On the social dimension of time and risk preferences: An experimental study

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Abstract

We report on an experiment designed to explore the interrelation of other-regarding concerns with attitudes towards risk and delay when the latter have a social dimension, i.e., pertain to one's own and another person's payoffs. For this sake, we compare evaluations of several prospects, each of which allocates either certain or risky and either immediate or delayed payoffs to the actor and to another participant. We find that individuals are mainly self-oriented as to social allocation of risk and delay, although they are other-regarding with respect to expected payoff levels.

Keywords: Willingness to accept; Risk attitudes; Time preferences; Other-regarding concerns

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1 Introduction

People frequently encounter situations in which they have to choose among options whose outcomes differ in delay and/or risk.[1] Moreover, people frequently make choices affecting not only their own but also other individuals' realm.[2] This paper reports on an experiment designed to investigate whether and how the attitudes governing these choices (i.e., delaying outcomes, increasing their risk, and affecting in this way also others) are interrelated.

It is commonly accepted that the subjective value of a reward decreases when its probability decreases or its occurrence is delayed: One would generally prefer to receive €100 now rather than in a month, and €100 for sure than a one-in-ten chance of receiving the same amount. In fact, the experimental literature on decision and choice provides abundant evidence that people care if their own rewards are uncertain (see, for example, the survey by Camerer, 1995) or delayed (see, e.g., Loewenstein and Elster, 1992). Other empirical studies have shown that individuals perceive risky outcomes and delayed outcomes in a cognitively similar manner (see, e.g., Rachlin et al., 1991; Mazur, 1997; Green et al., 1999; and Chesson and Viscusi, 2003). There are, however, only a few direct attempts investigating the interrelation of risk attitudes with time preferences, e.g., whether people who are more risk averse exhibit also less patience. One of the rare exceptions is Anderhub et al. (2001), who observed that risk-averse agents tend to discount future rewards more heavily than more risk-tolerant agents.

All previous studies have explored only the private dimension of the interrelation between risk attitudes and time preferences, i.e., when risks and delays affect only one's own rewards. The novelty of our study is that it relies on

[1] One, for instance, may have to choose how much to invest in a retirement fund, which implies sacrificing some money now in order to obtain a larger amount at a later time. Or one may have to choose between two investment opportunities, one of which is riskier but has a higher expected payoff, whereas the other is safer but has a lower expected return.

[2] Examples of these situations include reductions of water-use during droughts, conservation of energy to help solve an energy crisis, and donations to public television stations or charities.

prospects with social consequences where risk and delay pertain not only to own payoffs (which is common) but also to others' payoffs. Overwhelming evidence suggests that humans exhibit other-regarding preferences (i.e., preferences over one's own and others' material payoffs) when their own actions affect others' well-being. Such social concerns can be altruistic (Andreoni and Miller, 2002; Cox et al., 2002), inequality-averse (Fehr and Schmidt, 1999; Bolton and Ockenfels, 2000), quasi-maximin (Charness and Rabin, 2002), or even malevolent (Brennan, 1973; Kirchsteiger, 1994; Dufwenberg and Güth, 2000).

Other-regarding concerns have mainly been modeled via "social utilities" depending on the (expected) payoffs of other individuals. To the best of our knowledge, the more subtle interrelation of other-regarding concerns with attitudes to others' risks and delays of rewards has been so far neglected. The Rawlsian philosophical idea according to which "benevolent" individuals should locate themselves in the shoes of others (cf., Rawls, 1971) suggests other-regarding agents to have attitudes towards risks and delays faced by others similar to those they exhibit to risks and delays faced by themselves.[3] This poses more specific and straightforward empirical questions like: Is somebody who is risk loving (averse) if her own payoff is uncertain also risk loving (averse) when others' payoff is uncertain? Is somebody who is rather impatient when her own reward is delayed also rather impatient when others' reward is delayed? And how do other-regarding individuals weigh own risk and delay as compared to those of others? Specifically, do agents who are indifferent to risks and delays faced by others exhibit also weak other-regarding concerns?

This research is a follow-up to the study by Brennan et al. (2005), who focus only on the relation between other-regarding concerns and risk preferences when one's own and/or another person's payoff is risky. Their major finding is that behavior is influenced by the riskiness of own payoff but not by that of the other's payoff: Risk in what others get seems much less important than own

[3]For a discussion about this issue, see Brennan et al. (2005).

risk, even for those who are other-regarding. Here, we move one step further by taking into account idiosyncratic private and *social* time preferences, i.e., when own and/or another person's rewards are delayed.

In our experiment, each participant is asked to evaluate various allocations, each of which assigns a payoff to herself and to another participant. Payoffs can be immediate or delayed and certain or stochastic. Since each of these four possibilities applies independently to oneself as well as to the other, each participant must evaluate sixteen different allocations. As elicitation procedure we use the incentive compatible random price mechanism (Becker et al., 1964). Given that Brennan et al.'s (2005) results reveal a significant difference in individual valuations of risky prospects in the willingness-to-accept (but not in the willingness-to-pay) treatment, we employ only the willingness-to-accept mode. Thus, each participant is endowed with a prospect and asked to state the minimum price at which she is willing to sell it.[4]

In the following Section 2, the different prospects and the experimental procedures are described in detail. The results of the experiment are reported in Section 3. Section 4 concludes.

2 The experiment

2.1 Decision task

To address our research questions, we rely on the random price mechanism (Becker et al., 1964) to elicit individual valuations of several prospects. Valuations are defined as certainty equivalents in the form of willingness to accept a randomly fixed amount of money to forgo a given prospect. 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

[4] We are interested in the differences among individual evaluations of the several prospects and less so in absolute evaluations of each prospect; thus, we do not check whether our findings are robust with respect to the method of eliciting certainty equivalents (see Samuelson and Zeckhauser, 1988, and Tietz, 1992, for some experimental evidence on the endowment effect).

ticket U assigning $\underline{U}$ or $\overline{U}$ with 1/2 probability each.[5] The relation between the different payoffs is given by $0 < \underline{U} < u < \overline{U}$ and $\mathrm{E}U = (\underline{U}+\overline{U})/2 = u$. Furthermore, both the sure payoff and the risky payoff can be paid either immediately or after three months.

