

## Attitudes toward private and collective risk in individual and strategic choice situations

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Postprint / Postprint

Zeitschriftenartikel / journal article

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### Empfohlene Zitierung / Suggested Citation:

Brennan, G., González, L. G., Güth, W., & Levati, M. V. (2008). Attitudes toward private and collective risk in individual and strategic choice situations. *Journal of Economic Behavior & Organization*, 67(1), 253-262. <https://doi.org/10.1016/j.jebo.2007.02.001>

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## Accepted Manuscript

Title: Attitudes toward private and collective risk in individual and strategic choice situations

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PII: S0167-2681(07)00064-9  
DOI: doi:10.1016/j.jebo.2007.02.001  
Reference: JEBO 2090

To appear in: *Journal of Economic Behavior & Organization*

Received date: 4-10-2005  
Revised date: 22-2-2007  
Accepted date: 23-2-2007

Please cite this article as: Brennan, G., González, L.G., Güth, W., Levati, M.V., Attitudes toward private and collective risk in individual and strategic choice situations, *Journal of Economic Behavior and Organization* (2007), doi:10.1016/j.jebo.2007.02.001

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# Attitudes toward private and collective risk in individual and strategic choice situations

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## Abstract

Idiosyncratic risk attitudes are usually assumed to be commonly known and related to own payoffs only. However, the alternatives faced by a decision maker often involve risk about others' payoffs as well. Motivated by the importance of other-regarding preferences in social interactions, this paper explores idiosyncratic attitudes toward own and others' risk. We elicit risk attitudes in an experiment involving choices with and without strategic interaction. Regardless of the choice situation, the results do not support any relation between risk attitudes and other-regarding concerns.

*JEL classification:* C90; D63; D81; H41

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

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## 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). However, cases where the payoffs of others enter negatively into the preferences of an actor, as in envy or spite, have also been analyzed (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).

Most 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 the attempt to account for risk attitudes 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 risk both for oneself and others? How do attitudes toward own and others' risk interact? Are such attitudes different when strategic uncertainty is introduced? To the best of our knowledge, pure attitudes to risk borne by others have not been explicitly introduced into economic theory, although there is some literature that comes close to the issue. For instance, a recent contribution (Harrison et al. 2005b) investigates how preferences over social risk compare to preferences over individual risk and preferences over others' well-being. Harrison et al. elicit social risk attitudes by asking participants to vote for the risk that *everyone* in their group (including themselves) will bear. Thus, in their approach, different than ours, one's own and others' risks are necessarily correlated.<sup>1</sup>

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<sup>1</sup>Further studies verging on ours are Selten and Ockenfels (1998) and Bolton et al. (1998). In a solidarity experiment, Selten and Ockenfels explore people's willingness to help unlucky others via reducing the variance in their payoffs, yet the authors do not take expressly into account the riskiness of the others' outcome, which is a crucial aspect of our design. In an

Part of the background to the interest in our research 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,<sup>2</sup> they will rationally choose egalitarian institutions, and the chosen institutions will be more egalitarian the more risk-averse the chooser is. Following Rawls' reasoning, therefore, 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 risk faced by others similar to those they exhibit to risk they themselves face.

A straightforward empirical question is, therefore, how individuals who exhibit benevolence evaluate other people's risks. Do, for instance, those individuals who are indifferent to the risks borne by others also exhibit weak concerns toward others in general?

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. There is some experimental re-

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experiment on dictator behavior, Bolton et al. find that participants create variance in the others' payoff on purpose. Subjects in our experimental setting are not given such possibility.

