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Social Preferences under Risk: *Ex-Post* Fairness *vs.* Efficiency[*]

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Social lotteries are lotteries that are played along with someone else. The experimental literature indicates that risk attitudes depend on how one's situation in the safe alternative compares to that of a peer. Evaluation of the risky alternative also depends on whether the lottery gives equal payoffs ex-post. Experiments usually present payoffs side-by-side (payoff for me, payoff for the other). This draws attention to inequality in payoffs and thus gives weight to fairness concerns. We consider whether showing own payoff as a share of the total payoff changes risk preferences. Showing total payoffs explicitly draws attention to risk at the level of the pair and may thus moderate dislike for negatively correlated lotteries, as those are less risky at the level of the group. We find that a significant minority of subjects keeps on disliking lotteries that lead to ex-post unequal distributions of payoffs. Subjects also tend to prefer taking a risk rather than obtaining safe but unequal payoff distributions. Beyond reconciling findings from the previous literature, we also discuss differences in sensitivity to the social setting across individuals and the relation between social value orientation in safe and in risky settings.

JEL Codes: C91, D63, D81

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> Like all the men of Babylon, I have been proconsul; like all, I have been a slave.
>
> Borges, The Lottery in Babylon

We consider individual choice when faced with randomized wealth allocation procedures. Unlike individual lotteries, social lotteries determine an outcome both for oneself and for a peer. In our experiment, we asked individuals to choose whether to play a social lottery or receive a sure payoff. They made their choice individually, without consulting the peer, and they learned their outcome along with the outcome of the lottery for the other.

Early literature on the topic took a normative point of view and focused on the issue of balancing *ex-post* and *ex-ante* fairness. Fudenberg and Levine (2012) recently revived the topic by pointing out that outcome-based theories of social preferences for fairness could not be extended to risky environments *via* expected utility theory. Indeed, simply computing expected utility of social outcomes cannot translate observed preference for equality in terms of opportunities. Extensions of models of choice under risk must therefore take account not only of differences in outcomes but also of differences in expected payoffs.

Recent experimental literature investigates how subjects actually make choices when faced with social lotteries rather than how they should make choices. However, the way such experiments present payoffs, side-by-side, may itself be normative, *i.e.* it may lead subjects to choose in a particular way that puts the accent on individual payoffs comparisons rather than on social welfare. We propose to prove this point by considering whether presenting payoffs added up influences choice towards maximizing welfare at the level of the pair. Our two different ways of presenting payoffs ought to particularly influence preferences for or against negatively correlated lotteries. Whether one prefers one or the other depends on what one cares about, *ex-ante* efficiency or *ex-post* fairness (point 1). We hypothesize that whether one cares about one or the other depends on how payoffs are presented (point 2).

Let us explain our point 1 with the following thought experiment inspired by Diamond (1967); Broome (1984); Fishburn (1984). A subject faces the choice between a positively correlated lottery that gives $1 to himself and someone else with probability half, and nothing else, and a negatively correlated lottery that gives $1 to himself and $0 to the other with probability half, and the opposite outcome else (table 1).

Table 1: Negatively and positively correlated lotteries

	Head	Tail
Positive correlation	(1 for me, 1 for you)	(0 for me, 0 for you)
Negative correlation	(1 for me, 0 for you)	(0 for me, 1 for you)

Both lotteries are "fair processes of choice" (Diamond, 1967) but the positively correlated lottery is more risky at the level of the group (with probability half, the group gets $2, else nothing), while the negatively correlated lottery minimizes risk at the social level. A socially minded subject ought therefore to prefer the negatively correlated lottery. However, as mentioned in Fudenberg and Levine (2012, p.610), "misery likes company", and the negatively correlated lottery may indeed generate feelings of envy *ex-post*. Subjects who are prone to envy or who dislike inequality would anticipate their *ex-post* feelings and thus prefer the positively correlated lottery. The literature about social preferences has shown that many subjects prefer making efficient choices, even at the cost of their own welfare (Charness and Rabin, 2002; Güth et al., 2003; Engelmann and Strobel, 2004; Cappelen et al., 2015). As in the example above however, preference for efficiency often conflicts with concern for equality (Fehr et al., 2006). It is therefore interesting to see which way individuals tend to go and whether this can be influenced by changing the presentation of payoffs.

This leads us to our point 2, which starts from the observation that context is important in determining how individuals react to social lotteries. Whether subjects think of a social risk in terms of their own outcome or of the social outcome depends not only on the person but also on the situation. Not all individuals think of a given social risk in the same way, and a given individual may not think of all social risks in the same way. Some risks elicit concern for the welfare of the group as a whole (*e.g.* humanitarian disasters, such as after a tsunami or an earthquake), while some other risks are endured mainly on one's own even when others are also affected (*e.g.* taking exams, driving a car). Risks that elicit concern for others or are endured in a communal way are often positively correlated risks (all suffer together or none do), but some are also negatively correlated (*e.g.* revolutions, whereby some are raised and some brought down). Furthermore, that a risk affects society as a whole, as in our examples above, does not mean that an individual compares his outcome to the mean outcome in his society. Individuals differ in terms of social reference points and they might judge of their outcome in comparison to the outcomes of specific individuals – towards whom their feelings may vary – or of a reference group – former students in one's school or university for example. Depending on their reference group and their feelings towards them, a subject might rejoice in their relative fortune or misfortune. Other examples where the social context matters include the difference between perception of risk between friends – a friend losing his job does not make losing one's job less painful – *vs.* perception of risk between competitors – a jealous colleague enjoys keeping his job more if you lose yours. In our experiment, we try to vary how people feel and reason about a social risk by varying how we present that risk.

Treatments Our experiment consists of two treatments that differ in terms of whether we present a social risk mainly as an individual risk or as a joint risk. We consider whether this affects the perception of positively and negatively correlated social lotteries. We present payoffs the usual way in our first treatment: payoffs are shown side-by-side, so that it is easy for subjects to compare individual outcomes. We present payoffs in a modified way in our second treatment: payoffs are shown added up, so that it is easy for subjects to assess group payoffs. We call the first treatment the "fairness" treatment because it draws attention to inequality in payoffs, and we call the second treatment the "efficiency" treatment, because it draws attention to group outcomes and may therefore foster preferences that are more conducive to social efficiency (maximizing group payoffs and minimizing its variability). Figure 1 shows the way we presented payoffs in our "fairness" treatment, on the left, and in our "efficiency" treatment, on the right.

(a) Fairness treatment (b) Efficiency treatment

Figure 1: Screenshot

Recent experimental literature implicitly adopted the first approach (comparison at the individual level) by presenting payoffs either in terms of numbers for the payoffs of oneself and one's peer, or in figures, with columns of a height corresponding to each person's payoffs, shown side-by-side. This draws attention to payoffs comparisons at the individual level. As we argued, this way of presenting payoffs is not however necessarily how subjects perceive a social risk; some subjects might think of and perceive social risk at the group level rather than at the individual level. In order to gain more control over the way subjects perceive the situation, our treatments therefore induce the way subjects perceive the situation. In the fairness treatment, the subject sees payoffs for himself and his peer and would have to think further to compute the sum of payoffs for himself and his peer in each situation. In the efficiency treatment, the subject sees payoffs for himself and for the group and would have to think further to compute the payoffs for his peer. Behavior should therefore depend on the treatment, since it is difficult to consider efficiency in the fairness treatment and it is difficult to compare payoffs in the efficiency treatment. The fairness treatment should lead people to be more sensitive to *ex-post* inequality in lotteries and *ex-ante* inequality in sure payoffs, while the efficiency treatment should lead people to pay more attention to efficiency concerns, *i.e.* maximizing the sum of payoffs for themselves and the other, and minimizing overall risk.

A further contribution of this paper is to check whether findings from the experimental literature translate to the "efficiency" treatment. Our experiment therefore also provide a test of robustness of social preferences under risk. We now present the hypotheses we test, as drawn from the literature up to now.

1. Literature review and hypotheses

We limit ourselves in this part to the literature on the topic of the perception of risk in a social setting that is most directly related to our experiment. Trautmann and Vieider (2012) provides a more systematic review of the literature. We adopt notations from Brennan et al. (2008) to help our exposition:

- *u is a safe payoff. U is a lottery with equal chances of two possible outcomes, high payoff $\overline{U}$ and low payoff $\underline{U}$.*
- *uu denotes the event where both my peer and me receive u. Uu is the case where I play lottery U and my peer receives u. uU is the case where I receive u and my peer plays lottery U. UU is the case where we both play lottery U independently.*
- *UU^+ is the case where payoffs for my peer and for me are positively correlated (we get the same payoff after the random draw of the lottery) and UU^- is the case where payoff for my peer and for me is negatively correlated (we get opposite payoffs after the random draw of the lottery).*

We identify four main strands in the experimental literature. A first strand focuses on whether social preferences extend to the domain of risk by investigating whether experimental subjects are averse to imposing risk on others (Brennan et al., 2008; Güth et al., 2008, 2011; Koukoumelis et al., 2013). Subjects give their willingness to pay and/or willingness to accept payment for playing lotteries, denoted U, or to receive a sure payoff, denoted u. Choosing one or the other also determines what a peer gets. The authors find that subjects prefer uu to uU but are indifferent between Uu and UU. In words, subjects dislike imposing risk on others if their own payoff is safe, but not if their own payoff is risky. Their explanation is that subjects are not able to process both risk for themselves and risk for the other. Since the first is more important than the other is, they therefore focus on it and ignore the later. Concern for one's own risk crowds out distaste for imposing risk on the other. From this strand, we make the following hypothesis:

Hypothesis 1 (Crowding out)**.** *Experimental subjects are indifferent to whether their peer is exposed to risk when they are themselves exposed to risk (*$Uu \simeq UU$*).*

Note that we do not directly compare Uu and UU in our experiment. Rather, we elicit interval estimates of the certainty equivalents for Uu and UU. If we define v such that $vu \simeq Uu$ and v' such that $v'u \simeq UU$, the statement $Uu \simeq UU$ is considered to be fulfilled if $v = v'$. In our experiment, we consider this to be the case if a subject switches from the safe to the risky option at the same point for both situations. Note also that in our experiment, we do not have the case where payoffs for my peer and me are drawn independently; we therefore test $Uu \simeq UU^+ \simeq UU^-$.

A second strand of literature focuses on the burden of taking responsibility for the risk borne by one's peer (Charness and Jackson, 2009; Bolton et al., 2015; Vieider et al., 2015). Charness and Jackson (2009); Vieider et al. (2015) consider situations where both the peer and me receive the same payoffs while Bolton et al. (2015) consider both negatively and positively correlated lotteries (they find that correlation does not matter). The authors find that subjects are more conservative in their risk taking when faced with either UU^+ or UU^- than when faced with U. They interpret this as responsibility aversion (Charness, 2000), whereby subjects wish to avoid blame for a bad outcome. Subjects may thus wish to choose in a way that fits the preferences in the peer, which leads to less risk taking since people generally believe they are less risk averse than their peers, or they may have been socialized to be more careful with the welfare of others than with their own. We therefore make the following hypothesis:

Hypothesis 2 (Prudence)**.** *Experimental subjects are more reluctant to take risk if their choice to take risk also exposes their peer to risk (*$U \succ UU^+$*).*

Note that our hypothesis only compares U to UU^+ because that is the more common case that is tested. In our experiment, unlike that in Bolton et al. (2015), correlation turns out to matter, and subjects particularly dislike UU^- on average. $U \succ UU^+$ therefore implies $U \succ UU^-$ for our data.

A third strand of literature focuses on how the payoff of someone else may act as a social reference point (Linde and Sonnemans, 2012; Schwerter, 2013; Gamba et al., 2014). To borrow the notations above, the authors compare willingness to choose U when the peer receives u_H with the willingness to choose U when the peer receives u_L, with $u_L < u_H$.[1] Linde and Sonnemans (2012) find that subjects are less willing to take risk when the peer receives u_H than when he receives u_L. In words, risk aversion is higher if the social reference point is high than if it is low. This result is surprising because in the first case, a subject could see all outcomes as "losses" (he earns less than his peer could), which should induce more risk taking (Kahneman and Tversky, 1979). Results in Gamba et al. (2014) do not correspond to Linde and Sonnemans (2012) but their setting is rather different. Schwerter (2013) finds lower risk aversion if the social reference point is high. This leads us to the following hypothesis:

Hypothesis 3 (Social comparison and aspiration levels)**.** *Willingness to take risk depends on the payoff of the peer. Higher payoffs of the peer induce higher willingness to take risk ($Uu_H \succ Uu_L$, with $u_H > u_L$).*

Our experimental design does not fit neatly into the above setting however because we compare willingness to take risk Uu when the alternative is vu_H to the willingness to take risk Uu when the alternative is vu_L (v is the payoff to the subject, and u is such that $u_H > u > u_L$). Payoff for the other under risk differs from payoff for the other under the safe option, so that altruistic or competitive motives come into play. Our design is closer to the experiment in Bradler (2009) where relative position influenced choice: subjects were generally ready to make a choice that improved the situation of their peer unless that meant that their peer would obtain more than themselves. We interpret this to imply that a subject takes more risk to avoid a safe option that leaves their peer with only u_L, but does not take less risk to let their peer obtain a safe option u_H. This type of social preference – benevolence towards the disadvantaged, malevolence towards the privileged – has been largely documented in the literature on social preferences under certainty.

This leads us to the following more relevant hypothesis:

Hypothesis 4 (Ex-ante inequality aversion)**.** *Willingness to take risk depends on rel-*

[1] In order to abstract from the wish of some subjects to have higher payoffs than their peer, authors set u_H higher than $\overline{U}$, so that risk taking cannot change the hierarchy of payoffs. Similarly, to abstract from the fear of having less than others, u_L is set lower than $\underline{U}$.

ative position in the safe alternative. A subject has competitive preferences if the peer is advantaged in the safe option. Conversely, a subject has altruistic preferences if the peer is disadvantaged in the safe option.