We denote by $P_{i,t}^{j,\tau}$ the prospect assigning reward i to the decision maker at time t and reward j to her passive partner at time τ, where $i, j = u, U$ and $t, \tau = 0, 3$. Thus, we allow for $4 \times 4 = 16$ prospects as displayed in Table 1.

[Table 1 about here]

The decision maker is asked to submit a minimum selling price for each prospect, $b(P_{i,t}^{j,\tau})$, where $0 < \underline{b} \leq b(P_{i,t}^{j,\tau}) \leq \bar{b}$. Then a random draw from a uniform distribution determines an offer $p \in [\underline{p}, \overline{p}]$ with $0 \leq \underline{p} \leq \underline{U} < \bar{U} \leq \bar{p}$. If $p \geq b(\cdot)$, the decision maker sells the prospect and collects the random price p (that is paid immediately after the experiment), while her partner receives nothing. If $p < b(\cdot)$, the decision maker keeps the prospect, and she as well as her partner obtain a realization of the payoffs specified by the prospect. We preserve the riskiness of the final payoff for all possible bids by imposing $\underline{p} < \underline{b} < \bar{b} < \bar{p}$. Thus, notwithstanding $b(P_{i,t}^{j,\tau}) = \underline{b}$ (or $b(P_{i,t}^{j,\tau}) = \bar{b}$) the decision maker can never be sure whether she will keep the prospect or not.

A risk-neutral and time-indifferent decision maker who cares only for her own payoff should submit $b(P_{i,t}^{j,\tau}) = u = \mathrm{E}U$ for each of the sixteen prospects. However, if the decision maker cares for her partner and, thus, wants to increase the chances of keeping the prospect, she should report $b(P_{i,t}^{j,\tau}) > u$. Comparing bids across prospects allows us to disentangle attitudes towards one's own risk and delay from attitudes towards the other's risk and delay.

[5] By assigning equal probabilities to $\underline{U}$ and $\overline{U}$ we try to avoid the possibility of probability transformations as in cumulative prospect theory (see, e.g., Tversky and Kahneman, 1992).

2.2 Procedures

The computerized experiment was conducted at the laboratory of the Max Planck Institute in Jena (Germany) in August 2005. 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. Understanding of the rules was checked by a control questionnaire that subjects had to answer before the experiment started.[6]

Thirty-two students participated in a single session, which lasted about 60 minutes. The experimental currency unit (ECU) was converted into Euro according to 10 ECU = €2.5. Average earnings (including a show-up fee of €2.5) were €9.6 when delayed and €8.0 when immediate.[7]

To collect as many as possible independent observations for all 16 prospects in Table 1, the strategy method was used. This means that each participant had to submit sixteen reservation prices $b(P_{i,t}^{j,\tau})$, one for each prospect, before the roles of decision makers and passive partners were assigned.[8]

The parameter values were equal to those used by Brennan et al. (2005) in order to check for consistency of results as far as possible (i.e., for the top row of Table 1 with no delay of rewards at all). In particular, 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.[9] Participants could submit any integer value between 8 and 46 ECU. The prospect's parameters were $u = 27$, $\underline{U} = 16$, and $\overline{U} = 38$.

[6] English translations of instructions and control questionnaire are included in the Appendix.

[7] Note that only the immediate average earnings include 0-payments (to the passive partners) in case the prospect is sold.

[8] In order to avoid portfolio-diversification effects, participants were paid according to one choice only.

[9] Although there is no (normative) need of uniformity, this has been assumed because it seems the most unbiased and understandable (by the participants) distribution.

2.3 Deferred payment

As in Anderhub et al. (2001), a problematic feature of our experiment is that some of the payments should be made in the future, i.e., three months after the experiment. The corresponding incentive scheme may be ineffective if subjects doubt that they will actually be paid as described in the instructions. To avoid the problem, we used written assurances attesting that the money would be transferred into the subject's bank account three months after the experiment.[10] In particular, subjects whose payment had to be postponed were required to fill in the details of their bank account, and received a guarantee of late payment that was signed by an executive representative of the Max Planck Institute. Thus, at the end of the experiment, a subject could receive either ready money (as in the case of the prospect's sale) or a guarantee of late payment.

3 Experimental results

Figure 1 reports the reservation prices for each individual subject across all 16 prospects.

[Figure 1 about here]

Decisions are, in general, scattered around the opportunistic risk-neutral prediction given by $b(P_{i,t}^{j,\tau}) = 27$. Apart from 5 participants, who stick to the same reservation price for all prospects, the remaining participants undertake an "active" approach to decision making, i.e., they provide different valuations of the various prospects. Two patterns are recurrent. One focuses on personal risk, and varies, mainly, with prospects assigning the lottery to oneself (see, e.g., subjects 1 and 2). The other recurrent pattern focuses on own delay, and changes depending on whether one's own payment date is 0 or 3 (see, e.g.,

[10] The German system did not allow us to use 'deferred checks' as Anderhub et al. (2001) could do in Israel.

subjects 13 and 14). Though some patterns appear more complex than those described above, they present similar features.

3.1 Aggregate analysis

The results are summarized in Figures 2 and 3, which inform on the distribution of choices for each prospect. The 16 graphs in Figure 2 are distributed over 4 rows and 4 columns that match those of Table 1. Hence, the four distributions in, e.g., the top row of the figure refer to the prospects varying only in the risk component when $t = \tau = 0$.

[Figure 2 and 3 about here]

Choices span from the minimum to the maximum of the distribution in 14 out of 16 cases. In most prospects (7 out of 16) the mode is 27. The highest mean reservation price (31.16) is paid for the prospect granting sure and immediate payoffs to both the decision maker and her "passive" partner. Distributions tend to be rightward skewed when own reward is certain and immediate, and leftward skewed when own reward is risky and/or delayed. The lowest mean reservation prices refer to the four prospects with delayed and uncertain payments to the decision maker. Figure 3 clearly illustrates how the distribution values shift down dramatically for prospects of the form $P_{U,3}^{j,\tau}$.[11] Thus, decision makers show other-regarding concerns when they can rely on a sure and prompt reward, but, in lines with previous studies, uncertainty and delay in own reward induce a decrease in reservation prices.