<sup>2</sup>Rawls' scholars are divided as to whether it is appropriate to think of the difference principle as arising from risk aversion, which does after all assume a probabilistic calculus, or from decision-making under radical uncertainty, where probabilities are taken to be irrelevant.

search aimed at identifying the extent to which individuals' preferences for personal income risk and inequality are interrelated. Amiel et al. (2001) and Cowell and Schokkaert (2001), among others, provide a thorough discussion on the relationship and differences between an individual's perceptions of risk and inequality. Kroll and Davidovitz (2003) try to separate inequality from risk aversion and show that most participants (in their case, eight-year-old children) have a strong preference for an egalitarian distribution of income when holding individual risk constant. Carlsson et al. (2005) also estimate individual risk aversion and inequality aversion separately, and they find that many people dislike inequality *per se* (i.e., they are willing to pay for living in a more equal society). However, the risk aversion estimated from these experiments reflects individuals' preferences toward their own risk and inequality in the society. We extend this analysis to include preferences toward the risk borne by others. Moreover, we do not restrict ourselves to people's preferences regarding inequality but consider other-regarding concerns in general (i.e., independent of the form they may take).

Since individual dispositions toward others' risk and/or payoff may depend on the situation at hand, we consider choice problems with risky payoffs both in the presence of strategic interaction and in its absence. In the setting with no strategic interaction, each decision maker is required to evaluate four different allocations, each of which assigns a risky or certain payoff to herself and to another participant. As elicitation procedure we use the incentive compatible random price mechanism (Becker et al. 1964). This procedure is implemented both as a willingness-to-pay and as a willingness-to-accept decision task.

The setting with strategic interaction is a two-person public goods game that, 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 risk about one's own and/or other's marginal benefit from the public good.

The rest of the paper is organized as follows. 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 risk

### 2.1 Non-strategic settings

What is the relation between other-regarding concerns and risky outcomes when no strategic uncertainty is involved? To address this question we rely on the random price mechanism (Becker et al.) to elicit individual valuations of several risky prospects. Valuations are defined as reservation prices that a person is either *willing to pay* to acquire a prospect (henceforth, WTP-treatment) or *willing to accept* to forego a prospect that she owns (henceforth, WTA-treatment).<sup>3</sup> These two treatments are administered in a between-subjects design. Each player has to decide on four prospects that allocate payoffs to her and to an anonymous partner independently. More specifically, each prospect allocates to each member of the pair either a sure payoff,  $u$ , or a lottery ticket,  $U$ , whereby the lottery ticket yields a payoff equal to  $\underline{U}$  or  $\bar{U}$  with 1/2 probability each. The relation between the different payoffs is given by  $0 < \underline{U} < u < \bar{U}$  and  $EU = (\underline{U} + \bar{U})/2 = u$ .<sup>4</sup>

<sup>3</sup>Even though we are not interested in endowment effects as usually established by comparing WTA and WTP (see, e.g., Samuelson and Zeckhauser 1988, and Tietz 1992), we deem it important to check the robustness of our findings with respect to the method of eliciting certainty equivalents. In principle, it is possible that WTP-data reveal different risk preferences for one's own and the other's payoffs than WTA-data. Entitlement of the prospects and, thus, the obligations connected to them may, indeed, differ when the prospects are given as "manna from heaven".

<sup>4</sup>Our procedure does not allow a decision maker to reduce risk in the other's payoff. The investigation of this issue, though extremely interesting, goes beyond the purpose of the present study that intends to focus on the interrelation between one's own and another person's risk, holding both risks constant across prospects. After assessing how the actor reacts to the same level of risk in her own and in the other's payoff, the picture can be extended to examine whether and how bids differ when the decision maker can compensate her passive partner (via

We denote by  $P_{ij}$  the prospect assigning  $i$  to the decision maker and  $j$  to her passive partner. Thus, in both the WTP- and the WTA-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 WTA-treatment, the decision maker is asked to submit a minimum selling price for each prospect,  $b(P_{ij}) \in [\underline{b}, \bar{b}]$ , where  $0 < \underline{b} < \bar{b}$ . 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, 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 obtains a realization of the payoffs specified by the prospect.<sup>5</sup> 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 WTP-treatment, the decision maker is asked to report the highest 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 earns what the realization of the prospect prescribes.

In both treatments, a risk-neutral decision maker who cares only for her own payoff should submit  $b(P_{ij}) = u = EU$  in each of the four prospects. Nevertheless, if the decision maker cares for her partner and, thus, wants to

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money transfers) for losing the prospect.

