

SOCIAL PREFERENCES IN PRIVATE DECISIONS*

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Abstract

Social preference models were originally constructed to explain why people spend money to affect the earnings of others. Nevertheless these models make predictions in other settings as well. We therefore test these models in a novel experimental situation where participants face risky decisions that affect only their own earnings. In the social (individual) treatment participants do (not) observe the earnings of others. In the social treatment gambles therefore not only affect absolute but also relative earnings. All outcome-based social preference models predict a treatment difference. We find that decisions are generally the same in both treatments, which suggests these models are less general applicable than their formulation suggests.

Keywords: fairness, social preferences, decision making under risk, experiment

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1. Introduction

Other-regarding preferences have supplanted pure egoism in many economic models, from labor economics (e.g. Demougin, Fluet & Helm, 2006 and Bartling & von Siemens, 2010) to optimal taxation (e.g. Choi, 2009 and Doerrenberg & Peichel, 2012). A large body of literature supports the view that egotism does not accurately describe peoples' preferences and that models benefit from taking other regarding preferences into account (Fehr & Schmidt, 2006). However, other-regarding preferences are modeled in many different ways and there is no general agreement on what the best model is.

Social preference models are inspired by the results of experiments in which money is divided between participants, such as the ultimatum game and the dictator game, and in general they rationalize these results. However, it is unknown whether these models apply more generally. To explore this question we experimentally study social preferences in a new situation in which different social preference models make different predictions. Specifically we test the predictions of several social preference models in situations where people make choices under risk which only affect their own earnings in either a social or a private setting. We consider three different types of outcome-based social preference models: models based on inequity, maximin preferences, and preferences over income rankings. These models make different predictions in our experimental setup.

Earlier experiments show that social concerns can indeed influence decisions under risk. For example, Bohnet en Zeckhauser (2004) show that risk caused by others is more aversive than other forms of risk. In an earlier paper (Linde & Sonnemans, 2012) we show that people become more risk averse in a socially disadvantageous position. However, some anticipated effects of other-regarding preferences on decision making under risk are typically not observed. For example, although people are willing to pay to raise the (expected) earnings of others they will not pay to reduce others' risk (Brennan et al, 2008 and Güth, Levati & Ploner, 2008). Trautmann and Vieider (2012) provide an extensive overview of research on other-regarding preferences and risk. However none of the existing experiments test the predictions of different social preference models in a situation where people make decisions that only affect their own earnings.¹

The rest of this paper is organized as follows. Section 2 describes the experimental design and section 3 presents the theory and the hypotheses. Section 4 reports the results of our experiment. In short we find that behavior in the social treatment is indistinguishable from that in the individual treatment. Section 5 provides further discussion on these results and section 6 concludes.

¹ An exception is Bault et al. (2008), which will be discussed in more detail below.

2. Experimental design

Although we introduce social concerns in one of the treatments, the experimental setup stays as close as possible to common individual decision-making experiments. The individual (control) treatment consists of a series of choices between two lotteries. The social treatment retains the same general structure but introduces social comparison without changing the incentives for a person who does not care about relative income or her position in the income distribution. Importantly our social treatment does not introduce the possibility to influence the payoff of others.

Choose one of the sets of cards below. **The numbers on the three cards in a set always add up to 31.**

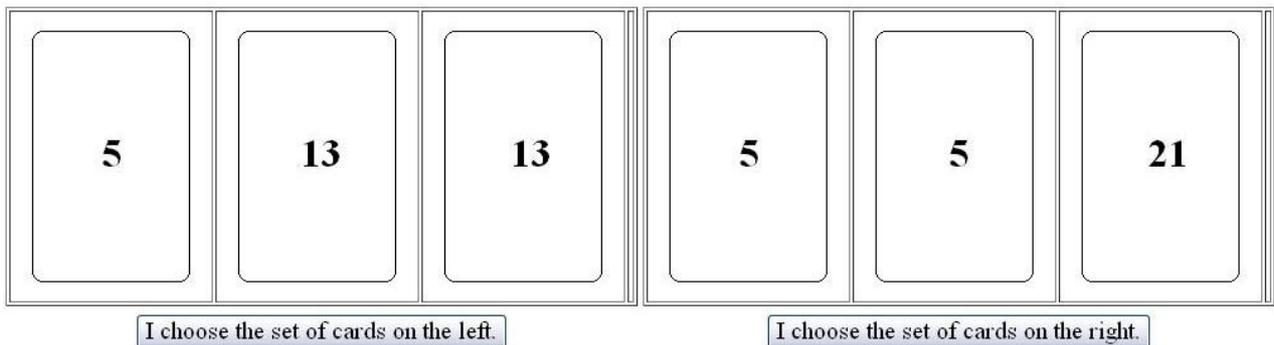


Figure 1: A translated example of the choice situation as presented to participants in both treatments.

2.1 Individual treatment

Participants face 20 pair-wise choice situations in an individually randomized order. In each of these situations participants choose between two sets of three cards². Each card has an integer number between 1 and 29 on it. The numbers on the three cards in a set always add up to 31. Figure 1 shows a screen shot of a choice situation and appendix B lists all 20 choice situations.

When all participants have made their decisions one choice situation is randomly selected. Participants are informed about the selected choice situation and reminded of the set they chose. They blindly draw one card from the set they preferred. The participant's earnings in euros equal the number on the card they draw divided by two. Choosing a set of cards implies the choice of a lottery.³

Because the sum of the numbers on three cards in a set is always 31 the lotteries represented by the sets of cards all have the same expected value. There are three types of sets: LLH sets with two low numbers (L) and one high number (H), LHH sets with one low (L) and two high numbers (H) and LMH sets with three different numbers, a low (L), a middle (M) and a high number (H).

² Which of these sets appears left or right is randomly determined for each participant individually.