This hypothesis thus predicts that there is more risk taking if the peer receives more than oneself does in the safe option even though that lowers expected payoffs for the peer, and there is more risk taking if the peer receives less than oneself does in the safe option, but only if the peer would also prefer the risky option. Said another way, v such that $vu \simeq Uu$ is lower than v' such that $v'u_L \simeq Uu$ and is also lower than v'' such that $v''u_H \simeq Uu$.

Predictions from hypothesis 4 are different from those of hypothesis 3 but do not necessarily contradict them. Indeed, it is not clear how competitiveness or altruism would come into play in the settings from the social reference literature. In those settings, when the peer receives u_H, competitiveness might induces the decision-maker to take risk so as to have a chance to reduce inequality, but might also induce him to not take risk so as to avoid the possibility of falling further behind. For the same reason, it is unclear how altruistic motives would play out when the peer receives u_L.[2]

Finally, a fourth strand of experimental literature focuses on the role of procedural fairness in the evaluation of social lotteries (Krawczyk and Le Lec, 2010; Krawczyk, 2011; Brock et al., 2013; Andreozzi et al., 2013; Linde and Sonnemans, 2015). The main point of this literature is that we cannot directly infer preferences over social risks from social preferences over *ex-post* outcomes. Rather, subjects might care only or mostly about *ex-ante* fairness, *i.e.* the utility of the expected outcomes rather than the expected utility of the outcomes ($U(E(L)$ rather than $E(U(L)$, with L the lottery). In this case, *ex-post* distribution of payoffs may matter little to subjects as long as everyone has equal chances to get the same outcomes.

A related theoretical literature focuses on the conflict between *ex-ante* and *ex-post* fairness and underlines why concern for one is not compatible with concern for the other (Trautmann, 2009; Fudenberg and Levine, 2012; Saito, 2013). The social choice literature identified this problem long ago (Diamond, 1967; Broome, 1984; Machina, 1989).

From the above literature, we make the following prediction:

Hypothesis 5 (Preference for procedural fairness)**.** *Subjects are indifferent to differ-*

[2]If inequality aversion is linear in the payoff difference, then we can show that it does not influence choice in settings from the social reference literature. Indeed, if the decision maker decides based on the expected utility of social payoffs as in Fehr and Schmidt (1999), then he compares utility $u(v) - \alpha(u(u_H) - u(v))$ in the safe option, and expected utility $p(u(\underline{U}) - \alpha(u(u_H) - u(\underline{U})) + (1-p)(u(\overline{U}) - \alpha(u(u_H) - u(\overline{U}))$ in the risky option – we use the fact that $\overline{U} < u_H$. Terms in u_H simplify out of the comparison of expected payoffs so that inequality aversion does not play a role.

ences in ex-post distribution of payoffs as long as both of them have the same opportunities ($UU^+ \simeq UU^-$)

Hypothesis 5 implies that decision-makers value negatively correlated lotteries (a good outcome for one means a good outcome for the other) the same as positively correlated lotteries (a good outcome for one means a good outcome for the other), as long as both lotteries do not differ in terms of *ex-ante* expected utility for one and for the other.

An alternative hypothesis is that of *ex-post* inequality aversion, as mentioned in the literature on procedural preferences:

Hypothesis 6 (Ex-post inequality aversion, or distributive fairness)**.** *Subjects prefer lotteries that minimize ex-post differences in outcomes across decision-maker and recipient ($UU^+ \succ UU^-$).*

The above hypothesis would seem to result directly from social preferences under certainty and the capacity of subjects to anticipate their own feelings *ex-post* (Loewenstein et al., 2001). There is however little support in the literature for this "misery likes company" effect (Fudenberg and Levine, 2012, p.610), other than Adam et al. (2014) and López-Vargas (2014) who report dislike for negatively correlated lotteries. Bolton and Ockenfels (2010); Linde and Sonnemans (2015) find no evidence of *ex-post* inequality. Krawczyk and Le Lec (2010) and Brock et al. (2013) state however that a mix of procedural (*ex-ante*) and distributive (*ex-post*) preferences is the best explanation for choices, thus allowing for a combination of hypotheses 5 and 6.

Finally, we express our hypothesis about the effect of payoffs representations, as discussed in our introduction:

Hypothesis 7 (Efficiency considerations)**.** *Presenting information about payoffs for oneself and payoffs for the group, rather than about payoffs for oneself and payoffs for the peer, affects social preferences under risk in the direction of maximizing social utility at the level of the group. In particular, this encourages choosing lotteries that minimize risk at the group level.*

The above hypothesis would imply that negatively correlated lotteries would be more likely to be chosen – and positively correlated lotteries less likely to be chosen – in the efficiency treatment than in the fairness treatment. Many experiments show that framing affects behavior, *cf.* most famously Tversky and Kahneman (1981) but also closer to our theme, Nikiforakis (2010); Dufwenberg et al. (2011). As stated in Bardsley et al. (2010, p.23), we "test the principle, embedded in consequentialist theories of choice, that logically equivalent descriptions of a decision problem will not affect behavior". We could not find other distribution experiments comparing choices made when the distribution of payoffs is shown as a share of the total (*e.g.* as a portion of a pie) *vs.* when the individual payoffs are shown side-by-side (*e.g.* as "payoff for me", "payoff for the other").

A few last experiments in the literature are not easily put into any of the categories above, as they focus on exploring regularities in the patterns of preferences of subjects between different types of social lotteries but are not wedded to one theory or the other (Bolton and Ockenfels, 2008; Adam et al., 2014). Our experimental design is very similar to that of Bolton and Ockenfels (2008), to whom we compare our findings. We also draw inspiration from Adam et al. (2014) when dividing subjects by types, those who are indifferent to the social context and those who respond to it.

We now go on to describe our experiment.

2. Design of the experiment

2.1. The choice tasks

Subjects were offered a series of choices between two lotteries, A, on the left and B, on the right. The representation of the two social lotteries depended on the treatment (figure 1). Lotteries specified social outcomes for oneself ("me" or "decision-maker") and for the pair ("you" or "recipient").

Notation. Social lottery $L = ((m_1, y_2), p; (m_2, y_2), 1-p)$ is a lottery that obtains outcome m_1 for **m**e (decision-maker) and y_1 for **y**ou (recipient) with probability p, and outcome m_2 for me and y_2 for you with complementary probability $1 - p$.

2.2. Menu of choices

The menu of lotteries that we offered to subjects is similar to that in Bolton and Ockenfels (2008), and like in that paper, we ask subjects to decide between a risky and a safe option. We use a variation of the multiple price list design (Andersen et al., 2006; Harrison and Rutström, 2008, p.50) however, as we offered subjects choices between decreasing safe amounts and a given lottery. Rather than presenting the whole list of binary choices in a table, we presented each row one after the other on the screen from the highest valued sure payoff to the lowest. This is because differences in visual representation of payoffs are important to our design and we could not have reduced the size of the representation of each choice situation to a sufficient extent to show them all in a table on one screen.

2.2.1. Individual lotteries

Individual risk attitude was elicited by presenting a succession of binary choices between descending payoffs X, with $X \in \{58, 53, 49, 46, 44, 42, 40, 38, 36, 34, 31, 27\}$, and a lottery with equal chances of 15 and 75 ECU (table 2). We show in the last column of table 2 the implied **r**ate **o**f **r**eturn ("*ror*") that is required by someone who would be indifferent between X and the lottery, for every level of X. The required rate of return is by how much the certainty equivalent CE_L of the lottery L would have to increase to equal the expected value EV_L of the lottery:

$$ror = \frac{EV_L - CE_L}{CE_L} \tag{1}$$

Table 2: Binary choices in individual lotteries

Safe option (A)		Risky option (B)				
X	Proba	Payoffs 1	Proba	Payoffs 2	Proba	Implied required rate of return (*ror*)
58	100%	15	50%	75	50%	-22%
53	100%	15	50%	75	50%	-15%
49	100%	15	50%	75	50%	-8%
46	100%	15	50%	75	50%	-2%
44	100%	15	50%	75	50%	2%
42	100%	15	50%	75	50%	7%
40	100%	15	50%	75	50%	13%
38	100%	15	50%	75	50%	18%
36	100%	15	50%	75	50%	25%
34	100%	15	50%	75	50%	32%
31	100%	15	50%	75	50%	45%
27	100%	15	50%	75	50%	67%

2.2.2. Safe social outcomes

We elicited social value orientation by showing pairs of safe social outcomes. Table 3 shows our menu of safe social outcome comparisons. We use choice in this menu to classify individuals as competitive, altruistic or egoists. For example, a subject who chooses B for choices S1-S5 and A for choices S1-S5 is an egoist (cares only about maximizing his own payoff), a subject who always chooses A is competitive (tries to minimize the difference between himself and the other), and a subject who always chooses B is an altruist or maximizes efficiency.

Table 3: Safe social outcome comparisons

Label	Payoffs A	Payoffs B	egoist	competitive	altruist
S1	(40,40)	(42,45)	B	A	B
S2	(40,40)	(42,50)	B	A	B
S3	(40,40)	(42,55)	B	A	B
S4	(40,40)	(42,60)	B	A	B
S5	(40,40)	(42,65)	B	A	B
S6	(40,40)	(38,45)	A	A	B
S7	(40,40)	(38,50)	A	A	B
S8	(40,40)	(38,55)	A	A	B
S9	(40,40)	(38,60)	A	A	B
S10	(40,40)	(38,65)	A	A	B

2.2.3. Social lottery pairs

Finally we presented social lottery pairs, which we index $l = \{Aa, Ab, ..., Cc\}$ (table 4). The risky option was always a lottery between 15 and 75 ECU but with different associated payoffs for the other: 40 ECU in case of no-correlation, 15 and 75 ECU in case of positive correlation and 75 and 15 ECU in case of negative correlation.

As in Bolton and Ockenfels (2008), we vary how payoffs compare in the safe option. The recipient gets 40 ECU in the “equality” situations, 30 ECU in the “advantage” situations and 50 ECU in the “disadvantage” situation.

Table 4: Social lotteries

Label	Situation		Safe option (A) Payoffs	Proba	Risky option (B) Payoffs 1	Proba	Payoffs 2	Proba
Aa	Equality	No correlation	(X,40)	100%	(15,40)	50%	(75,40)	50%
Ab		Positive corr.	(X,40)	100%	(15,15)	50%	(75,75)	50%
Ac		Negative corr.	(X,40)	100%	(15,75)	50%	(75,15)	50%
Ba	Advantage	No correlation	(X,30)	100%	(15,40)	50%	(75,40)	50%
Bb		Positive corr.	(X,30)	100%	(15,15)	50%	(75,75)	50%
Bc		Negative corr.	(X,30)	100%	(15,75)	50%	(75,15)	50%
Ca	Disadvantage	No correlation	(X,50)	100%	(15,40)	50%	(75,40)	50%
Cb		Positive corr.	(X,50)	100%	(15,15)	50%	(75,75)	50%
Cc		Negative corr.	(X,50)	100%	(15,75)	50%	(75,15)	50%

Note: payoff Xs with $X \in \{58, 53, 49, 46, 44, 42, 40, 38, 36, 34, 31, 27\}$ are shown one after the other in descending order as in table 2.

2.2.4. Randomization of lottery order

We ran 9 sessions for each treatment (Fairness, Efficiency). As in Bolton et al. (2015) we "gradually increase the complexity of the task" by presenting first the individual choice under risk, then the social context under certainty and finally the social context under risk. In addition to this, subjects first had to practice with 5 decisions that were not incentivized, and we elicited choice in individual lotteries twice, first at the beginning of the menu of choice and then at the end, in order to account for a possible evolution of risk-preferences when subjects get more experience. We systematically randomized the order of social risk lotteries so that each social risk situation was presented in a different order depending on the session. Table 5 shows the order of choice for each session. Overall, subjects had to make 147 binary choices, which took them 20 to 30 minutes.

Table 5: Order of lottery presentation, by session, for each treatment.

Period	Session 1	Session 2	Session 3	Session 4	Session 5	Session 6	Session 7	Session 8	Session 9
1-5					Practice				
6-17					Individual Risk				
18-27					Safe Social Outcomes				
28-39	Aa	Ab	Ac	Ba	Bb	Bc	Ca	Cb	Cc
40-51	Ab	Ac	Aa	Bb	Bc	Ba	Cb	Cc	Ca
52-63	Ac	Aa	Ab	Bc	Ba	Bb	Cc	Ca	Cb
64-75	Ba	Bb	Bc	Ca	Cb	Cc	Aa	Ab	Ac
76-87	Bb	Bc	Ba	Cb	Cc	Ca	Ab	Ac	Aa
88-99	Bc	Ba	Bb	Cc	Ca	Cb	Ac	Aa	Ab
100-111	Ca	Cb	Cc	Aa	Ab	Ac	Ba	Bb	Bc
112-123	Cb	Cc	Ca	Ab	Ac	Aa	Bb	Bc	Ba
124-135	Cc	Ca	Cb	Ac	Aa	Ab	Bc	Ba	Bb
136-147					Individual Risk				

2.3. Payment

We chose to ask subjects to make pairwise choices between lotteries rather than eliciting certainty equivalents because pairwise choice is more precise and less biased than other popular preference elicitation methods according to Hey et al. (2009). In adopting a variation of the multiple price list design, we were however aware of issues mentioned in Charness et al. (2013) and therefore employed the PRIor INCEntive System (PRINCE) as per Johnson et al. (2014).