A series of Wilcoxon signed-rank tests (two-sided) comparing reservation prices for the prospect with no delay and no risk for both parties and the prospects where, *ceteris paribus*, one's own payoff is risky or/and delayed confirm that valuations are highly significantly different ($p < 0.05$ for $P_{u,0}^{u,0}$ vs. $P_{U,0}^{u,0}$; $p < 0.001$ for $P_{u,0}^{u,0}$ vs. either $P_{u,3}^{u,0}$ or $P_{U,3}^{u,0}$). The prospect granting an uncertain

[11] These prospects together with $P_{u,3}^{U,0}$ (whose mean evaluation is 24.97) are the only ones which are evaluated, on average, less than 27.

and delayed reward to oneself but not to the other is also evaluated significantly differently than the prospects with neither own risk nor own delay ($p < 0.01$ for $P^{u,0}_{U,3}$ vs. either $P^{u,0}_{u,3}$ or $P^{u,0}_{U,0}$).

Next, we check whether reservation prices react also to the other's risk or delay. Wilcoxon signed-rank tests comparing $P^{u,0}_{u,0}$ with $P^{U,0}_{u,0}$, $P^{u,3}_{u,0}$, and $P^{U,3}_{u,0}$, indicate that valuations are not significantly different when the other's payoff is delayed ($p = 0.373$ for $P^{u,0}_{u,0}$ vs. $P^{u,3}_{u,0}$). On the contrary, in line with the results of Brennan et al. (2005), a weak significance is registered when introducing risk in the other's payoff ($p = 0.049$ for $P^{u,0}_{u,0}$ vs. $P^{U,0}_{u,0}$; $p = 0.053$ for $P^{u,0}_{u,0}$ vs. $P^{U,3}_{u,0}$). The other's situation has no impact on reservation prices when one's own payoff is both risky and delayed ($p > 0.1$ for all possible comparisons).

The effects of own and other's risk, and own and other's delay on reservation prices are explored in more detail via a generalized linear random-effects model (based on a Poisson distribution) regressing average reservation prices on the dummies *OwnRisk*, *OwnDelay*, *OtherRisk*, and *OtherDelay*. The variable *OwnRisk* takes value 1 for the prospects with risky payoff for the decision maker (i.e., $P^{j,\tau}_{U,t}$ for all j, t, and τ) and 0 otherwise. *OtherRisk* equals 1 for the prospects involving risk for the other (i.e., $P^{U,\tau}_{i,t}$ for all i, t, and τ) and 0 otherwise. *OwnDelay* is 1 when the prospects include delayed payoff for the decision maker (i.e., $P^{j,\tau}_{i,3}$ for all i, j, and τ) and 0 otherwise. Finally, *OtherDelay* is 1 for the prospects with delay in the other's payoff (i.e., $P^{j,3}_{i,t}$ for all i, j, and t) and 0 otherwise. Table 2 lists the estimates for the coefficients, standard errors and z-statistics.[12]

[Table 2 about here]

While an increase in one's own risk and payment date tends to significantly reduce reservation prices, a risky or delayed prospect for the partner has not

[12] We estimated several models to test the interaction between the various explanatory variables. The reported model fits better the data on the basis of the Akaike Information Criterion (AIC). Although the best AIC was observed for the model omitting *OtherDelay*, we preferred to include this variable for completeness of information.

significant impact on behavior. These results corroborate those suggested by the non-parametric tests: Decision makers do not react differently to variations in the other's reward, but remain particularly attentive to risk and delay in their own payoffs.

The time preferences with respect to oneself and to the other can be better assessed via estimation of the intertemporal discount factor embedded in the evaluation of alternative prospects. In particular, the average "private" and "social" discount factors (δ_{own} and δ_{other}, respectively) can be estimated from

$$P_{u,3}^{u,0} = \left(P_{u,0}^{u,0}\right)(1 + \delta_{own})^{-t}$$

$$P_{u,0}^{u,3} = \left(P_{u,0}^{u,0}\right)(1 + \delta_{other})^{-t}$$

where $t = 1/4$. The distributions of $(1 + \delta_{own})^{-t}$ and $(1 + \delta_{other})^{-t}$ differ significantly.[13] The estimate for the annual δ_{own} is 128.70% whereas that for δ_{other} is 11.71%, thereby confirming that one is much more impatient when her own reward is delayed than when the other's reward is delayed.

3.2 Individual types

In this section, we investigate the interrelation of other-regarding concerns with attitudes towards other's risk and delay in more detail. First, we will define a measure for each of the various attitudes we are interested in, thereby identifying typologies of behavior. Then we will examine how types are related.

To assess individual i's concerns towards j's ($j \neq i$) payoffs, we look at i's valuation of the prospect granting the sure reward u to both i and j at time 0. An "other-regarding" individual i should evaluate the prospect $P_{u,0}^{u,0}$ at a price higher than u. On the other hand, if i is willing to accept less than u to sell the same prospect, she can be viewed as "spiteful" (cf., Dufwenberg and Güth, 2000).

To measure i's attitudes towards her own risk, we use the difference in

[13] The p-value obtained from the Wilcoxon rank-sum test with continuity correction is 0.004.

reservation prices between the prospects $P_{u,0}^{u,0}$ and $P_{U,0}^{u,0}$. If this difference is positive, the subject can be considered as "risk-averse" since, *ceteris paribus*, she evaluates the prospect assigning her the sure payoff more than the prospect assigning her the lottery. Alternatively, if $P_{u,0}^{u,0} - P_{U,0}^{u,0}$ is negative, subject i can be considered as "risk-seeking". Attitudes towards own delay are measured in a similar way by considering how the valuation of $P_{u,0}^{u,0}$ compares to that of $P_{u,3}^{u,0}$. If $P_{u,0}^{u,0} - P_{u,3}^{u,0}$ is positive, the subject is classified as "delay-averse"; if it is negative, she is categorized as "delay-seeking".