³ The experiment was computerized using php/mysql and no actual cards were used. Appendix A gives the English translation of the instructions.

2.2 Social treatment

In the social treatment participants face the same choice situations as in the individual treatment, one of which is again randomly selected for payment. In contrast to the individual treatments however participants are then matched with two others who chose the same set in that choice situation. These three participants successively, blindly, draw a card from this set without replacement. Participants are informed about this procedure before choosing a set. As a result a set of cards not only represents a lottery over the decision maker's own earnings, but also over her relative earnings.

It is possible that the number of participants choosing a set is not a multiple of three. In that case the number of participants choosing one set is always a multiple of three plus one and the number choosing the other set a multiple of three minus one. We then randomly select one of the participants who chose the set chosen by a multiple of three plus one and reallocate him or her to the other set. Participants are aware of this. Given this procedure there is at most one participant per session who does not get to choose from his or her preferred set. Therefore participants in both treatments have an incentive to choose the set they prefer.

Compared to the individual treatment the social treatment only changes one thing: sets of cards now also imply a distribution of earnings between three peers. All other aspects of the decision situation, such as the implied risk or the presentation of the decision situation, remain the same. Importantly, although we introduce social comparison, participants cannot affect the set from which another participant draws a card or influence earnings of other participants in any way. Altruism or similar concerns therefore cannot affect participants' decisions.

2.3 Related experiments

This experimental design is similar to so-called “veil of ignorance” experiments, inspired by Rawls' (1971) classic thought-experiment. In such experiments, participants choose an income distribution for a group without knowing their place in the distribution (e.g. Beckman et al., 2002 and Carlsson et al., 2005). Schildberg-Hörisch's (2010) experiment comes closest to our design because she compares behavior in treatments with and without the possibility of social comparison. The fundamental difference between our design and veil of ignorance experiments is that in the latter decisions makers affect the earnings of others while we exclude this possibility.

As far as we know only three other experiments on decision making under risk and other-regarding preferences share the feature that participants do not affect the earnings of others: Bault Coricelli and Rustichini (2008), Rohde and Rohde (2011) and Linde and Sonnemans (2012). In all three of these experiments participants choose between lotteries in a social setting, but their designs

are tailored to explore different questions than the one addressed here. Rohde and Rohde (2011) explore whether risk attitudes are affected by the risks others face and Linde and Sonnemans (2012) whether risk attitudes are affected by the relative size of another person's fixed earnings. These two papers do not directly compare choices with and without social comparison; instead they manipulate the situation of others to create different social situations.

Bault et al. (2008) examine a situation in which two participants simultaneously choose between two different lotteries and observe each other's choices and outcomes. If both participants choose the same lottery they also get the same outcome. The other participant was, unbeknownst to the participants, actually a computer who made either very risk averse or risk neutral choices. Inequity aversion models, as well as a preference for conformity, predict that participants would try to match their "peer's" choices as this guarantees the same outcome and therefore minimizes inequity. Bault et al. observed the opposite behavior. Participants matched to a risk averse computer choose the risky option more often than participants matched to a risk neutral computer. The social preference model they propose to explain this behavior is discussed in section 3.1.

As we do in this paper Bault et al. (2008) examine a social preference model (specifically inequity aversion) in a context with risk where participants cannot influence the earnings of others. In that sense our experiment can be seen as a reexamination of the effect observed by Bault et al. using methods more acceptable to economists, i.e. without deceiving subjects. Moreover Bault et al.'s findings rely on the assumption that participants form correct beliefs about their "peer's" behavior. Participants in Bault et al.'s experiment may for instance have believed that participants who took more risk in the past were actually less likely to take risk in the future. In that case the observed behavior would actually be an attempt to match the other's choices and thereby avoid unequal outcomes. Lastly, behavior observed by Bault et al. may also be an attempt to express individuality by consciously choosing something different than the other. Neither beliefs nor a preference to express individuality affect decisions in our experiment as participants have full information about the resulting distribution and no information about the choices of others. Furthermore our experiment is able to distinguish between several different types of social preferences.

3. Theory and hypotheses

As social preferences have gained credence they more and more often incorporated into applied economic models (e.g. Demougin, Fluet & Helm (2006), Choi (2009), Bartling & von Siemens (2010) and Doerrenberg & Peichel (2012)). The kind of other-regarding preferences that are assumed can have a profound impact on the predictions and policy recommendations of these applied economic models (e.g. Bowles & Hwang, 2008). Although the existence of other-regarding

preferences is hardly ever questioned anymore, the exact form of these preferences is still up for discussion. We focus on a particular type of social preference models, namely models where agents care about their relative position. What makes these models particularly interesting is that, although they are based on situations where people affect the earnings of others, these models also make predictions in situations where people cannot affect the earnings of others. That means that these types of social preferences have implications in many different situations. For example Englmaier and Wambach (2010) show that inequity aversion affects the optimal labor contract, even when agents are paid independent of each other.

Our experiment examines whether such broad applications of social preference models are warranted. It also provides a new way to distinguish between three different outcome-based social preference models which are all successful in explaining much of the existing evidence: preferences related to inequity, maximin preferences and ranking preferences⁴. Each of these makes a different prediction in our experiment and will be discussed in the next paragraphs.

3.1 Inequity aversion and envy

Inequity aversion models such as those of Bolton & Ockenfels (2000) and Fehr and Schmidt (1999) provide an accurate description of behavior in many games where the division of money is at stake such as the dictator game and the ultimatum game. These models explain this behavior by an aversion to unequal earnings; both earning more and earning less than peers leads to a loss in utility. In other words: an aversion to inequity implies distaste for more dispersed income distributions, for a given level of (expected) own earnings.⁵

To see the implications of these models in our experiment we compute the difference in the utility, according to the model of Fehr and Schmidt (1999), of drawing from a certain set in the individual and the social treatment. Independent of the type of set (LLH, LHH or LMH) the utility of a set in the individual treatment minus the utility of a set in the social treatment is given by⁶:

⁴ By focusing on relative position models we exclude from consideration models based on altruism (e.g. Andreoni & Miller, 2002) or reciprocity (e.g. Rabin (1993), Dufwenberg and Kirchsteiger (2004) and Falk and Fischbacher (2006)). These motives are often important determinants of behavior, but are irrelevant in situations where the decision maker cannot affect the earnings of others.