The PRINCE system consists in giving to subjects closed envelopes at the beginning of the experiment and tell them that the decision that is going to determine their payoff is described in that envelope. This procedure alleviates the issue whereby subjects may not understand that only one of their decision is going to determine their payoff. It reduces a potential problem whereby subjects "average" across choice situations (Holt, 1986).[3][4] We adapted this system for our case where subjects could play different roles

[3]Note that Cubitt et al. (1998) does not anyway find evidence of cross task contamination effects associated with selecting one choice at random.

[4]Rather than offering subjects a list of choices between decreasing safe amounts and a given lottery, we could have asked them to state their certainty equivalent for the lottery. However, eliciting certainty equivalent for lotteries (willingness to pay, willingness to accept) is subject to reversal of preferences (Lichtenstein and Slovic, 1971; Grether and Plott, 1979). Furthermore, we would need to incentivize this elicitation with the Becker-DeGroot-Marschak ("BDM") incentive mechanism (Becker et al., 1964). This is problematic as expressing a price under that mechanism determines a lottery, so that the price may itself depend on attitude to risk. Finally, Horowitz (2006) raises some issues about incentive compatibility in the BDM mechanism. One last reason we did not want to use a BDM mechanism is

in the experiment and different tasks could be paid out. We followed Güth et al. (2008); Rohde and Rohde (2011); Linde and Sonnemans (2012); Gamba et al. (2014); Vieider et al. (2015) in delaying the revelation of what type, decision-maker or recipient, a subject is.[5][6] There were 118 "decision-maker" envelopes that described one of the 9 times 12=108 social lotteries comparisons or one of the 10 safe social outcome comparisons. 2 times 12=24 envelopes described one of the individual lotteries comparisons. Before each session, and given that there were 12 subjects in each sessions, we drew 5 envelopes at random among the 118 "decision-maker" envelopes, 2 envelopes out of the 24 "individual lottery" envelopes, and added 5 envelopes assigning the subject who drew them to the role of recipient. At the end of each session, we asked subjects to open their envelopes and first called the 5 decision-makers in the social lotteries one after the other and implemented their decision in the situation described in their envelope. We then let the 5 recipients draw one of the decision-maker at random and gave them the payoff corresponding to the decision of their decision-makers. We finally called the 2 subjects who were assigned individual lotteries and implemented their decision.

We now detail how sessions were run and go on to analyze data from the experiment.

3. Conduct of the experiment

We carried out the experiment in the experimental economics laboratory of the Friedrich Schiller University in Jena from the 4th to the 13th of March 2015. Upon their arrival in the lab, we gave subjects some time to read printed out instructions while we played a recording of the instructions to ensure common knowledge. Instructions to participants are available on demand. Subjects then answered some control questions and we gave them the opportunity to ask questions individually. The experiment began

that understanding the representation of social lotteries and what those imply in terms of payoffs is already quite difficult for subjects to process. Asking them to also process the explanations for the BDM mechanism would probably be too much to ask. The cost of this decision was that subjects had to make many binary choices simply for us to obtain an interval for their switching point between a safe payoff and the lottery. In practice, subjects quickly understood that only one decision mattered for each lottery, *i.e.* at what point to switch. They therefore chose very quickly across safe and risky lotteries, except for payoffs close to their switching point, when decision times increased substantially.

[5] Andreoni and Miller (2002) give half of one's payoff based on one's decision and the other half based on the decision of the pair.

[6] Krawczyk and Le Lec (2010) mention that if subjects care only about procedural fairness, then *ex-post* assignment of roles would make them more selfish because assignment to roles is random and therefore fair. However, the same argument also holds with *ex-ante* assignment to roles as a subject who was assigned the role of decider may reason the recipient also had a fair chance to be a decider. Subjects in fact probably differ in terms of whether they feel responsible for the recipient or not when assignment to roles is random. Similarly, reciprocity could also justify indifference to how one's peer fares in comparison to oneself if one thinks the peer also chooses egoistically. However, a subject can justify such reciprocal behavior in the case of *ex-post* as well in the case of *ex-ante* assignment by imagining what the peer would have done if he had been assigned to be a decision-maker.

only once all subjects had answered all control questions correctly. Subjects then went through the main part of the experiment as explained in Section 2. We programmed and conducted the experiment with the software z-Tree (Fischbacher, 2007). Once they were finished with both parts; we asked subjects to answer a short questionnaire about how they took decisions in the experiment (table 7). We also asked them some demographic information (age, gender, field of study..., see table 8) and asked them a few questions about their attitude to risk and fairness and their level of trust in others (table 9).

We carried out recruitment with ORSEE (Greiner, 2004) on a subject pool that was mainly composed of undergraduate students at the Friedrich Schiller University in Jena. A total of 211 subjects took part over 18 experimental sessions, with 9 sessions for each treatment. There were 107 subjects in the fairness treatment and 104 subjects in the efficiency treatment. Age ranged from 19 to 62 with an average of 25. 35% of the subjects were male. Demographics were similar across both treatments (table 8). Subjects obtained €9.01 on average, ranging from €4.80 to €13.80, for an experiment that lasted about one hour on average.

4. Analysis of the data

Our data consists of the choices made by 211 individuals who each had to make 147 binary choices. Excluding the 5 initial choices which were for practice only, 142 of those choices are incentivized. Of those, 10 were safe social outcome comparisons (table 3), $2 \times 12 = 24$ were two repetitions of 12 choices between safe payoffs and an individual lottery (table 2) and $9 \times 12 = 108$ were choices between safe payoffs and nine different social lottery configurations (table 4). Overall, the safe alternative was chosen 7.7 times out of 12. Expressed another way, the subjects chose the safe options 64% of the time. The lower bound of the certainty equivalent of equal chances of 15 ECU and 75 ECU lottery was 36.4 ECU – this is the average value at which subjects switched to the risky option, for those subjects who switched only once. This corresponds to a required rate of return of 23.6%.

Inconsistent choices 73% of choices were such that a subject switched from the safe to the risky option only at one point, when the safe payoff became too low. In another 10% of cases, the subject always chose the safe option and in 2% of cases the subject always chose the risky option. 10 subjects chose the safe option systematically for all lotteries. A total of 84% of choice cases are thus consistent with monotonic preferences across lotteries. A further 3% of cases were such that the subject chose lottery B when lottery A was 58 ECU and chose lottery A afterwards before switching back to lottery B again after a certain point. This pattern can be attributed to inattention as we believe it is due to keeping on choosing lottery B mechanically without noticing that the situation has changed and the safe payoff is back up to the maximum.

Of the 13% of cases remaining, we observe two main patterns. The "tremble" (5% of cases) is such that a subject interrupts a consistent series of choice for one option with *one* switch to the other option (*e.g.* AABAABBBB). The "back-and-forth" (2% of cases) is such that a subject starts by choosing lottery A for high values of the safe option, then switches back and forth between A and B for a given interval, and ends up choosing B for low values of the safe option (e.g. AABABBBBB). Some of the "back and forth" can also be attributed to trembles (as in this last example), while some other cannot (*e.g.* AABABABBB). As discussed in Andersen et al. (2006) and Charness et al. (2013) and observed in Harrison et al. (2013), a back-and-forth pattern may be a sign that the subject is indifferent between the two lotteries for the range of payoffs over which back-and-forth switching is observed.

6% of cases remain that are not accounted for by inattention, trembles or indifference. Such cases are concentrated among a relatively small subset of subjects. A subject who had an inconsistent choice pattern for one lottery often also displayed inconsistent choices in at least two or more other lotteries. This irreducible portion of cases may be due to improper understanding of the experiment, lack of motivation or confusion.

4.1. Overall regression

We test our hypotheses by using three different specifications of the regression function, one based on the number of safe choices for each type of lotteries (1), the other based on a logit specification for choice (2), the last comparing required rate of returns (equation 1) implied by switching point across lotteries (3). The first and second specifications are robust to inconsistencies in choice patterns, while the third takes account only of those subjects whose choices were consistent across values.

Fixed effect logit regressions (choice of the safe lottery A is coded as 1, choice of the risky lottery B is coded as 0) are shown in column 1 of table **10** in appendix B. The regression equation is:

$$\textit{choice of A} = \textit{value of A} + \alpha^{+} \times UU^{+} + \alpha^{-} \times UU^{-} + \beta_L \times u_L + \beta_H \times u_H + \alpha_R \times U + \textit{constant} + u_i + \epsilon_{ij} \quad (2)$$

with i the individual and j an index for the choice situation. UU^{+} is a dummy taking value 1 if the social lottery is positively correlated. UU^{-} takes value 1 if the social lottery is negatively correlated. u_L takes value 1 if the peer receives u_L in lottery A. u_H takes value 1 if the peer receives u_H in lottery A. U takes value 1 if the subjects faces individual risk only. The base is therefore lottery Uu.

As in other regressions, we performed 100 bootstrap replications to obtain normal-based 95% confidence intervals for our estimates. This is adequate for normal-approximation confidence intervals (Mooney and Duval, 1993).

We find that β_L and β_H are negative and significantly different from 0. This means that subjects are on average less likely to choose the safe option if the safe option gives the other more or less than the *status quo* (40 ECU). This is consistent with *ex-ante* inequality aversion (hypothesis 4).

We also find that $\alpha^+ < 0 < \alpha^-$ and both are significantly different from 0. This means that subjects also are more likely to choose the safe option if risky payoffs are negatively correlated than if they are not correlated, and if they are not correlated than if they are positively correlated. Those results are consistent with *ex-post* inequality aversion (hypothesis 6) but not with crowding out (hypothesis 1), and are not consistent with subjects caring only about procedural fairness (hypothesis 5).

Finally, we can reject the hypothesis that $\alpha_R = \alpha^+$. We find that $\alpha^+ - \alpha_R$ is positive and significantly different from 0 (last row in table 10). This means that subjects are on average less risk averse in an individual setting than when facing positively correlated social lotteries. Since UU^+ are the most preferred social lotteries overall, we can therefore confirm that subjects are more risk averse in a social context than in an individual setting. Hypothesis 2 is therefore supported.

Column 2 of table **10** shows estimates for a random effect panel logit regressions. Age, nationality, education level, field of study, religiosity, political orientation as well as level and source of income do not influence risk taking. Social environment (living alone, size of town) and trust (index of trustfulness) also plays no role. The only significant parameters are gender and general risk attitude (table 9). Men are less risk averse and people who report they are generally ready to take risk are indeed less likely to choose the safe option. Iterated elimination of parameters using the Bayesian Information Criterion results in only those two parameters being included in our regressions. A Hausman specification test rejects the hypothesis that a random-effects model adequately represents individual-level effects.

Column three of table **10** is a fixed effect regression of the number of safe choices on lottery characteristics. The regression specification is the same as in equation 2 except for the first term:

$$\textit{number of safe choices} = \alpha^{+} \times UU^{+} + \alpha^{-} \times UU^{-} + \beta_L \times u_L + \beta_H \times u_H + \alpha_R \times U + \textit{constant} + u_i + \epsilon_{ij} \quad (3)$$

Column four shows the random-effect equivalent. A robust form of the Hausmann specification test (Wooldridge, 2002, p. 291) rejects the hypothesis that regressors are uncorrelated with the group-specific error, so that only the fixed effect estimates are consistent.

Column five is a regression of the required rate of return at the switching point (if switching occurs and is unique). Column six is the equivalent random effect regression. Both a Hausman specification test and its robust version confirm that the random effect estimates are consistent.

All results confirm that one can reject the hypothesis that subjects are indifferent to *ex-ante* and to *ex-post* inequality. The effects outlined above are not large however. The middle point of the confidence intervals for our parameter estimates correspond to the effect of changing safe payoffs by about 2 ECU, or increasing the frequency of choosing a safe option by one half, or increasing one's required rate of return by 2%. The two-sided 95% confidence interval for our parameter estimates indicate that the real effect of several aspects of the social context could be close to 0.

We further tested our results for robustness by considering only choices that were consistent. We also ran regressions with choices revised for the 3% of choice cases where inattention could account for inconsistency in choices (*cf.* page 4). Results are robust to those changes. We also performed regressions by sub-groups (table 11), for males, subjects who study social sciences, subjects who lived most of their life in towns with more than 100000 inhabitants, subjects who indicated they were religious, subjects who were politically on the left and subjects who reported living alone. We find that average effects are similar to those in the main regressions (table 10), although not all effects remain significant – this is because of the lower number of observations to draw from.

4.2. Categorization of individual behavior

We now analyze individual behavior by comparing the number of safe choices made by our subjects across social situations. Looking at behavior of our subjects on a case-by-case basis allows us to determine if the small but significant effects identified in the previous part are driven by moderate but general tendencies of all individuals, or by the strong preferences of a small portion of the population. In the first case, we would find that subjects react to the context all in the same but moderate way, in the second case, we would find that only a few individuals are choosing significantly safer or riskier options depending on the context.

We identify individual behavior by running regressions of the number of safe choices on lottery characteristics, individual-by-individual (equation 3). Parameter estimates give us the average number of safe choices by the subject (constant term), how many more safe choices he made in the individual risk situation (α_R), how many more safe choices he made when faced with positively correlated social lotteries (α^+), *etc*...

