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# Peer Effects in Risk Taking

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## Abstract

We examine peer effects in risk taking with complete information and compare explanations for peer effects based on relative payoff concerns to explanations that allow peer choices to matter. We vary experimentally whether individuals can condition a simple lottery choice on the lottery choice, lottery allocation or an unrelated act of a peer. We find that peer effects increase significantly, almost double, when peers make choices, relative to when they are allocated a lottery. In contrast, peer effects are equally strong when individuals can condition on the lottery allocation or unrelated act of the peer. Further, imitation is the most frequent form of peer effect. Hence, peer effects in our environment are explained by a combination of relative payoff concerns and preferences that depend on peer choices. Comparative statics analyses and structural estimation results suggest that a norm to conform to the peer may explain why peer choices matter.

JEL-Code: C910, C920, D030, D830, G020.

Keywords: peer effects, decision making under risk, social comparison, laboratory experiment.

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*"Investing in speculative assets is a social activity"*

Shiller (1984)

# 1 Introduction

Decision making under risk is mainly studied at the individual level. Yet, an increasing body of research documents peer effects in risk taking. Peers have a large impact on stock market participation (e.g., Shiller, 1984; Hong et al., 2004), investment decisions (Bursztyn et al., 2012) and insurance choices (Cai et al., 2012), among others.[1] A main source of peer effects are preference interactions, in the terminology proposed by Manski (2000), whereby individual preferences depend on the actions of others.[2] Such preferences were argued as central to risk taking early on by Shiller (1984). A key open question is, *how* do preferences depend on others? Which factors matter?

As Manski (2000) writes, preference interactions may arise from "everyday ideas" such as envy or conformism. In other words, in environments with complete information, peer effects may be generated because individuals care about other's outcomes (envy) or because they care about other's choices (conformism) or both. Much attention in the literature on peer effects has been given to envy, a central concept in models of distributional social preferences, e.g., Fehr and Schmidt (1999).[3] These types of preferences have been used to explain peer effects in risk taking, including asset pricing (e.g., Galí, 1994; Gebhardt, 2004, 2011). Less attention has been given to preferences where the choices of peers, conditional on payoffs, have a direct impact on an individual's behavior. Among others, a main reason why choices may matter is provided by studies in social psychology, which show that individuals are often driven by a norm to conform to others' behavior (e.g., Cialdini and Trost, 1998; Cialdini and Goldstein, 2004). In models of conformity, others' choices provide a social anchor to which individuals conform (Festinger, 1954). However, in most existing studies on risk taking, peers either do not make choices, and thus the focus is only on payoffs, or payoffs and choices are directly linked and, hence, one cannot distinguish between explanations for peer effects based solely on distributional social preferences and those that allow choices to matter. This paper

[1] Peers might generally influence risk and other economic attitudes (Ahern et al., 2013). Peers also affect credit decisions (e.g., Banerjee et al., 2013; Georgarakos et al., 2012), savings decisions (e.g., Duflo and Saez, 2002; Kast et al., 2012) as well as different teenager (risky) behaviors (for an overview, see Sacerdote, 2011). Generally, peer effects are important in education (e.g., Sacerdote, 2001; Duflo et al., 2011), in labor (e.g., Falk and Ichino, 2006; Mas and Moretti, 2009; Card et al., 2010), and pro-social behavior (e.g., Gächter et al., 2013).

[2] See Manski (2000) for an overview of the sources of social interaction effects, which include market interactions, expectations interactions and preference interactions.

[3] Different models of distributional preferences have been proposed in the literature (for a survey, see Camerer, 2003; Fehr and Schmidt, 2006).

examines peer effects in simple decisions under risk and tests whether these can be explained by preferences over others' payoffs, preferences over others' choices or both. The main contribution is to show that peer choices play a significant role and, hence, that peer effects in our environment are not solely explained by preferences over others' payoffs, but by a combination of preferences over others' payoffs *and* choices.

To be able to cleanly identify peer effects, we use a controlled lab experiment in which individuals make risky choices, first individually and then in groups of two.[4] One player is assigned to be the first mover (peer) and the other the second mover (decision maker). Risky choices are made between two simple lotteries, with at most two outcomes and the same probabilities, and there is complete information.[5] We examine behavior in three main treatments. In the first treatment the peer chooses among lotteries (Choice treatment). In the second treatment, the peer is randomly allocated a lottery (Rand treatment). In the third treatment, as a control, the peer is asked to make a random draw, by clicking on a computer-simulated die, whose outcome (odd or even) is completely unrelated to the lotteries or payoffs. Since there are only two equally-likely outcomes, we refer to this as the Coin treatment.