⁵ A type of social preference model similar to inequity aversion is frequently put forward as an explanation for the Easterlin (1974) paradox, the finding that happiness scores are strongly increasing in income within countries but much less so between countries (Clark, Frijters and Shields, 2008). Other studies also show a negative relation between the income of a reference group, smaller than the whole country, and reported happiness (e.g. McBride (2001), Stutzer (2004), Ferrer-i-Carbonell (2005) and Vendrik & Woltjer, (2007)). The usual explanation for these observations is that happiness is at least partly determined by relative income. In contrast to inequity aversion models these models (e.g. Layard, 1980 and Clark and Oswald, 1996) assume that utility is increasing in advantageous inequality. People with such preferences are not inequity averse, but unconditionally envious. The disutility caused by disadvantageous inequality is commonly held to be greater than the utility of advantageous inequality; in terms of the Fehr and Schmidt model $\beta_i < 0$ and $\alpha_i > -\beta_i$ and thus $\alpha_i + \beta_i > 0$. As equation 1 shows, this last inequality ensures that these models predict behavior in line with hypothesis 1a.

⁶ Appendix C provides the proof of this expression. It further shows that also according to Bolton and Ockenfels' (2000) ERC model the difference in utility between treatments is directly related to the difference between H and L

$$\frac{1}{3}(\alpha_i + \beta_i)(H - L) \quad (1)$$

α_i and β_i are the disutility caused by disadvantageous and advantageous inequality respectively. As the individual and social treatment do not differ with respect to risk this utility difference and the behavioral predictions derived from it do not depend on participant's risk preferences.

Equation 1 shows that the difference in utility between treatments is directly related to the difference between the highest (H) and the lowest amount (L). Both α_i and β_i are assumed to be positive by Fehr and Schmidt (1999). Therefore sets with a larger difference between H and L should be *relatively* less attractive in the social than in the individual treatment, compared to sets with a smaller difference between H and L. Interestingly, the difference in value between the social and individual treatment is independent of the type of set (LLH, LHH or LMH). Given this analysis inequity aversion models lead to the following hypothesis:

Hypothesis 1a: (inequity aversion): Sets where H-L is larger are chosen less often in the social than in the individual treatment.

As discussed in section 2.3 Bault et al. (2008) observe behavior opposite to that predicted by inequity aversion models. Nevertheless these authors use a model very similar to that of Fehr and Schmidt to rationalize this behavior. In Bault et al.'s model people are assumed to dislike disadvantageous inequality, as in the Fehr and Schmidt model, but, in contrast to that model, to like advantageous inequality. They further assume that advantageous inequality is more important than disadvantageous inequality.⁷ Translated in terms of the Fehr and Schmidt model this means that people have a β_i that is negative and in absolute terms larger than α_i . From equation 1 it then follows that in our experiment a larger difference between the best and the worst outcome (H-L) actually increases the utility of an option in the social treatment. This leads to a hypothesis that is the exact opposite of the inequity aversion hypothesis:

Hypothesis 1b (inequity seeking): Sets where H-L is larger are chosen more often in the social than in the individual treatment.

A possible way to reconcile inequity aversion with Bault et al.'s model is that inequity aversion models are based on situations where distributing money was at stake, e.g. dictator games (DG) or ultimatum games (UG). In such games altruism or social norms may lead to an observed dislike of

for LLH and LHH sets. HML sets yield a slightly different expression but this expression leads to the same expected treatment effects.

⁷ This is where their model differs from the models used to explain the Easterlin paradox discussed in footnote 5.

advantageous inequality (proposer in the DG and UG) and reciprocity to a stronger dislike of disadvantageous inequality (receiver in the UG). Both altruism and reciprocity are not present in the situation studied by Bault et al. (2008) so these findings may be a better description of people's preferences over outcomes per se. If so, Bault et al.'s model should provide a better prediction of behavior in situations, such as that studied in our experiment, where people's decisions only influence their own earnings. However, as discussed in subsection 2.3 Bault et al.'s results can plausibly be explained by other features of their design.

3.2 Maximin preferences

Rawls' (1971) maximin principle is one of the most well-known philosophical ideas about distributive justice. According to this principle resources in a society should be divided in the way that most benefits the least well off. Rawls justified the maximin principle with a veil of ignorance thought-experiment. He thought that if we do not yet know our place in a society we would prefer a society in which the least well off are best off.

The empirical relevance of maximin preferences has been demonstrated experimentally. Veil of ignorance experiments (e.g. Beckman et al., 2002, Carlsson et al., 2005 and Schildberg-Hörisch, 2010) show that people indeed care about the least well off, but also about average earnings or efficiency. Even without a veil of ignorance maximin preferences may have a bite. Engelmann and Strobel (2004) and Charness and Rabin (2002) show that a combination of efficiency concerns and maximin preferences provides the best description of behavior in their experiments. In our experiment efficiency does not play a role because total earnings are equal in all sets. Maximin preferences would however predict that sets where the amount earned by the person who earns the least (L), are relatively more attractive in the social treatment:

*Hypothesis 2 (maximin preferences): Sets where L is larger are chosen more often in the social than in the individual treatment.*⁸

3.3 Ranking preferences

Inequity aversion models include *earnings differences* between the decision maker and others as an argument in the utility function, but another plausible option is to include the *rank* of the decision maker's earnings. Such models are less popular in economics, although some papers (e.g. Layard,

⁸ In many cases this hypothesis provides the same prediction as inequity aversion. There are however choice situations where that is not the case. Take for example choice situation 1 (see appendix B): 1-1-29 versus 1-15-15. In this case the lowest amount a participant can earn is the same in both sets. Maximin preferences would therefore predict no treatment difference in this situation. On the other hand the difference between H and L is smaller in 1-15-15 and inequity aversion therefore predicts that this will be chosen more often in the social treatment than in the individual treatment. This allows us to distinguish between these two models.

