) with 10 ECU = €2.5. The average earning per subject was €9.00 (including a show-up fee of €2.50).

To collect a high number of independent observations per treatment, the strategy method was used. This means that in both the WA-treatment and the WP-treatment each participant had to submit four reservation prices $b(P_{ij})$, one for each prospect, before the roles of decision makers and passive partners were assigned. Similarly, subjects in the PG-treatment had to submit four contribution decisions of the form $c(Q_{ij})$ without knowing which situation they would finally face.[4]

[3] An English translation of the instructions can be found in the Appendix.

[4] In order to avoid portfolio-diversification effects (see Markowitz, 1952), participants in each session/treatment were paid according to one choice only.

3.1 Reservation prices: WTA- and WTP-treatments

The lower and upper bounds, $\underline{p}$ and $\overline{p}$, of the uniform distribution from which the random offer prices were selected amounted to 4 and 50 ECU, respectively. Participants in either treatment could submit any integer value between 8 and 46 ECU. As for the prospect's parameters, we set $u = 27$, $\underline{U} = 16$, and $\overline{U} = 38$.

The experimental results under the WTA- and WTP-treatments are summarized in Table 1 and Figures 1 and 2. Roughly speaking, the typical reservation prices in all cases are centered around the opportunistic, risk-neutral prediction given by $b(P_{ij}) = 27$ (the histograms' "mode" in Figures 1 and 2 is in the middle category).

Insert Table 1 and Figures 1 and 2 about here

Average reservation prices, however, tend to exceed the opportunistic prediction in the WTA-treatment, indicating that decision makers put some value on other people's payoffs. Furthermore, in both treatments, the reservation prices tend to decrease with both one's own and other's risk. This indicates that risk-aversion not refers only to individual payoffs, but has also a social dimension. Statistically, however, reservation prices are significantly different only when introducing uncertainty in either one's own or the other's payoff under the WTA-treatment (see the "uu vs. Uu" and "uu vs. uU" comparisons in Table 2). Not surprisingly, we also find that reservation prices tend to exhibit larger variability with risk than without it (particularly in the WTA-treatment).

Insert Table 2 about here

The effect of own and other's risk on reservation prices is explored in more detail via Poisson regressions with individual random effects, whose results are reported in Table 3. These regressions model average reservation prices as loglinear functions of dummy variables indicating whether the prospect involves risk for the decision maker and/or the player she is matched with. While an increase in one's own risk tends to significantly reduce the average reservation price, a more risky prospect for the other player has no significant impact on average behavior after controlling for heterogeneity among individuals via random effects. Notice also that, in agreement with previous analysis, the WTA-treatment induces significantly higher reservation prices than the WTP-treatment.

Insert Table 3 about here

The above findings indicate that risk concerns are mainly self-centered. Figure 3 makes this more evident by separating risk-aversion from social attitudes in individual valuations of risky prospects.[5] On the vertical axis, the difference in reservation prices between the prospects Uu and uU captures *social orientations*, in the sense of differences in valuations depending on whether the risk is assumed by oneself or another person. On the horizontal axis, the difference in reservation prices between the prospects uu and UU is a measure of *pure risk-aversion* under symmetric allocation of risks (which is by definition independent of social orientations).

Combining these two measures, we can classify individual decision makers into four different types, namely:

- "Self-centered, risk-averse" (lower-right orthant),
- "Self-centered, risk-lover" (upper-left orthant),
- "Other-regarding, risk-averse" (upper-right orthant),
- "Other-regarding, risk-lover" (lower-left orthant).

Insert Figure 3 about here

Since in Figure 3 most observations lie on the diagonals, we can conclude that most individuals tend to be self-centered, with heterogeneity being due to different risk attitudes.

[5] We added some white noise to the plots in order to improve the visual presentation of overlapping data points.

