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Dictating the risk – experimental evidence on giving in risky environments

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Abstract

We study if and how social preferences extend to risky environments. By providing experimental evidence on different versions of "dictator games" with risky outcomes, we establish that social preferences of players who give in standard dictator games cannot be described solely by concerns over *ex post* distributions. Instead, dictators take the distribution of *ex ante* chances to win into account: the more money decision-makers transfer in the standard dictator game, the more likely they are to equalise to payoff chances under risk. Risk to the recipient does, however, generally decrease the transferred amount. Ultimately, preferences that are exclusively based on *ex post* or on *ex ante* comparisons cannot generate the observed behavioural patterns and a utility function with a combination of these concerns may best describe behaviour.

Keywords: dictator game, risk, social preferences

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1. Introduction

The effects of generosity are often subject to uncertainty. When deciding to give to charity, donors may not know how their money will be spent and if the intended effects will occur. Physicians exert (costly) effort in order to increase their patients' *chances* to be healed and parents may choose safe or risky options to invest or save for their children. At the policy level, the same pattern of risky consequences of giving applies. Consider climate policy. Sure abatement costs for the current generation have uncertain benefits for future generations, as benefits depend on the sensitivity of the climate to the atmospheric stock of greenhouse gases. Common to all these examples is that a decision-maker foregoes some benefits in order to increase the payoff chances of others, rather than transferring income for sure. In this paper, we study how the riskiness of such transfers affects giving decisions.

With this, we contribute to a large experimental and behavioural literature that investigates the potential social behaviour of subjects: dictator, gift exchange, the public good and other games show that some subjects are willing to transfer money to other players without receiving any material benefits in return (see Camerer (2003); Schokkaert (2006)). Such giving decisions are often interpreted as a preference for equitable or efficient outcomes (Fehr and Schmidt (1999); Charness and Matthew Rabin (2002); Engelmann and Strobel (2004)), as a preference for giving (Andreoni (1990)), or as a desire for being seen as behaving fairly (Andreoni and Bernheim (2009); Benabou and Tirole (2006); Dana, Weber and Kuang (2007)). Surprisingly little thought has been given so far to the role of risk in giving decisions or to if and how such social preferences extend to environments of risky decision-making.

In this paper, we report experimental results from variations of a standard dictator game that capture different variants of risky transfers. By studying giving decisions in risky environments, we address the question of whether individual perceptions of fairness relate to comparisons of outcomes/payoffs or rather to comparisons of opportunities, that is, to *ex post* versus *ex ante* comparisons. The finding that some subjects display non-selfish behaviour, for example, choosing a 50-50 split in dictator games, is the basis for theories on inequality aversion with respect to final payoffs (see Fehr and Schmidt (1999); Bolton and Ockenfels (2000)). Falk and Fischbacher

(2008) show that besides distributional preferences on the fairness of outcomes, the interpretation of fairness intentions plays an important role in subjects' decisions. Another strand of the literature considers *ex ante* fairness. Machina (1989) provides a classical example: a mother with two children may be indifferent between allocating the indivisible treat to either of her children, but she may strictly prefer giving the treat based on the result of a coin toss. Although being a fair procedure, as it gives both children the same chance to win, it will not result in a fair outcome as only one child can receive the treat (see also Kircher, Ludwig and Sandroni (2009); Trautmann (2009)). Just as in this example of not discriminating between the two kids, the ethical debate on *ex post* versus *ex ante* fairness is usually rooted in normative considerations (for example, Grant (1995)). In this paper, we yield new insights into this debate by considering the *choices* of individuals who are themselves directly affected by the outcome. That is, rather than deciding the allocation between two other persons as in Machina's example, the decision-maker decides the allocation between herself and one other person. Doing so allows us to discuss how social preference theories may extend to risky situations.

To explore the determinants of giving under risk, we run a series of modified dictator games. We first replicate the standard dictator game.[1] This standard dictator game highlights the decision-makers' fairness in outcomes between the recipient and himself. We are interested in whether this fairness in outcomes translates into *ex ante* fairness in risky situations. Our modified treatments coincide with the standard dictator game in terms of expected payoffs. The payoff to the decision-maker or to the recipient or to both is, however, subject to risk. For example, we consider treatments in which the dictator receives a certain amount of money but the recipient does not. By sacrificing some of his monetary payoff, the dictator can increase the recipient's chance to win a prize. If the dictator does not give any money, then the recipient will

[1] A vast literature has been devoted to studying giving behaviour in such games in which one player (dictator) is asked to allocate a certain amount between himself and another player (recipient). While any dictator who is solely maximising his or her own payoff should keep the entire endowment, Kahneman, Knetsch, and Thaler (1986) were first to show that most subjects choose an even split giving US$ 10 to each player over an uneven split (US$ 18, US$ 2) that favoured themselves. Following the first dictator experiment with a continuous choice (Forsythe, et al. (1994)), most studies show that a significant proportion of dictators give positive amounts (for summary see Camerer (2003)). List (2007) shows that if taking is allowed, fewer but still a significant portion of players do not choose the selfish outcome.

definitely not get the prize. If he gives the maximum amount, the recipient wins the prize for sure. Another set of treatments involve a transfer of lottery tickets. This situation is similar to the mother's example, only that the decision-maker needs to choose the *probability* with which *she herself* or the other person wins the prize (that is, the treat). That is, the decision-maker dictates the allocation of *chances* to win a given prize: giving zero secures the prize to the dictator and increasing giving increases chances of winning for the recipient while decreasing the dictator's chances. These treatments allow us to evaluate whether – when valuing equality – individuals compare their outcomes *after* resolution of uncertainty (*ex post* comparison) or if they compare their *ex ante* chances to gain certain incomes (*ex ante* comparison): no player who solely considers *ex post* distribution of payoffs would give a positive amount if the lottery draws are exclusive, that is, if only one of the players wins the prize. We complement these treatments with one in which the dictator *cannot* change the expected value allocated to himself and the recipient, but only their exposure to risk.

In our results we first establish that the social preferences of most players who give non-zero amounts in a standard dictator game cannot be based on *ex post* payoff comparisons only. Rather, subjects are found to also take into account an *ex ante* comparison of the chances to win. Decisions are, however, affected by the riskiness of final payoffs: decision-makers generally give up less income than in the standard dictator game if the transfer is risky, that is, if it does not increase the recipient's income for sure but only her chances to gain income. Importantly, the propensity to give in a standard dictator game is a good predictor for giving in risky situations: those who transfer more money in the dictator game are more likely to equalise the *ex ante* situation, that is, payoff chances in other games. Our results thus bring to light how existing theories of social preferences can extend to risky contexts.

The extension of social preferences to risky situation has received some recent interest in the literature: Fudenberg and Levine (2011) provide an axiomatic approach to model social preferences that include fairness measures that are defined on *ex ante* versus *ex post* comparisons. They show that *ex ante* fairness usually violates the independence axiom and therefore does not fit in an expected utility framework. They provide an example of extending Fehr and Schmidt (1999) preferences by using a linear combination of *ex post* and *ex ante* comparisons.