We define a subject as being significantly affected by a given social situation ($UU^+, UU^-, ...$) if the absolute value of the parameter for that situation ($\alpha^+, \alpha^-, ...$) is greater or equal to 1. This indicates that the subjects made on average at least one more or less safe choice in that situation, on average, compared to his average number of safe choices, while controlling for other lottery characteristics. We represent individual β_L and β_H in a scatterplot (figure 2, appendix C). Figure 3 represents individual α^+ and α^-. Individual $\alpha^+$and α_R are shown in figure 4. Table 6 shows the count of subjects who exhibited behavior that fit each hypothesis, by treatment and overall. Behavior consistent with hypothesis 1 is such that both $|\alpha^+|$ and $|\alpha^-|$ are strictly less than 1 (represented by points in the center square of figure 3). Behavior consistent with hypothesis 2 is such that $\alpha^+ - \alpha_R \geq 1$ (represented by points above the bold line in figure 4). Behavior consistent with hypothesis 4 is such that $\beta_H \leq -1$ (represented by points below the horizontal bold line in figure 2). Behavior consistent with hypothesis 4' is such that $\beta_L \leq -1$ (represented by points to the left of the vertical bold line in figure 2). Behavior consistent with hypothesis 5 is such that $|\alpha^+ - \alpha^-| < 1$ (represented by points between the two dotted diagonals in figure 3). Behavior consistent with hypothesis 6 is such that $\alpha^- - \alpha^+ \geq 1$ (point below the lower dotted diagonal in figure 3).

Table 6: Classification of decision patterns, by individuals.

	Fairness treatment	Efficiency treatment	Total
Hypothesis 1: no effect of risk on others if bear risk as well ($Uu \simeq UU^+ \simeq UU^-$)	65	46	111
Hypothesis 2: aversion to risk on other ($U \succ UU^+$)	30 (*vs.* 18 prefer risk on other),	35 (*vs.* 21 prefer risk on other)	65 (*vs.* 39 prefer risk on other)
Hypothesis 4: more risk taking if peer receives 50 ($Uu_H \succ Uu$)	21 (*vs.* 16 less risk taking)	30 (*vs.* 19 less risk taking)	51 (*vs.* 35 less risk taking)
Hypothesis 4': more risk taking if peer receives 30 ($Uu_L \succ Uu$)	30 (*vs.* 14 less risk taking)	30 (*vs.* 22 less risk taking)	60 (*vs.* 36 less risk taking)
Hypothesis 5: indifference to correlation in payoffs ($UU+ \simeq UU-$)	72	59	131
Hypothesis 6: aversion to *ex-post* inequality in lotteries ($UU+ \succ UU-$)	31 (*vs.* 4 prefer UU^-)	32 (*vs.* 13 prefer UU^-)	63 (*vs.* 17 prefer UU^-)
N	107	104	211

Table 6 shows that hypotheses 1 and 5 hold for a majority of subjects; that is, most subjects are indifferent to whether their peer bears risk (hypothesis 1) and to *ex-post* distribution of payoffs as long as payoffs are equal in expectations (hypothesis 5). Only a minority of subjects are sensitive to the social setting; hypotheses 2, 4 and 6 are verified in terms of the average behavior only because more subjects behave in a way that fits that hypothesis than in a way that contradicts it, and the weight of their behavior is sufficient to lead to a small although significant effect overall.

Robust social context effects are those where many people are subject to the effect of this social context and the majority of those who are subject to it react in the same way to it. When observing numbers (n_1, n_2, n_3), with n_1 those who prefer A to B, n_2 those who are indifferent and n_3 those who prefer B to A, we can test whether $n_1 > n_3$ by comparing those numbers to $\frac{n_1+n_3}{2}$, which is the number of people who would be expected to be at the extremes if being at the extreme was simply the result of a symmetrically distributed random process. The χ^2 statistic for this test is $\frac{(n_1-\frac{n_1+n_3}{2})^2}{\frac{n_1+n_3}{2}} + \frac{(n_2-n_2)^2}{n_2} + \frac{(n_3-\frac{n_1+n_3}{2})^2}{\frac{n_1+n_3}{2}} = \frac{(n_1-n_3)^2}{n_1+n_3}$. The critical value of this χ^2 test with 2 degrees of freedom and a *p*-value of 5% is 5.99. We find that the most significant effect is less risk taking if payoffs are negatively correlated (hypothesis 6) (63 subjects for, 17 against, 131 indifferent, $\chi^2 = 26.5$). Lower risk aversion in an individual setting is also significant (65 subjects for, 39 against, 107 indifferent, $\chi^2 = 6.5$). Finally, there is more risk taking if the peer receives a low payoff in the safe alternative (hypothesis 4')

(60 subjects for, 36 against, 115 indifferent, $\chi^2 = 6$). The effect of the peer receiving a high payoff in the safe alternative is however not significant. We also confirm that the effect of correlation in payoffs is stronger in the fairness treatment (hypothesis 7); that is, more subjects exhibit behavior that is consistent with this hypotheses in this treatment.

We go further in the next part into the analysis of differences in behavior across treatments.

4.3. Treatment effect

In this section, we compare results in the fairness and in the efficiency treatment. We therefore run the regressions presented in table 10 for each treatment (table 12). One significant differences occurs in the logit regressions (columns 1 and 2), whereby sensitivity to own payoff is higher in the fairness treatment. This may be because this treatment focused attention on own payoff, while in the efficiency treatment, one could more easily make choices based on the sum of payoffs. We also find that subjects in the fairness treatment are significantly more likely than subjects in the efficiency treatment to take a risk when the peer receives a low 30 ECU payoff in the safe option. Other differences are not significant. We do find however that effects of the social context appear to be better defined in the fairness treatment than in the efficiency treatment, in the sense that parameter estimates are more precise.

We find that the effect of inequality in safe payoffs is significant only in the fairness treatment. In that treatment, a subject is more likely to choose a safe payoff that gives 40 ECU to his peer than a safe payoff that gives 30 ECU to his peer (dislike for safe payoffs that are disadvantageous to his peer). He is also less likely to choose a safe payoff that gives 40 ECU to his peer than a safe payoff that gives 50 ECU to his peer (dislike for safe payoffs that are advantageous to his peer). This finding is confirmed when comparing individual behavior by treatment (section 4.2). This combination of altruism when advantaged and competitiveness when disadvantaged is typical of social choice under certainty (Fehr and Schmidt, 1999) and corresponds to hypothesis 4. This pattern of inequality aversion is not significant however in the efficiency treatment, possibly because the payoff of the peer is less salient there.

We also find that aversion to *ex-post* inequality in payoffs is consistently significant in the fairness treatment but not than in the efficiency treatment. It may be that as per hypothesis 7, presenting payoffs added up moderated the distaste of subjects for *ex-post* inequality in payoffs by underlining the efficiency benefits of having negatively correlated payoffs (less risk at the level of the pair). Presenting payoffs added up also may have moderated the preference of subjects for *ex-post* equality in payoffs by underlining the efficiency costs of positively correlated payoffs (higher risk at the level of the pair). This finding is confirmed when considered results from section 4.2, whereby a greater number of subjects preferred negatively correlated lotteries in the efficiency treatment than in the fairness treatment.

4.4. Comparing expressed and actual preferences

A topic that existing research does not usually deal with is whether preferences of the subjects are the result of conscious preferences or are driven by sub-conscious processes. We therefore asked our subjects a series of eight questions about the experiment and about how they reached their decisions. The questionnaire was designed based on written feedback in a pilot of the experiment, and on our own theoretical interests. Summary statistics for the answers are shown in table 7. The questionnaire is available on demand.

We find that most subjects reported not caring what their peer would receive (answers to question 7 and 8.a). However, they also had a tendency to agree that they tried to maximize the sum of payoffs for themselves and their peer (question 8.d), and they reported not caring if they got higher payoffs than their peer (question 8.f). This goes against our finding that they disliked the safe option if it gave a high payoff to their peer.

We find that most subjects who said they did not consider the payoffs of their peer in their decision (question 7) were however aware that the experiment dealt with how payoffs of someone else influence one's risk attitude (answers to question 1). Even before being asked whether they took their peer into account in their decision, many of them already said they did not care about what their peer would receive and whether that was more or less than themselves (answers to question 2). None of our subjects attempted to justify why they did not care what their peer received. However, one subject in the pilot study for this experiment explained that there was no reason for him to care what the specific peer that was assigned to him would receive, since what matters are broader outcomes at the level of the laboratory.

Answers to question 2 by those who said they took their peer into account in their decisions were notable by their variety, showing that there are many ways to take account of others. Some of the subjects said they chose so they would be satisfied by the outcome whether they were the decider or the recipient, others that they tried to minimize overall risk, some others that they tried to guarantee a given minimum payoff for both, or payoffs that were similar for both, or the same chances of a high payoff. Quite understandably, those who took into account their peer reported finding it significantly more difficult to reach decisions (question 3, mean 2.1 *vs.* 1.7 for those who did not take their peer into account). There are significant differences also in how they answer question 8, (a) to (g). Those who did not consider their peer were more likely to agree with the first statement (a), as can be expected since this is the same question reversed, and they were more likely to disagree with the other statements (b to g), which also makes sense since those questions pertain to how the social context influenced their decision.

There are no great differences in the average answers to questions about the experiment across treatments, but subjects in the efficiency treatment appear to have found it slightly more difficult to make choices (question 3). This may be because more of them took their peer into account, and those who took their peer into account found it more difficult to reach decisions. Maybe for the same reason, subjects in the efficiency treatment were more likely to prefer no risk on their peer (question 8.b). Subjects in the fairness treatment were more likely to disagree that getting higher payoffs than their peer was important (question 8.f) or that they preferred positively correlated payoffs (question 8.c). This goes against our observations about differences in behavior across treatments in the experiment.

We ran regressions on the sub-samples of those subjects who took into account their peer and those who did not (table 13). We find that *ex-post* inequality in payoffs indeed did not influence the subjects who said they did not take into account their peer. However, those subjects appear to have been influenced by the payoff of their peer in the safe option. Subjects who said they ignored payoffs of their peer may be those who reasoned that it does not make sense to think about the distribution of payoffs *ex-post* as long as the allocation procedure is fair, while they may still have cared about distribution of payoffs *ex-ante*. That is confirmed when we observe that not all those who said they did not take into account their peer were categorized as egoists from their choice of lotteries from the list of safe social outcome comparisons (see section 4.5 below). Alternatively, those subjects may have reacted to inequality in the safe payoff in a non-conscious way.

Regressions also show that the subjects who said they took their peer into account did not have an overall bias for or against inequality in safe payoffs. As we see in section 4.5, this may be the result of how who took their peer into account are a mix of competitive and altruistic subjects. While a competitive subjects would favor safe payoffs that give him an advantage, thus resulting in a bias for the safe option when the peer receives 30 ECU, an altruistic subject would instead favor the risky option in this case. The reverse applies for the case when the peer receives 50 ECU.

This section showed that subjects were aware of how they reached their decisions in the sense that those who reported ignoring their peer indeed were less sensitive to the social context. However, the average report by subjects did not necessarily fit with their average behavior. Finally, subjects who took their peer into account had more difficulty reaching decisions, which supports hypothesis 1 whereby risk and fairness concerns are difficult to combine.

4.5. Social risk aversion and social preferences

Previous experiment have shown that there is no obvious link between social preferences under risk and under certainty (Brennan et al., 2008; Bradler, 2009; Schwerter, 2013; Bolton et al., 2015; Linde and Sonnemans, 2015). We consider if this is the case in our experiment as well by classifying choices in the safe social payoff comparisons as per table 3. We find that we can classify 129 of our 211 subjects as either egoist, altruistic or competitive. Of those, 78% are egoists and 16% are altruistic.

If we compare those types with answers to question 7, we find that 74% of the "egoists" answered that they did not take their peer into account, while 75% of the altruists and competitive subjects answered that they took their peer into account. The correlation between social choice under certainty and answer to question 7 is high but not perfect.

A broader definition of types allows us to classify 171 of our 211 subjects. This broader definition allows for one deviation from the choices of the "ideal type" (table 3) in the first five safe social outcome comparisons and one deviation in the last five safe social outcome comparisons. Proportion of types and correspondence with answers to question 7 are the same as before.

Running logit regressions for each type of subjects, first under the strict definition of type, then under the enlarged definition of types (table 15), we find that altruists (columns 3 and 6) are more likely than other types to select the risky option if the safe option gives only 30 ECU to their peer. They are also those who react the most strongly to *ex-post* inequality in payoffs, being particularly averse to negatively correlated lotteries. It may be that altruists anticipate the negative emotions that their peer might experience if outcomes of the lottery are unequal and in favor of the decision-maker. Preferences of altruists under risk are therefore compatible to some extent with their preferences under certainty.

On the other hand, egoists still favored positively correlated lotteries (columns 2 and 5), and they also preferred individual risk to social risk. This shows that egoism under certainty does not mean a subject does not care about the social context under risk. Finally, competitive subjects (columns 1 and 4) were consistent in their preferences under risk, as they preferred the safe option if it gave a low payoff to their peer and were particularly likely to choose to take a risk rather than leave their peer with a high payoff.

This part showed that social preferences under certainty influence risk taking if inequality in payoffs appears in the safe alternative. Altruists and competitive subjects then behave in a way that is consistent with their preferences under certainty. On the other hand, the social context of a decision under risk still influences the choice of subjects who ignored payoffs for their peer under certainty. It may be that some subjects who are egoist out of principle in the safe condition do not know how to apply this principle under risk and therefore follow a more intuitive decision process.

5. Conclusion

We contrasted two different ways to present the social context in a social lottery experiment. The first underlines inequalities in payoffs and risk at the individual level, while the second underlines variations in joint payoffs and risk at the level of the pair. The first, "fairness", treatment presented payoffs for oneself and for one's peer side-by-side, as was done in previous experiments on the topic of social preferences under risk. The second, "efficiency", treatment presented payoffs added-up, so subjects learned how their own payoff and the sum of their and their peer's payoffs varied depending on the outcome of a coin draw.