3.2 PG-treatment

In the public goods experiment, the certain and stochastic marginal benefits a, $\underline{A}$, and $\overline{A}$ were chosen so as to satisfy $(\underline{A} + \overline{A})/2 = a$. More specifically, we set $a = 6$, $\underline{A} = 4$ and $\overline{A} = 8$, so that a risk-neutral, self-interested player i should choose $c_i^*(Q_{a\cdot}) = c_i^*(Q_{A\cdot}) = 3$, and an efficiency-oriented player should choose $c_i^+(Q_{a\cdot}) = c_i^+(Q_{A\cdot}) = 6$.

By allowing c_i (for $i = 1, 2$) to vary from 0 to 8,[6] we can distinguish various contribution intervals, each of which is associated with a specific behavioral typology. Given the opportunistic and efficient benchmark solutions derived above, a contribution $c_i < 3$ (being costly for i himself) can only be rationalized as a spiteful attempt to reduce the other player's earnings. Similarly, $6 < c_i < 8$ is an inefficient self-sacrifice (because what i gives to j is less than what i loses). The interval $3 < c_i \leq 6$ allows for a clear-cut diagnosis of other-regarding concerns.[7]

The experimental results under the PG-game are summarized in Table 4 and Figure 4. Both the median and the average investments in the four possible marginal benefit-scenarios lie within the interval $(3, 6)$, and are therefore compatible with other-regarding concerns.

<u>Insert Table 4 and Figure 4 about here</u>

Similarly to the findings of the reservation-price experiments, contributions to the public good are, on average, decreasing both in one's own and other's risk. This indicates that the social dimension of risk-aversion is still present after introducing strategic uncertainty, although subjects' behavior is statistically

[6] 8 is the maximum contribution decision that guarantees player i to end up with 0 payments (including the show-up fee).

[7] In this paper we mainly focus on behavior. We do not intend to provide insights into the motivations underlying other-regarding concerns. The latter may assume the form of inequity aversion (cf., Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000), reciprocity (cf., Sugden, 1984; Palfrey and Prisbrey, 1997), conditional cooperation (cf., Fischbacher et al., 2001) or altruism (cf., Trivers, 1971; Becker, 1976; Bester and Güth, 1998).

different only when uncertainty in either one's own or other's productivity is introduced (see the "*aa* vs. *Aa*" and "*aa* vs. *aA*" comparisons in Table 5).

Insert Table 5 about here

Several random-effects Poisson regressions, with individual contribution decisions as dependent variable and attitudes toward one's own and the other's risks as independent dummy variables (cf., Table 6), confirm that contributions are significantly smaller when there is an increase in personal risk. On the other hand, other people's risks do not seem to influence the average amount of contributions.

Insert Table 6 about here

4 Conclusions

Our concern in this paper has been the relation between other-regarding concerns and attitudes towards risk – both risk borne by the actor and risk borne by others who are potential objects of benevolence.

The experiment shows evidence of other-regarding concerns in situations where monetary payoffs are common knowledge. It also shows that situations with risk trigger significantly different behavior than do situations with no risk. But the regression results reveal no significant effect of *other*'s risk on individual behavior, independently of whether the choice situation involves strategic uncertainty or not. The results also do not seem to support any relation between attitudes to (own) risk and other-regarding concerns.

In terms then of general messages, we can confirm that in small number interactions where monetary payoffs are commonly known, other-regarding concerns play a significant role in behavior. Further, behavior is affected by the riskiness of payoffs to oneself. But risk in what others get is much less important than own-risk, even for those who are relatively other-regarding. In this sense, none of our conclusions support either the specific Rawlsian account of the psychological grounds for distributive justice, or the more general thought that beneficent behavior comes from a desire to treat others in the same way as one treats oneself. Further work needs to be done in order to be confident about the implications of these findings for “distributive psychology”. But the experimental evidence garnered here is suggestive in an interestingly non-Rawlsian direction.

Appendix: Sample instructions (originally in German)

In this appendix we report the instructions for the WTP- and the PG-treatment. The instructions for the WTA-treatment were adapted accordingly.

