DECISIONS UNDER RISK IN A SOCIAL AND INDIVIDUAL CONTEXT:

THE LIMITS OF SOCIAL PREFERENCES? *

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March 2015

(forthcoming \textit{Journal of Behavioral and Experimental Economics})

Abstract

(An earlier version of this paper was titled: “Social Preferences in Private Decisions”) Social preference models were originally constructed to explain why people spend money to affect the earnings of others. These social preference theories are now widely used to model situations where decision makers do not influence the earnings of others, for example the labor market. Outcome-based social preference models make predictions in these 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

PsycINFO Classification codes: 2340, 3000, 3040

JEL Classification codes: C91, D63, D81

* We would like to thank Roel van Veldhuizen for useful comments in an early phase, and an anonymous referee and the associate editor Stefan Trautmann for their very constructive help with improving this paper. Financial support from the University of Amsterdam Research Priority Area in Behavioral Economics is gratefully acknowledged.
1. Introduction

Experimental evidence that people have social preferences is abundant (Fehr & Schmidt, 2006). People give to others who are worse off and pay to punish others who did them wrong. Many different models have been proposed to explain this behavior. An influential set of models, outcome-based models, assumes that people care about the final distribution of earnings. Fehr and Schmidt’s (1999) inequity aversion model is probably the most well-known model in this category. This type of model can explain much of the behavior observed in experiments.¹

Outcome based social preferences, especially inequity aversion, are often used in applied theory. They have been included in models on labor contracts (Englmaier & Wambach, 2010, Fehr, Klein, & Schmidt, 2007, Dur & Glazer, 2007, Demougin, Fluet & Helm, 2006, Bartling & von Siemens, 2010, Rey-Biel, 2008, Pepper & Gore, 2012), optimal taxation (Choi, 2009 and Doerrenberg & Peichel, 2012), property division after a divorce (Smith, 2007), grading (Dubey & Geanakoplos, 2012), the efficiency of double-auctions (Rasch, Wambach & Wiener, 2012), trade protection (Lü, Scheve & Slaughter, 2012) and even crime deterrence (Rizzolli & Stanca, 2012). Cooper (2014) in his popular book “Money Blood and Revolution” even suggests that social comparison, and especially the urge to be better off than others, should be a cornerstone of economic theory.² As Bowles and Hwang (2008) show the type of social preferences these models assume can have a major impact on their conclusions and, by extension on their policy recommendations.

Outcome based social preference models are originally based on experimental evidence concerning distributional games (like the ultimatum game and the dictator game) and it is not obvious that we can apply these models in other settings. The main question is whether these models apply in situations where the decision maker can compare her own outcomes to those of others, but is not able to influence the earnings of these others. We test the predictions of several outcome-based social preference models in an innovative design: 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.

Earlier experiments show that social concerns can indeed influence decisions under risk. For example, Bohnet and 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-

¹ Although reciprocity needs to be taken into account in addition to outcome-based preferences (Falk, Fehr & Fischbacher, 2008), this does not mean that outcomes do not matter in addition to reciprocity.
² 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 & Shields, 2008).
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.

Our experimental design is very 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, Carlsson et al., 2005 and Schildberg-Hörisch's, 2010). 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 explore whether risk attitudes are affected by the risks others face and Linde and Sonnemans test 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. do examine a social preference model (specifically inequity aversion) in a context with risk where participants cannot influence the earnings of others. They find that people are inequity seeking when choosing between lotteries. However, their interpretation depends on participants not realizing their partner is in fact a computer and forming correct beliefs about their partner’s behavior. We discuss this experiment and its results in more detail in section 3, where we discuss our hypotheses.

We find no evidence that social preferences affect decisions in our experiment. There are two possible interpretations of this result, both of which show that outcome based social preference models may not be as comprehensive as they appear at first sight. The first interpretation is that people only consider social preferences in situations where the outcomes of others are conspicuously relevant, such as when decision makers can affect each other’s earnings. If that is the case social preferences may not be relevant in many applications such as those discussed above. The second possible interpretation is that other social-preference models, not based on outcomes, provide a better description of people’s behavior. Procedural fairness models (e.g. Trautmann, 2010 and Krawczyk, 2011) appear to be a good candidate for such a model.

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.

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. The experiment was computerized and programmed using php/mysql.

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

![Choice situation screenshot](image)

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

2.1 Individual treatment
Participants face 20 pairwise choice situations in an individually randomized order. In each of these situations participants choose between two sets of three cards. 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 screenshot 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 by clicking on one of three blank cards on the screen. 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.