1980 and Robson, 1992) do model a concern for rank to explain patterns in reported happiness.⁹ Veblen's theory of the leisure class (1899, 2005), is also based on the idea that people care about their rank in society. In other sciences, for example biology (e.g. Sapolsky, 2005), sociology (e.g. Gould, 2002), and cognitive neuroscience (e.g. Zink et al., 2008) research on the importance of social hierarchies is much more common. Sapolsky (2005) considers the effect of social rank on stress levels for social species, especially non-human primates, and discusses the implications of these findings for humans. Zink et al (2008), but also Charness, Masclet, and Villeval (2010) show experimentally that people care about their social rank when this rank is determined by their performance. Dijk, Holmen, and Kirchler (2014) establish that rank also matters when it is determined by stochastic outcomes. In their experiment participants with different ranks choose different portfolios, apparently in an effort to maintain a good rank or improve a bad one.

In our experiment people make decisions before any rank has been established, but nevertheless a concern for rank has implications for these decisions. As discussed in the design section the sets of cards used in our experiments can be divided into three types. In the social treatment a LLH set means that one person will hold top rank while the two others will share bottom rank: one winner and two losers. In contrast, in a LHH set there will be two winners and only one loser. The third kind of set (LMH) results in a complete ranking without ties. Intuitively it is much nicer to be the sole winner than one of the two winners and in case of losing the pain will be less if there is a fellow sufferer, which suggests that, compared to their preference ranking in the individual treatment, LLH sets are relatively more attractive than LHH sets in the social treatment. We will now express this intuition more formally.

We label ranks, from top to bottom, 1, 2 and 3 and ties as 1.5 for two winners and 2.5 for two losers. The expected utility of a set in the social treatment if people care about rank can then be represented by the following equations¹⁰:

$$\text{LLH: } \frac{1}{3}H + \frac{2}{3}L + \frac{1}{3}R(1) + \frac{2}{3}R(2.5) \quad (2)$$

$$\text{LHH: } \frac{2}{3}H + \frac{1}{3}L + \frac{2}{3}R(1.5) + \frac{1}{3}R(3) \quad (3)$$

$$\text{LMH: } \frac{1}{3}H + \frac{1}{3}M + \frac{1}{3}L + \frac{1}{3}R(1) + \frac{1}{3}R(2) + \frac{1}{3}R(3) \quad (4)$$

where $R(r)$ is the function that represents the effect of rank on an agents utility.

⁹ Both a concern for income differences and a concern for rank can explain the Easterlin paradox (see footnote 5) because in both models a higher average income for others lowers a person's utility, either through a lower relative income or a lower rank. It is difficult to distinguish between these types of models with field data; however, in our experiment we created situations where these two theories make different predictions.

¹⁰ Like the Fehr & Schmidt model we assume linear utility in own income, but as this component is the same in both treatments this does not affect the hypotheses.

Predicted treatment effects are caused by the part of the utility function that is different between the social and individual treatments, the terms that contain the function $R(r)$. The difference in difference between the value of LLH and LHH between the social and individual treatment is given by:

$$\left(\frac{1}{3}R(1) + \frac{2}{3}R(2.5) - \frac{2}{3}R(1.5) - \frac{1}{3}R(3) \right) = \left(\frac{1}{3}(R(1) - R(1.5)) + \frac{1}{3}(R(2.5) - R(1.5)) + \frac{1}{3}(R(2.5) - R(3)) \right) \quad (5)$$

So in the social treatment LLH becomes relatively more attractive than LHH when

$$(R(1) - R(1.5)) + (R(2.5) - R(3)) > (R(1.5) - R(2.5)) \quad (6)$$

In words: the extra utility of winning alone over winning together plus the extra utility of losing together over losing alone should be larger than the difference between winning together and losing together. This inequality holds for a function that is relatively flat in the middle, compared to the average slope at the top and the bottom.¹¹ Or put differently, it holds if coming first and/or not coming last is more important to the agent than moving up a place in the ranking in the middle¹². In our view this type of preference is intuitively plausible.

If we compare the LMH sets to LLH and LHH sets we find a similar set of inequalities. The LMH set is relatively attractive compared to the LHH set in the social treatment if

$$\frac{1}{3}R(1) + \frac{1}{3}R(2) > \frac{2}{3}R(1.5) \quad (7)$$

The LMH set is relatively unattractive in the social treatment compared to the LLH set if:

$$\frac{2}{3}R(2.5) > \frac{1}{3}R(2) + \frac{1}{3}R(3) \quad (8)$$

By the same reasoning as above we believe it plausible that both inequalities will hold. Compared to the LMH sets the LLH sets exclude the chance to be the only loser while compared to LHH sets, LMH sets introduce the chance to be the only winner. This results in the following hypotheses:

Hypothesis 3 (ranking preferences):

a. LLH sets are chosen over LHH sets more often in the social treatment than in the

¹¹ Straightforward functions such as $(C-r)^\alpha$ with $0 < \alpha < 1$ or $\ln(C-r)$ fulfill this requirement. (C can be any arbitrary number larger than 3. It is required to ensure that the part between brackets is positive, because 3 is the maximum rank number possible.)