A further question we address is *how* decision making changes in the presence of peers. Depending on the type of preference interaction, peer effects may lead to imitation or deviation (Clark and Oswald, 1998). To identify the direction of peer effects, as well as to avoid feedback effects, we elicit the decision maker's choices conditional on the peer's choice, allocation or unrelated act. This allows us to observe four different potential strategies. The decision maker may condition his choice on the peer's choice, allocation or act, by either imitating or deviating.[6] On the other hand, the decision maker may choose not to condition. In this case he either makes the same choice as he made individually or changes it, both being irrespective of the peer's choice, allocation or act. We say peer effects occur if the decision maker chooses *not* to stay with his individual choice.

Our results show that peer effects differ significantly when the peer is allocated a lottery compared to when he chooses a lottery, though payoffs remain constant across treatments. Decision makers choose not to stay with their individual choices in 18% of the cases in Rand and in 33% of the cases in Choice. Hence, choices of the peer matter, above and beyond their direct impact on payoffs, and almost double peer effects. Second, peer effects are not significantly different in

[4] See Manski (1993) for a discussion of the problems with the identification of peer (or social interaction) effects.

[5] We label one lottery as riskier than the other, in terms of variance.

[6] In Coin, the definition of imitation and deviation is arbitrary, as the decision maker cannot condition on the lottery of the peer but an unrelated random outcome, odd or even, as we detail below.

Rand and Coin, where decision makers change their individual choices in 17% of the cases. Thus, somewhat surprisingly, the possibility to condition on a peer's allocated lottery does not lead to stronger peer effects than the possibility to condition on an unrelated act of the peer.

In Coin and Rand, decision makers exhibit a similar likelihood to condition their choices on the peer. However, while they are equally likely to imitate or deviate in Coin, they are significantly more likely to imitate in Rand. This indicates that, conditional on being affected by the peer's presence, individuals seem to exhibit preferences over others' payoffs and, in particular, these are such that individuals prefer to imitate their peers. From Rand to Choice, the increase in peer effects mainly stems from a significant increase in the frequency of imitation, which doubles. Hence, in our environment, peer effects cannot *only* be explained by concerns about others' payoffs relative to own. This implies that a parsimonious explanation of preference interactions in risk taking needs to allow peer choices to matter.

We examine two alternative explanations for why peer choices matter. First, one may consider a more flexible specification of preferences over others' payoffs, by which these change depending on whether the peer makes choices or not. Intention-based models of social preferences (e.g., Blount, 1995; Bolton et al., 2005; Falk and Fischbacher, 2006) and studies of fairness considerations in risk taking (e.g., Cappelen et al., 2013) suggest that the strength of relative payoff concerns might depend on whether the peer actually makes a choice and, if so, whether she chooses to take on more or less risk than the decision maker. We examine whether this can explain the increase in peer effects from Rand to Choice by deriving predictions on how peer effects would change across treatments under such assumptions. First, we consider an increase in envy, i.e. the disutility from falling behind the peer, when the peer makes choices. This would increase the likelihood of imitation and, at the same time, increase the importance of expected payoff differences between lotteries, as these are relevant for (expected) payoff comparisons. We also examine the possibility that, when peers make choices, individuals especially dislike falling behind a peer who makes a safe choice. In this case, when the peer chooses among lotteries, we should observe a stronger increase in imitation towards the safer compared to the riskier lottery.

A second, alternative explanation for the increase in peer effects is, broadly speaking, that individuals are influenced by a norm to conform to others. More specifically, according to Festinger's (1954) theory of social comparison, individuals care about making correct choices and, in the absence of objective measures of correctness, consider others' choices as an anchor for correctness. Hence, if individuals exhibit such a preference to conform, peer choices should matter. They should increase the likelihood of imitation in Choice and this increase should not depend systematically on the type of lottery, risky or safe, or its expected payoff.