Unlike many experiments in the literature, we did find that the social context had an impact on the choices of our subject at the aggregate level. While this impact was small, it was significant from a statistical point of view. We do not think however that our results contradict the existing literature. Our experiment simply had more subjects making more decision than other papers.[7] Indeed, we would also have concluded that the effect of the social context was not significant if we had had a smaller sample. Effects of the social context on risk taking are difficult to identify because most subjects are indifferent to the social context; it is the behavior of a minority of subjects that drives aggregate effects in one direction.

Our most robust result was that subjects disliked social lotteries that led to inequality *ex-post*. This was consistent with *ex-post* inequality aversion (hypothesis 6). This effect was particularly strong in the fairness treatment, and was more moderate in the

[7] We had 211 subjects making a total of 142 binary choices each. Only a few other experiments have more than 100 decision-makers – we do not count subjects who are passive recipients. Bolton and Ockenfels (2010) has 364 deciders, but each of them takes one decision in one social context only. Rohde and Rohde (2011); Linde and Sonnemans (2012) both have about 120 participants making about 40 choices each. Each subject has half a chance to be a decider. Gamba et al. (2014) has 434 participants but those are divided across four treatments (between-subject design). Bolton et al. (2015) also has a between-subject design, with 160 deciders divided across five treatments. Adam et al. (2014) has a within-subject design with 140 subjects making a total of 63 binary choices. Vieider et al. (2015) reports on 24 certainty equivalents elicited from each of 200 subjects who are divided into two treatments, one with individual risk and the other with social risk.

efficiency treatment. This fit with our hypothesis 7 whereby drawing attention to joint payoffs would make subjects more inclined to reduce risk at the level of the pair, and thus to moderate their dislike for negatively correlated payoffs in social lotteries.

We confirmed that aggregate behavior was such that subjects were less likely to take risk if another person was then also exposed to risk (hypothesis 2). We also found that on average subjects were *ex-ante* inequality averse (hypothesis 4). However, this effect held only in the fairness treatment, which drew attention to inequality in payoffs. Payoff of the peer did not appear to act as an aspiration level (hypothesis 3). Indeed, low safe payoffs for the peer led subjects to favor the risky option, rather than low safe payoff for the peer making subjects more likely to be satisfied with a low safe payoff for themselves. Our design was however not strictly comparable with the usual social comparison experimental design, so that our results do not necessarily contradict this strand of literature.

We further explored the origin of social preferences under risk by looking at individual behavior and at answers to our post-experimental questionnaire. About half of our subjects reported not taking care of the payoff of their peer, which is behavior that fits hypothesis 1. Further confirming hypothesis 1, subjects who reported that they did not take account of their peer found the choice tasks easier to perform than those who reported that they took into account their peer. This confirms that the difficulty of taking into account both risk and social concerns may be a factor leading to social concerns being crowded out in the mind of some of our subjects. We found however that hypothesis 1 held only for half of the subjects. Aggregate behavior varied depending on the social context and many subjects reported taking their peer into account, with their behavior in the experiment confirming that they were indeed more sensitive to the social context than others.

Further examination of individual behavior showed that subjects who reported not taking care of their peer were also majoritarily egoistic in their choices among different distributions of safe payoffs. Indifference to the social context may therefore not be a result of crowding out (hypothesis 1), but simply of egoism. Further showing a link between social concerns under risk and under risk, we found that subjects who were altruistic when choosing among distribution of payoffs under certainty were also particularly likely to take risk to prevent their peer receiving a low payoff in the safe option. We would need more data to explore further the relation between social preferences under certainty and under risk; indeed, most subjects are egoistic which means that one must invite many individuals in order to obtain a good sample of altruistic or competitive subjects.

In conclusion, we found that the social context matters for risk perceptions, but the aggregate effect is small, especially because only about half of the subjects do take the context into account. Our results are therefore consistent with most of the literature, including papers that argue that risk crowds out fairness considerations (this is the case for most of our subjects) and papers that argue that subjects care mostly about procedural fairness (most of our subjects are indifferent to correlation in social lottery payoffs). It is only because we have a large sample that we are able to show that social context has a significant effect overall, which is driven by the preferences of a few subjects against *ex-post* and *ex-ante* inequality.

Further research about preferences over social risk therefore requires large samples as effects of the social setting are small and most people cannot or do not want to think of their decisions in terms of their own interest and that of their peer. This is understandable in so far as there is no clear and established criterion for evaluating the relative desirability of different types of social risks. It is therefore not so surprising that subjects would decide to act on the one thing they know about (their own interest) rather than having to wonder if less variability of payoffs at the aggregate level is desirable or if it is important to get equal payoffs *ex-post*.

Future smaller scale laboratory research could complement the way we tried to draw the attention of our subjects towards different aspects of social risks. For example, one may focus on comparing the behavior of people when they are paired with someone under a "cooperative" condition and under a "competitive" condition. We could do this by inducing a cooperative or competitive spirit before asking people to choose among social risks. For example, people might be asked to play a cooperative or a competitive game with their peer before making choices among social lotteries. One could also invite people who are partners in real life (couples, friends) or competitors (members of competing football clubs, for example). This would permit further testing of the role of the social context in the decision to take risks.

Another lesson of our experiment is methodological and is about the benefit of asking subjects directly, after the experiment, how they made their choice. Experimental economics does not generally exploit this possibility even though it can allow us to address the discovered preferences hypothesis of Plott (1996). Post-experimental feedback is particularly interesting from a methodological point of view because they provide reports that are informed by the experience of a specific situation, and therefore more informative than simple surveys based on hypothetical questions. This is a way to address the common argument that experiments do not reflect reality; while the laboratory situation does not represent any real life situation accurately, the type of reasoning and feelings the experimental conditions elicit are similar to those of the real life situation. Therefore, getting subjects into one of those situations elicits from them relevant behavior, reasoning and feedback.

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A. Answers to the post-experimental questionnaire

Table 7: About the experiment

	Fairness treatment			Efficiency treatment					Significance
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Min	Max	of difference
1. What was this experiment about in your opinion? (free field)									
2. Please briefly describe how you took your decisions. (free field)									
3. Decisions were easy to make (1 agree, 4 disagree)	107	1.8	.6	104	2	.6	1	4	*
4. Instructions were easy to understand (1 agree, 4 disagree)	107	1.8	.8	104	1.8	.7	1	4	
5. I knew another participant (1 yes 0 no)	107	8%		104	2%	0.1	0	1	*
6. Payment is appropriate (1 yes 0 no)	107	62%		104	68%	0.5	0	1	
7. I took peer into consideration (1 yes 0 no)	107	44%		104	52%	0.5	0	1	
8.a) I consider only my own payoff (1 agree, 4 disagree)	107	1.7	.8	104	1.8	.8	1	4	
8.b) I prefer no risk on peer (idem)	107	3	.9	104	2.7	.9	1	4	*
8.c) I prefer positively correlated payoffs (idem)	107	2.8	1	104	2.5	1	1	4	*
8.d) I maximized the sum of payoffs (idem)	107	2.2	1.1	104	2.2	1	1	4	
8.e) I prefer risk on peer if risk on me (idem)	107	2.6	1	104	2.4	.9	1	4	
8.f) Getting higher payoff than peer is important (idem)	107	3.2	.9	104	2.9	.9	1	4	*
8.g) I prefer not knowing payoff of peer (idem)	107	2.5	1	104	2.3	.9	1	4	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Two-sample Wilcoxon rank-sum (Mann-Whitney) test for differences in ordinal variables
Two-sample test of proportions for differences in binary variables

Table 8: Demographics

Variable	Fairness treatment Obs	Mean	Std. Dev.	Efficiency treatment Obs	Mean	Std. Dev.	Min	Max
Age	107	24.7	5	104	25.1	4.1	19	62
Males	107	39%	0.5	104	29%	0.5	0	1
Germans	107	96%	0.2	104	92%	0.3	0	1
Education level	107			104				
High school degree (Abitur)		61%			47%			
University up to Bachelor		25%			31%			
Master, Diplom, PhD		9%			17%			
Other		5%			5%			
Field of study	107			104				
Social sciences		38%			35%			
Human sciences		17%			20%			
Natural sciences		14%			15%			
Size of town (Higher is smaller)	107	3.5	1.4	104	3.2	1.4	1	6
Religious	107	19%	0.4	104	26%	0.5	0	1
Political affiliation	107			104				
Left		16%			9%			
Social democrat		25%			22%			
Liberal		6%			3%			
Conservative		4%			13%			
Neutral / Moderate		32%			30%			
Revenue source	107			104				
Work (full time, part time)		20%			34%			
Parents		37%			34%			
Bursary / grants		26%			23%			
Credit		6%			2%			
Expenses per month[1]	107	1.9	1	104	2	1.1	1	6
Home alone	107	36%	0.5	104	28%	0.5	0	1

[1] Expenses per month are coded as 1=less than 500€, 2=501-800€, 3=801-1200€, 4=1201-200€, 5=more than 2000€.

Table 9: Attitudes to risk, fairness and trust

	Fairness treatment			Efficiency treatment				
Variable	Obs	Mean	Std. Dev.	Obs	Mean	Std. Dev.	Min	Max
Risk attitude (Higher is less risk averse)	107	2.3	.6	104	2.3	.6	1	4
Equal pay is fairer (1 yes 0 no)	107	19%	.4	104	30%	.4	0	1
One can trust in people (1=agree, 4=disagree)	107	2.3	.6	104	2.3	.7	1	4
One cannot rely on people (idem)	107	2.9	.8	104	2.8	.7	1	4
One should not trust unknown people (idem)	107	2.2	.8	104	2.1	.8	1	4
People try to be fair (1 yes 0 no)	107	61%	.5	104	64%	.5	0	1
People follow their own interest (1 yes 0 no)	107	62%	.5	104	58%	.5	0	1
Trustfulness index	107	0	4.6	104	0	5	-11.2	12.4

The last five questions are taken from the fairness, trust and helpfulness questions in the General Social Survey of the National Opinion Research Center at the University of Chicago. Answers to those questions are highly correlated (Cronbach's alpha is 78%). Rather than simply sum up the answers however, we compute an index of trustfulness from the answer to those questions by using a single-factor measurement model whereby answers are modeled as ordered logit. The index ranges from -11 (most trustful) to 12 (least trustful).

B. Regression tables

Table 10: Overall regressions, fixed and random effects

	fixed effect logit	random effect logit	fixed effect	random effect	fixed effect	random effect
dependent =	choice of lottery A (safe option)		number of safe choices		ror at switching point	
safe payoff=31	1.93*** [1.62,2.24]	1.89*** [1.55,2.23]				
safe_payoff=34	2.64*** [2.25,3.02]	2.59*** [2.24,2.95]				
safe_payoff=36	3.30*** [2.86,3.74]	3.26*** [2.88,3.64]				
safe_payoff=38	3.95*** [3.49,4.41]	3.91*** [3.46,4.36]				
safe_payoff=40	5.34*** [4.83,5.85]	5.31*** [4.81,5.80]				
safe_payoff=42	5.82*** [5.25,6.40]	5.79*** [5.21,6.38]				
safe_payoff=44	6.20*** [5.58,6.81]	6.17*** [5.56,6.77]				
safe_payoff=46	7.05*** [6.28,7.82]	7.03*** [6.37,7.69]				
safe_payoff=49	7.68*** [6.90,8.46]	7.66*** [6.92,8.40]				
safe_payoff=53	8.38*** [7.53,9.24]	8.37*** [7.53,9.21]				
safe_payoff=58	7.87*** [7.04,8.69]	7.85*** [7.09,8.62]				
peer receives 30	-0.27** [-0.46,-0.07]	-0.27** [-0.45,-0.08]	-0.29** [-0.49,-0.08]	-0.29* [-0.51,-0.06]	-0.02* [-0.04,-0.00]	-0.02* [-0.04,-0.00]
peer receives 50	-0.23** [-0.37,-0.08]	-0.23** [-0.40,-0.06]	-0.24** [-0.41,-0.08]	-0.24* [-0.43,-0.06]	-0.02+ [-0.04,0.00]	-0.02+ [-0.04,0.00]
negative correlation	0.16** [0.04,0.29]	0.16* [0.03,0.30]	0.18** [0.05,0.30]	0.18** [0.05,0.30]	0.02* [0.00,0.03]	0.02* [0.00,0.03]
positive correlation	-0.25*** [-0.39,-0.11]	-0.25*** [-0.37,-0.13]	-0.27*** [-0.41,-0.13]	-0.27** [-0.44,-0.10]	-0.01+ [-0.03,0.00]	-0.01* [-0.03,-0.00]
individual risk	-0.54*** [-0.74,-0.34]	-0.54*** [-0.73,-0.35]	-0.59*** [-0.79,-0.38]	-0.59*** [-0.80,-0.37]	-0.04*** [-0.07,-0.02]	-0.04*** [-0.07,-0.02]
male		-1.52*** [-2.16,-0.89]		-1.58*** [-2.26,-0.91]		-0.16*** [-0.23,-0.10]
risk loving		-1.49*** [-2.07,-0.90]		-1.47*** [-1.96,-0.97]		-0.14*** [-0.19,-0.09]
Constant		0.71 [-0.70,2.12]	8.00*** [7.61,8.39]	11.93*** [10.87,12.98]	0.34*** [0.31,0.38]	0.71*** [0.60,0.82]
N	26532	27852	2321	2321	1959	1959
Subjects	201	211	211	211	209	209
ll	-7508.1	-8475.6	-4223.7		1199.1	
χ^2	695.0***	630.9***	41.4***	104.2***	37.3***	113.0***
$\alpha^+ - \alpha_R$	0.29** [0.07,0.51]	0.29* [0.07,0.52]	0.32* [0.07,0.56]	0.32** [0.11,0.52]	0.03** [0.01,0.05]	0.03* [0.01,0.05]