¹² Evidence of such preferences can be found in athletic competitions. In such competitions the prizes are typically Gold, Silver, Bronze or no medal (which can be interpreted as losing). Medvec, Madey and Gilovich (1995) find that Bronze winners are typically happier than Silver winners. This suggests that the difference in utility between losing and Bronze and between Silver and Gold is quite high but an improvement from Bronze to Silver adds little utility and is in their study even negative. (The authors explain this by a change in reference point; Silver winners focus on the Gold that they missed and Bronze winners on the losers who get no medal).

individual treatment.

b. LLH sets are chosen over LMH sets more often in the social treatment than in the individual treatment.

c. LMH sets are chosen over LHH sets more often in the social treatment than in the individual treatment

These hypotheses are based on a particular type of ranking preferences. However, we can distinguish between several types of ranking preferences. Specifically the inequality in equation 7 not only holds for the type of preferences described above, but also if $R(r)$ is a concave function. The inequality in equation 8 would however be reversed for concave preferences over rank. Such preferences would therefore also predict the behavior described in hypothesis 3b, but the opposite of that in hypothesis 3c.¹³ Convex preferences would predict the opposite pattern. Indeed almost all types of ranking preferences predict that the type of set will influence choices in the social treatment. Only a very specific set of functional forms, particularly linear utility over ranks, would predict no effect if rank is important.

4. Results

The experiment was run at the CREED lab in Amsterdam. A total of 79 participants participated in 4 sessions, 42 in the social treatment and 37 in the individual treatment. 58% were male and 40% were economics majors. All participants had first participated in another, unrelated experiment. That experiment was a pure individual experiment where social comparison was impossible (Sonnemans & van Dijk, 2012). Our experiment took about 20 minutes and the average earnings were around 5.2 euro (in addition to the show up fee and the earnings in the other experiment).

To test our hypotheses we calculate, for each hypothesis, per individual how often (s)he chose the lottery predicted to be more attractive in the social treatment. This we take as an independent observation. We then compare the distribution of percentages in both treatments to test the hypotheses. All tests in this section are two-sided.

4.1 Hypothesis 1a (inequity aversion) and 1b (inequity seeking),

Inequity aversion predicts an aversion to a greater dispersion of earnings: sets with a larger difference between the highest amount (H) and the lowest amount (L) should be relatively less attractive in the social than in the individual treatment (hypothesis 1a). However, findings by Bault et al. (2008) suggests that the exact opposite behavior should be observed, leading to hypothesis 1b.

¹³ Without further conditions concave nor convex preferences make any prediction for the relative preference for LLH over LHH sets.

Table 1 shows that neither of these hypotheses holds up. People choose the set with the smaller difference between H and L about as often in the individual treatment as in the social treatment. A Wilcoxon-Mann-Whitney test shows that the difference between treatments is far from significant ($p=0.81$).

Statistic (percentage of choices)	Individual treatment	Social treatment	Difference	p-value Wilcoxon-Mann-Whitney test
Hypothesis 1a (Inequity Aversion) and 1b (Inequity seeking) (20 choice situations) ^a	76.90%	75.35%	1.55%	0.81
Hypothesis 2 (Maximin preferences) (15 choice situations)	69.73%	69.20%	0.53%	0.90
Hypothesis 3 (Ranking preferences)				
a) LLH versus LHH (8 choice situations)	41.22%	38.99%	2.23%	0.72
b) LLH versus LMH (4 choice situations)	43.24%	42.26%	0.98%	0.74
c) LMH versus LHH (2 choice situations)	33.78%	38.10%	4.31%	0.44
Total (14 choice situations)	40.57%	40.14%	0.43%	0.94

Table 1: Treatment differences: Average percentage of choices for the set predicted to be relatively more attractive in the social treatment. One individual is one independent observation.

^a In this case the percentage shown are the percentage of choices for the set predicted to be more attractive in the social treatment by hypothesis 1a.

4.2 Hypothesis 2 (maximin preferences)

The maximin model predicts that in the social treatment the set where the lowest amount (L) is highest becomes relatively more attractive. Not all choice situations can be used to test this hypothesis as in some situations the lowest amount is the same in both sets. The benefit of this is however that it is possible to distinguish between maximin and inequity aversion preferences. Maximin and inequity aversion make different predictions in choice situations where the lowest amount is the same in both sets. Table 1 shows maximin preferences influence behavior no more than inequity aversion or inequity seeking. The choice pattern in the 15 choice situations where maximin preferences predict a treatment difference is almost exactly the same in the individual and social treatments (Wilcoxon-Mann-Whitney test $p=0.90$).

4.3 Hypothesis 3 (ranking preferences)

Ranking preferences hypothesize that behavior is not influenced by the size of the difference between earnings, but only by the implied ranking. In our experiment that means only the type of set, LLH, LHH or LMH, matters. Specifically hypothesis 3 states that in the social treatment LMH sets should be relatively more attractive than LHH sets and LLH sets should be relatively more

attractive than both LMH and LHH sets. However the treatment difference predicted by this hypothesis is not observed. Testing the three parts of hypothesis 3 on the choice between LLH and LHH sets (a), LLH and LMH sets (b) and LHH and LMH sets (c) separately shows that for none of these types of decision situations behavior is significantly different in the social and individual treatments. (Wilcoxon-Mann-Whitney all p-values >0.44) and also taking the three parts of the hypothesis together does not reveal a treatment effect ($p=0.94$).

Rejecting hypothesis 3 a, b, and c provides evidence against the importance of rank as a driver of behavior. Given that we do not find an effect for any of the types of sets other types of ranking preferences, e.g. convex or concave preferences also do not appear to affect behavior.

5 Discussion

So far, we have rejected all hypotheses based on the most commonly used social preference models. It is however possible that behavior is influenced by some other type of social preferences over outcomes. Comparing behavior in each of the 20 choice situations (see Appendix B) suggests that this is not the case. According to a Fisher exact test there is no difference in choices between the social and individual treatments for any choice situation (all 20 p-values are larger than 0.08, see appendix B).