Our paper is also related to a couple of recent papers that experimentally examine the role of social preferences for risk-taking. Bolton, Brandts and Ockenfels (2005) use ultimatum and battle-of-the-sexes games to look at the trade-off between how an outcome is determined and the fairness of the outcome from recipients' perspective. Relatedly, Bohnet and Zeckhauser (2004) and Bohnet et al. (2008) analyse how recipients in a risky dictator game adjust acceptance rates depending on whether an actual person or a random process determines the outcome of the game. Unlike these authors, however, we use variations on ordinary dictator games and study the dictator's allocation choice rather than recipient preferences to see how giving decisions are affected by risk. Thus, in our setting the recipient is a completely passive player. In that sense our work builds on Bolton and Ockenfels (2010) who explore how dictator choices between a safe and a risky option for themselves depend on the corresponding payoffs to the recipient. In their experiments, dictators have a binary choice between a safe payout option and a risky payout option. They do not vary the degree of risk in the risky options. They find that dictators tend to be more risk averse when the risk applies to themselves as well as to others. They also find that dictators prefer the risky situation over a situation where outcomes are unfair with certainty. While this study reveals that decision-makers are sensitive to risk borne by recipients, it falls short of addressing the degree to which dictators are willing to surrender their own sure gains in order to reduce the risk of a partner. We address this by giving decision-makers a continuous choice set and varying the distribution of risky versus certain outcomes for the dictator and the recipient, respectively. Cappelen, Konow, Sorensen and Tungodden (2011) also investigate trade-offs between safe and risky options. Importantly, they distinguish between *ex ante* and *ex post* fairness motives of decision-makers by allowing for redistribution after the resolution of risk. They find evidence in favour of preferences for *ex ante* fairness motives, but also show that *ex post* redistribution takes place, thereby indicating mixed motives of individuals.

Other papers that have risk components in dictator games are Klempt and Pull (2010) and Andreoni and Bernheim (2009). In both papers, the risk itself is fixed while the information available to dictator and recipient varies. Klempt and Pull's uninformed dictator treatment evaluates dictator behaviour when the dictator does not know how his choice will translate to payoffs, but does know the risk involved. The authors find that uninformed dictators tend to allocate more to themselves than when they are informed. The authors interpret this as suggesting that dictators hide their selfishness behind risk. Andreoni and Bernheim (2009) conduct experiments that obscure the role dictators play in determining payoffs. They allow for either the dictator or "nature" to determine the recipient's payout, where the probability of nature deciding is fixed, as is the payment if nature decides. Further, recipients only know their final payment; they do not know whether it was decided by a person or by nature. Dictators typically settle on the fixed amount nature would pay if nature was deciding, hiding their greed behind the recipients' lack of information, similar to Klempt and Pull's study. While considering the effects of risk on giving, both studies cannot fully differentiate between *ex ante* and *ex post* notions of inequality.[2]

In our study, we close this gap in the literature by carefully designing the experimental treatments to be able to differentiate between two fairness notions. By observing decision-makers in a series of dictator choices, where payoffs equal those in the standard dictator game in terms of expected value, we are able to identify if dictators give because they are considering *ex post* outcome inequality or inequality of *ex ante* payoff chances. We further observe to what extent giving in non-risky situations is predictive of how dictators behave when risk is involved. We believe that our study contributes substantial new insights on social preferences under risk.

The paper is structured as follows. In section 2, we motivate and describe the principle features of our experiment. Section 3 sets up the experimental design in detail. We discuss our experimental findings in section 4 and relate those to the existing literature. Section 5 concludes.

[2] In fact, Andreoni and Bernheim note that "concerns for *ex ante* fairness are … confounds in the context of our current investigation" and purposefully exclude it from their experimental design.

2. *Ex ante* versus *ex post* comparison

Existing models of social preferences consider individual preferences over certain payoffs, represented by a utility function $u(c^1, c^2)$ where c^1 and c^2 are the (final) consumption levels of person 1 and 2, respectively. Charness and Rabin (2002) define $u(c^1, c^2)$ as a combination of concerns for own payoff, minimum payoff, and efficiency. Fehr and Schmidt (1999) and Bolton and Ockenfels (2000) study inequality aversion and let $u(c^1, c^2)$ capture aversion toward payoff *differences*. For example, Fehr and Schmidt (1999) posit a model of inequality aversion that compares the final payoffs of individuals:

$$u(c^1, c^2) = c^1 - \alpha \max[0, c^2 - c^1] - \beta \max[0, c^1 - c^2] \tag{1}$$

with $0 \leq \alpha$, $\beta \leq \alpha$, and $\beta \leq 1$. None of these authors explicitly looks at how these kinds of social preferences extend to situations under risk.

To address these issues, we consider individual preferences over joint payoff distributions $F(c^1, c^2)$. There exist two straightforward ways of extending social preferences as given by $u(c^1, c^2)$ to situations under risk, that is, to preferences over lotteries $F(c^1, c^2)$ (see also Fudenberg and Levine (2011)).

First, individuals may evaluate lotteries by their expected utility:

$$W^{\text{ex post}}(F) = \int u(c^1, c^2) dF(c^1, c^2) \tag{2}$$

Fehr and Schmidt (1999), for example, appear to interpret their inequality aversion in risky situations under such an assumption of expected utility maximisation. Note that this implies that inequality averse individuals compare the final payoffs to them and the other person. We therefore refer to the extension in (2) as the *ex post comparison*.

This extension of social preferences to risky situations does, however, not capture preferences as illustrated in an adaptation of Machina's example to an allocation of an undividable object between the decision-maker and the recipient: here, any outcome leads to *ex post* inequality and the final allocations are $(c^1, c^2) = (1,0)$ or $(c^1, c^2) = (0,1)$.

If the decision-maker has preferences based on (2) and at least marginally prefers *ex post* inequality in her own rather than the other person's favour, she would choose an allocation of risk that secures the object to herself. Differently, suppose the decision-maker has a preference for *ex ante* fairness and is willing to accept the inequitable outcome as long as it is decided on fairly (as in Bolton and Ockenfels (2010)). Then, she might want to avoid *ex ante* inequality and choose an allocation of risk that gives equal chances to the decision-maker and the other person to obtain the object. For example, a 50/50 gamble would equalise the chances to win the item and therefore avoid inequality from an *ex ante* perspective.

In order to formalise preferences on *ex ante* comparisons of payoff chances, we assume that each agent's utility is a function of expected payoffs for both themselves ($E(c^1)$) and their partner ($E(c^2)$) where the expectations for person one and person two are evaluated over the lottery F.[3] Then the second possible extension of social preference to risky situations is given by

$$W^{\text{ex ante}}(F) = u(E(c^1), E(c^2)) \tag{3}$$

More generally, both *ex ante* and *ex post* comparisons may enter the utility of an agent such that we write the general utility function as

$$W(F) = \int w(c^1, c^2, E(c^1), E(c^2))dF(c^1, c^2) \tag{4}$$

with some appropriately defined function $w(\cdot,\cdot)$. Fudenberg and Levine (2011) give the example of a linear combination of (2) and (3) for the case of Fehr and Schmidt preferences:

[3] More generally, individuals may not just compare the expected value, but – for example – may also compare the certainty equivalent of payoff chances. For illustrating the differences between *ex post* and *ex ante* comparison, however, we concentrate on a simple, and in some ways more straightforward comparison of expected values (see also Fudenberg and Levine (2011); Trautmann (2009)). It should be noted that a similar distinction between *ex ante* and *ex post* comparisons has been made in the literature on social welfare functions. Similarly, one could interpret individual preferences on fairness and inequality as individuals partially incorporate social welfare concerns in their own preferences. Recently, Chambers (forthcoming) studies social welfare functions that incorporate inequality aversion with respect to certainty equivalents.

$$\gamma \int u(c^1, c^2) dF(c^1, c^2) + (1-\gamma) u(E(c^1), E(c^2)) \tag{5}$$

with $\gamma \in [0,1]$. Our experimental treatments are designed to differentiate between the preference structures that are exclusively based on *ex post* or *ex ante* comparisons as formulated in (2) and (3). In particular, all our treatments coincide in *ex ante* expected values such that any theory that is based exclusively on *ex ante* comparisons as in (3) will not be consistent with observations that vary across treatments.[4]

We will see that neither a theory that is exclusively based on *ex ante* nor one that is exclusively based on *ex post* comparisons can fully describe the behaviour of individuals. As a consequence, a more comprehensive approach as indicated in (4) is warranted.