<sup>5</sup>This way of capturing other-regarding concerns can be compared to the one by dictator experiments.



increase the chances of not selling or buying the prospect in the WTA- or WTP-treatment, she should report  $b(P_{ij}) > u$ . Comparing bids across prospects in each treatment allows us to disentangle attitudes toward one's own risk from attitudes toward another person's risk. In particular, we can assess preferences over individual risk by comparing bids for the prospect where own payoff is risky to bids for the prospect where it is not (i.e., evaluating how  $b(P_{uu})$  is in relation to  $b(P_{Uu})$ ).<sup>6</sup>

## 2.2 Strategic settings

In a separate experimental session 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 randomly matched pair, indexed by  $i = 1, 2$ , choose their respective contributions,  $c_1$  and  $c_2$ , thus determining individual payoffs according to

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

The above specification allows us to study if and how behavior depends on whether the players' marginal benefits from the public good,  $\alpha_1$  and  $\alpha_2$ , are stochastic or not. In this experiment, player  $i$ 's marginal benefits,  $\alpha_i$ , can assume either a fixed value,  $a$ , or one of the two (equiprobable) values  $\underline{A}$  and  $\bar{A}$ , where  $0 < \underline{A} < a < \bar{A}$ . 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  $\bar{A}$  (with probability 1/2 each),

$Q_{Aa}$  :  $i$ 's marginal benefit can be either  $\underline{A}$  or  $\bar{A}$  (with probability 1/2 each),

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<sup>6</sup>An alternative approach to determine individual risk attitudes is developed by Holt and Laury (2002) and consists of using some complementary and unrelated (to the prospects) tasks. As our design allows for an independent measure of individual risk preferences *per se*, we viewed it unnecessary to use Holt and Laury's methodology, which, notwithstanding its widespread use in the experimental literature, is not exempt from critics (see, e.g., Heineemann 2003, or Harrison et al. 2005a).

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  $\bar{A}$  (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  $\alpha_j$  is certain, and  $c_i^+(Q_{aA}) = (2a + \underline{A} + \bar{A})/4$  if  $\alpha_j$  is stochastic. If a risk-neutral player  $i$  does not know whether her marginal productivity is  $\underline{A}$  or  $\bar{A}$ , 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  $c_i^+(Q_{AA}) = (\underline{A} + \bar{A})/2$ .<sup>7</sup>

### 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 2007). Participants were undergraduate students from different disciplines at the University of Jena. After being seated at a computer terminal, participants received written instructions.<sup>8</sup> 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. In each session/treatment, choices were elicited in a random order to exclude ordering effects. 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).

<sup>7</sup>Although  $c_1 + c_2$  affects both parties, risks are idiosyncratic if  $\alpha_1$  and  $\alpha_2$  are stochastically uncorrelated. Thus, we do not capture social risk like Harrison et al. (2005b).

<sup>8</sup>An English translation of the instructions is available from the authors upon request.

To collect a high number of independent observations per treatment, the strategy method was used. This means that in both the WTA-treatment and the WTP-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.<sup>9</sup>

### 3.1 Reservation prices: WTA- and WTP-treatments

The lower and upper bounds,  $\underline{p}$  and  $\bar{p}$ , 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  $\bar{U} = 38$ .

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 only refers to individual payoffs, but has also a social dimension. Statistically, however, reservation prices are significantly different only when introducing risk 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).

<sup>9</sup>In order to avoid portfolio-diversification effects (see Markowitz 1952), participants in each session/treatment were paid according to one choice only.

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 reduce the average reservation price significantly, 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.<sup>10</sup> Another way to look at this result is by separating each individual's valuations of risky prospects into a pure risk-aversion component and a social-orientation component. The *pure risk-aversion* component reflects whether a person likes or dislikes risk in general, assuming that all members of society face exactly the same risks. The *social-orientation* component, in contrast, refers to whether a person is self-centered (i.e., "selfish") or other-regarding (i.e., "altruistic") when evaluating how asymmetric risks are distributed between herself and another person.

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<sup>10</sup>These findings stand against those of Harrison et al. (2005b), who do not detect any systematic difference between social risk attitudes and individual risk attitudes. In Harrison et al.'s experiment, however, one's own and others' risks are closely related to each other because the social setting in which the actor had to express her risk preferences included the actor herself. This may have triggered their results, thereby explaining the differences with respect to ours.