Finally, to assess subject i's attitudes towards risk and delay faced by her partner j, we take into account i's preferences for social allocation of risky and delayed prospects. Following Brennan et al. (2005), we capture *social orientation* by the difference in reservation prices between the prospects $P_{U,0}^{u,0}$ and $P_{u,0}^{U,0}$ as far as risk is concerned, and the prospects $P_{u,3}^{u,0}$ and $P_{u,0}^{u,3}$ as far as time is concerned. Combining i's risk (delay) attitudes and her social risk (delay) orientation, we can define whether i is self- or other-oriented when allocating risk (delay). In particular, a risk (delay)-averse subject with a positive social risk (delay) orientation can be considered as "other-oriented" with respect to risk (delay): Notwithstanding her aversion to risk (delay), she prefers the prospect including risk (delay) for herself rather than for the other. Being other-oriented when i is risk (delay)-seeking requires the corresponding measure to be negative. A brief description of the identified measures for each type is provided in Table 3, which also reports the number of observations which comply with a specific typology.

[Table 3 about here]

Computing these measures for each individual, and combining them allow us to examine how the different attitudes interact. Table 4 displays Kendall's correlation coefficient between the various attitudes. Risk aversion and delay aversion with respect to own payoffs induce a negative correlation (-0.482 and -0.284) between other-regarding concerns and social orientations, although the correlation is not significant as to the time dimension. The opposite holds for risk seeking behavior. Given our definition of social orientation, the observed correlation coefficients imply that people who are more other-regarding tend, on average, to be more self-oriented when allocating risky and delayed prospects.

Attitudes towards own risk and delay are always positively related with other-regarding concerns, but only risk (delay) aversion significantly so. Furthermore, more risk-averse behavior induces, on average, more self-oriented behavior in decisions involving social redistribution of risk (the correlation coefficient between RA and $Soc.Or.RA$ is significantly negative). The same holds for delay-averse behavior. Finally, risk attitudes and time preferences with respect to own rewards are positively correlated (Kendall's coefficient equals 0.208, $p = 0.1$).

[Table 4 about here]

How concerns towards the other's payoffs compare with social orientation to risk and delay is graphically illustrated in Figures 4 and 5, separately for risk-averse (top graph) and risk-seeking (bottom graph) subjects.

[Figures 4 and Figure 5 about here]

In line with the correlation analysis, risk-averse subjects tend to cluster in the upper-left quadrant while risk-seeking subjects are more likely found in the upper-right quadrant (cf., Figure 4). This confirms that most individuals are concerned about what the other gets, but remain self-oriented when allocating social risk. The picture does not change when considering time preferences (cf., Figure 5).

4 Conclusions

In this paper we have studied the interrelation between other-regarding concerns and attitudes towards risk and delay, when risk and delay are borne not only by the actor but also by another person.

We find evidence of other-regarding concerns when monetary payoffs are certain and immediate for both involved parties. Our results also suggest that agents react to changes in the other's status (in terms of both risk and delay) when their own reward is immediate and certain. However, they disregard the other, and focus on their own condition when the latter becomes risky and/or delayed. The regression results reveal, in fact, that only own risk and own delay have significant effect on individual behavior. One may explain this finding by cognitive crowding out: If a participant has to evaluate how to consider risk and/or delay of her own reward, she loses her ability to consider how the other is affected. Only when neither difficulty (with respect to own risk or own delay) is present, she does not mind to be concerned with the other's outcome.

In agreement with previous research, we find that people are rather impatient when their own reward is delayed. But this strong impatience is not projected upon the other. Furthermore, in line with Anderhub et al. (2001), risk attitudes and time preferences with respect to own rewards are positively correlated: Agents who are risk averse (seeking) when their own payoffs are uncertain tend to be delay averse (seeking) when their own payoffs are deferred.

Finally, our type analysis reveals that, while exhibiting other-regarding preferences with respect to the other's expected payoff levels, individuals are mainly self-oriented as to social allocation of risk and delay. This is consistent with Brennan et al.'s (2005) findings indicating that risk in what others get is much less important than own risk, even for those who are relatively other-regarding.

Appendix: Sample instructions (originally in German)

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 or concerns, 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.

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 "the other".

You will face 16 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*, and either *immediate* or *deferred*.

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.

Four cases are possible depending on whether the payment is

1. certain for both you and the other,
2. uncertain for both you and the other,
3. certain for you and uncertain for the other,
4. uncertain for you and certain for the other.

The *immediate* payment will be paid out today; i.e., ECU will be converted to Euros at the end of the experiment, and the obtained amount will be paid to you and/or to the other in cash straight away. The *deferred* payment will be paid out later; i.e., ECU will be converted to Euros at the end of the experiment, but the obtained amount will be transferred to your and/or the other's bank account in three months. You and/or the other will receive a guarantee of late payment at the end of the experiment, after filling out a form concerning your bank account's details.

As before, four cases are possible depending on whether the payment is

1. immediate for both you and the other,
2. deferred for both you and the other,
3. immediate for you and deferred for the other,
4. deferred for you and immediate for the other.

Combining the 4 cases related to the time of the payments with the 4 cases related to their certainty yields the $4 \times 4 = 16$ prospects that you will face. In particular, these 16 prospects are:

1. **You** get 27 ECU for sure *now*, and **the other** gets the lottery *now*.
2. **You** get 27 ECU for sure *later*, and **the other** gets the lottery *later*.
3. **You** get 27 ECU for sure *now*, and **the other** gets the lottery *later*.
4. **You** get 27 ECU for sure *later*, and **the other** gets the lottery *now*.
5. **You** get the lottery *now*, and **the other** gets 27 ECU for sure *now*.
6. **You** get the lottery *later*, and **the other** gets 27 ECU for sure *later*.
7. **You** get the lottery *now*, and **the other** gets 27 ECU for sure *later*.
8. **You** get the lottery *later*, and **the other** gets 27 ECU for sure *now*.
9. Both **you** and **the other** get 27 ECU for sure *now*.
10. Both **you** and **the other** get 27 ECU for sure *later*.
11. **You** get 27 ECU for sure *now* and **the other** gets 27 ECU for sure *later*.
12. **You** get 27 ECU for sure *later* and **the other** gets 27 ECU for sure *now*.
13. Both **you** and **the other** get the lottery *now*.
14. Both **you** and **the other** get the lottery *later*.
15. **You** get the lottery *now* and **the other** gets the lottery *later*.
16. **You** get the lottery *later* and **the other** gets the lottery *now*.