[4] In the Appendix, we use the Fehr-Schmidt preference structure (1) for convex combinations of *ex post* and *ex ante* comparisons (5) as an example to derive testable predictions for the different treatments. The qualitative predictions for differences between treatments in our experiment are identical if the Charness and Rabin (2002) approach is used instead.

3. Experimental design

Our experiment consisted of a series of dictator games in which the dictator must allocate 100 tokens between himself/herself and a second player (recipient). We report the results of six choice tasks. Tasks differ according to the payoff consequences for each of the players. One of the tasks replicates the standard dictator game. In the other five tasks, the dictators allocate risk for their recipient counterparts or between themselves and their counterparts.

We conducted our experiment in September 2009 in the Experimental Economics Laboratory at the University of Maryland. A total of 152 subjects were recruited from among University of Maryland undergraduates representing a variety of undergraduate majors, including but not limited to economics, finance, chemistry, government and biology. Subjects first gathered in one room where they reviewed consent forms. After signing a consent form, all subjects were given a copy of the general instructions, which were also read aloud by an experimenter. Subjects were randomly assigned to be either person 1 (dictator) or person 2 (recipient).[5] The dictator subjects were then led into a separate room. The recipient subjects remained in the first room. Each dictator was randomly matched with one recipient without revealing the identity to either of the subjects. No subjects were permitted to communicate before or during the session. An experimenter was present in each of the two rooms for the duration of the experiment. A copy of the instructions can be downloaded from the journal's web site.

All subjects participated in all six choice tasks, accordingly our results are within rather than between comparisons. Dictators submitted all of their allocation decisions via computer and did not learn of the outcomes of their choices between rounds. Computer stations were randomly assigned. We also randomised the order of tasks for each dictator to minimise order effects.[6]

The receivers filled out decision forms using pen and paper and also did not learn

[5] In the experiment, the words "dictator" and "recipient" were not used.

[6] We also tested for order effects and did not find any evidence that our results depend on the order in which tasks were performed.

dictator choices between rounds. Their task was to determine how much they *expected* their dictator partner to allocate to them for each task. The recipients' decisions had no bearing on the final allocations and this was made clear before each session began. Dictators did not learn recipients' expectations, either between tasks or at the end of the experiment. Similarly, recipients did not receive feedback on decisions by the dictators. It should be noted that the recipient task was not incentivised; there were no consequences for reporting beliefs inaccurately, but there were also no reasons for recipients not to disclose their true beliefs. Receivers earned the same participation fee as dictators and also earned whatever their randomly matched partner allocated to them in a randomly selected payment round. Because the receiver task was somewhat informal, we do not provide a rigorous exposition of these results. Rather, outcomes from the recipient task are largely exploratory.

After all subjects completed all tasks, payment was determined from one randomly selected task round. Using the computer, we selected payment rounds independently for each dictator-recipient pair. We did not reveal which round was the randomly selected payment round or what the dictator choice was in that round. Thus subjects did not learn the outcomes of their choices at any time during or after the experiment. They only learned of their final earnings. Likewise, the recipients did not know if their final earnings were the result of a kind (or unkind) dictator or due to a lottery. Subjects received US$ 1.00 in cash at the end of the session for each 10 experimental currency units (ECUs) they earned in the randomly selected task round. A US$ 5 show-up fee was included in the subject payments, which were paid at the end of each session. Dictators and receivers were paid separately and in private.

3.1. Description of tasks

In each task, the decision-maker was asked to allocate 100 tokens between himself and the recipient, giving away $x \in [0,100]$ and keeping $100 - x$ tokens. The payoff consequences differed between tasks and were denoted in ECUs during the experiment ($100ECU = 10USD$). Table 1 summarises the payoff consequences for each task.

Task 1 (*T1*) replicates the ordinary dictator game, as a baseline for comparison with risky decisions: the players' payoffs are given by $(c^1, c^2) = (100 - x, x)$. The purpose of this task is to position our results within the existing work on the dictator game, as well as to serve as a benchmark for other tasks.

In Tasks *2* and *3,* the dictator allocates tokens as in Task 1, but unlike Task 1 the tokens given to the recipient represent lottery tickets. Tokens kept by the dictator are interpreted the same as in Task 1. More formally, in Tasks 2 and 3, the dictator receives a certain payoff in ECU equal to his allocation of tokens kept, $c^1 = 100 - x$, while giving the recipient the chance to win a prize. The recipient earns the prize of $P = 100$ tokens with probability $\pi(x) = x / 100$, $x \in [0, 100]$, in *T2.* In *T3* the recipient can win the prize $P = 50$ tokens with probability $\pi(x) = x / 50$, $x \in [0, 50]$. Thus in these two treatments the dictator does not face any risk himself. For the recipient a lottery is drawn to determine if he receives the payment. *T2* and *T3* resemble situations as described in the introduction, for example a physician's costly effort to increase the healing chances of patients or bearing greenhouse gas abatement costs to reduce climate change faced by future generations.

We can attribute any difference between the dictator's decisions in *T2* and *T3* and the standard dictator game (*T1*) to his assessment of the risk to the recipient as both the dictator's payoff and the recipient's expected value are identical. For the combination of *ex post* and *ex ante* comparisons as outlined in (5), in the Appendix we derive the prediction based on Fehr-Schmidt preferences that giving in *T2* should be positive but less than in *T1* if agents put sufficient weight on *ex post* comparisons.[7] The reason for this is that if the recipient wins, he receives a higher payoff than the dictator. *T3* avoids this unfavourable inequality as the recipient can only win a maximum of $c^2 = 50$. If agents are therefore largely driven by *ex post* inequality concerns, we

[7] Note that the Fehr-Schmidt model is linear in payoffs and therefore resembles risk-neutral decisions. A risk-averse dictator with preferences based on *ex ante* comparisons (3) would evaluate the certainty equivalent to the recipient below the expected value. If the dictator is interested in efficiency (for example, the sum of certainty equivalents), he would therefore give less in *T2* than in *T1.* If he is interested in equalising *ex ante* chances by equalising the certainty equivalents, he might allocate more tokens to the recipient. The reverse holds for risk-loving agents. If, on the other hand, the agent compares *ex post* payoffs and is highly averse to unfavourable inequality, he would reduce giving in *T2* compared with *T1*.

should expect more giving in *T3* than in *T2*. For the Fehr-Schmidt formulation as given by (1) and (5), we show that giving coincides with *T1*.

Task 4 (*T4*) aims to test whether preferences based on *ex ante* or *ex post* comparisons are more appropriate to model dictators' allocation decisions under risk. In this treatment, both the dictator and recipient face risk. Here the dictator distributes the *chances* to win a prize. The probability for winning the prize of $P=100$ are given by $\pi^1(x)=1-x/100$ and $\pi^2(x)=x/100$. Thus the token allocations represent the chances of winning a lottery. In task *T4*, the draws are dependent: either the dictator or recipient wins. Again, Task *T4* was designed to differentiate between preferences based on *ex ante* and *ex post* comparisons. Note that *ex post* formulations of preferences (2) imply

$$W^{\text{T4, ex post}}(F) = (100 - x/100)u(100,0) + (x/100)u(0, 100)$$

such that for any preference with u(100,0) we expect subjects to choose $x^{T4} = 0$. As long as agents put slightly more weight on their own than on others' payoffs, we have a clear theoretical prediction. Note that this assumption is satisfied by all models in the literature (for example, Fehr and Schmidt 1999, Charness and Rabin 2002). Furthermore, this prediction would also hold for specific non-expected utility models: for example, if agents have rank-dependent preferences or weigh utility in a non-linear way, $x^{T4}=0$ would result as long as the utility functional, *W*, is strictly monotonic in the objective probability *x*.