Normal-based 95% confidence intervals in brackets, 100 bootstrap replications.
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 11: Fixed effect regressions, by group of subjects

	males	social science	big town	religious	leftist	home alone
dependent =			number of safe choices			
peer receives 30	-0.25	-0.00	-0.18	0.07	-0.22	-0.39*
	[-0.57,0.08]	[-0.31,0.31]	[-0.59,0.23]	[-0.48,0.62]	[-0.53,0.09]	[-0.78,-0.00]
peer receives 50	-0.19	-0.07	-0.30+	-0.05	-0.32*	-0.33*
	[-0.49,0.10]	[-0.29,0.15]	[-0.60,0.00]	[-0.42,0.32]	[-0.62,-0.02]	[-0.65,-0.01]
negative correlation	0.07	0.03	0.18	0.41*	0.08	0.20+
	[-0.13,0.27]	[-0.17,0.24]	[-0.17,0.53]	[0.02,0.80]	[-0.16,0.32]	[-0.03,0.43]
positive correlation	-0.20	-0.29*	-0.44*	-0.24	0.00	-0.59***
	[-0.48,0.07]	[-0.56,-0.02]	[-0.81,-0.08]	[-0.74,0.26]	[-0.26,0.27]	[-0.91,-0.27]
individual risk	-0.58***	-0.58***	-0.45+	-0.42	-0.53**	-0.75***
	[-0.91,-0.25]	[-0.89,-0.27]	[-0.91,0.00]	[-0.98,0.13]	[-0.85,-0.21]	[-1.12,-0.37]
Constant	6.76***	8.03***	8.18***	8.09***	8.15***	7.85***
	[6.12,7.40]	[7.41,8.64]	[7.62,8.73]	[7.34,8.85]	[7.57,8.72]	[7.23,8.46]
N	792	847	737	517	836	737
Subjects	72	77	67	47	76	67
ll	-1354.37	-1456.71	-1417.93	-1034.59	-1470.22	-1360.57
χ^2	14.06*	15.84**	12.16*	15.25**	15.85**	26.10***

Normal-based 95% confidence intervals in brackets, 100 bootstrap replications.
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 12: Fixed effect regressions, fairness treatment *vs.* efficiency treatment

	fairness	efficiency	fairness	efficiency	fairness	efficiency
dependent =	choice of lottery A (safe option)		number of safe choices		ror at switching point	
safe payoff=31	2.10*** [1.60,2.61]	1.79*** [1.27,2.31]				
safe_payoff=34	2.95*** [2.29,3.60]	2.41*** [1.85,2.96]				
safe_payoff=36	3.72*** [3.05,4.38]	3.01*** [2.39,3.62]				
safe_payoff=38	4.63*** [3.91,5.36]	3.47*** [2.77,4.18]				
safe_payoff=40	6.25*** [5.46,7.05]	4.73*** [3.95,5.51]				
safe_payoff=42	6.80*** [5.97,7.62]	5.18*** [4.32,6.05]				
safe_payoff=44	7.32*** [6.49,8.15]	5.45*** [4.60,6.29]				
safe_payoff=46	8.15*** [7.19,9.12]	6.35*** [5.38,7.31]				
safe_payoff=49	9.10*** [7.97,10.23]	6.72*** [5.68,7.75]				
safe_payoff=53	10.06*** [8.84,11.27]	7.24*** [6.09,8.39]				
safe_payoff=58	9.57*** [8.36,10.78]	6.72*** [5.67,7.76]				
peer receives 30	-0.45* [-0.83,-0.08]	-0.13 [-0.37,0.11]	-0.41** [-0.71,-0.11]	-0.16 [-0.47,0.15]	-0.03+ [-0.06,0.00]	-0.02 [-0.05,0.01]
peer receives 50	-0.27* [-0.52,-0.02]	-0.20+ [-0.43,0.02]	-0.24* [-0.45,-0.03]	-0.25 [-0.56,0.06]	-0.02 [-0.04,0.01]	-0.02 [-0.04,0.01]
negative correlation	0.25* [0.03,0.48]	0.10 [-0.11,0.31]	0.23** [0.06,0.39]	0.12 [-0.13,0.37]	0.02* [0.00,0.04]	0.01 [-0.01,0.03]
positive correlation	-0.34** [-0.56,-0.13]	-0.18+ [-0.39,0.03]	-0.31** [-0.55,-0.08]	-0.22+ [-0.48,0.03]	-0.01 [-0.03,0.01]	-0.01 [-0.04,0.01]
individual risk	-0.65*** [-0.94,-0.37]	-0.47** [-0.75,-0.18]	-0.59*** [-0.87,-0.32]	-0.58*** [-0.91,-0.25]	-0.04* [-0.08,-0.01]	-0.04* [-0.08,-0.01]
Constant			8.09*** [7.55,8.63]	7.90*** [7.36,8.45]	0.34*** [0.29,0.40]	0.34*** [0.28,0.41]
N	13332	13200	1177	1144	1063	896
Subjects	101	100	107	104	107	102
ll	-3188.4	-4224.7	-2067.1	-2146.0	686.1	516.1
χ^2	502.9***	315.4***	33.0***	18.9**	23.9***	9.4+

Normal-based 95% confidence intervals in brackets, 100 bootstrap replications.
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 13: Fixed effect regressions, by level of consideration for the peer

	care	do not care	care	do not care	care	do not care
dependent =	choice of lottery A (safe option)		number of safe choices		ror at switching point	
safe payoff=31	1.87***	2.06***				
	[1.40,2.35]	[1.43,2.68]				
safe_payoff=34	2.35***	3.23***				
	[1.84,2.86]	[2.43,4.03]				
safe_payoff=36	2.73***	4.40***				
	[2.20,3.25]	[3.42,5.39]				
safe_payoff=38	3.19***	5.44***				
	[2.61,3.77]	[4.30,6.58]				
safe_payoff=40	4.39***	7.40***				
	[3.79,4.99]	[6.13,8.67]				
safe_payoff=42	4.78***	8.13***				
	[4.14,5.42]	[6.85,9.40]				
safe_payoff=44	5.09***	8.68***				
	[4.44,5.73]	[7.33,10.02]				
safe_payoff=46	5.59***	10.21***				
	[4.88,6.31]	[8.72,11.71]				
safe_payoff=49	6.03***	11.27***				
	[5.24,6.81]	[9.83,12.71]				
safe_payoff=53	6.66***	12.22***				
	[5.80,7.52]	[11.03,13.41]				
safe_payoff=58	6.30***	11.27***				
	[5.44,7.16]	[10.02,12.52]				
peer receives 30	-0.26+	-0.31+	-0.35*	-0.22*	-0.02	-0.02*
	[-0.56,0.04]	[-0.63,0.01]	[-0.71,-0.00]	[-0.45,-0.00]	[-0.06,0.02]	[-0.04,-0.00]
peer receives 50	-0.25*	-0.22	-0.34**	-0.16	-0.02	-0.02
	[-0.45,-0.05]	[-0.51,0.07]	[-0.60,-0.08]	[-0.36,0.05]	[-0.06,0.02]	[-0.04,0.01]
negative correlation	0.35***	-0.13	0.47***	-0.09	0.04*	-0.00
	[0.16,0.54]	[-0.35,0.09]	[0.20,0.74]	[-0.23,0.04]	[0.01,0.07]	[-0.01,0.01]
positive correlation	-0.31**	-0.16+	-0.44**	-0.12	-0.03+	-0.00
	[-0.54,-0.09]	[-0.35,0.03]	[-0.73,-0.15]	[-0.26,0.03]	[-0.05,0.00]	[-0.02,0.01]
individual risk	-0.46**	-0.75***	-0.63***	-0.55***	-0.05+	-0.04***
	[-0.75,-0.17]	[-1.03,-0.46]	[-1.01,-0.26]	[-0.78,-0.31]	[-0.09,0.00]	[-0.06,-0.02]
Constant			7.72***	8.25***	0.32***	0.36***
			[7.20,8.24]	[7.72,8.79]	[0.26,0.38]	[0.31,0.41]
N	12936	13596	1111	1210	838	1121
Subjects	98	103	101	110	100	109
ll	-4537.4	-2617.2	-2229.0	-1851.4	340.7	966.1
χ^2	362.6***	754.2***	47.3***	26.09***	20.3**	15.2**

Normal-based 95% confidence intervals in brackets, 100 bootstrap replications.
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 14: Fixed effect regressions, fairness treatment *vs.* efficiency treatment, sub-sample who took the peer in consideration

	fairness	efficiency	fairness	efficiency	fairness	efficiency
dependent =	choice of lottery A (safe option)		number of safe choices		ror at switching point	
safe payoff=31	2.10*** [1.46,2.74]	1.73*** [1.17,2.30]				
safe_payoff=34	2.78*** [2.03,3.52]	2.07*** [1.48,2.67]				
safe_payoff=36	3.19*** [2.46,3.92]	2.44*** [1.76,3.11]				
safe_payoff=38	3.95*** [3.15,4.76]	2.69*** [1.99,3.39]				
safe_payoff=40	5.28*** [4.36,6.20]	3.83*** [3.09,4.57]				
safe_payoff=42	5.73*** [4.89,6.57]	4.19*** [3.40,4.98]				
safe_payoff=44	6.10*** [5.24,6.96]	4.46*** [3.71,5.20]				
safe_payoff=46	6.50*** [5.48,7.51]	5.05*** [4.12,5.97]				
safe_payoff=49	7.10*** [6.02,8.18]	5.37*** [4.41,6.33]				
safe_payoff=53	7.88*** [6.73,9.03]	5.92*** [4.91,6.92]				
safe_payoff=58	7.63*** [6.36,8.91]	5.50*** [4.51,6.49]				
peer receives 30	-0.44 [-0.97,0.09]	-0.14 [-0.45,0.17]	-0.51 [-1.22,0.20]	-0.22 [-0.62,0.18]	-0.02 [-0.07,0.03]	-0.03 [-0.09,0.04]
peer receives 50	-0.19 [-0.56,0.17]	-0.29+ [-0.59,0.01]	-0.22 [-0.64,0.20]	-0.44* [-0.84,-0.05]	-0.01 [-0.05,0.03]	-0.03 [-0.07,0.02]
negative correlation	0.50*** [0.23,0.76]	0.26* [0.03,0.49]	0.56** [0.22,0.90]	0.39+ [-0.00,0.78]	0.06** [0.02,0.10]	0.02 [-0.03,0.06]
positive correlation	-0.44** [-0.76,-0.12]	-0.23 [-0.52,0.05]	-0.52* [-0.95,-0.10]	-0.36 [-0.81,0.08]	-0.01 [-0.07,0.04]	-0.04* [-0.07,-0.00]
individual risk	-0.54* [-0.96,-0.12]	-0.42* [-0.80,-0.03]	-0.63* [-1.18,-0.07]	-0.64** [-1.12,-0.16]	-0.03 [-0.09,0.03]	-0.06* [-0.12,-0.00]
Constant			8.03*** [7.34,8.72]	7.45*** [6.69,8.22]	0.33*** [0.25,0.41]	0.32*** [0.23,0.40]
N	5940	6996	517	594	432	406
Subjects						
ll	-1796.2	-2698.3	-1024.8	-1201.4	180.3	161.6
χ^2						

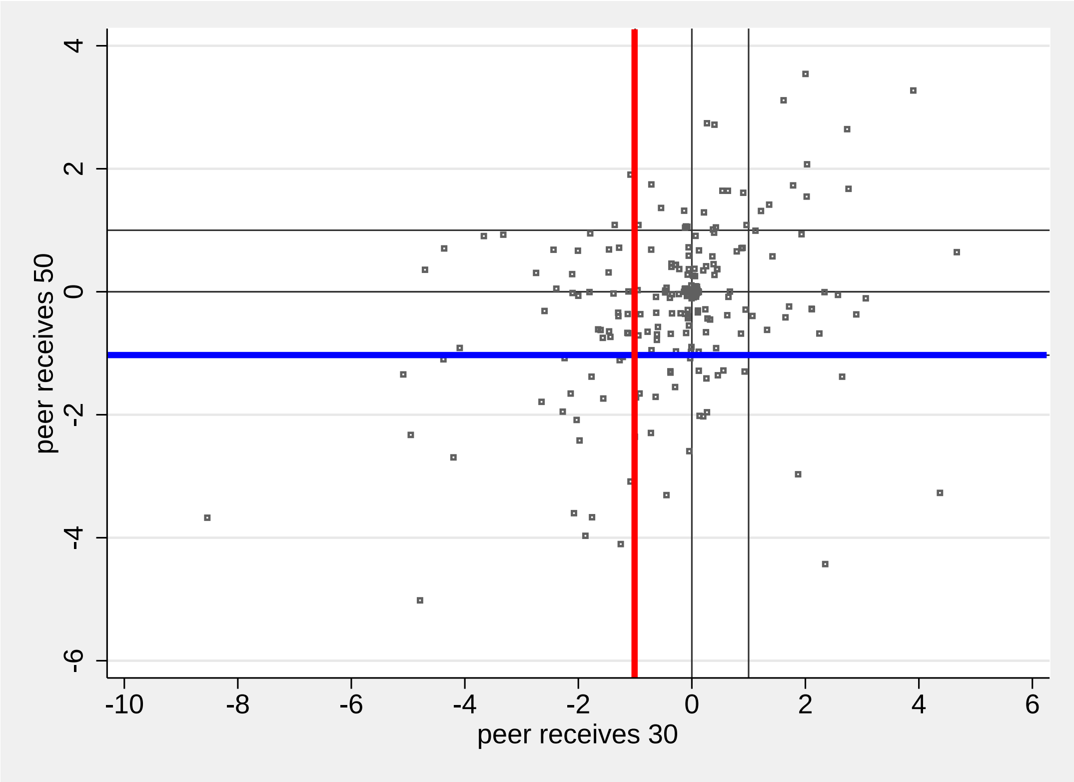
Normal-based 95% confidence intervals in brackets, 100 bootstrap replications.
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 15: Fixed effect regressions, by social value orientation in the safe social choices