What you have to do

Your task (as well as the task of each other participant) is to report the lowest amount of ECU for which you would be willing to sell each prospect. In other words, you have to state a minimum selling price for each of the 16 prospects. Each of your sixteen 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 payoffs

Your payoff depends on the choices made by the two members of the 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.

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

(II) Once the active player has been determined, the computer will select one of the sixteen prospects faced by this player as the “relevant prospect”, where all sixteen prospects are equally likely.

(III) 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 minimum selling price reported by the active player (either you or the other participant) for the relevant prospect.

- If the random integer is smaller than the minimum selling price reported by the active player for the relevant prospect, the active player keeps the relevant prospect and the two members of the group obtain the payments specified by it.

- If the random integer is equal to or greater than the minimum selling price reported by the active player for the relevant prospect, the active player sells the relevant prospect and earns an amount of ECU equal to the random integer, which will be paid out to him/her in cash today. 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 *now* and to the other either 16 or 38 ECU *later* is the relevant prospect. Suppose also that you have reported a minimum selling price of 20 ECU for that particular prospect.

- If the computer chooses the integer 18, you keep the prospect (because $18 < 20$). This implies that you get 27 ECU today, and the other obtains either 16 or 38 ECU in three months, where these two amounts are equally likely.
- If the computer chooses the integer 22, you sell the prospect (because $22 > 20$). This

implies that you get 22 ECU today, 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.

Control questions:

(1) Suppose you are the active player. The prospect paying to you either 16 or 38 ECU later, and to the other 27 ECU for sure later is the relevant prospect. You reported a minimum selling price of 25 ECU and the other reported a minimum selling price of 27 ECU for that particular prospect. The computer chooses the integer 25. The computer determines that the outcome of the lottery is 16. Please, calculate your and the other's payoffs in this case, and specify when each payoff will be paid out (please, type in "today", "in three months", or "never").

(2) Suppose you are the active player. The prospect paying to both you and the other 27 ECU for sure now is the relevant prospect. You reported a minimum selling price of 33 ECU and the other reported a minimum selling price of 27 ECU for that particular prospect. The computer chooses the integer 13. Please, calculate your and the other's payoffs in this case, and specify when each payoff will be paid out.

(3) Suppose the other is the active player. The prospect paying to you 27 ECU for sure now and to the other either 16 or 38 ECU later is the relevant prospect. You reported a minimum selling price of 18 ECU and the other reported a minimum selling price of 30 ECU for that particular prospect. The computer chooses the integer 24. The computer determines that the outcome of the lottery is 16. Please calculate your and the other's payoffs in this case, and specify when each payoff will be paid out.

(4) Suppose that the other is the active player. The prospect paying to both you and the other 27 ECU for sure later is the relevant prospect. You reported a minimum selling price of 35 ECU and the other reported a minimum selling price of 12 ECU for that particular prospect. The computer chooses the integer 19. Please calculate your and the other's payoffs in this case, and specify when each payoff will be paid out.

References

Anderhub, V., W. Güth, U. Gneezy and D. Sonsino (2001). On the interaction of risk and time preferences: An experimental study. *German Economic Review*, 2(3): 239–253.

Andreoni, J. and J. Miller (2002). Giving according to GARP: An experimental test of the consistency of preferences for altruism. *Econometrica*, 70: 737–753.

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

Bolton, G. and A. Ockenfels (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., L. González, W. Güth and M.V. Levati (2005). Attitudes toward private and collective risks in individual and strategic choice situations. Discussion Paper 22-2005, Max Planck Institute of Economics, Jena.

Camerer, C. (1995). Individual decision making. In J.H. Kagel and A.E. Roth (eds.), *The Handbook of Experimental Economics*, Princeton University Press, Princeton (NJ).

Charness, G. and M. Rabin (2002). Understanding social preferences with simple tests. *Quarterly Journal of Economics*, 117: 817–869.

Chesson, H. and W. Viscusi (2003). Commonalities in time and ambiguity aversion for long-term risks. *Theory and Decision*, 54: 57–71.

Cox, J., K. Sadiraj and V. Sadiraj (2002). A theory of competition and fairness for egocentric altruists. University of Arizona Working Paper.

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

Fehr, E. and K. Schmidt (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 21, University of Zurich.

Green, L., J. Myerson and P. Ostaszewski (1999). Amount of reward has opposite effects on the discounting of delayed and probabilistic outcomes. *Journal of Experimental Psychology-Learning Memory and Cognition*, 25: 418-427.

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

Loewenstein, G. and J. Elster (1992). *Choice over time*. Russell Sage Foundation: New York.

Mazur, J.E. (1997). Choice, delay, probability, and conditioned reinforcement. *Animal Learning & Behavior*, 25: 131-147.

Rachlin, H., A. Raineri and D. Cross (1991). Subjective probability and delay. *Journal of the Experimental Analysis of Behavior*, 55: 233-244.

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

Samuelson, W. and R., Zeckhauser (1988). Status quo bias in decision making. *Journal of Risk and Uncertainty*, 1(1): 7–59.

Tietz, R. (1992). An endowment effect in market experiments. In: S.E.G. Lea, P. Webley and B.M. Young (eds.), *New Directions in Economic Psychology: Theory, Experiment and Application*, Edward Elgar, Cheltenham.

Tversky, A. and D. Kahneman (1992). Advances in prospect theory: cumulative representation of uncertainty. *Journal of Risk and Uncertainty*, 5: 297-323.