Conversely, if agents have preferences based on *ex ante* comparisons as in (3), they may give positive amounts. For example, subjects that try to avoid inequality in expected payoffs are expected to choose $x^{T4} = 50$. [8] For the combination of *ex post* and *ex ante* comparisons as outlined in (5), we show in the Appendix that, based on Fehr-Schmidt preferences, inequality-averse subjects are less likely to give if their weight on *ex post* comparison increases. If they give, they are predicted to give 50.

[8] Note that the same prediction of zero giving would result in the standard dictator game because of identifiable actions. In *T4* and *T5*, however, a zero payoff to the recipient could result even if the dictator gave all but one token to the recipient. Consistent with Dana et al. (2007), we would then also expect less giving in *T4* and *T5* than in *T1*.

Task 5 (*T5*)[9] is identical to task *T4* except that instead of one lottery, two independent lotteries are drawn, one for each player. Here, one of the players, both players or neither of them wins the prize. In terms of *ex post* comparisons, *T4* and *T5* therefore differ. In terms of *ex ante* expected payoff, these tasks are the same. Comparing *T4* and *T5* therefore may provide us with further evidence in favour of or against *ex ante* comparisons. Note that the prediction under *ex ante* considerations is clear for this comparison, but the same is not true of *ex post* considerations. This is because of potential second order uncertainty in *T5* – while the dictator can discover whether or not he will win the lottery in *T5*, he does not know if his partner wins. Consequently, if giving in *T4* and *T5* is the same, we interpret the result as support of *ex ante* based preferences, rather than as a definitive test. In the Appendix, we show that Fehr-Schmidt preferences defined by (1) and (5) lead to identical giving decisions in *T5* and *T2*.

We complement these five treatments with one additional task, *T6*, in which the dictator *cannot* change the expected value allocated to herself and recipient, but can change the risks involved. The potential allocations are a 50/50-gamble between $x/2$ and $100-x/2$ for person 1 and a 50/50-gamble between $50-x/2$ and $50+x/2$ for person 2. Independent lotteries are drawn for each player to determine if they win the high or low ECU amount. The purpose of this final treatment is to gain insights into whether social preferences affect the allocation of risks consistently with the allocation of expected payoffs. As such, predictions for task *T6* complement those in *T4. Ex ante* equality in chances would be generated by a choice of $x^{T6}=50$ for which both players face a gamble between 25 and 75. We would therefore expect players with preferences based on *ex ante* comparisons who choose to give larger amounts in the standard dictator game to choose an allocation close to $x^{T6}=50$.[10] If, however, dictators are fully selfish (they give nothing in the dictator game) we would expect $x^{T6}=100$ if they are risk-averse and $x^{T6}=0$ if they are risk-loving. We thus predict that decisions in task *T1* should be informative for the absolute distance of between

[9] Engel (2011) discusses positive sum games (like our T5) and the strategy method (asking each dictator to identify binding choices for several games, in each case conditional on nature not intervening, and then choose one game at random to determine the outcome).

[10] In the Appendix, we show that Fehr-Schmidt preferences defined by (1) and (5) lead to $x^{T6}=50$, independent of the degree of inequality aversion.

decisions in *T6* to 50.

In all treatments, recipients were not informed about the actual choice, x, but only about their own final payoff. Dictators did not receive direct information about the final payoff to the recipient. The effect of such information on giving decisions is left to further research.

4. Experimental results

The results on the dictators' choices and the recipients' expectations are summarised in Table 2 and 3. These tables provide the summary statistics of average choices as well as the proportion of players choosing x=0 or x=50 in each task. For example, average giving in the dictator game is x=21.07 and thereby consistent with numbers reported in the literature (Camerer 2003). It can immediately be seen that significant positive giving occurs for all tasks. Figure 1 again shows the average contribution by task, while Figure 2 displays the percentage of subjects giving non-zero amounts (participation rate) and Figure 3 shows the average contributions for those that chose to give non-zero amounts. The summary statistics of these conditional contributions is given in Table 4. Notably, the figures already show important differences between treatments. We explore those in detail below.

In a first step, we can study giving decisions in *T4.* Here, giving is significantly different from zero: 33 subjects (43 per cent) chose to give positive amounts which amounts to an average contribution of x=18.04 (significantly different from zero based on Wilcoxon test, test, all 1 per cent significance).

We therefore can clearly reject the hypotheses that preferences based exclusively on *ex post* comparisons are able to explain their behaviour.

Result 1: *Preferences based exclusively on* ex post *payoff comparisons cannot explain giving decisions under risk.*

This finding is consistent with an *ex ante* comparison of payoff consequences, and cannot be explained by any preference structure that solely relies on *ex post* comparisons.

In fact, the percentage of agents with positive giving and the contributions in *T4* do not significantly differ from those in the standard dictator game. For Task 4 there is slightly more mass on x=0 than for Task 1 (50 per cent versus 57) and slightly less mass on x=50 in Task 4 than for Task 1 (22 per cent versus 16 per cent). While this is consistent with some players putting weight on *ex post* comparison as described in the predictions (also see Appendix), the difference is found to be insignificant (using Wilcoxon signed-rank tests on the binary variable *for x=0 and x=50*, respectively).

The conditional contributions are given in Figure 3 and Table 5a (differences between treatments checked using Wilcoxon test). The average contributions are given in Table 5b (test for differences using Wilcoxon test).[11]

In line with the interpretation of preferences as primarily driven by *ex ante* comparisons is the apparent similarity between *T4* and *T5*. The comparison between *T2* and *T3* also informs whether or not dictators evaluate *ex post* payoff differences only. As is discussed in the description of the tasks, if agents are largely driven by *ex post* inequality concerns, we would expect more giving in *T3* than in *T2*. We find the opposite to be true, however: conditional on giving, *T2* has a significantly higher mean than *T3* (Wilcoxon test, 5 per cent).

Our within-subjects design allows us to study how giving in the dictator game is correlated with giving in the other treatments. In fact, if agents' preferences were exclusively based on comparisons of *ex ante* expected value, treatments *T1* to *T5* would coincide such that larger giving in *T1* should lead to more giving in the other treatments. In *T6*, the dictator faces a 50-50-gamble between $x/2$ and $100\text{-}x/2$ while the recipient faces potential outcomes of $50\text{-}x/2$ and $50+x/2$ As such, the decision x does not affect the expected value for both players, but it does impact the risk allocation. For x=50, both players face the same payoff chances. An *ex ante* oriented player who allocates more to the recipient in the dictator game can therefore be expected to choose closer to x=50 in *T6*.

Indeed, we can establish the following result:

[11] The unconditional sample includes those who did not give positive amounts in either treatment being compared and thus averages are skewed by the concentration of giving at zero. Nonetheless, the directions of differences between treatments are the same as in the conditional giving comparisons. Thus by excluding zeros from the analysis we are simply concentrating on a pattern that exists more generally in the data.

Result 2: *The more subjects give in a standard dictator game, the more they equalise the* ex ante *expected value for risky decisions.*

For this, Table 6a provides reports a series of tobit regressions that explain the choice in the respective tasks as a function of the choice in the standard dictator game (*T1*).[12] We find that giving in the dictator game is highly informative of giving in risky situations at the individual level: the coefficient for giving in *T1* is always significant (1 per cent level of significance), its sign is positive for *T2*-*T5*, and negative for explaining $|x^{T6}\text{-}50|$ as predicted above. That is, even if the decision does not involve a trade off of own expected value, agents' choices in the dictator game are informative for the allocation of risks between themselves and some recipient. This is further supported by the fact that when giving in *T1* is higher, then agents also deviate further from their safe option (x^{T6}=100) that secures dictators a payoff of 50 while giving all the risk to the recipient. The last column of Table 6a shows that a positive relationship (10 per cent significance level) between giving in *T1* and $|x^{T6}\text{-}100|$. We interpret this as further evidence that the generosity in the standard dictator game predicts a tendency towards equating *ex ante* chances.