Given there was complete information, peer effects in our experiment cannot be explained by a model of rational social learning (e.g., Bikhchandani et al., 1998).[7] In the presence of complete information, under standard assumptions of rationality and self-interest, decision makers do not learn from others. However, decision makers who exhibit preferences for conformity may learn about the correctness of their choice.[8]

Our results reveal that the increase in imitation from Rand to Choice occurs both towards safer and riskier lotteries. At the same time, the expected payoffs of the lotteries do not play a systematic role in the increase in imitation. The latter suggests that the increase in imitation is not driven by an increase in envy. The former is at odds with an increase in envy that is dependent on how much risk the peer chooses to take. These findings are broadly in line with an explanation that choices matter due to a norm to conform to others. As an additional test, we structurally estimate a model of relative payoff concerns and a model based on social comparison theory, where individuals derive a constant utility from conforming to the peer's choice or allocation. We allow both relative payoff concerns and the utility from conforming to vary depending on whether the peer makes choices or not. We find that, under a model of relative payoff concerns, preference parameters do not change significantly when moving from Rand to Choice. In contrast, the utility from conforming increases significantly in Choice. The model based on social comparison theory fits our data significantly better, which provides further suggestive evidence that a reason why choices of peers matter may be due to a norm to conform to others.

Recent laboratory experiments have documented peer effects when peers are allocated lotteries (see Trautmann and Vieider (2011) for an overview). Bault et al. (2008), Rohde and Rohde (2011) and Linde and Sonnemans (2012) report that lotteries allocated to peers affect, in varying degrees, individual risky choices and emotions. Our control treatment, Coin, provides new insights relative to these previous results. It reveals that unrelated acts of peers may generate equally large peer effects. Lotteries allocated to peers may hence be seen as affecting the type of choices made,

[7] To increase the salience of complete information in our experiment, instructions were read aloud, for both potential roles in the experiment, and roles were assigned randomly within the same session. Also, we designed the lotteries to have at most two outcomes to minimize complexity. For a given probability distribution over the good and bad outcome, there were always six pairs of choices, which featured the exact same risky lottery. In half of the situations the safe lottery had two outcomes, and only one in the other half. The number of outcomes of the safe lottery, which can be viewed as a measure of complexity, does not have a significant influence on peer effects.

[8] In the famous experiments on conformity by Asch (1956) individuals conform to peers choosing an incorrect answer, though individually they are able to identify the correct answer.

imitation versus deviation, conditional on there being a peer effect. Two other related studies show that observing either the desired risky choices of others (Viscusi et al., 2011) or their past choices (Cooper and Rege, 2011) significantly affects in risk taking. In Cooper and Rege (2011) individuals are put in groups of six and provided either with private or social feedback. The comparative statics reveal that individuals move to safer choices with social feedback and, hence, suggest that social regret, a form of relative payoff concerns, is a better explanation for the peer effects they observe than conformity. In line with their results, we find a similar movement towards safer choices when decision makers can condition on the peer's lottery, within each treatment, Rand and Choice. A main contribution of our study is to show that, over and above relative payoff concerns, the choices of peers play a significant role. Hence, when modeling preference interactions in risk taking it may be misguided to focus only on relative payoff concerns.

Our experiment also complements studies testing the channels of peer effects in other environments. Gächter et al. (2013) and Goeree and Yariv (2007) examine whether peer effects are driven by distributional social preferences or social norms (or a norm to act like others), in a gift-exchange game and a social learning environment, respectively. While Gächter et al. (2013) find that peer effects can be explained by distributional social preferences, Goeree and Yariv (2007) find that conforming behavior cannot be explained by distributional social preferences, but is consistent with a preference for conformity.[9] Additionally, two recent field experiments focus on separating social learning from preference interactions. Cai et al. (2012) and show that social learning matters most in the context of rainfall insurance in China, while Bursztyn et al. (2012) find that preference interactions also play a significant role in investment decisions in Brazil.

Overall, our finding that choices by peers matter in risk taking can be important from a policy perspective. In different environments, policy makers as well as private companies may be interested in influencing risky choices of individuals. Our results suggest that whether peers are viewed as having made choices, e.g., they have actively chosen to buy insurance or to purchase a financial product, relative to having been endowed or given that same product, may be important for the spread of risky choices. A specific example are pension plan choices, where peers may be viewed as having chosen a plan or as following the default plan (under automatic enrollment).