Table 1: The sixteen prospects evaluated by each participant

	Risk			
Delay	No-one	Own	Other	Both
No-one	$P^{u,0}_{u,0}$	$P^{u,0}_{U,0}$	$P^{U,0}_{u,0}$	$P^{U,0}_{U,0}$
Own	$P^{u,0}_{u,3}$	$P^{u,0}_{U,3}$	$P^{U,0}_{u,3}$	$P^{U,0}_{U,3}$
Other	$P^{u,3}_{u,0}$	$P^{u,3}_{U,0}$	$P^{U,3}_{u,0}$	$P^{U,3}_{U,0}$
Both	$P^{u,3}_{u,3}$	$P^{u,3}_{U,3}$	$P^{U,3}_{u,3}$	$P^{U,3}_{U,3}$

Table 2: Generalized linear mixed-effects regression on reservation prices

	Coefficient	Std. Error	z	$Pr(\lvert z \rvert)$
Intercept	3.485***	0.028	124.01	0.000
$OwnRisk$	−0.098***	0.017	−5.770	0.000
$OwnDelay$	−0.142***	0.017	−8.376	0.000
$OtherRisk$	−0.020	0.017	−1.212	0.225
$OtherDelay$	0.002	0.017	0.144	0.885

$*** = 0.1\%$ significance level

Table 3: Measures of individual attitudes towards payoffs, risks and delays

Attitudes	Description	n
Other-regarding	$P^{u,0}_{u,0} - u > 0$	20
Spiteful	$P^{u,0}_{u,0} - u < 0$	5
Risk-averse	$P^{u,0}_{u,0}$-$P^{u,0}_{U,0} > 0$	16
Risk-seeking	$P^{u,0}_{u,0}$-$P^{u,0}_{U,0} < 0$	7
Delay-averse	$P^{u,0}_{u,0}$-$P^{u,0}_{u,3} > 0$	18
Delay-seeking	$P^{u,0}_{u,0}$-$P^{u,0}_{u,3} < 0$	2
Risk other-oriented	$P^{u,0}_{U,0}$-$P^{U,0}_{u,0}$	0
Risk self-oriented	$P^{u,0}_{U,0}$-$P^{U,0}_{u,0}$	22
Delay other-oriented	$P^{u,0}_{u,3}$-$P^{u,3}_{u,0}$	1
Delay self oriented	$P^{u,0}_{u,3}$-$P^{u,3}_{u,0}$	19

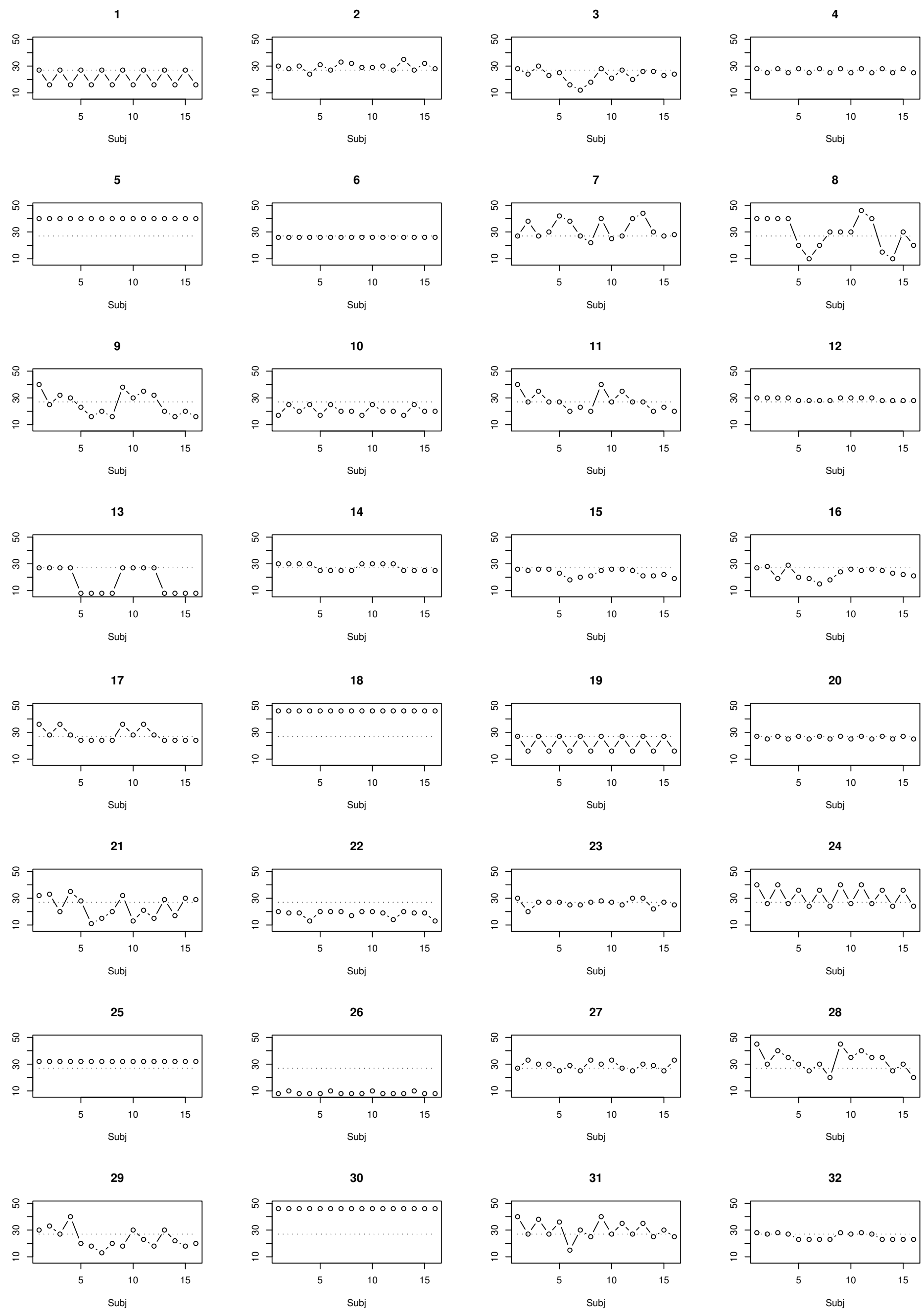
Note: n denotes the number of observations. We do not report the (neutral) cases in which the values were zero.