In order to confirm that this result is not driven by those who give zero in all tasks (that is, that the regressions are not simply telling us that selfish dictators in *T1* are selfish in all the other treatments), we also report results from these regressions with an adjusted sample to exclude the selfish players. "Selfish" in Table 6b is defined as people who give zero in *all* tasks. Table 6c gives a further robustness check when excluding only those who give zero in *T1* and the task *Ti*. We find that the relationship between giving in the dictator game and giving in the risky decisions remains (see Tables 6b and 6c).[13] Together these regressions thereby show that Result 2 is not just driven by the selfish players who always give zero.

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[12] We use tobits because of the concentration of giving at zero in all tasks.

[13] Tobit regressions still make sense when excluding selfish types because there is still 30-42 per cent zeros in the various tasks. That is, selfish is defined as giving zero in all tasks. We do not consider those that give zero in at least one task to be selfish, so many zero values remain

While Result 2 showed that giving in the standard dictator game is correlated with agents equalising the *ex ante* expected value in other decisions tasks, the correlation is not perfect. In fact, we do find evidence that risk faced by the recipient affects the dictators' choices. A series of Wilcoxon signed-rank tests reveals that agents give more in the standard dictator game than in *T2* (5 per cent significance) and *T3* (10 per cent significance), which is when the recipient's payoff is subject to risk while the dictator's is not. As such, we get the following result:

Result 3: *Players' decisions are affected by the recipient's exposure to risk.*

Further insights into this result can be obtained from explicitly comparing the distributions for the decisions (see Table 2). Columns 1 to 3 of Table 7 show that contributions tend to be lower in the tasks involving risk than in the standard dictator game. For this we defined explanatory dummy variables that take value 1 if task is *T2*, *T3*, *T4*, *T5*, respectively. The result is robust to multiple specifications. In the first specification (columns 1 and 2) we use a hurdle model, regressing the participation indicator on the treatment dummies in the first stage. In the second stage we perform a truncated regression (truncated from below at zero), to adjust the distributional assumption of normality. The truncated regression differs from the GLS model in the magnitude of the coefficients and in one case in significance of coefficients (*T5* is not significant in the truncated model). Otherwise the truncated regression gives the same pattern of significance and the coefficients have the same signs as the single regression model. While this result is also illustrated in Figure 1, Figures 2 and 3 reveal that this effect is primarily driven by a reduction in the conditional contributions, rather than by a change in the participation rate. In fact, a Wilcoxon test (see Table 5a) shows a difference in conditional contributions between 1 and 2 (1 per cent level of significance) and 1 and 3 (1 per cent level). We also show significance in

after removing the "selfish" players from the sample. Tables 6c uses a linear regression as all zero values are excluded in each of the regressions. As a further check of the explanatory power of giving in the standard dictator game (*T1*), we regress the decision in each task on a binary variable that equals 0 if the person was selfish in *T1* and 1 otherwise (Table 6d), again finding evidence for the discussed results.

the comparison of *T2* versus *T3*, which gives us transitivity with respect to *T1*, *T2* and *T3* (that is, *T1*>*T2*, *T2*>*T3*, *T1*>*T3*). This result is consistent with the results in columns 4-6 of Table 7 where we decompose the choice options to distinguish between positive giving, giving between 1 and 49 and giving equal to 50. We find that fewer subjects choose to give 50 in *T2* and *T3*, than in the standard dictator game, while more agents give smaller amounts (between 1 and 49).

Note that Result 2 immediately implies that agents' preferences cannot be exclusively based on comparisons of *ex ante* expected values as otherwise all tasks should lead to the same choice patterns. One conclusion could be that preferences need to incorporate both *ex ante* and *ex post* inequality measures as indicated in (4).

However, the observations that giving in *T2* and *T3* is less than in the standard dictator game is also in line with findings by Dana et al. (2007): since the potential payoffs to the recipient do not depend on the dictator's choice, the dictator can exploit the "moral-wiggle room". Even if the dictator gives 1 token, the recipient faces the same potential payoffs of 0 (losing the lottery) and 100 (winning the lottery). If the dictator gives zero, the recipient earn zero for certain. But since the recipient may earn zero in any case, the recipient will not be able to perfectly infer the dictator's action from observing the outcome. As such a dictator hiding behind risk may choose to give their partner nothing. Conversely, a dictator may assuage bad feelings by at least giving one token as this makes it possible that the recipient will receive the lottery prize. This may be the reason that giving remains significantly above zero. Thus while dictators may to some extent use the risk as a chance to hide their greed, as Andreoni and Bernheim (2009) or Klempt and Pull (2010) suggest, this does not completely crowd out giving. As such, it is interesting and puzzling to see that the proportion of players giving zero is also smaller in *T3* than in *T1* (the difference between *T2* and *T1* is insignificant). This indicates that some players who displayed selfish behaviour in the standard dictator game give a positive amount in *T3*, thereby giving the recipient a chance to win some large amount.

Our experimental design further allows us to compare the decisions made by dictators with the expectations of the recipient. While recipients' answers were not incentivised, we believe that the comparison of their expectations with the actual choices of the dictators provides interesting insights. Table 4 displays the respective averages, standard deviations, and proportion of subjects expecting x=0 or x=50. Figure 4 shows the averages of choices and expectations for all tasks.

Comparing expectations with actual choices, we see that they almost coincide for the standard dictator game. In presence of risk, however, expectations generally differ from choices. For *T2* and *T3*, subjects expect more generosity than dictators actually provide (t-test at 1 per cent significance, Mann-Whitney at 5 per cent for *T3*). Recipients therefore do *not* expect the dictator's choices to change when only recipients are exposed to risk.

The expectations for *T4*, however, are significantly lower than those in the standard dictator game (1 per cent, Wilcoxon). The expectations of recipients are therefore more in line with potential *ex post* comparisons than actual choices: 58 per cent of them expect to get a zero allocation if the dictator allocates lottery tickets which only allow either person to win. They expect a more generous allocation in *T5* when both agents could potentially win (1 per cent, Wilcoxon between expectations in *T4* and *T5*). This expectation, however, is not justified by the actual decisions (10 per cent significance difference in *T5*, Mann-Whitney).

Lastly, in task *T6* recipients expect a larger exposure to risk, that is, they anticipate the dictator to choose safer options than these actually do (Mann-Whitney, 1 per cent significance). This is in particular driven by recipients not expecting a risk-loving choice (x=0): this extreme choice is taken by 16 per cent of dictators while it was only expected by 3 per cent of recipients. We can summarise this discussion as follows:

Result 4: *While correctly anticipating decisions in the dictator game, subjects are less able to predict choices when payoffs are risky.*

Result 4 has implications for extensions of the current experimental setup to strategic environments: it may be problematic to find equilibrium strategies when beliefs do not coincide with actual behaviour. Similarly, when extending the current dictator game to an ultimatum game context, for example, wrong expectations may affect acceptance decisions if players' preferences depend on expectations (for example, , reference-based models).

5. Discussion and conclusion

Many recent theories attempt to explain behaviour in laboratory and field experiments by modelling some sort of social preferences. Giving in dictator, ultimatum, gift exchange, public good, and many other games has been rationalised using preference structures that allow for motivations other than selfishness, such as inequality aversion, concerns for efficiency or consideration of lowest payoffs. It remained an open question, however, how such "social" behaviour extended to situations that involve risk and how the theories can be extended. In our paper we provide evidence on these questions by studying how risks may affect the willingness of people to give up consumption in order to benefit others.