	strict definition			extended definition		
	competitive	egoist	altruist	competitive	egoist	altruist
dependent =	choice of lottery A (safe option)					
safe payoff=31	1.24***	2.07***	2.24*	1.63***	2.16***	2.19*
	[0.57,1.91]	[1.56,2.57]	[0.31,4.17]	[0.99,2.26]	[1.60,2.73]	[0.47,3.91]
safe_payoff=34	1.67***	3.20***	2.71**	1.75***	3.08***	2.54**
	[0.73,2.61]	[2.60,3.79]	[0.83,4.59]	[1.14,2.36]	[2.45,3.72]	[0.80,4.28]
safe_payoff=36	2.10***	4.03***	3.31**	2.23***	3.80***	3.45***
	[1.28,2.92]	[3.32,4.74]	[1.30,5.32]	[1.68,2.77]	[3.11,4.48]	[1.66,5.24]
safe_payoff=38	2.27***	5.00***	3.93***	2.38***	4.65***	4.17***
	[1.22,3.32]	[4.18,5.81]	[1.86,6.01]	[1.60,3.15]	[3.87,5.44]	[2.27,6.08]
safe_payoff=40	2.86***	6.89***	5.14***	3.14***	6.28***	5.41***
	[1.73,4.00]	[5.91,7.87]	[3.00,7.28]	[2.27,4.00]	[5.35,7.22]	[3.33,7.50]
safe_payoff=42	2.70***	7.58***	6.01***	2.99***	6.97***	6.25***
	[1.43,3.98]	[6.57,8.59]	[3.73,8.28]	[2.02,3.96]	[6.01,7.94]	[3.99,8.51]
safe_payoff=44	3.18***	8.04***	6.19***	3.67***	7.33***	6.61***
	[2.08,4.29]	[6.93,9.15]	[3.88,8.50]	[2.80,4.53]	[6.30,8.36]	[4.35,8.86]
safe_payoff=46	3.02***	9.35***	7.15***	3.55***	8.63***	8.02***
	[1.71,4.34]	[8.02,10.68]	[4.78,9.52]	[2.48,4.61]	[7.47,9.78]	[5.72,10.33]
safe_payoff=49	3.24***	10.15***	7.59***	3.79***	9.27***	8.40***
	[1.90,4.58]	[8.80,11.49]	[4.94,10.25]	[2.71,4.86]	[8.06,10.48]	[6.01,10.79]
safe_payoff=53	4.22***	11.39***	7.97***	4.67***	10.24***	8.58***
	[2.54,5.91]	[9.88,12.90]	[5.19,10.74]	[3.37,5.98]	[8.76,11.71]	[6.09,11.07]
safe_payoff=58	4.38***	10.62***	7.66***	4.61***	9.59***	8.12***
	[2.95,5.81]	[9.23,12.02]	[4.79,10.53]	[3.40,5.83]	[8.20,10.98]	[5.47,10.77]
peer receives 30	0.56	-0.37*	-1.15*	0.59+	-0.26+	-0.88**
	[-0.37,1.49]	[-0.70,-0.03]	[-2.06,-0.23]	[-0.01,1.20]	[-0.53,0.00]	[-1.47,-0.30]
peer receives 50	-0.21	-0.15	0.03	-0.58*	-0.27+	-0.02
	[-0.74,0.31]	[-0.44,0.15]	[-0.72,0.78]	[-1.05,-0.11]	[-0.56,0.01]	[-0.52,0.48]
negative correlation	0.40	0.10	0.68**	0.27	0.03	0.49*
	[-0.77,1.58]	[-0.05,0.26]	[0.22,1.14]	[-0.46,1.00]	[-0.13,0.18]	[0.12,0.86]
positive correlation	-0.52	-0.34**	-0.12	-0.43	-0.38***	-0.08
	[-1.38,0.33]	[-0.55,-0.14]	[-0.73,0.48]	[-1.03,0.17]	[-0.60,-0.17]	[-0.50,0.35]
individual risk	-0.04	-0.69***	-0.71+	-0.35	-0.66***	-0.64*
	[-1.22,1.15]	[-0.99,-0.38]	[-1.48,0.07]	[-1.33,0.62]	[-0.93,-0.39]	[-1.24,-0.04]
N	1188	12408	2376	1848	15972	3564
Subjects	9	94	18	14	121	27
ll	-539.4	-2567.4	-702.0	-798.4	-3728.9	-994.0
χ^2	609.8***	489.8***	470.8***	1241.5***	401.6***	325.5***

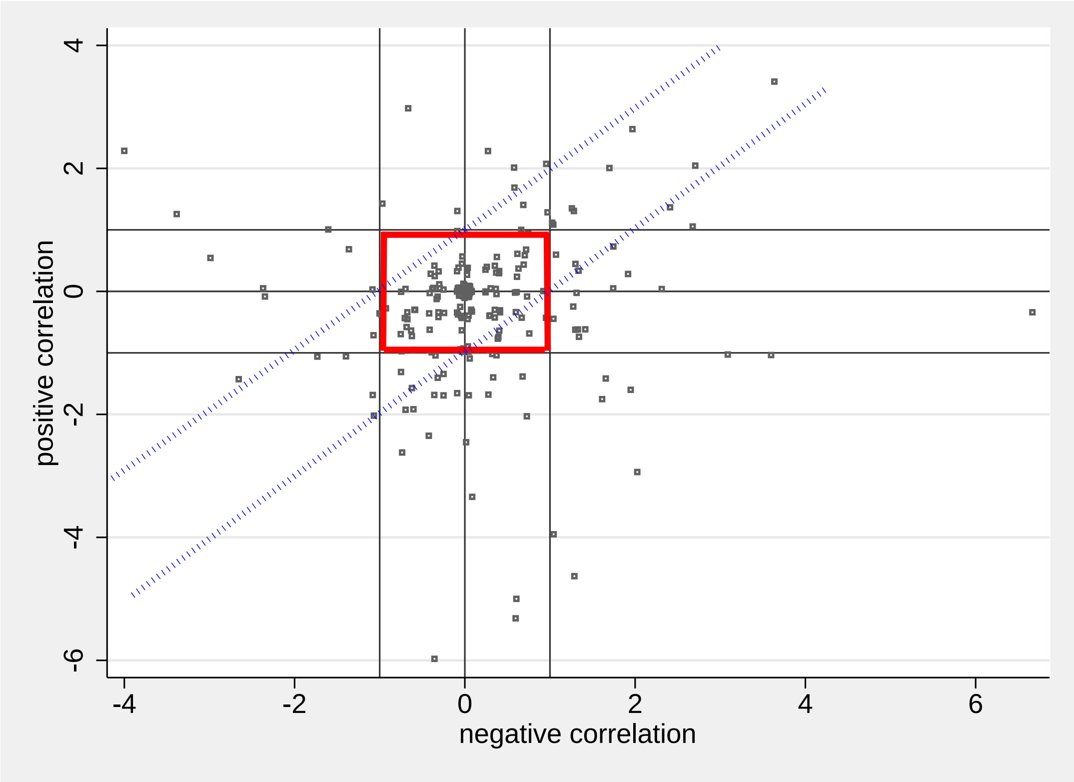
Normal-based 95% confidence intervals in brackets, 100 bootstrap replications.
+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

C. Graphs



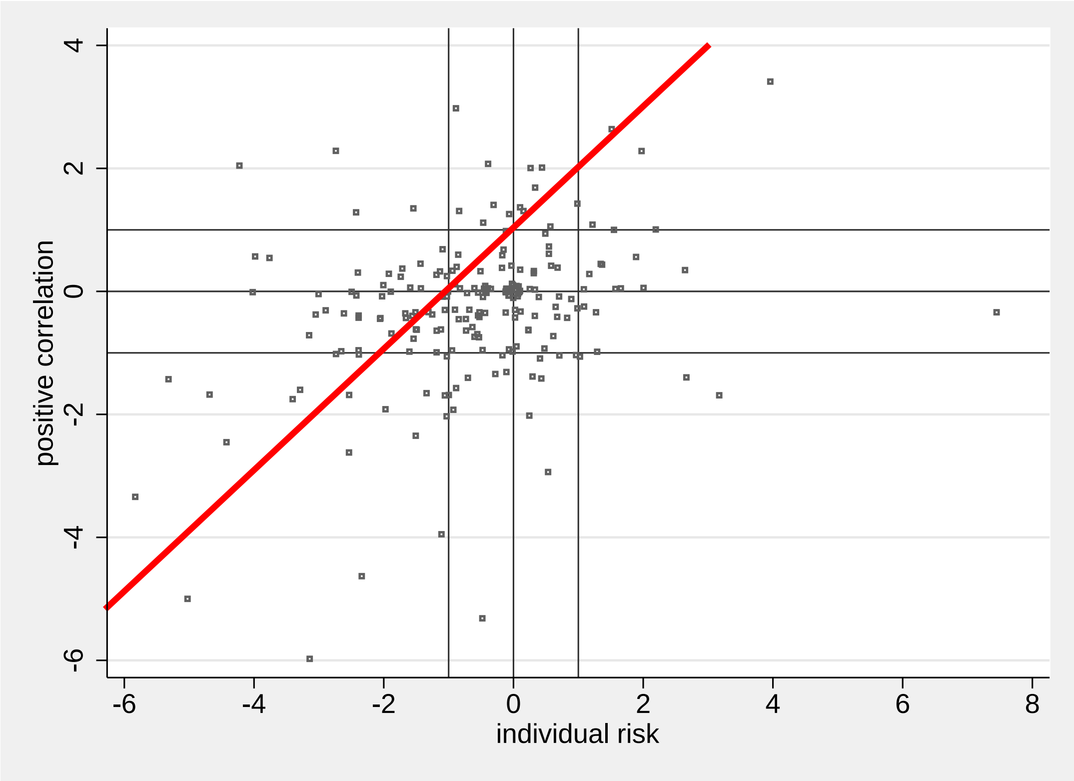
Note: Small random noise was added to the coordinates of points in the graph to avoid overplotting (jittering).

Figure 2: Individual aversion to inequality in safe payoffs



Note: Small random noise was added to the coordinates of points in the graph to avoid overplotting (jittering).

Figure 3: Individual aversion to ex-post inequality



Note: Small random noise was added to the coordinates of points in the graph to avoid overplotting (jittering).

Figure 4: Individual aversion to social risk *vs.* individual risk

D. Instructions (translated from the German original)

Welcome and thank you for your participation! You can earn a sum of money in this experiment which depends on your decisions and those of another participant. It is therefore very important that you thoroughly and carefully read these instructions.

Please turn off your mobile phone now!

Communication with other participants is not allowed. If you have a question, please raise your hand. We will then come to you and answer your question.

You have drawn an envelope from a basket at the beginning of the experiment. PLEASE DO NOT OPEN IT. Only once the experiment is over and you have completed all the necessary tasks will we let you know that you can open the envelope. We will unfortunately have to exclude you from the experiment if you violate these rules.

You will make decisions during the experiment. The point is not to make the right or wrong decisions, but the ones you deem best. All results of the study will be kept strictly confidential and none of the other participants will learn what decisions you took.

Your earnings will be calculated in ECU (Experimental Currency Units). 1 ECU corresponds to 0.15€. At the end of today's session, your total earnings will be converted in euros and will be paid to you confidentially in cash. You will additionally receive a payment of 2.55€ for your participation (=17 ECU).

Running of the experiment

After you read the instructions completely, we will ask you some control questions to check your understanding of the experiment. The experiment does not begin until all participants have answered the control questions correctly. In the experiment, you will have to choose among several options that affect you and another person. Once the main part of the experiment is completed, we will ask you to complete a short questionnaire. This will be presented to you on your screen.

Explanation of the main part of the experiment

Each person in the room will be assigned to another person. We will call the person that will be assigned to you "person X". This assignment is done randomly and neither you nor person X will learn the identity of the other. You will have to make a series of decisions that determine what payment will be made to you and person X at the end of the experiment.

We discuss below the steps in a possible decision situation. There are two types of decision situations:

Situations of type 1

Top right you see an example of a decision situation of type 1 (see Figure 1). Please look at the graph carefully and read the supplemental explanations thoroughly.

(a) Fairness treatment

(b) Efficiency treatment

Figure 5: Screenshot

In the illustration above you can see two lotteries: A and B. The payouts are shown above each bar. The payout on the left side of the bar graph is for you, the payout on the right side of the bar (Fairness treatment: is for person X) (Efficiency treatment: also includes the payout for person X).

Fairness treatment: Lottery A gives you as the decision maker 74 ECU and person X as the recipient 32 ECU. The payout in lottery B depends on chance. The probability that you get 79 ECU is 50% (person X then receives 31 ECU), otherwise you get 37 ECU (person X then receives 31 ECU).

Efficiency treatment: Lottery A gives you as the decision maker 74 ECU and person X as the recipient gets the rest of the 106 ECU. The payout in lottery B depends on chance. The probability that you get 79 ECU is 50% (person X gets the rest of the 110 ECU), otherwise you get 37 ECU (person X gets the rest of the 68 ECU).