General instructions (common to all treatments)

Welcome and thanks for participating in this experiment. You receive €2.50 for having shown up on time. Please read the following instructions carefully. From now on any communication with other participants is forbidden. If you have any questions, please raise your hand. We will answer your questions individually. The unit of experimental money will be the ECU (Experimental Currency Unit), where 1 ECU = €0.25.

Specific instructions for the WTP-treatment

In this experiment you will be randomly paired with another participant, whose identity will not be revealed to you at any time. In the following, we shall refer to the person whom you are paired with as "the other".

You will face 4 different prospects, each of which pays to you and to the other some positive amounts of ECU. These payments can be either *certain* or *uncertain* The certain payment gives 27 ECU for sure. The uncertain payment consists of a *lottery* giving either 16 ECU or 38 ECU, where both amounts are equally likely.

The 4 prospects that you will face are the following:

1. You get 27 ECU for sure, and the other gets the lottery.
2. You get the lottery, and the other gets 27 ECU for sure.
3. Both you and the other get 27 ECU for sure.
4. Both you and the other get the lottery.

Your task (as well as the task of each other participant) is to report the highest amount of ECU that you would be willing to pay for each prospect. In other words, you have to state a maximum buying price for each prospect. Each of your four choices must be not smaller than 8 ECU and not greater than 46 ECU. Furthermore, it must be an integer number (i.e., 8, 9, 10, ..., 44, 45, 46).

Your payoff depends on the choices made by the two members of each group, and on three random choices made by the computer. These random choices determine an "active" player, a "relevant" prospect, and an "integer" between 4 and 50.

More specifically, payoffs are determined as follows.

1. After you and the other participant have reported the maximum buying price for each prospect, the computer will select either you or the other participant as the "active player". The maximum buying prices reported by the active player will affect the payoffs of the group, whereas the maximum buying prices reported by the other (non-active) participant do not have any effect.

2. Once the active player has been determined, the computer will select one of the four prospects faced by this player as the "relevant prospect", where all four prospects are equally likely.

3. Finally, the computer will randomly choose an "integer" between 4 and 50. You can think of this choice as drawing a ball from a bingo cage containing 47 balls numbered 4, 5, . . . , 50. Any number between 4 and 50 is equally likely.

Your final payoff is computed by comparing this random integer to the maximum buying price reported by the active player (either you or the other participant) for the relevant prospect.

• If the random integer is equal to or smaller than the maximum buying price reported by the active player for the relevant prospect, the active player buys the relevant prospect paying an amount of ECU equal to the random integer. In this case, the active player earns [46 *minus* the random integer] ECU and, in addition, the two members of the group obtain the payments specified by the relevant prospect.

• If the random integer is greater than the maximum buying price reported by the active player for the relevant prospect, the active player does not buy the relevant prospect and earns 46 ECU. In this case, the other (non-active) player earns nothing.

EXAMPLE:

Suppose that the computer chooses you as the active player, and that the prospect paying to you 27 ECU for sure and to the other either 16 or 38 ECU is the relevant prospect. Suppose also that you have reported a maximum buying price of 20 ECU for that particular prospect.

• If the computer chooses the integer 18, you buy the prospect (because $18 < 20$). This implies that you earn $(46 - 18) = 28$ ECU plus the 27 ECU paid by the relevant prospect, and the other obtains either 16 or 38 ECU, where these two amounts are equally likely.

• If the computer chooses the integer 22, you do not buy the prospect (because $22 > 20$). This implies that you earn 46 ECU, and the other participant earns nothing.

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

Please remain quiet until the experiment starts and switch off your mobile phone. If you have any questions, please raise your hand now.

Specific instructions for the PG-treatment

In this experiment you will be randomly paired with another participant, whose identity will not be revealed to you at any time. In the following, we will refer to the person whom you are paired with as "your partner".

Your task (as well as the task of your partner) is to decide how much to invest in a common project. The common project yields to both of you some amounts of ECU. Hereafter, we shall refer to these amounts as *income from the project*.