The remainder of the paper is organized as follows. In Section 2 we describe the experimental design and procedures in detail and derive testable hypotheses. Our main results are presented and

[9]There are a variety of studies examining social comparison effects in games such as public good games or coordination games (e.g., Falk and Fischbacher, 2002; Falk et al., 2013). In social learning environments, Çelen and Kariv (2004) also study herding behavior, and identify substantial herding behavior.

discussed in Section 3. Section 4 concludes.

# 2 Experimental Design

## 2.1 Treatments

Our experiment elicits multiple choices between two lotteries, $A$ and $B$, with at most two possible outcomes. $A$ always has a larger variance than $B$. We refer to $A$ as the risky option or lottery, and $B$ as the safe one.[10] The exact lotteries are described in Section 2.2 below.

In the first part of the experiment (Part I), subjects make lottery choices individually. In the second part (Part II), they make the same choices, but in a different order, and in groups of two. In each group, one subject is assigned to be *first mover* and the other *second mover*.[11] We consider a weak form of a peer: The decision maker (second mover) only knows that the peer (first mover) is a subject in the same session, but she remains anonymous throughout.[12] In Part II risks are *perfectly correlated* across group members: a single draw of nature determines the payoffs of both members. Perfect correlation is common in risk taking environments, where peer effects have been studied. Among others, risks are perfectly correlated in stock purchases as well as for many investment products, such as that considered by Bursztyn et al. (2012). They are also almost perfectly correlated in the weather insurance considered by Cai et al. (2012).[13]

In our two main treatments the decision maker can condition his choice in Part II on the peer. In the first treatment (Rand) the peer does not make a decision in Part II, instead she is exogenously (randomly, with equal probability) allocated lottery $A$ or $B$. In the second treatment (Choice), the peer chooses lottery $A$ or $B$. Additionally, in a control treatment (Coin), the decision maker can make choices conditional on the peer, but based on a dimension that is unrelated to the lottery choice situation. At the end of the experiment, the peer rolls a computer-simulated die, by clicking a button on the screen, and the decision maker can condition his choices on whether the outcome is *odd* or *even*. For simplicity, we refer to this as a coin flip.

We use the strategy method in Part II, which allows us to observe the strategy of the decision

[10] In terms of risk preferences B cannot be labeled as safe since it does not necessarily yield a certain payoff. In comparison to $A$, we still label it as safe, for simplicity, as its variance is always smaller. But note that a risk averse individual does not necessarily prefer $B$ over $A$.

[11] Groups remain the same for the whole of Part II. All choices are made without any feedback until the end of the experiment. During Part I participants only know there will be a Part II in the experiment, but do not know anything about the decisions they will be asked to make.

[12] Throughout, we will refer to the peer as "she" and the decision maker as "he".

[13] At the end of the experiment, individuals are informed about their payoff and, if Part II is drawn for payment, the choice and payoff of the other individual in the group.

maker conditional on the two possible choices, allocations or the unrelated act of the peer. This allows us to examine four potential strategies of second movers:

i) *Imitate* the first mover: choose $A$ if the peer has $A$ or *odd*, $B$ if the peer has $B$ or *even*,

ii) *Deviate* from the first mover: choose $A$ if the peer has $B$ or *even*, $B$ if the peer has $A$ or *odd*,

iii) *Revise* own choice: make a different choice than in Part I, independent of the peer,

iv) *No change*: make the same choice as in Part I.

Note that in Coin the definition of imitation and deviation is arbitrary, as there is no direct link between the lottery choice of the decision maker and that of the peer. Additionally, while the last strategy, no change, implies the absence of a peer effect, the first three strategies all involve different forms of peer effects. As an overall measure, we define a peer effect to occur if the individual *switches*, i.e. chooses a different lottery in Part II than in Part I for at least one potential choice, allocation or act of the peer.

The strategy method avoids any feedback effects, by keeping information about the risk preferences or consistency of the peer absent, during the experiment. At the same time, it may potentially affect the choices made by subjects. Brandts and Charness (2000) find that the strategy method does not generally generate differences in treatment effects, and Cason and Mui (1998) do not find an effect of the strategy method in a dictator game where the effects of social information are studied. Similarly, in two additional treatments, we do not find evidence suggesting the strategy method had an effect in our setting.[14]

## 2.2 Lotteries

The lotteries presented to subjects are summarized in Table 1. $A$ yields the same payoffs throughout, a payoff $m_A^g = 20$ in the good state ($g$), which occurs with probability $p$, and a payoff $m_A^b = 0$ in the bad state ($b$). The payoffs of $B$ are similar to those of an insurance product, $m_B^g = 20 - (1-p)cf$ and $m_B^b = 0 + c - (1-p)cf$, with the same probabilities as $A$. Compared to $A$, in each state a "premium" of $\delta = (1-p)cf$ is subtracted, while in the $b$ state $B$ pays a coverage $c$. We vary $c$, $p$ and $f$ across choice situations.