Please enter your choice by clicking on A if you prefer A lottery and on B if you prefer lottery B. Please then click on "OK" to go to the next decision. Once you made your decision, a new decision situation with two new lotteries to compare will be shown

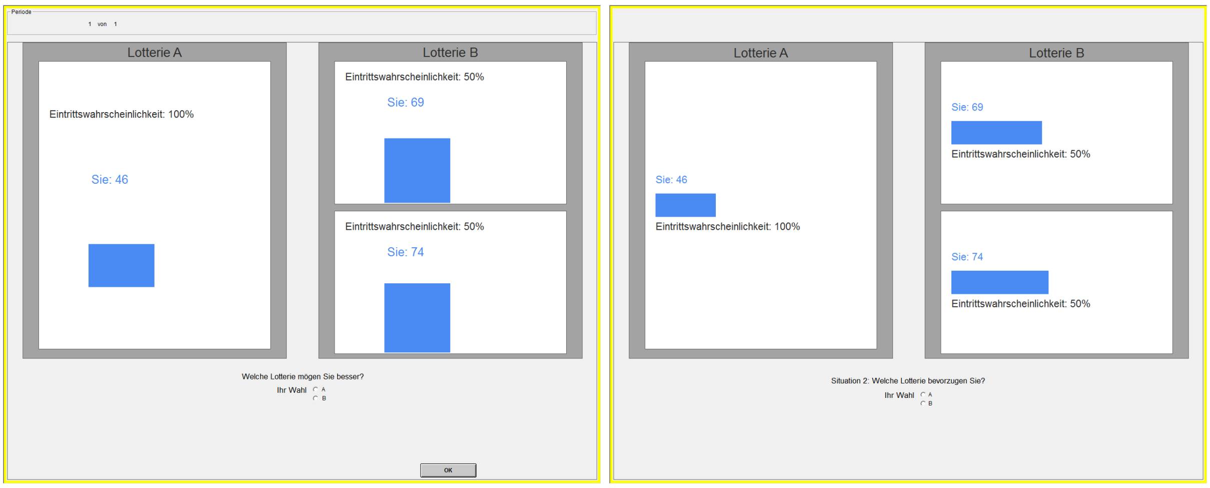
In some other decision situations of the type 1, both lotteries lead to a secure payment. Figure 2 shows the selection screen in this case. Please choose, as in the previous case, the lottery that you prefer.

(a) Fairness treatment (b) Efficiency treatment

Figure 6: Screenshot

Situations of type 2

You see below an example of a decision situation of the type 2 (see Figure 3). In a decision situation of the type 2, the payout for person X does not appear. In this case, the lottery determines only your own payout. Your decision does not affect payment for person X and you will not learn how much person X receives. Please choose as before the lottery that you prefer



(a) Fairness treatment (b) Efficiency treatment

Figure 7: Screenshot

You will go through a total of 147 rounds of decision situations as described above. The first five rounds are only for practice and are not paid. All decision rounds differ from each other and you should therefore pay careful attention to the payouts for yourself and person X.

Determination of payout

Before the experiment, we took 5 envelopes out of a basket with 118 envelopes, 5 envelopes out of a second basket with 5 envelopes and 2 envelopes from a third basket with 24 envelopes. This total of 12 envelopes were then placed in a basket and each of you was asked to draw an envelope from this basket, one after the other (see Figure 4).

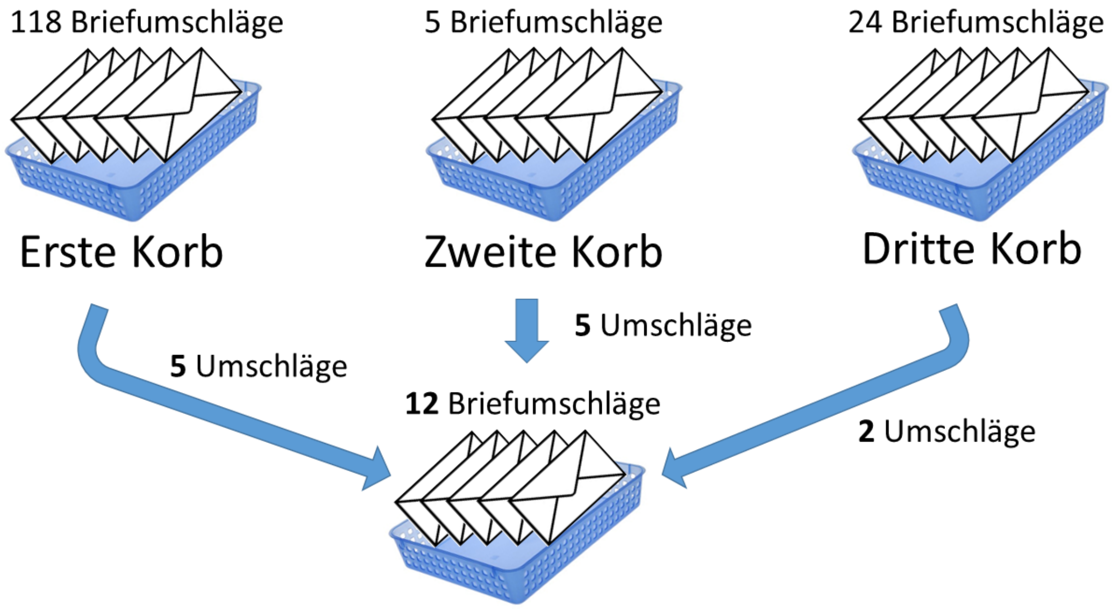


Figure 8: Procedure for the draw of envelopes

You also pulled out another number from 1 to 12 from a deck of cards, which determined your booth in the laboratory.

You were asked to keep your envelope closed until the end of the experiment. At the end of the experiment, when you will have finished all the required tasks, we will ask you to open your envelope and read the paper inside.

Five of the papers say you are a decision-maker

Each envelope in the first basket describes a different decision situation of type 1. If the paper in your envelope says that you are a decision-maker, then your decision determines your payout and the payout of the person X. We will call decision-makers individually in turn in the order of their cabin number. If your cabin number is called and you are a decision-maker, you should get up and go forward to the experimenters (if your number is called and you are not a decision maker, then please keep seated). Below you can see an example of how your paper would look like if you were a decision-maker and the situation described there is as in Figure 1. The name of each decision situation is a unique combination of letters and a number. This name does not refer to the sequence of the situation and is used by us to identify more quickly which situation applies to you.

You are a decision-maker
The decision situation, which determines your payment is situation Qf5.

Fairness treatment: In decision situation Qf5 you had a choice of either 74 ECU (32 ECU for person X) in lottery A and an equal chance of either 79 ECU (31 ECU for person X) or 37 ECU (31 ECU for person X) in lottery B.

Efficiency treatment: In decision situation Qf5 you had a choice of either 74 ECU out of 106 ECU in lottery A and an equal chance of either 79 ECU out of 110 ECU or 37 ECU out of 68 ECU in lottery B.

When you come forward, we will take your cabin number and look on our computers which lottery (A or B) you chose in the situation that is described on the paper in your envelope.

You can not change your decision at this time. We will only carry out the decision you have taken during the experiment. Please make sure, therefore, that your decisions during the experiment correspond to what you want to see carried out at the end of the experiment!

If you chose lottery B in this situation and the lottery B is as in Figure 1, then you will be asked to toss a coin. You get the top payoff in lottery B if the coin shows "head". You get the lower payoff if the coin shows "tail". If you chose lottery A in this situation, then you will get the payout of lottery A. In either case, you will also see how much person X will be paid.

Five of the papers say you are a recipient

Each envelope in the second basket says "You are a recipient". If the sheet in your envelope says that you are a recipient, then we will call you AFTER all decision-makers have received their payments and left the room. The decision-makers left their cabin numbers with us and we put those in a basket. You will be asked to draw a number out of this basket. You will receive the payment which corresponds to the decision of the decision-maker whose number you have drawn. You will see what was the relevant situation for your decision, which lottery (A or B) was chosen by your decision-maker in this situation, and, if the situation called for it, the result of the coin toss (*i.e.* whether the decision maker tossed "head" or "tail"). Therefore, you will know how much your assigned decision-maker earned at the same time as you learn how much you get paid. For example, if your decision-maker opted for lottery A in the situation indicated on his sheet, then you will win the payout for person X in lottery A in this situation.

Below you can see how the sheet of paper would look like if you were a recipient:

You are a recipient

Two of the papers says you are neither a recipient nor a decision-maker

Each envelope in the third basket describes a different decision-making situation of the type 2. If the piece of paper in your envelope says that "you are neither a recipient nor a decision-maker", then your payoff is determined from a decision situation of the type 2 (as shown in Figure 3). After all decision-makers and recipients have left the laboratory, we will ask you to come forward. Below you can see how your paper would look like in this case:

> **You are neither a recipient nor a decision-maker**
> The decision situation which determines your payment is situation Kb2.
> In decision situation Kb2 you had a choice between 46 ECU (Lottery A) and an equal chance of either 69 ECU or 74 ECU (Lottery B).

When you come forward to us, we will check on our computer which lottery (A or B) you chose in the decision situation that is printed on the sheet of paper in your envelope. If you chose lottery B, then you will be asked to toss a coin. If the coin shows "head", then you will get the top payout (on the screen). If the coin shows "tail" then you will get the bottom payout (on the screen). If you chose lottery A, then you will get the payout for lottery A. You will not know what payment the other person who got the same type of envelope as you got.

Summary

1. You will be faced with a series of decision situations.
2. In every decision round you will be asked to choose between two lotteries (A or B).
3. It will take about 20 to 30 minutes for you to make your choices for all 147 decision situations.
4. Once all the decision rounds are over, we will ask you to complete a questionnaire.
5. Once you have completed the questionnaire, we will ask you to open your envelope. The sheet contained in the envelope indicates either that your decision in a given round determines your payment or that the decision of another participant determines your payment. Alternatively, your decision determines only your own payment.
6. Any decision that you made during the experiment could be that which is described in the envelope drawn by you and any participant in the laboratory could be your person X. The chance to be a decision-maker is the same as the chance that you are a recipient. You should therefore always make your decisions as if you will be a decision-maker and as if the decision you make will be the one that determines your payout.

E. Control questions

Please consult figure 5 to answer the control questions:

(a) Fairness treatment (b) Efficiency treatment

Figure 9: Screenshot

1. How many ECU does lottery A give you if you are the decision-maker? (Answer: 59 ECU)
2. How many ECU does person X get in lottery A if you are the decision-maker? (Answer: 49 ECU)
3. What is the probability that you get 35 ECU in lottery B if you are the decision-maker? (Answer: 50%)
4. Assume you are a decision maker: When do you get 73 ECU in lottery B? (Answer: If the coin shows “tail”.)
5. Suppose you win 60 ECU in the main part of the experiment. What does this amount correspond to in euros? (Answer: 9 Euros)
6. How likely is it that you are the decision maker if a situation of type 1 determines your payoff? (Answer: 50 percent)

F. Post experimental questionnaire (translated from the German original)

F.1. About the experiment

1. What was this experiment about in your opinion? (free field)
2. Please briefly describe how you took your decisions. (free field)

3. How difficult was it for you to make your decisions? (From 1 to 4, with very easy = 1, very difficult = 4)

4. How understandable were the instructions? (From 1 to 4, with easy to understand = 1, unintelligible = 4)

5. Did you know someone among the participants in this session? (Yes, No)

6. Is payment appropriate for this experiment? (Yes, No)

7. Did you take the payment for person X into account? (Yes, No)

8. Please give your level of agreement with the following propositions (From 1 to 4, with agree fully = 1, totally disagree = 4)

   a) I chose based on my own payout only.

   b) I prefer that person X not incur risk.

   c) I prefer that person X get the same payment as me in lottery B.

   d) I chose the option that maximizes payoff for me and person X.

   e) If I incur some risk then it is only fair that person X also incur risk.

   f) It was important for me to obtain a higher payoff than person X.

   g) I prefer not to know how much person X obtains.

F.2. Demographics

Finally, we would like to have a few more statistical informations about you.

1. What is your age?

2. What is your gender?

3. What is your nationality?

4. What is your highest qualitfication? (Abitur (High School), two-years University degree, Bachelor, Master, Diplom (=Master), PhD, Other)

5. In case you are studying, what are you studying? (Humanities, Social sciences, Natural sciences, Formal sciences, Other applied sciences, Not relevant)

6. Where have you been living most of your life?

   1. City with more than 1 million inhabitants 2. City with more than 100,000 inhabitants 3. City with more than 10,000 inhabitants 4. Town of less than 10,000 inhabitants 5. Village 6. Countryside.

7. Are you religious? (Yes, No, Unspecified)

8. How would you classify your political affiliation? (Left, social-democrat, liberal, conservative, neutral / moderate, none of the above)

9. What is the main source of income that allows you to fund your living expenses?

   1. Work (full-time) 2. Work (part-time) 3. Parents 4. Scholarship / BAFöG 5. Credit 6. Other

10. How much money do you spend in total over a month? (including food, clothing, rent, heating, water, education, entertainment, etc...)

    1. less than 500 € 2. 501 € - 800 € 3. 801 € -1200 € 4. 1201 € - 2000 € 5. More than 2000 € 6. Unspecified

11. Do you live alone? (Yes, No)

F.3. Risk, fairness and trust.

1. Are you someone who is ready to take risk or do you try to avoid risk overall? (from 1 to 4, not at all ready to take risk, very ready to take risk)

2. Suppose that two people perform the same job in the same company . Both have the same qualifications, but Person A is more productive than person B. Is it fair that Person A get a higher salary? (Yes, No)

3. Do you agree with the following three statements (from 1 to 4, agree fully to disagree completely):

   a) In general, one can trust people.

   b) Nowadays, one cannot rely on anybody.

   c) When dealing with strangers, it's better to be cautious before trusting them.

4. Would you say that most people...

   a) would try to take advantage of you if given the opportunity...

   b) or would try to be fair to you?

5. Would you say that most people...

   a) try to be helpful...

   b) or follow only their own interests?