In our experimental setting, pure risk-aversion can be measured by the difference in reservation prices between the prospects  $P_{uu}$  and  $P_{UU}$ : A decision maker is classified as “pure risk-averse” or “pure risk-lover” depending on whether  $b(P_{uu}) - b(P_{UU})$  is positive or negative.<sup>11</sup> On the other hand, a person having a higher reservation price for the prospect  $P_{Uu}$  than for the prospect  $P_{uU}$  prefers exposing herself, rather than the other, to more risk. The decision maker’s elicited preferences with respect to social distribution of risks are then described as “self-centered” or “other-regarding” depending on whether she is pure risk-lover or pure risk-averse. In a similar fashion, we say that a decision maker with  $b(P_{Uu}) - b(P_{uU}) < 0$  is “self-centered” if she is pure risk-averse, but that she is “other-regarding” if she is pure risk-lover. In this sense, social-orientation with respect to the distribution of asymmetric risks always depends on the fundamental risk attitudes that we assume to antecede distributional concerns.

Figure 3 uses this decomposition to 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 main diagonal,<sup>12</sup> we can confirm that most individuals tend to be self-centered, with heterogeneity in valuations being due to different fundamental risk attitudes.

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<sup>11</sup>If this difference is positive, the decision maker can be considered as pure risk-averse since, *ceteris paribus*, she evaluates the prospect assigning her the sure payoff more than the prospect assigning her the lottery. Alternatively, if  $P_{uu} - P_{UU}$  is negative, the decision maker can be considered as pure risk-lover.

<sup>12</sup>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  $\bar{A}$  were chosen to satisfy  $(\underline{A} + \bar{A})/2 = a$ . More specifically, we set  $a = 6$ ,  $\underline{A} = 4$  and  $\bar{A} = 8$ , so that a risk-neutral, self-interested player  $i$  should choose  $c_i^*(Q_{a.}) = c_i^*(Q_{A.}) = 3$ , and an efficiency-oriented player should choose  $c_i^+(Q_{a.}) = c_i^+(Q_{A.}) = 6$ .

By allowing  $c_i$  (for  $i = 1, 2$ ) to vary from 0 to 8,<sup>13</sup> 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.<sup>14</sup>

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.

Insert Table 4 and Figure 4 about here

Similar 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. Subjects behave statistically differently

<sup>13</sup>8 is the maximum contribution decision that guarantees that player  $i$  ends up with 0 payments (including the show-up fee).

<sup>14</sup>As noted in the introduction, 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).

only when risk in either one's own or the 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 risk 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 risk does 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 toward 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 the 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 necessarily involves a desire to treat others in essentially 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.

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Table 1  
 Reservation prices: summary of experimental results

<i>Prospects</i>	WTA-Treatment				WTP-Treatment			
	<i>uu</i>	<i>uU</i>	<i>Uu</i>	<i>UU</i>	<i>uu</i>	<i>uU</i>	<i>Uu</i>	<i>UU</i>
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

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Table 2  
Two-sided Wilcoxon tests on paired reservation prices

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

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Table 3  
Random-effects Poisson regression on reservation prices

	Model 1	Model 2	Model 3
(Intercept)	3.300** (0.052)	3.430** (0.078)	3.419** (0.077)
treatment WTP	0.084 (0.063)	-0.251** (0.081)	-0.251** (0.081)
Own Risk	-0.106** (0.035)	-0.090** (0.025)	-0.090** (0.025)
Other Risk	-0.039 (0.035)	-0.024 (0.025)	-
Own Risk $\times$ 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

<i>Situations</i>	PG-Treatment			
	<i>aa</i>	<i>aA</i>	<i>Aa</i>	<i>AA</i>
Min.	2.0	1.2	2.0	1.0
1st Qu.	4.0	3.0	3.0	3.0
Median	5.0	5.0	4.0	4.0
Mean	5.25	4.67	4.35	4.27
3rd Qu.	6.0	5.75	5.0	5.75
Max.	8.0	8.0	8.0	8.0
Std. Dev.	9.38	9.10	9.95	10.17

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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

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Table 6  
Random-effects Poisson regression on contribution decisions

	Model 1	Model 2	Model 3
(Intercept)	1.637 (0.088)	1.615 (0.080)	1.581 (0.068)
Own Risk	-0.189 (0.118)	-0.141* (0.085)	-0.141* (0.085)
Other Risk	-0.115 (0.116)	-0.068 (0.085)	-
Own Risk $\times$ 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.