[14] More specifically, we conducted a Base treatment, in which choices were made twice, in Part I and Part II, without the strategy method and without social feedback. We also conducted an Anticipation treatment, without the strategy method, but where individuals were aware they would be given feedback about the peer's choice *at the end* of the experiment. Consistent with the effects of our main treatments, we observe peer effects increase significantly with anticipated social feedback, from occurring in 6.7% of the decisions in Base to 17.5% in the Anticipation treatment (Mann-Whitney test, p-value=0.016).

We use the notation $m^g{}_p m^b$ in Table 1 to define a lottery that pays $m^g$ with probability $p$ and $m^b$ with remaining probability $1-p$. First, we divide the lotteries into three groups: lotteries with $p = 0.2$, $p = 0.5$ and $p = 0.8$. Within each group, there are six decision problems: two with $f = 1.2$, two with $f = 1$ and two with $f = 0.8$. Throughout the paper, when $f = 0.8$, $B$ has a higher expected value than $A$ ($EV_B > EV_A$), when $f = 1$, $EV_B = EV_A$, and when $f = 1.2$, $EV_B < EV_A$.[15] For each possible combination of $p$ and $f$, $c$ is either 20 or 15. We label lotteries with $c = 20$ as *certainty lotteries*, and those with $c = 15$ as *uncertainty lotteries*.[16]

| Nr. | Lottery $A$ | Lottery $B$ | $c$ | $f$ | $EV_A$ | $EV_B$ |
|---|---|---|---|---|---|---|
| | | **Panel A: 20/80 Lotteries** | | | | |
| 1 | $20_{0.2}0$ | $0.80_1$ | 20 | 1.2 | 4.00 | 0.80 |
| 2 | $20_{0.2}0$ | $5.60_{0.2}0.60$ | 15 | 1.2 | 4.00 | 1.60 |
| 3 | $20_{0.2}0$ | $4.00_1$ | 20 | 1.0 | 4.00 | 4.00 |
| 4 | $20_{0.2}0$ | $8.00_{0.2}3.00$ | 15 | 1.0 | 4.00 | 4.00 |
| 5 | $20_{0.2}0$ | $7.2_1$ | 20 | 0.8 | 4.00 | 7.20 |
| 6 | $20_{0.2}0$ | $10.40_{0.2}5.40$ | 15 | 0.8 | 4.00 | 6.40 |
| | | **Panel B: 50/50 Lotteries** | | | | |
| 7 | $20_{0.5}0$ | $8.00_1$ | 20 | 1.2 | 10.00 | 8.00 |
| 8 | $20_{0.5}0$ | $11.00_{0.5}6.00$ | 15 | 1.2 | 10.00 | 8.50 |
| 9 | $20_{0.5}0$ | $10.00_1$ | 20 | 1.0 | 10.00 | 10.00 |
| 10 | $20_{0.5}0$ | $12.50_{0.5}7.50$ | 15 | 1.0 | 10.00 | 10.00 |
| 11 | $20_{0.5}0$ | $12.00_1$ | 20 | 0.8 | 10.00 | 12.00 |
| 12 | $20_{0.5}0$ | $14.00_{0.5}9.00$ | 15 | 0.8 | 10.00 | 11.50 |
| | | **Panel C: 80/20 Lotteries** | | | | |
| 13 | $20_{0.8}0$ | $15.20_1$ | 20 | 1.2 | 16.00 | 15.20 |
| 14 | $20_{0.8}0$ | $16.40_{0.8}11.40$ | 15 | 1.2 | 16.00 | 15.40 |
| 15 | $20_{0.8}0$ | $16.00_1$ | 20 | 1.0 | 16.00 | 16.00 |
| 16 | $20_{0.8}0$ | $17.00_{0.8}12.00$ | 15 | 1.0 | 16.00 | 16.00 |
| 17 | $20_{0.8}0$ | $16.80_1$ | 20 | 0.8 | 16.00 | 16.80 |
| 18 | $20_{0.8}0$ | $17.60_{0.8}12.60$ | 15 | 0.8 | 16.00 | 16.60 |

Table 1: Decision Problems

Each panel in Table 1, if divided by the level of $c$, can be seen as a multiple decision list (e.g., Holt and Laury, 2002). We presented choices individually, instead of using a list format, to have maximum control over the individuals' information and potential reference point. The order of the lotteries was randomized across Part I and II. The position of lottery $A$ and $B$ on the screen (left

[15] We will use the terms expected value and $f$ interchangeably.