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

4 The experiment was computerized using php/mysql and no actual cards were used. Appendix A gives the English
Because the sum of the numbers on three cards in a set always equals 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) (e.g. 8, 8, 15), LHH sets with one low (L) and two high numbers (H) (e.g. 5, 13, 13) and LMH sets with three different numbers, a low (L), a middle (M) and a high number (H) (e.g. 1, 8, 22).

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. The order in which they draw is randomly determined. 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 the earnings of other participants in any way. Altruism or similar concerns therefore cannot affect participants' decisions.

3. Theory and hypotheses
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 Englmair and Wambach (2010) show that inequity aversion affects the optimal labor contract, even when agents are paid independently of each other. Often both risk and inequality are pertinent in these situations. For example, a labor contract determines both a workers payoff and the inequality between her payoff and that of her colleagues, both of which are uncertain until their earnings are realized. Many other situations, for example tournaments, judicial procedures and lotteries share this feature that the resolution of uncertainty simultaneously determines absolute and relative payoffs. This is the type of situation we replicate in our experiment.

Our experiment examines whether such broad applications of social preference models are warranted. If we do not find an effect of social preferences that suggests one of two things. First, it can be that social preferences are irrelevant in settings where people do not affect each other. In that case social preferences have less of an impact that previously thought and do not need to be taken into account in many cases. Second, it can be that peoples’ preferences are better described by other types of preferences. Procedural fairness models (e.g. Trautmann, 2010), where people care about equal opportunities rather than equal outcomes, or models where people care about the earnings of the group (Charness & Rabin, 2002) are promising alternatives. 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 & Kirchsteiger, 2004 and Falk & 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.

Our experiment 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 preferences. 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 and 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.

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 given 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 by:

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

\(\alpha_i\) and \(\beta_i\) 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 participants’ 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 \(\alpha_i\) and \(\beta_i\) 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.*

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.

Bault et al. interpret this behavior as inequity seeking. However, that explanation depends on the assumption that participants form correct believes 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 where actually less likely to take risks 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. The behavior observed by Bault et al. may also be an attempt to express individuality by consciously choosing something different than the other.

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5 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 for LLH and LHH sets. HML sets yield a slightly different expression but this expression leads to the same expected treatment effects.
If we interpret the behavior in Bault et al.’s experiment as inequity seeking, that is the opposite of the behavior 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. This means people are assumed to be envious rather than inequity averse. They further assume that advantageous inequality is more important than disadvantageous inequality. Translated in terms of the Fehr and Schmidt model this means that people have a $\beta_i$ that is negative and in absolute terms larger than $\alpha_i$. 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 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 their finding 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.

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) is higher than in the alternative set, 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._

### 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, 1980 and Robson, 1992) do model a concern for rank to explain patterns in reported happiness. 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, LLH, LHH, and LMH sets. 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.

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.
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 equations:

LLH: \[ \frac{1}{3}H + \frac{2}{3}L + \frac{1}{3}R(1) + \frac{2}{3}R(2.5) \] (2)

LHH: \[ \frac{2}{3}H + \frac{1}{3}L + \frac{2}{3}R(1.5) + \frac{1}{3}R(3) \] (3)

LMH: \[ \frac{1}{3}H + \frac{1}{3}M + \frac{1}{3}L + \frac{1}{3}R(1) + \frac{1}{3}R(2) + \frac{1}{3}R(3) \] (4)

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

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:

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

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

\( (R(1) - R(1.5)) + (R(2.5) - R(3)) > (R(1.5) - R(2.5)) \) (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.\(^8\) 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 middle\(^9\).

\(^7\)Like the Fehr and 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.

\(^8\)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.)

\(^9\)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
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

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

(7)

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

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

(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 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. 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 euros (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.

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).

<table>
<thead>
<tr>
<th>Hypothesis 1a (Inequity Aversion) and 1b (Inequity seeking) (20 choice situations)</th>
<th>Individual treatment</th>
<th>Social treatment</th>
<th>Difference</th>
<th>p-value Wilcoxon-Mann-Whitney testa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hypothesis 2 (Maximin preferences) (15 choice situations)</td>
<td>69.73%</td>
<td>69.20%</td>
<td>0.53%</td>
<td>0.90</td>
</tr>
<tr>
<td>Hypothesis 3 (Ranking preferences)</td>
<td>40.57%</td>
<td>40.14%</td>
<td>0.43%</td>
<td>0.94</td>
</tr>
<tr>
<td>a) LLH versus LHH (8 choice situations)</td>
<td>41.22%</td>
<td>38.99%</td>
<td>2.23%</td>
<td>0.72</td>
</tr>
<tr>
<td>b) LLH versus LMH (4 choice situations)</td>
<td>43.24%</td>
<td>42.26%</td>
<td>0.98%</td>
<td>0.74</td>
</tr>
<tr>
<td>c) LMH versus LHH (2 choice situations)</td>
<td>33.78%</td>
<td>38.10%</td>
<td>4.31%</td>
<td>0.44</td>
</tr>
</tbody>
</table>

a One individual is one independent observation.