In particular, we address the issue of whether social preferences are based on comparisons of *final (ex post) payoffs* or on comparisons of *ex ante chances*. By observing decisions in situations that expose the decision-maker, another person, or both to risk, we differentiate between these two preference structures. We find that the behaviour in a standard dictator game serves as a good predictor for social preferences under risk. Moreover, the behaviour of most subjects is inconsistent with dictators comparing exclusively final payoffs. Rather, comparing *ex ante* chances (in terms of expected value comparisons) has a larger predictive power. However, the risk that recipients face does affect giving by dictators, such that expected value comparisons cannot fully explain our data. As such, we find that a more comprehensive approach that combines *ex ante* and *ex post* comparisons may be warranted.

Our study clearly can only provide a first step towards a better understanding of giving decisions under risk that affect other subjects as well as the decision-maker. For example, while we fixed the attainable payoff levels in the lottery situations, it appears worthwhile to explore how downside versus upside risk affects behaviour or how the availability of insurance options changes transfer decisions. The same holds for possible effects of risk-aversion on giving under risk. We leave those questions to future research.

1. Tables

Table 1: Summary of tasks

Task	Payoff for the dictator (ECU)	Payoff for recipient (ECU)
T1	100-*x*	*x*
T2	100-*x*	0 or 100, determined by a lottery in which the recipient faces the chances of winning equal to *x*/100
T3	100-*x*	0 or 50, determined by a lottery in which the recipient faces the chances of winning equal to *x*/50
T4	0 or 100, determined by a shared lottery with the recipient, in which the dictator faces the chance of winning equal to 1 - *x*/100, either the dictator or the recipient wins, not both.	0 or 100, determined by a shared lottery with the dictator, in which the recipient faces the chance of winning equal to *x*/100, either the dictator or the recipient wins, not both.
T5	0 or 100, determined by an independent lottery, in which the dictator faces the chance of winning equal to 1 - *x*/100. Draws are independent, that is, one, or both, or none may win the lottery.	0 or 100 determined by an independent lottery, in which the recipient faces the chance of winning equal to *x*/100. Draws are independent, that is, one, or both, or none may win the lottery.
T6	50/50 gamble between *x*/2 and 100 - *x*/2 determined by an independent lottery	50/50 gamble between 50 - *x*/2 and 50 + *x*/2 determined by an independent lottery

Table 2: Summary statistics of the dictator's choices

	Number of subjects	Mean of choices	SD of choices	Number of subjects with x=0	Number of subjects with x=50	% of subjects with x=0	% of subjects with x=50
T1	76	21.08	27.45	38	17	50%	22%
T2	76	15.57	20.13	37	9	49%	12%
T3	76	15.44	17.67	30	9	39%	12%
T4	76	18.24	27.12	43	12	57%	16%
T5	76	16.30	21.74	41	12	54%	16%
T6	76	48.16	33.59	12	17	16%	22%

Table 3: Summary statistics of the recipient's expectations

	Number of subjects	Mean of choices	SD of choices	Number of subjects with x=0	Number of subjects with x=50	% of subjects with x=0	% of subjects with x=50
T1	76	21.43	23.80	32	18	42%	24%
T2	76	21.25	26.77	32	11	42%	14%
T3	76	23.51	20.74	20	17	26%	22%
T4	76	15.74	23.01	44	10	58%	13%
T5	76	22.72	23.06	29	17	38%	22%
T6	76	65.91	28.91	2	26	3%	34%

Table 4: Summary statistics of conditional giving, by task

	Number of subjects	Mean of choices	SD of choices	% of subjects with x=50	% of subjects with 0<x<50
T1	38	42.16	24.79	45%	45%
T2	39	30.33	18.44	23%	72%
T3	46	25.52	16.06	20%	80%
T4	33	42.00	26.36	36%	45%
T5	35	35.40	18.62	34%	57%
T6	64	57.19	28.62	27%	34%

* All subjects who give positive amounts in tasks 1-5 also give positive amounts in task 6.

Table 5a: Differences in average tokens given, conditional on giving

Task	2	3	4	5
1	12.55*** (31)	14.94*** (35)	0.39 (26)	8.04 (30)
2		6.34** (32)	-7.27 (26)	-5.22** (27)
3			-16.76*** (29)	-10.10*** (32)
4				3.63 (27)

Sample size for each comparison in brackets. Differences tested with Wilcoxon signed-rank tests. *** (**,*) indicates significance at 1% (5%, 10%) level.

Table 5b: Differences in average tokens given, unconditional (N=76)

Task	2	3	4	5
1	5.51**	5.63*	2.84	4.78
2		0.12	-2.67	-0.74
3			-2.79	-0.86
4				1.93

Differences tested with Wilcoxon signed-rank tests.

*** (**,*) indicates significance at 1% (5%, 10%) level.

Table 6a: Tobit regression of choices in tasks on dictator game decisions, with robust standard errors (clustering at the individual level), full data set

	Dependent variable					
	Tokens given in T2	Tokens given in T3	Tokens given in T4	Tokens given in T5	|T6-50|	|T6-100|
Tokens given in T1	0.71*** (0.14)	0.47*** (0.12)	0.85*** (0.23)	0.87*** (0.15)	-0.30*** (0.12)	0.26* (0.14)
Constant	-11.04** (4.86)	-1.68 (3.98)	- 23.73*** (8.96)	- 17.87*** (6.23)	30.16*** (3.78)	42.74*** (7.21)
Pseudo R-squared	0.07	0.04	0.04	0.08	0.01	0.004
F statistic	27.57***	16.16***	14.05***	34.47***	6.50***	3.32*

Standard errors in brackets. *** (**) indicates significance at 1% (5%) level. We report McFadden's pseudo R-squared statistics and F statistics for joint significance.

Table 6b: Tobit regression of choices in tasks on dictator game decisions, with robust standard errors (clustering at the individual level), conditional on giving in at least one task

	Dependent variable					
	Tokens given in T2	Tokens given in T3	Tokens given in T4	Tokens given in T5	|T6-50|	|T6-100|
Tokens given in T1	0.46*** (0.11)	0.21** (0.09)	0.43** (0.21)	0.60*** (0.14)	-0.25** (0.12)	0.53*** (0.17)
Constant	3.38 (5.05)	13.57*** (3.86)	0.72 (9.20)	-2.40 (6.27)	26.99** * (4.92)	27.56*** (7.02)
Pseudo R-squared	0.04	0.01	0.01	0.04	0.01	0.02
F statistic	9.80***	3.22*	3.39***	16.82***	3.13*	9.76***

Standard errors in brackets. *** (**) indicates significance at 1% (5%) level. We report McFadden's pseudo R-squared statistics and F statistics for joint significance.

Table 6c: Linear regression of choices in tasks on dictator game decisions, with robust standard errors (clustering at the individual level), conditional on Task1>0 and Taski>0

	Dependent variable			
	Tokens given in T2	Tokens given in T3	Tokens given in T4	Tokens given in T5
Tokens given in T1	0.45*** (0.16)	0.25* (0.13)	0.67*** (0.17)	0.20 (0.18)
Constant	11.39* (5.51)	15.93*** (5.01)	13.41*** (6.70)	27.89*** (7.80)
Pseudo R-squared	0.35	0.02	0.39	0.08
F statistic	8.19***	3.73*	15.92***	1.37

Standard errors in brackets. *** (**, *) indicates significance at 1% (5%, 10%) level. We report McFadden's pseudo R-squared statistics and F statistics for joint significance. The results reported in this table are robust to adjusting for a truncated normal error distribution.

Table 6d (selfish binary): Tobit regression of choices in tasks on dictator game decisions, with robust standard errors (clustering at the individual level).