The "income from the project" for you and your partner is determined as follows:

$$\text{Your income from the project} =$$
$$= \big[(\text{Your investment}) + (\text{Investment of your partner})\big] \times \big(\text{Your multiplier}\big)$$

$$\text{Your partner's income from the project} =$$
$$= \big[(\text{Your investment}) + (\text{Investment of your partner})\big] \times \big(\text{Your partner's multiplier}\big)$$

In words, your investment and the investment of your partner are added up, and the resulting sum is multiplied by a number which is specific to each member of the group. You will face four different situations depending on the multipliers for you and your partner. Specifically, a multiplier can be either *certain* or *uncertain*. The certain multiplier is equal to 6 for sure. The uncertain multiplier is either 4 or 8, where both values are equally likely.

The 4 situations that you will face are the following:

1. Your multiplier is 6 for sure, and your partner's multiplier is either 4 or 8.
2. Your multiplier is either 4 or 8, and your partner's multiplier is 6 for sure.
3. Both multipliers are 6 for sure.
4. Both multipliers are either 4 or 8.

You (as well as your partner) have to decide how many ECU you want to invest for each situation. Each of your four investment decisions must be not smaller than 0 ECU and not greater than 8 ECU (i.e., 0.0, 0.1, ..., 7.9, 8.0).

Your payoff depends on your "income from the project" and on the amount of ECU that you invest. In particular, your payoff is given by subtracting the square of your investment from your "income from the project". That is,

$$\text{Your payoff} = \text{Your income from the project} - (\text{Your investment})^{\mathbf{2}}.$$

After all participants have taken their decisions, the computer will randomly choose one situation for each group, where all situations are equally likely. The two members of the group will be paid according to the investments and the multipliers corresponding to that situation. If the selected situation includes an uncertain multiplier, the computer will determine whether it is 4 or 8.

EXAMPLE

Suppose that the computer chooses the situation in which your multiplier as well as your partner's multiplier are equal to 6.

• If you invested 3 and your partner invested 4 in that specific situation, then your payoff is: $(3+4) \times 6 - 3^2 = 7 \times 6 - 9 = 42 - 9 = 33$ ECU, and the payoff of your partner is: $(3+4) \times 6 - 4^2 = 7 \times 6 - 16 = 42 - 16 = 26$ ECU

• If both you and your partner invested 5, then your payoff and the payoff of your partner are: $(5+5) \times 6 - 5^2 = 10 \times 6 - 25 = 60 - 25 = 35$ ECU.

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

Please remain quiet until the experiment starts and switch off your mobile phone. If you have any questions, please raise your hand now.

References

Becker, G. S. (1976). Altruism, egoism, and genetic fitness: Economics and sociobiology. *Journal of Economic Literature* 14/3, 817–826.

Becker, G. M., DeGroot, M. H., Marschak, J. (1964). Measuring utility by a single-response sequential method. *Behavioral Science* 9, 226–232.

Bester, H., Güth, W. (1998). Is altruism evolutionary stable? *Journal of Economic Behavior and Organization* 34, 193–209.

Bolton, G. E. (1991). A comparative model of bargaining: Theory and evidence. *American Economic Review* 81/5, 1096–1136.

Bolton, G. E., Ockenfels, A. (2000). ERC: A theory of equity, reciprocity and competition. *American Economic Review* 90, 166–193.

Brennan, G. (1973). Pareto optimal redistribution: The case of malice and envy. *Journal of Public Economics* 2, 173–183.

Brennan, G. (1975). Pareto desirable redistribution: A perspective. *Finanzarchiv*, 33, 234–271.

Dufwenberg, M., Güth, W. (2000). Why do you hate me? On the survival of spite. *Economics Letters* 67, 147–152.

Fehr, E., Schmidt, K.M. (1999). A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics* 114(3) 817–868.

Fischbacher, U. (1999). Zurich toolbox for readymade economic experiments. Working Paper No. 21, University of Zurich, Switzerland.