b In this case the percentages 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). The fact that we perform a large number of tests and find no evidence for any treatment effect in any of the choice situations strengthens the case against the effect of outcome-based social preferences in this setting.
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. Firstly, social comparison is clearly more focal in the social treatment. Secondly, previous experiments with similar protocols (e.g. Bault et al., 2008 and Linde & Sonnemans, 2012, see the introduction) 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. Although these studies show that social concerns do influence behavior in settings where decisions makers cannot influence the earnings of others, they do not show that people care about the earnings of others in the way predicted by social preference models. It may be that these types of preferences only manifest themselves in settings where the decision maker can affect the earnings of others.

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, 2010, and Krawczyk, 2011) 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 uncertainty\textsuperscript{11}.

All three matched participants in our social treatments have the same expected earnings so

\textsuperscript{11} 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 models\textsuperscript{11}. 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.
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. In that case social preferences are less broadly relevant than suggested by many models. Another possibility is that alternative models of social preferences better describe peoples’ preferences. Procedural fairness models seem to be a promising alternative as they capture behavior in situations where people can affect others as well as outcome based models, but do not predict a treatment effect in our experiment. Future research on decisions in which people can compare their earnings to others, but cannot change others’ outcomes may be able to distinguish between these explanations of our results.

Historically the development of models in experimental and behavioral economics of social preferences on the one hand and 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.

References


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

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

<table>
<thead>
<tr>
<th>Choice situation</th>
<th>Set A(^a)</th>
<th>Set B</th>
<th>Hypotheses(^b)</th>
<th>Results (% A)</th>
<th>Indiv.</th>
<th>Social</th>
<th>p(^c)</th>
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</thead>
<tbody>
<tr>
<td>#</td>
<td>Cards</td>
<td>Type</td>
<td>#</td>
<td>Cards</td>
<td>Type</td>
<td>La Inequity aversion</td>
<td>Lb Inequity seeking</td>
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<tr>
<td>1</td>
<td>1</td>
<td>LLH</td>
<td>4</td>
<td>1,1,15</td>
<td>LHH &lt; &gt; 0 &gt;</td>
<td>5.41%</td>
<td>11.90%</td>
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<td>2</td>
<td>1</td>
<td>LLH</td>
<td>7</td>
<td>8,8,15</td>
<td>LLH &lt; &gt; &lt; 0</td>
<td>8.11%</td>
<td>7.14%</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>LLH</td>
<td>2</td>
<td>1,8,22</td>
<td>LMH &lt; &gt; 0 &gt;</td>
<td>8.11%</td>
<td>19.05%</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>LLH</td>
<td>5</td>
<td>5,11,15</td>
<td>LMH &lt; &gt; &lt; &gt;</td>
<td>13.51%</td>
<td>9.52%</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>LHH</td>
<td>7</td>
<td>8,8,15</td>
<td>LHH &lt; &gt; &lt; &lt;</td>
<td>24.32%</td>
<td>33.33%</td>
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<tr>
<td>6</td>
<td>4</td>
<td>LHH</td>
<td>2</td>
<td>1,8,22</td>
<td>LMH &lt; &lt; 0 &lt;</td>
<td>83.78%</td>
<td>78.57%</td>
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<tr>
<td>7</td>
<td>4</td>
<td>LHH</td>
<td>5</td>
<td>5,11,15</td>
<td>LMH &lt; &gt; &lt; &lt;</td>
<td>48.65%</td>
<td>45.24%</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
<td>LHH</td>
<td>2</td>
<td>1,8,22</td>
<td>LMH &lt; &lt; &gt; &gt;</td>
<td>16.22%</td>
<td>21.43%</td>
</tr>
<tr>
<td>9</td>
<td>7</td>
<td>LHH</td>
<td>5</td>
<td>5,11,15</td>
<td>LMH &lt; &lt; &gt; &gt;</td>
<td>32.43%</td>
<td>38.10%</td>
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<tr>
<td>10</td>
<td>2</td>
<td>LHH</td>
<td>5</td>
<td>5,11,15</td>
<td>LMH &lt; &gt; &lt; 0</td>
<td>18.92%</td>
<td>19.05%</td>
</tr>
<tr>
<td>11</td>
<td>3</td>
<td>LHH</td>
<td>6</td>
<td>5,13,13</td>
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<td>10.81%</td>
<td>11.90%</td>
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<td>12</td>
<td>3</td>
<td>LHH</td>
<td>8</td>
<td>9,9,13</td>
<td>LLH &lt; &gt; &lt; 0</td>
<td>18.92%</td>
<td>11.90%</td>
</tr>
<tr>
<td>13</td>
<td>3</td>
<td>LHH</td>
<td>9</td>
<td>9,11,11</td>
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<td>16.22%</td>
<td>19.05%</td>
</tr>
<tr>
<td>14</td>
<td>3</td>
<td>LHH</td>
<td>10</td>
<td>10,10,11</td>
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<td>14.29%</td>
</tr>
<tr>
<td>15</td>
<td>6</td>
<td>LHH</td>
<td>8</td>
<td>9,9,13</td>
<td>LLH &lt; &gt; &lt; &lt;</td>
<td>48.65%</td>
<td>50.00%</td>
</tr>
<tr>
<td>16</td>
<td>6</td>
<td>LHH</td>
<td>9</td>
<td>9,11,11</td>
<td>LHH &lt; &gt; &lt; 0</td>
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<td>54.76%</td>
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<tr>
<td>17</td>
<td>6</td>
<td>LHH</td>
<td>10</td>
<td>10,10,11</td>
<td>LLH &lt; &gt; &lt; &lt;</td>
<td>24.32%</td>
<td>26.19%</td>
</tr>
<tr>
<td>18</td>
<td>8</td>
<td>LHH</td>
<td>9</td>
<td>9,11,11</td>
<td>LLH &lt; &gt; 0 &gt;</td>
<td>35.14%</td>
<td>23.81%</td>
</tr>
<tr>
<td>19</td>
<td>8</td>
<td>LHH</td>
<td>10</td>
<td>10,10,11</td>
<td>LLH &lt; &gt; &lt; 0</td>
<td>18.92%</td>
<td>14.29%</td>
</tr>
<tr>
<td>20</td>
<td>9</td>
<td>LHH</td>
<td>10</td>
<td>10,10,11</td>
<td>LLH &lt; &gt; &lt; &lt;</td>
<td>43.24%</td>
<td>40.48%</td>
</tr>
</tbody>
</table>