	Dependent variable			
	Tokens given in T2	Tokens given in T3	Tokens given in T4	Tokens given in T5
Non selfish	41.33*** (7.58)	30.96*** (5.68)	53.47*** (12.47)	55.88** (8.37)
Constant	-18.67 (6.80)	17.25*** (5.51)	-35.19*** (11.56)	-29.99*** (8.25)
Pseudo R-squared	0.07	0.06	0.04	0.10
F statistic	24.77***	22.65***	11.68***	42.19***

Standard errors in brackets. *** (**) indicates significance at 1% (5%) level. We report McFadden's pseudo R-squared statistics and F statistics for joint significance.

Table 7: Hurdle model (column 1-2) ,maximum likelihood estimates in random effects regression (column 3) or probit models (columns 4-6) on dictators' choices for the different tasks (baseline is dictator game T1)

	Probit participate (Choice>0)	Truncated linear regression Choice	Linear random effects model, GLS robust se's Choice	Probit participate (Choice>0)	Probit choice in [1,49]	Probit choice= 50
T2	0.07 (0.28)	-17.51** (7.34)	-5.51** (2.55)	0.07 (0.28)	0.66** (0.27)	-0.65** (0.32)
T3	0.57** (0.29)	-26.67*** (7.60)	-5.63** (2.84)	0.57** (0.29)	1.13*** (0.28)	-0.65* (0.32)
T4	-0.34 (0.29)	-0.20 (6.98)	-2.84 (3.36)	-0.34 (0.29)	-0.12 (0.28)	-0.39 (0.31)
T5	-0.21 (0.29)	-9.37 (7.17)	-4.78* (2.52)	-0.21 (0.29)	0.21 (0.27)	-0.37 (0.30)
Const.	-0.02 (0.30)	38.57*** (4.95)	21.07*** (3.17)	-0.02 (0.30)	-1.19*** (0.26)	-1.24*** (0.29)
Wald stat.	9.42**	17.99***	6.75	9.42**	27.03***	5.00

Standard errors in brackets. *** (**,*) indicates significance at 1% (5%, 10%) level. We report Wald statistics for joint significance of the covariates given a Chi Squared distribution with four degrees of freedom.

2. Charts

Figure 1: Average contribution by task

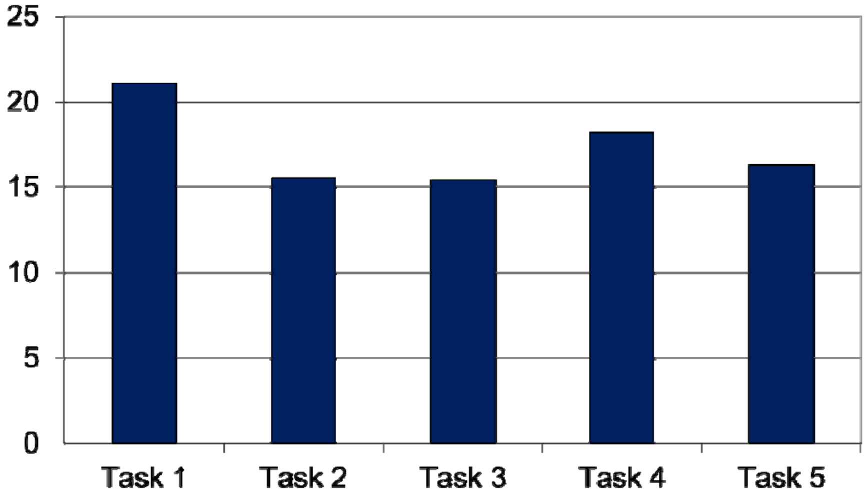


Figure 2: Percent of subjects that choose to give non-zero amounts

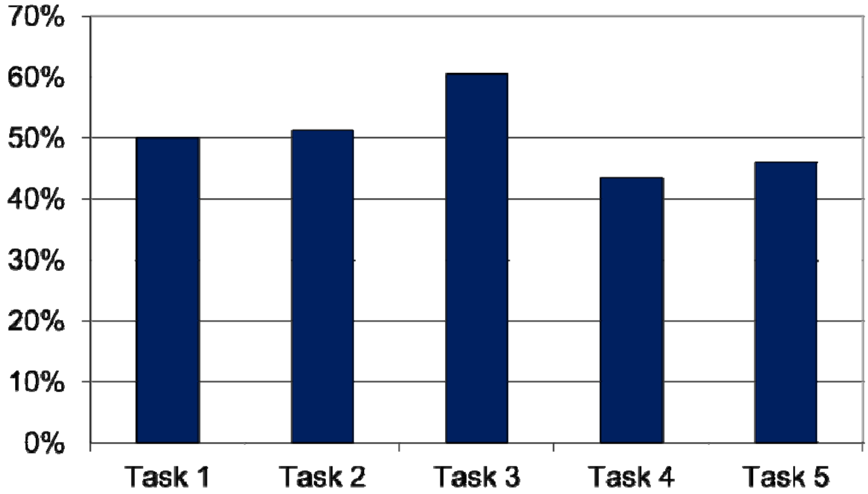


Figure 3: Average tokens given, conditional on giving greater than zero

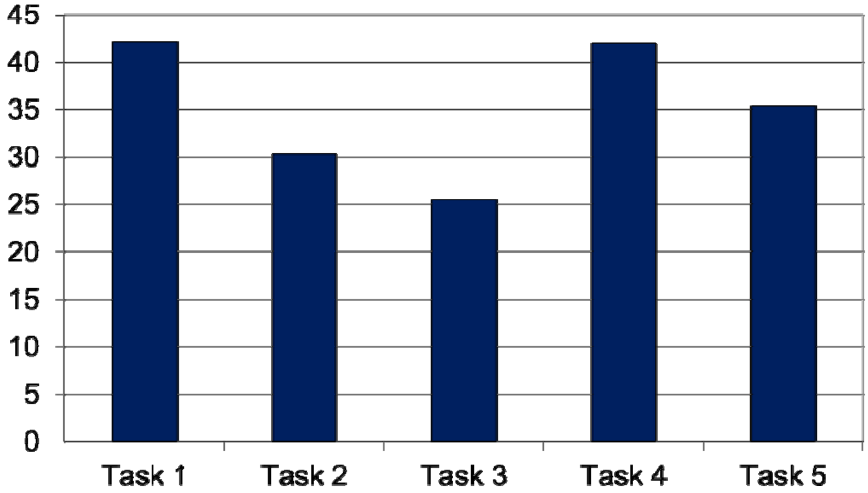
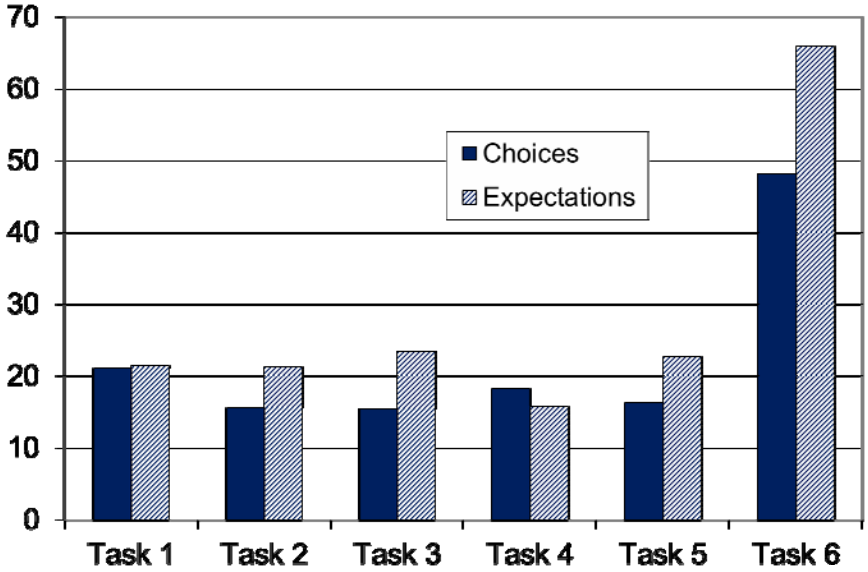