Fischbacher, U., Gächter, S., Fehr, E. (2001). Are people conditionally cooperative? Evidence from a public goods experiment. *Economics Letters* 71, 397–404.

Kirchsteiger, G. (1994). The role of envy in ultimatum games. *Journal of Economic Behavior and Organization* 25/3, 373–389.

Markowitz, H. M. (1952). Portfolio selection. *Journal of Finance* 7, 77–91.

Palfrey, T., Prisbrey, J. (1997). Anomalous behavior in public goods experiments: How much and why? *American Economic Review* 87, 829–846.

Rawls, J. (1971). *A Theory of Justice*. Harvard University Press, Cambridge, Massachusetts.

Sugden, R. (1984). Reciprocity: the supply of public goods through voluntary contributions. *Economic Journal* 94, 772–787.

Trivers, R. (1971). The evolution of reciprocal altruism. *Quarterly Review of Biology* 46, 35–57.

Table 1: Reservation prices: Summary of experimental results

	WTA-treatment				WTP-treatment			
Prospects	uu	uU	Uu	UU	uu	uU	Uu	UU
Min.	14	10	10	8	8	8	8	8
1st Qu.	27	25.5	20	20	20	20.5	16	16
Median	30	27.5	25	25.5	25	25	24	24
Mean	30.8	29.13	27.1	27.63	25.37	24.9	23.43	22.50
3rd Qu.	35	35	36.5	37.75	27	27	27.75	25.75
Max.	46	46	46	46	46	46	46	46
std. dev.	7.71	8.95	10.74	11.16	9.38	9.10	9.95	10.17

Table 2: Two-sided Wilcoxon tests on paired reservation prices

	WTA-treatment		WTP-treatment	
Comparisons	Test Statistic	p-value	Test Statistic	p-value
uu vs. Uu	193	0.032	80	0.089
uU vs. UU	180	0.206	64	0.054
uu vs. uU	67.5	0.027	20	0.352
Uu vs. UU	29.5	0.789	30	0.107

Table 3: Random-effects Poisson regression on reservation prices

	Model 1	Model 2	Model 3
(Intercept)	3.300**	3.430**	3.419**
	(0.052)	(0.078)	(0.077)
treatment WTP	0.084	−0.251**	−0.251**
	(0.063)	(0.081)	(0.081)
Own Risk	−0.106**	−0.090**	−0.090**
	(0.035)	(0.025)	(0.025)
Other Risk	−0.039	−0.024	–
	(0.035)	(0.025)	
Own Risk × Other Risk	0.031	–	–
	(0.050)		
Std. deviation of mixing distribution	0.408	0.344	0.3441
AIC	1638	1626	1625

** Significant at the 1% level.

Numbers in parenthesis are estimated standard errors.

Table 4: Contribution decisions: Summary of experimental results

	PG-Treatment			
Situations	*aa*	*aA*	*Aa*	*AA*
Min.	2	1.2	2	1
1st Qu.	4	3	3	3
Median	5	5	4	4
Mean	5.25	4.67	4.35	4.27
3rd Qu.	6	5.75	5	5.75
Max.	8	8	8	8
Std. Dev.	9.38	9.10	9.95	10.17

Table 5: Two-sided Wilcoxon tests on paired contribution decisions

Comparisons			Test Statistic	p-value
aa	vs.	*Aa*	169.5	0.003
aA	vs.	*AA*	96.0	0.359
aa	vs.	*aA*	91.0	0.001
Aa	vs.	*AA*	38.0	0.683

Table 6: Random-effects Poisson regression on contribution decisions

	Model 1	Model 2	Model 3
(Intercept)	1.637	1.615	1.581
	(0.088)	(0.080)	(0.068)
Own Risk	−0.189	−0.141*	−0.141*
	(0.118)	(0.085)	(0.085)
Other Risk	−0.115	−0.068	–
	(0.116)	(0.085)	
Own Risk × Other Risk	0.0991	–	–
	(0.170)		
Std. deviation of mixing distribution	0.1907	0.1907	0.1906
AIC	476	474.3	473

* Significant at the 10% level.