Table 4: Kendall's correlation coefficients between attitudes (OR: other-regarding, $Soc.Or.$: social orientation, RA: risk-averse, RS: risk-seeking, DA: delay-averse, DS: delay-seeking)

Attitudes	OR	$Soc.Or.RA$	$Soc.Or.RS$	$Soc.Or.DA$
$Soc.Or.RA$	-0.482***			
$Soc.Or.RS$	0.617*			
$Soc.Or.DA$	-0.284			
$Soc.Or.DS$	$-$			
RA	0.637***	-0.735***		
RS	0.264		0.098	
DA	0.346**			-0.599***
DS	1.000			

Note: Significance levels: $*** = 1\%$, $** = 5\%$, $* = 10\%$.
Missing values are due to low number of observations.

Figure 1: Individual reservation prices



Prospects are reported on the horizontal axis in the following order: $P^{u,0}_{u,0}$; $P^{u,0}_{U,0}$; $P^{U,0}_{u,0}$; $P^{U,0}_{U,0}$; $P^{u,0}_{u,3}$; $P^{u,0}_{U,3}$; $P^{U,0}_{u,3}$; $P^{U,0}_{U,3}$; $P^{u,3}_{u,0}$; $P^{u,3}_{U,0}$; $P^{U,3}_{u,0}$; $P^{U,3}_{U,0}$; $P^{u,3}_{u,3}$; $P^{u,3}_{U,3}$; $P^{U,3}_{u,3}$; $P^{U,3}_{U,3}$.

Figure 2: Distribution of reservation prices in each prospect

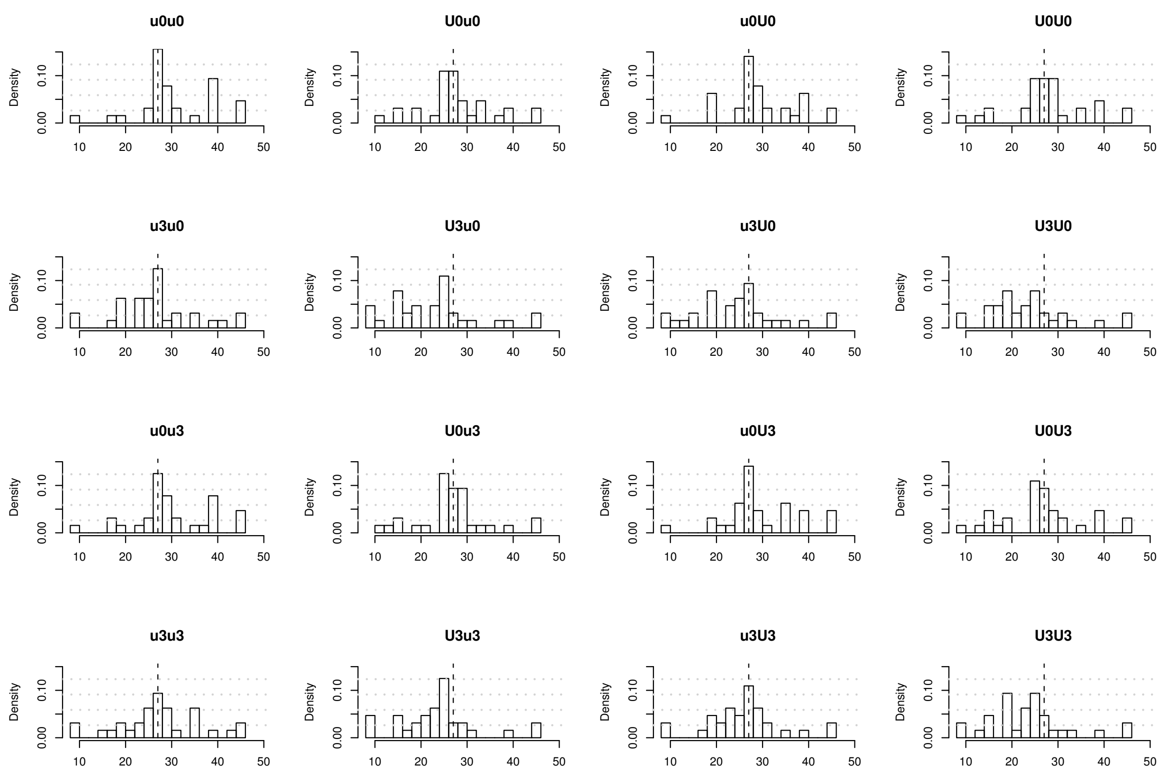
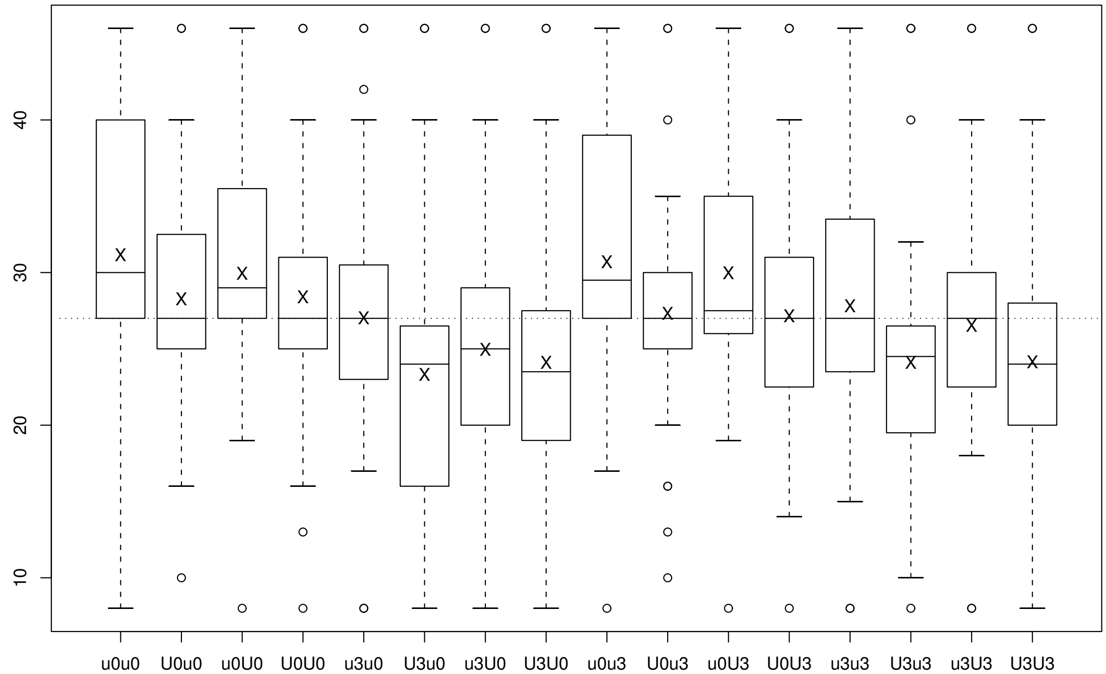