Figure 4: Choices and expectations in the respective tasks



Appendix A – Fehr-Schmidt-preferences based on *ex ante* or *ex post* preferences

In order to illustrate the consequences of preferences that incorporate *ex ante* and *ex post* comparisons, we combine the Fehr-Schmidt (1999) preference structure as given in (1) with the linear combination of *ex ante* and *ex post* extensions as stated in (5)

Treatment 1:

For the standard dictator game (T1), there is no risk such that the utility measure for $x \leq 50$ is given by

$$W(x)=100 - x - \beta(100 - 2x)$$

such that we obtain the well-known result from Fehr and Schmidt (1999) (note that no dictator would choose x>50)

$$x^{T1} \begin{cases} = 0 & \beta < 0.5 \\ \in [0,50] \quad \text{if} & \beta = 0.5 \\ = 50 & \beta > 0.5 \end{cases}$$

the weight on the *ex post* comparisons $\gamma \in [0,1]$.

Treatment 2:

The *ex ante* expected values are again given by $E(c^1)$=100– x and $E(c^2)$=x. Therefore, for x>50,

$$W(x)=100 - x - (1-\gamma)\,\alpha\,(2x-100) - \gamma\alpha\,\frac{x}{100}x - \gamma\beta\,\frac{100-x}{100}(100\text{-}x)$$

such that differentiation leads to

$$-1 - 2(1-\gamma)\,\alpha\; \underbrace{-2\,\gamma\alpha\frac{x}{100} + 2\,\gamma\beta\,\frac{100-x}{100}}_{<0} < 0$$

which implies that $x \leq 50$. In this case, we obtain:

$$W(x)=100-x-(1-\gamma)\beta\,(100-2x)-\gamma\alpha\,\frac{x}{100}x-\gamma\beta\,\frac{100-x}{100}(100\text{-}x)$$

such that differentiation leads to

$$-1+2(1-\gamma)\beta-2\,\gamma\alpha\frac{x}{100}+2\,\gamma\beta\,\frac{100-x}{100}\;\leq 0$$

or – equivalently –

$$x^{T2}=\min\left(50\,\frac{\max[0,2\beta-1])}{(a+\beta)\gamma},50\right)$$

As in the standard dictator game, agents give only if β >0.5. However, they may give less than in the standard dictator if they put sufficient weight γ on *ex post* comparisons. To see this note that 50(max[0,2β–1]) / (α + β) <50. We would thus predict a similar number of players giving in Treatment 2 and Treatment 1 if agents' preferences are based on *ex post* comparisons, but with smaller giving amounts in Treatment 2. Note that increases in the weight γ put on *ex post* comparisons would decrease giving.

Treatment 3:

Here the utility for player 1 (when giving $x \leq 50$) is given by

$$W(x)=100-x-(1-\gamma)\beta\,(100-2x)$$

$$-\beta\gamma\,\frac{x}{50}(100-x-50)-\beta\gamma\,\frac{100-2x}{100}(100-x)$$

The derivative with respect to x is given by $W'(x)=-1+2\beta$ such that the same decisions as in the standard dictator game are predicted. Intuitively, the payoffs can be equalized for sure if the agent chooses x=50. The optimal choice is therefore given by (C.1).

Treatment 4:

Here the utility for player 1 (when giving $x \leq 50$) is given by

$$W(x)=(1-\gamma)(100-x)-(1-\gamma)\beta(100-2x)$$

$$+\gamma\,\frac{100-x}{100}(100-\beta 100)+\gamma\,\frac{x}{100}(-\alpha 100)$$

such that

$$W`(x) = -(1-\gamma) + 2(1-\gamma)\beta - \gamma(1-\beta) - \gamma\alpha$$
$$= -1 + (2-\gamma)\beta - \gamma\alpha$$

This implies that agent give only if $\beta \geq (1+\gamma\alpha) / (2-\gamma)$ If they do, then they are predicted to give x=50. Note that if γ=0 the same subjects are predicted to give as under *T1*. If, however, the weight on *ex post* preferences gets larger, the range of inequality parameters that lead to positive giving shrinks.

Treatment 5:

Here the expected utility for player 1 is given by

$$W(x) = (1-\gamma)(100-x) - (1-\gamma)\beta(100-2x)$$
$$+\gamma\left(\frac{100-x}{100}\right)^2(100-\beta 100)$$
$$+\gamma\left(\frac{100-x}{100}\right)\left(\frac{x}{100}\right)(100)$$
$$+\gamma\left(\frac{x}{100}\right)^2(-\alpha 100)$$

The derivative with respect to x is given by

$$W`(x) = -(1-\gamma)(1-2\beta) - 2\gamma\left(\frac{100-x}{100}\right)(1-\beta) + \gamma\frac{100-2x}{100} - 2\gamma\frac{x}{100}\alpha$$

such that

$$x^{T5} = \min\left(50\frac{\max[0,2\beta-1])}{(a+\beta)\gamma},50\right)$$

Note that this prediction coincides with the prediction in *T2*.

Treatment 6:

The utility for player 1 if x<50 is given by

$$(1-\gamma)\frac{1}{2} + \frac{\gamma}{2}\left(\frac{x}{2} - \frac{a}{2}((50-x/2-x/2) + (50+x/2-x/2))\right)$$

$$+\ \frac{\gamma}{2}\left(100-\frac{x}{2}-\frac{\beta}{2}((100-\frac{x}{2}-(50-x/2))+(100-\frac{x}{2}-(50+x/2))\right)$$

$$=(1-\gamma)\frac{1}{2}+\frac{\gamma}{2}\left(\frac{x}{2}-\frac{a}{2}(100-x)\right)+\frac{\gamma}{2}\left(100-\frac{x}{2}-\frac{\beta}{2}(100-x)\right)$$

$$=(1-\gamma)\ \frac{1}{2}+\frac{\gamma}{2}\left(100-\frac{a+\beta}{2}(100-x)\right)$$

For the case of x>50, expected utility is given by

$$(1-\gamma)\ \frac{1}{2}+\frac{\gamma}{2}\left(\frac{x}{2}-\frac{a}{2}((50-x/2-x/2)-\frac{\beta}{2}(x/2-(50-x/2)))\right)$$

$$+\ \frac{\gamma}{2}\left(100-\frac{x}{2}-\frac{\beta}{2}(100-\frac{x}{2}-(50-x/2))-\frac{a}{2}((50+x/2)-(100-\frac{x}{2}))\right)$$

$$=(1-\gamma)\ \frac{1}{2}+\frac{\gamma}{2}\left(\frac{x}{2}-\frac{a}{2}50+\frac{\beta}{2}(50-x)\right)+\frac{\gamma}{2}\left(100-\frac{x}{2}-\frac{\beta}{2}50+\frac{a}{2}(50-x)\right)$$

$$=(1-\gamma)\ \frac{1}{2}+\frac{\gamma}{2}\left(100-\frac{a+\beta}{2}x\right)$$

That is, expected utility is increasing for x<50 but decreasing for x>50 such that any inequality averse player would be predicted to choose x=50.

We can summarise the predictions as follows:

- Contributions in T1 equal those in T3, if they give, they give 50.
- Contributions in T2 equal those in T5 and are smaller than those in T1/T3, while participation is predicted to be the same as in T1/T3.
- Fewer agents give in T4 than in T1/T3 if they are putting weight on *ex post* comparisons. If they give, they still give 50.
- Inequality averse agents in T6 equalise *ex ante* chance by choosing x=50.

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