Numbers in parenthesis are estimated standard errors.

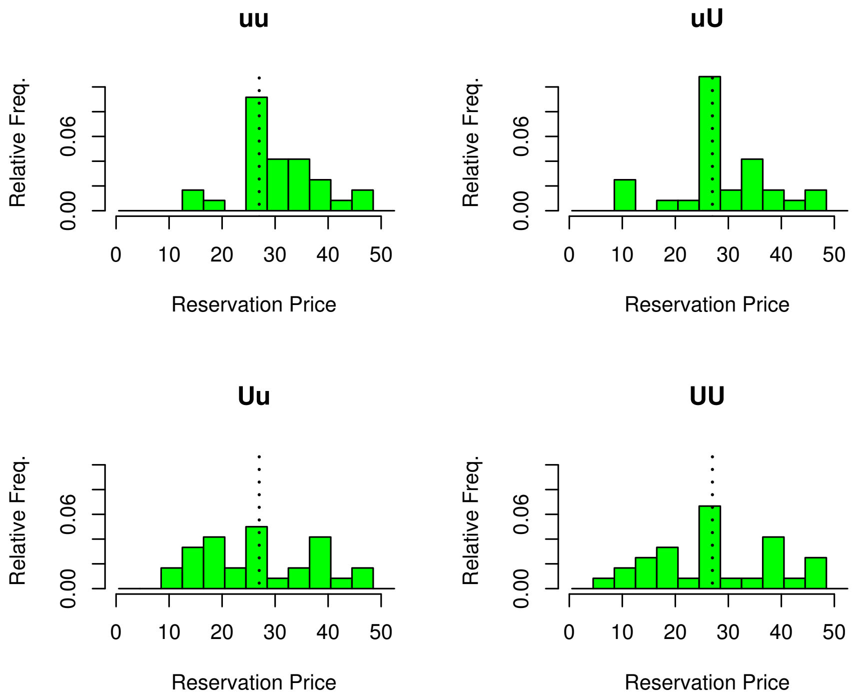


Figure 1: WTA-treatment: Distribution of reservation prices

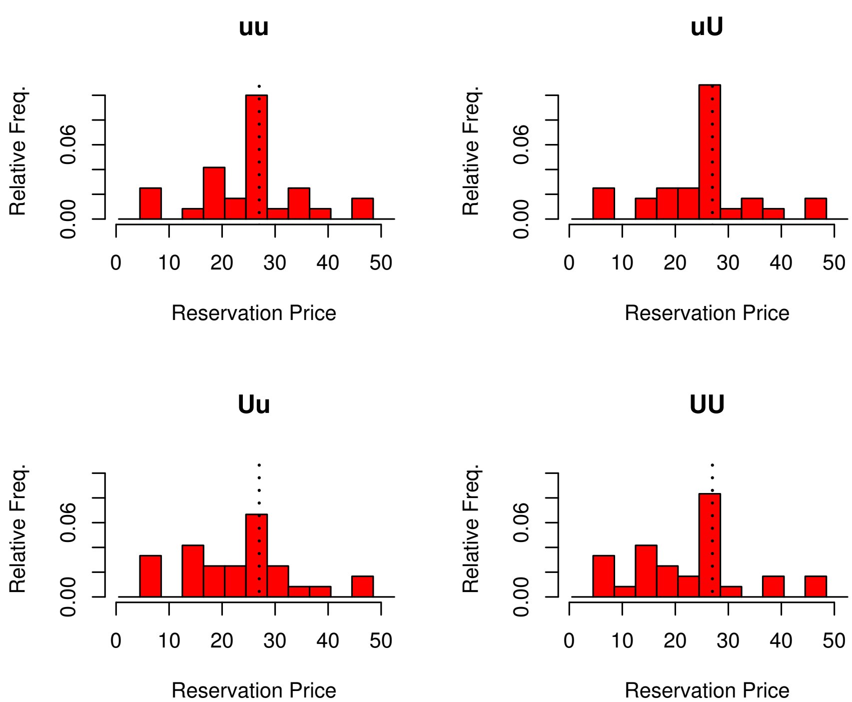
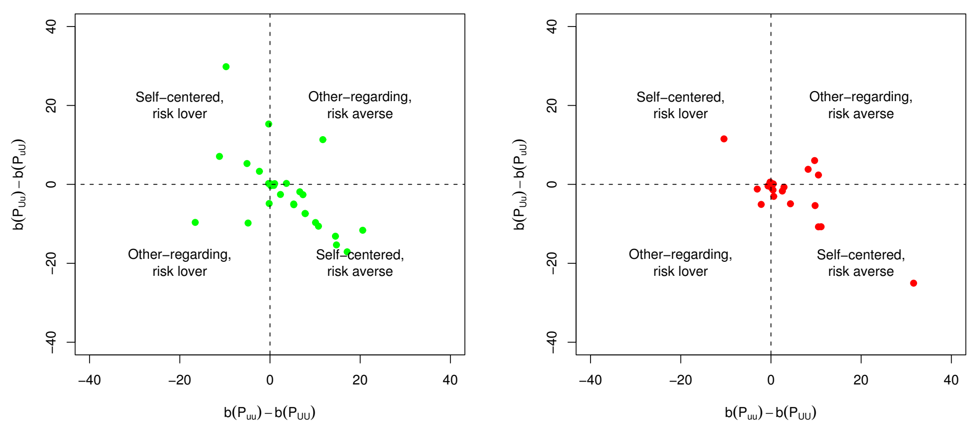