\(^a\) 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 and Schmidt model. For two peers the utility function of this model is:

\[ x_i - \frac{1}{2} \alpha_i \left( \max \left( x_i - x_j, 0 \right) + \max \left( x_j - x_i, 0 \right) \right) - \frac{1}{2} \beta_i \left( \max \left( x_i - x_j, 0 \right) + \max \left( x_j - x_i, 0 \right) \right) \]

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 \( x_j \) and \( x_2 \) the earnings of her two peers. \( \alpha_i \) and \( \beta_i \) 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:

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

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

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

And for a LMH set:

\[ \frac{1}{3} \left( H - \frac{1}{2} \beta_i (H - L) \right) - \frac{1}{2} \beta_i (H - M) \right) + \frac{1}{3} \left( M - \frac{1}{2} \alpha_i (H - M) - \frac{1}{2} \beta_i (M - L) \right) + \]

\[ \frac{1}{3} \left( L - \frac{1}{2} \alpha_i (H - L) - \frac{1}{2} \alpha_i (M - L) \right) = \]

\[ \frac{1}{3} H + \frac{1}{3} M + \frac{1}{3} \frac{1}{6} (\alpha_i + \beta_i) (H - L) - \frac{1}{6} (\alpha_i + \beta_i) (H - M) - \frac{1}{6} (\alpha_i + \beta_i) (M - L) = \]

\[ \frac{1}{3} H + \frac{1}{3} M + \frac{1}{3} \frac{1}{3} (\alpha_i + \beta_i) (H - L) \]

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.

---

12 The Fehr and 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 would not 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 $\beta_i$, disadvantageous inequality a disutility of $\alpha_i$. 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 1/3 because the numbers on the cards always add up to 31. This yields the following utility function:

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

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

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

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

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

Combining these equalities with function A6 yields:

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

For the LLH set we have the following expected utility:

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

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

Combining with A8 yields:

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

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:

$$\frac{1}{3} \left( H - \beta_i \left( H - 10 \frac{1}{3} \right) \right) + \frac{1}{3} \left( M - \beta_i \left( M - 10 \frac{1}{3} \right) \right) + \frac{1}{3} \left( L - \alpha_i \left( 10 \frac{1}{3} - L \right) \right)$$
if $M$ is bigger than $10 \frac{1}{3}$. If $M$ is smaller it is given by:

$$
\frac{1}{3} \left( H - \beta \left( H - 10 \frac{1}{3} \right) \right) + \frac{1}{3} \left( M - \alpha \left( 10 \frac{1}{3} - M \right) \right) + \frac{1}{3} \left( L - \alpha \left( 10 \frac{1}{3} - L \right) \right) \tag{A11}
$$

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 deceasing 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.