A possible competing reason why we find no difference between decisions in the social and individual treatments is that risk preferences are so strong that they overrule social preferences. However in 25% of the decisions participants choose the riskier option, so it is clearly not the case that risk aversion determines all decisions. Also most participants sometimes choose the risky and sometimes the risk-averse option. Furthermore in several choice situations the difference in the risk between options is very small, for example in choice situation 20 where participants choose between the set 9,11,11 and the set 10,10,11. Especially in those situations we would expect to see the influence of outcome based social preferences.

Of course it is also possible that participants did not compare themselves to their matched participants in the social treatment, but rather to all participants in the session, in which case the social environment is similar in both treatments. However we believe that this is unlikely. Social comparison is clearly more focal in the social treatment and previous experiments with similar protocols (e.g. Bault et al., 2008, Rohde & Rohde, 2011 and Linde & Sonnemans, 2012) show that participants compare themselves to people they are matched with rather than others, also when matched participants do not influence each other's earnings.

Finally, note that in this study we only test outcome-based social preference models. A promising alternative approach is to use fairness models that are not outcome-based, but expectation-based. For example, procedural fairness assumes that people have a preference for

equal chances rather than equal outcomes. Procedural fairness models (e.g. Trautmann, 2009) represent these preferences through a utility function in which differences in expected outcomes cause disutility, but differences in final earnings do not. Such models can explain results in the traditional Ultimatum and Dictator Games just as well as outcome-based models, but make different predictions in situations with uncertainty¹⁴.

All three matched participants in our social treatments have the same expected earnings so there is no ex-ante inequality. Participants who base their decisions on procedural fairness only should therefore behave the same way in the social and the individual treatments, just as we found. Of course, this is only weak evidence for procedural fairness models; a challenge for future research is to develop new experimental designs where the procedural fairness and outcome-based models predict different treatment effects.

6. Conclusion

Other-regarding preference models were developed to explain consistent violations of selfishness, like the spending of money to affect the earnings of others in ultimatum and other games. As always, it is easier to explain old facts than predict new ones. A real test of these models can be found in novel situations that were not yet available when the models were created. Our experiment provides such a situation.

In our experiment the decisions of the participants influence only their own outcomes and in that sense they face purely individual and non-strategic decisions. We compare an individual treatment without peers with a social treatment where social comparison is possible (there are winners and losers). Models that assume preferences over outcomes, like inequity aversion or seeking, maximin preferences, and ranking preferences, all predict that the introduction of social comparison would affect behavior in our experiment. In contrast we find that behavior is essentially the same in the social and individual treatments.

An obvious interpretation of our result is that the outcome-based fairness models we studied are less general than supposed and are only valid in situations where decision makers can influence the earnings of others. However, this would mean that we need two separate models, one for

¹⁴ For example, Krawczyk and Le Lec (2010) study a version of the dictator game in which the dictator divides the (100%) probability of winning a prize between herself and the recipient. The two possible final outcomes are that either the dictator or the recipient wins the prize. If the dictator dislikes disadvantageous inequity more than advantageous inequity, the dictator should keep 100% to herself, according to outcome-based preference models¹⁴. Procedural fairness in contrast motivates a division of the probabilities, which is what Krawczyk and Le Lec find. Several other studies also show that, as predicted by procedural fairness, people care mainly about equality in expected rather than final earnings. Bartling and Von Siemens (2011) show this in an experiment on team production. In their experiment wage schemes with the same level of ex-ante inequality but different levels of ex-post inequality are valued about the same. Brennan et al (2008) and Güth, Levati and Ploner (2008) show that people are not willing to reduce the risk others face and thereby the expected inequality. This is in line with procedural fairness because changing others' risk does not influence ex-ante inequality.

situations where people can influence the earnings of others and another for situations where they cannot. Alternatively, the application of procedural fairness models seems to be a promising future approach, as discussed in section 5.

Historically the development of models in experimental and behavioral economics about social preferences on the one hand and the models of individual decision-making on the other hand occurred parallel without much interaction. However, economists who try to predict real world behavior or give policy advice face the problem that many real situations combine elements of both fields and they have to fit two kinds of models together in some way. Camerer and Loewenstein, (2004) suggest viewing behavioral economics as a toolbox. After looking at a situation the economist can turn to this “toolbox”, select the appropriate behavioral models and combine them as required. In practice things can be more difficult than the analogy suggests because many different models are available and it is not always clear what will be the best choice in these specific circumstances. Of course, these are in essence empirical questions. Our research gives an answer for one particular situation, to wit a situation where both risk and social comparison are relevant: it suggests that outcome-based models such as inequity aversion or seeking, maximin preferences or ranking preferences are not relevant here.

We do not claim that this is the end-all answer. Other research has found social comparison effects on decisions under risk which are predicted by none of the existing models. For example Bohnet en Zeckhauser (2004) show that the source of the risk, “nature” or other people, needs to be considered. As we show in an earlier paper (Linde & Sonnemans, 2012) the relative position of a person prior to making the decision also influences risk attitudes. A general model that aims to describe behavior in situations with both social comparison and risk will need to incorporate these findings.

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Appendix A: Experimental instructions

Instructions individual treatment

Your earnings in this experiment are determined by drawing 1 card from a set of 3 cards. **Your earnings in euros are the number on the card divided by 2 (each point is worth 50 cents).** The numbers on the 3 cards in a set always add up to 31.