Figure 2: WTP-treatment: Distribution of reservation prices



WTA-treatment WTP-treatment

Figure 3: Classification of individuals by social orientations and risk attitudes

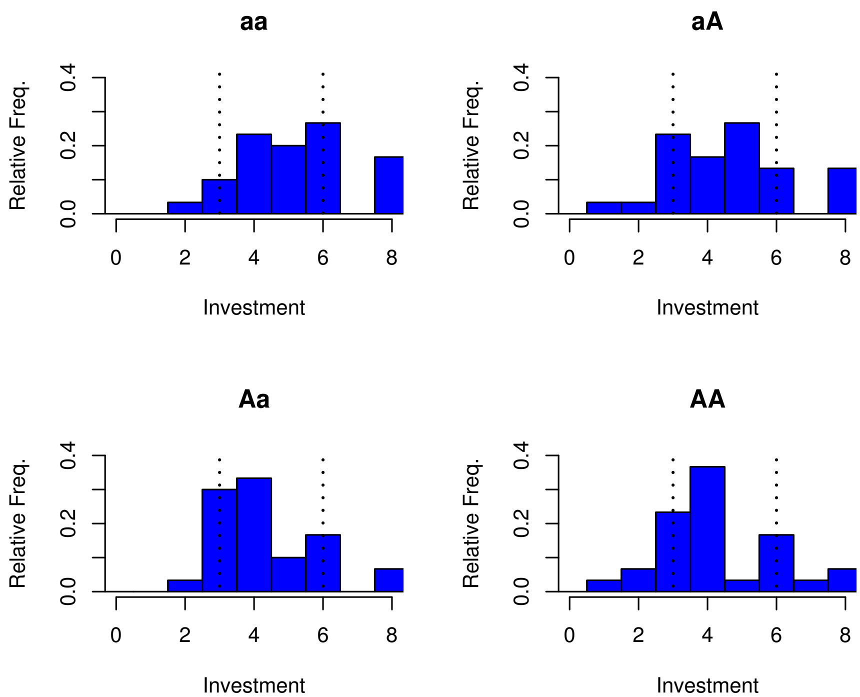


Figure 4: PG-treatment: Distribution of contribution decisions