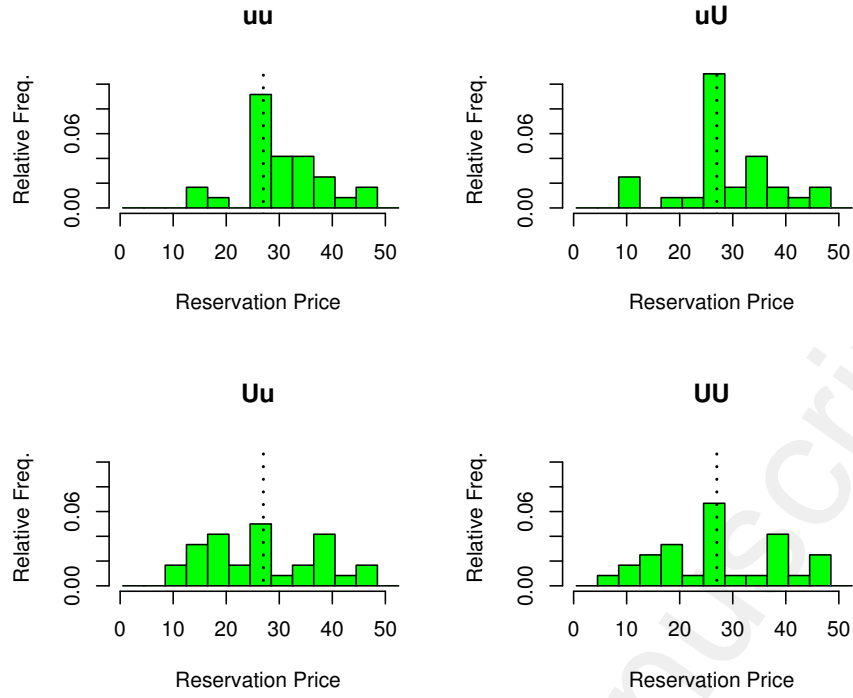


Fig. 1. WTA-treatment: distribution of reservation prices.

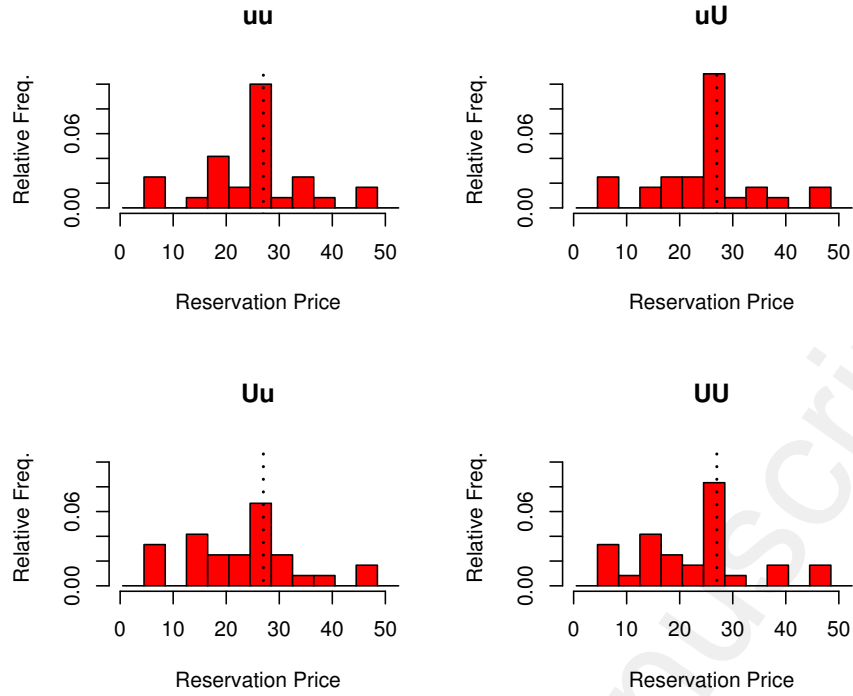


Fig. 2. WTP-treatment: distribution of reservation prices.