When drawing a card you do not get to see the number on the card and each card has the same chance to be in a certain position. **Therefore you cannot know which card you will draw.**

The set of cards you will draw from depends on your choices. In total you will be asked 20 times to choose between two sets of cards. One of these choice situations is randomly selected. The set from which you will draw a card is the set you choose in that choice situation. **Therefore you should always choose the set you prefer.**

Instructions social treatment

In this experiment you are matched with 2 other participants. Your earnings are determined by consecutively, without replacement, drawing a card from a set of 3 cards. You cannot draw a card that has already been drawn by another participant. **Your earnings in euros are the number on the card divided by 2 (each point is worth 50 cents).** The numbers on the 3 cards in a set always add up to 31.

When drawing a card you do not get to see the number on the card and each card has the same chance to be in a certain position. **Therefore you cannot know which card you will draw.** You cannot see which numbers are on the cards already drawn by the other participants.

The set of cards you will draw from depends on your choices. In total you will be asked 20 times to choose between two sets of cards. One of these choice situations is randomly selected. You are then matched to 2 other participants who choose the same set in the selected choice situation. Then all three of you will draw, in a randomly determined order, a card from the set you choose. Sometimes it is impossible to match everyone to two others who choose the same set. In that case one participant is randomly selected to draw from the set he or she did not choose. The chance you do not get to draw from the set you choose is therefore very small. **Therefore you should always choose the set you prefer.**

Appendix B: Choice situations

Choice situation	Set A ^a			Set B			Hypotheses ^b				Results (% A)		
	#	Cards	Type	#	Cards	Type	1a Inequity aversion	1b Inequity seeking	2 Maximin prefs	3 Ranking prefs	Indiv.	Social	p ^c
1	1	1,1,29	LLH	4	1,15,15	LHH	<	>	0	>	5.41%	11.90%	0.195
2	1	1,1,29	LLH	7	8,8,15	LLH	<	>	<	0	8.11%	7.14%	0.321
3	1	1,1,29	LLH	2	1,8,22	LMH	<	>	0	>	8.11%	19.05%	0.101
4	1	1,1,29	LLH	5	5,11,15	LMH	<	>	<	>	13.51%	9.52%	0.237
5	4	1,15,15	LHH	7	8,8,15	LLH	<	>	<	<	24.32%	33.33%	0.135
6	4	1,15,15	LHH	2	1,8,22	LMH	>	<	0	<	83.78%	78.57%	0.192
7	4	1,15,15	LHH	5	5,11,15	LMH	<	>	<	<	48.65%	45.24%	0.171
8	7	8,8,15	LLH	2	1,8,22	LMH	>	<	<	>	16.22%	21.43%	0.192
9	7	8,8,15	LLH	5	5,11,15	LMH	>	<	>	>	32.43%	38.10%	0.163
10	2	1,8,22	LMH	5	5,11,15	LMH	<	>	<	0	18.92%	19.05%	0.225
11	3	5,5,21	LLH	6	5,13,13	LHH	<	>	0	>	10.81%	11.90%	0.273
12	3	5,5,21	LLH	8	9,9,13	LLH	<	>	<	0	18.92%	11.90%	0.171
13	3	5,5,21	LLH	9	9,11,11	LHH	<	>	<	>	16.22%	19.05%	0.221
14	3	5,5,21	LLH	10	10,10,11	LLH	<	>	<	0	13.51%	14.29%	0.253
15	6	5,13,13	LHH	8	9,9,13	LLH	<	>	<	<	48.65%	50.00%	0.177
16	6	5,13,13	LHH	9	9,11,11	LHH	<	>	<	0	40.54%	54.76%	0.082
17	6	5,13,13	LHH	10	10,10,11	LLH	<	>	<	<	24.32%	26.19%	0.201
18	8	9,9,13	LLH	9	9,11,11	LHH	<	>	0	>	35.14%	23.81%	0.108
19	8	9,9,13	LLH	10	10,10,11	LLH	<	>	<	0	18.92%	14.29%	0.205
20	9	9,11,11	LHH	10	10,10,11	LLH	<	>	<	<	43.24%	40.48%	0.175

Table B.1: The choice situations used in the experiment.

^a In the experiment set A and B were randomly displayed on the left or right side, without labels.

^b Shows per hypothesis whether choosing set A over set B is more (>), less (<), or equally (0) likely in the social treatment than in the individual treatment. Hypothesis 4 predicts no difference between treatments. These hypotheses are explained in section 3.

^c P-values for a two-sided Fisher-exact test.

Appendix C: Inequity aversion hypothesis

The hypothesized effect of inequity aversion can be found using the Fehr & Schmidt model. For two peers becomes the utility function of this model is:

$$x_i - \frac{1}{2}\alpha_i(\max(x_1 - x_i, 0) + \max(x_2 - x_i, 0)) - \frac{1}{2}\beta_i(\max(x_i - x_1, 0) + \max(x_i - x_2, 0)) \quad (\text{A1})$$

with $\alpha_i \geq \beta_i$ and $0 \leq \beta_i \leq 1$

In this equation x_i are the earnings of the decision maker and x_1 and x_2 the earnings of her two peers. α_i and β_i are the disutility caused by respectively disadvantageous and advantageous inequality. Using this utility function the expected utility, according to the Fehr and Schmidt model, of choosing a certain set in the social treatment can be computed. The expected utility of a LLH set is:¹⁵:

$$\frac{1}{3}(H - \beta_i(H - L)) + \frac{2}{3}\left(L - \frac{1}{2}\alpha_i(H - L)\right) = \frac{1}{3}H + \frac{2}{3}L - \frac{1}{3}(\alpha_i + \beta_i)(H - L) \quad (\text{A2})$$

By the same reasoning the expected utility of a LHH set is:

$$\frac{2}{3}\left(H - \frac{1}{2}\beta_i(H - L)\right) + \frac{1}{3}(L - \alpha_i(H - L)) = \frac{2}{3}H + \frac{1}{3}L - \frac{1}{3}(\alpha_i + \beta_i)(H - L) \quad (\text{A3})$$