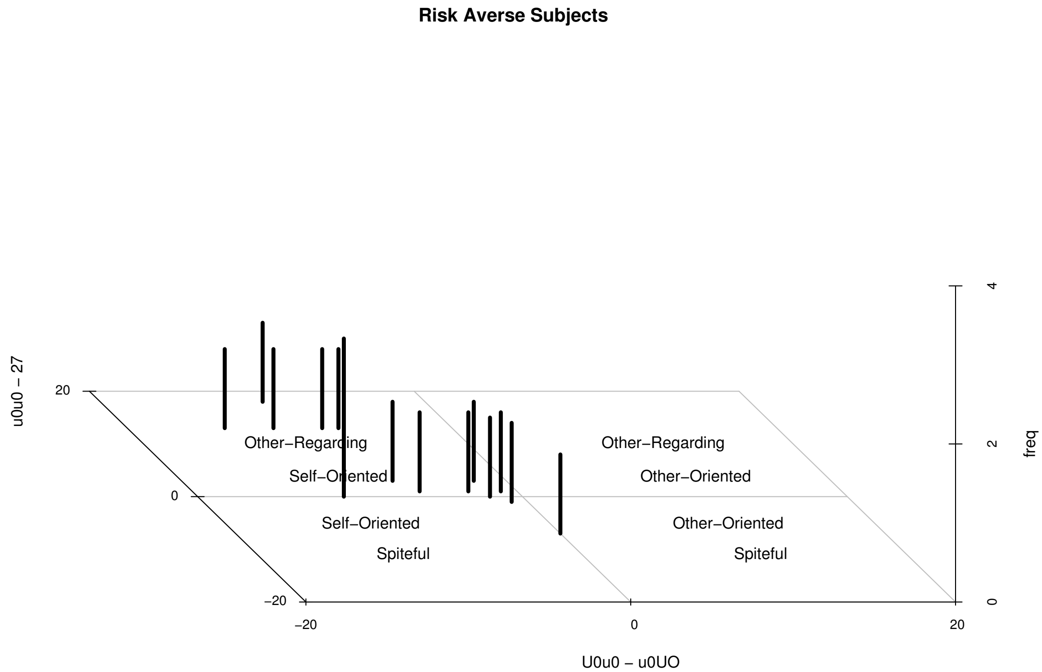
Figure 3: Box plots of the distribution of reservation prices in each prospect



Note: × denotes the mean of the distribution.

The dotted horizontal line is drawn at $u = \mathrm{E}U = 27$.

Figure 4: Joint distribution of socially oriented and other-regarding choices with respect to risk



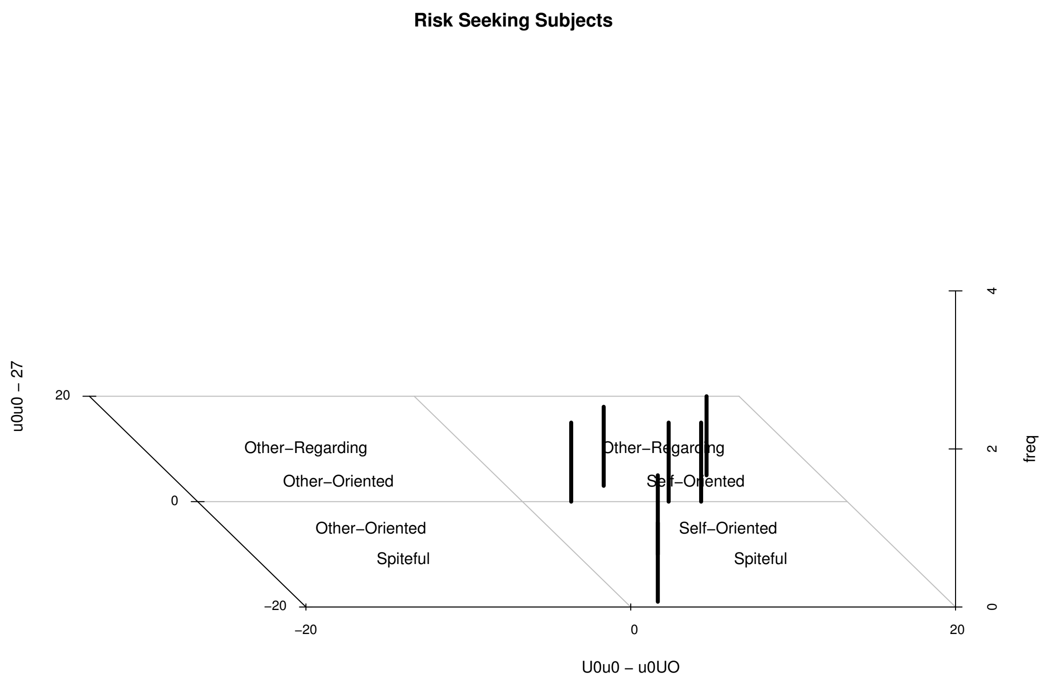


Figure 5: Joint distribution of socially oriented and other-regarding choices with respect to delay