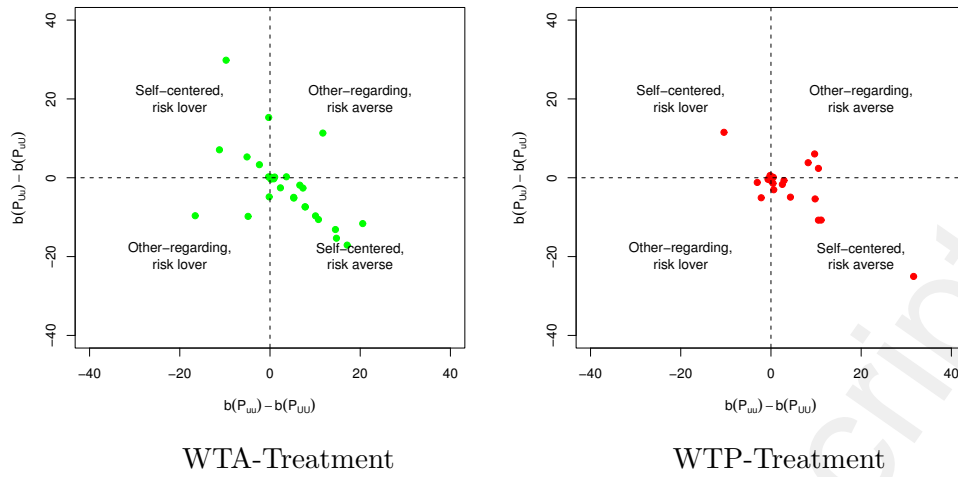


Fig. 3. Classification of individuals by social orientations and risk attitudes.

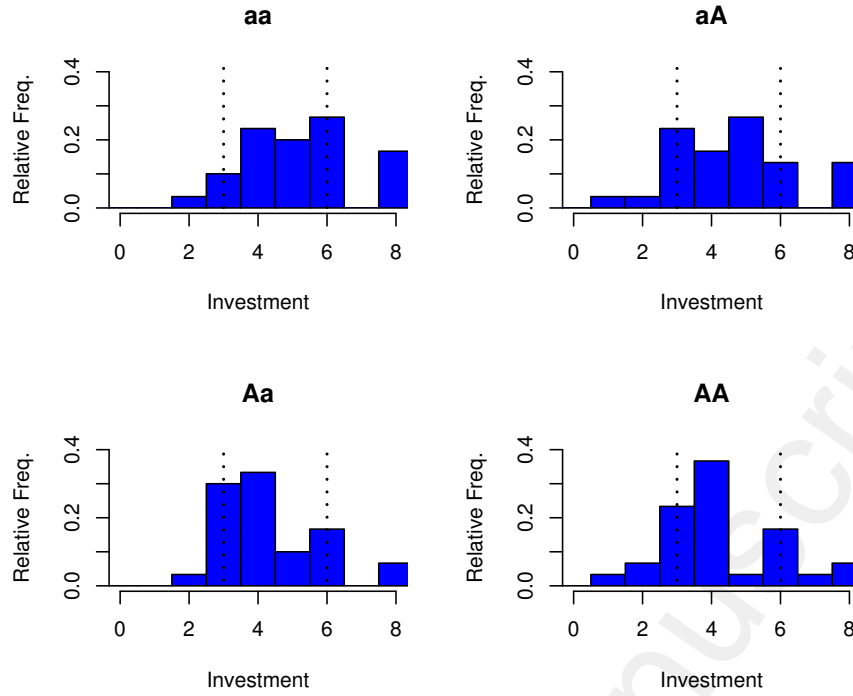


Fig. 4. PG-treatment: distribution of contribution decisions.