And for a LMH set:

$$\begin{aligned} & \frac{1}{3}\left(H - \frac{1}{2}\beta_i(H - L) - \frac{1}{2}\beta_i(H - M)\right) + \frac{1}{3}\left(M - \frac{1}{2}\alpha_i(H - M) - \frac{1}{2}\beta_i(M - L)\right) + \\ & \frac{1}{3}\left(L - \frac{1}{2}\alpha_i(H - L) - \frac{1}{2}\alpha_i(M - L)\right) = \\ & \frac{1}{3}H + \frac{1}{3}M + \frac{1}{3}L - \frac{1}{6}(\alpha_i + \beta_i)(H - L) - \frac{1}{6}(\alpha_i + \beta_i)(H - M) - \frac{1}{6}(\alpha_i + \beta_i)(M - L) = \\ & \frac{1}{3}H + \frac{1}{3}M + \frac{1}{3}L - \frac{1}{3}(\alpha_i + \beta_i)(H - L) \end{aligned} \quad (\text{A4})$$

The last term of all these three equations: $-\frac{1}{3}(\alpha_i + \beta_i)(H - L)$ is relevant to determine the

hypothesized treatment difference as this term is only relevant in the social treatment, as in the individual treatment there is no social comparison. It shows that, according to the Fehr and Schmidt model sets where H-L is large become relatively unattractive in the social treatment.

¹⁵ The Fehr & Schmidt model assumes linear utility as a simplification. This does not allow for anything but risk neutrality when social concerns are irrelevant. This is obviously an inaccurate description of observed behavior. Risk attitudes can however easily be incorporated by a non-linear utility function of own earnings. This would not change the difference between the social and individual treatments illustrated here as there wouldn't be any difference in this regard between treatments.

To make the Bolton and Ockenfels ERC model most comparable to the Fehr and Schmidt model we assume a utility function that is separable in terms of the individual and social component and linear in the social component with a kink at the social reference point. Advantageous inequality yields a disutility of β_i , disadvantageous inequality a disutility of α_i . Such a utility function fulfills Bolton and Ockenfels' assumptions.

The most important difference with the Fehr and Schmidt model is that agents compare their own outcome to a fair share of the pie instead of with the earnings of each referent. In our experiment a fair share is always $10 \frac{1}{3}$ because the numbers on the cards always add up to 31. This yields the following utility function:

$$x_i - \alpha_i \left(\max \left(10 \frac{1}{3} - x_i, 0 \right) \right) - \beta_i \left(\max \left(x_i - 10 \frac{1}{3}, 0 \right) \right) \quad (\text{A5})$$

The expected utility of a LHH set is therefore given by:

$$\frac{1}{3} \left(H - \beta_i \left(H - 10 \frac{1}{3} \right) \right) + \frac{2}{3} \left(L - \alpha_i \left(10 \frac{1}{3} - L \right) \right) \quad (\text{A6})$$

As the numbers in a set add up to 31 we know that $H - L = 31 - 3L = 3 \left(10 \frac{1}{3} - L \right)$ and

$H - L = H - \frac{31 - H}{2} = \frac{1}{2} 3 \left(H - 10 \frac{1}{3} \right)$. Combining these equalities with function A6 yields:

$$\frac{1}{3} H + \frac{2}{3} L - \frac{1}{3} \beta_i \left(\frac{2}{3} (H - L) \right) - \frac{2}{3} \alpha_i \left(\frac{1}{3} (H - L) \right) = \frac{1}{3} H + \frac{2}{3} L - \frac{2}{9} (\alpha_i + \beta_i) (H - L) \quad (\text{A7})$$

For the LLH set we have the following expected utility:

$$\frac{2}{3} \left(H - \beta_i \left(H - 10 \frac{1}{3} \right) \right) + \frac{1}{3} \left(L - \alpha_i \left(10 \frac{1}{3} - L \right) \right) \quad (\text{A8})$$

In this case $H - L = H - (31 - 2H) = 3 \left(H - 10 \frac{1}{3} \right)$ and $H - L = \frac{31 - L}{2} - L = \frac{1}{2} 3 \left(10 \frac{1}{3} - L \right)$.

Combining with A8 yields:

$$\frac{1}{3} L + \frac{2}{3} H - \frac{2}{9} (\alpha_i + \beta_i) (H - L) \quad (\text{A9})$$

As with the Fehr and Schmidt model the last term shows the hypothesized treatment effect.

Dropping the assumption of linear social effects causes the effect of $H-L$ to be non-linear, but utility is still decreasing in $H-L$ in the social treatment.

For LMH set the utility is given by:

$$\frac{1}{3} \left(H - \beta_i \left(H - 10 \frac{1}{3} \right) \right) + \frac{1}{3} \left(M - \beta_i \left(M - 10 \frac{1}{3} \right) \right) + \frac{1}{3} \left(L - \alpha_i \left(10 \frac{1}{3} - L \right) \right) \quad (\text{A10})$$

if M is bigger than $10 \frac{1}{3}$. If M is smaller it is given by:

$$\frac{1}{3}\left(H - \beta_i\left(H - 10\frac{1}{3}\right)\right) + \frac{1}{3}\left(M - \alpha_i\left(10\frac{1}{3} - M\right)\right) + \frac{1}{3}\left(L - \alpha_i\left(10\frac{1}{3} - L\right)\right) \quad (\text{A11})$$

From A10 and A11 the utility in the social treatment decreases if an amount is transferred from L to H. Utility is no longer linearly decreasing in $H-L$ though. For example if M is bigger than $10\frac{1}{3}$ transferring an amount from H to M decrease $H-L$ but does not affect the disutility from inequity. However for all choice situations in our experiment it still holds that the set where $H-L$ is bigger should be relatively less attractive in the social treatment.