[16] We also included two additional choices to serve as controls for the certainty effect (Kahneman and Tversky, 1979; Andreoni and Sprenger, 2009). We analyze these decisions and the role of peers in a separate working paper.

or right) was also randomized across subjects to avoid systematic reference point effects (Sprenger, 2012).

### 2.3 Experimental procedures

Sessions were conducted in MELESSA (Munich Experimental Laboratory for Economic and Social Sciences) at the University of Munich. Each session lasted approximately one hour. Instructions were handed out in printed form and read aloud by the experimenter at the beginning of each session.[17,18] The experiment was computerized using zTree (Fischbacher, 2007). In total, 188 subjects participated in the main treatments of the experiment (68 in Coin, 60 in Rand, and 60 in Choice). Their average age was 24 years and roughly 65% of all participants were female. Fields of study were almost equally distributed over 20 different fields, ranging from medicine, through cultural studies to business and economics.

One choice from one part was randomly selected at the end of the experiment for payment. If Part I was selected for payment, then one decision problem was drawn for each participant. If Part II was drawn, one decision problem was selected for each and every group only. Thus, for both group members the same decision problem was payoff-relevant.[19] Subjects were paid a show-up fee of 4 Euro additionally to their earnings from their lottery choices, yielding in total an average of 15 Euro per subject.

### 2.4 Hypotheses

A large literature argues that individuals have preferences over their outcomes (payoffs) relative to others. It is usually assumed that individuals dislike payoff differences, especially falling behind others, and hence that they want to "keep up with the Joneses".[20] A widely used model of relative

[17] The instructions of the Choice treatment can be found in Appendix B, the instructions of the other treatments can be obtained from the authors.

[18] In every treatment, subjects were provided with an answer sheet at the beginning of Part I, which displayed every decision problem in the same order as presented in Part I and on which they could record their decisions made in Part I.

[19] To ensure credibility, one participant was randomly selected as assistant at the end of the experiment. The assistant drew one ball from an opaque bag containing balls corresponding to each part and from a second bag with balls corresponding to each decision problem. For each decision problem, the respective combination of black and white balls was put in an opaque bag and the assistant again drew one ball. Once all draws were done, payoffs were computed and subjects were paid out in cash.

[20] This literature started with Veblen (1899) and Duesenberry (1949), who argued that conspicuous consumption choices can be explained by a desire to signal a superior status, prowess or strength. A game-theoretic literature has focused on the implications of status concerns on conspicuous consumption (see, e.g., Hopkins and Kornienko, 2004) and conformity (see, e.g., Bernheim, 1994). Here we focus on ex-post payoff differences between the decision maker and his peer, and measure strategy choices of decision makers, who make conditional choices for each of the two possible lotteries of the peer. Related studies on social preferences under risk (e.g., Trautmann, 2009; Saito, 2013)

payoff concerns is that by Fehr and Schmidt (1999), in which individuals dislike being behind but also dislike earning more than the peer.[21]

Across Rand and Choice payoffs remain the same. Hence, *independently* of the specific functional form of relative payoff concerns, if these are the central motive behind peer effects, these should be the same in Rand and Choice. Relatedly, in Coin, decision makers cannot condition on the lotteries of the peers. Hence, no conditioning is expected.[22] This leads to the following Hypothesis.

**Hypothesis 0:** *Peer effects are the same in Rand and Choice. Peer effects are weaker in Coin than in Rand and Choice.*

Note that Hypothesis 0 relies on the assumption of perfectly correlated risks. This allows for potential imitation of both risky and safe choices. In contrast, under idiosyncratic risks, relative payoff concerns à la Fehr and Schmidt (1999), may yield to situations in which choosing the safe lottery is the unique equilibrium, as shown in Friedl et al. (2013).

While the assumption of relative payoff concerns is central in the literature, recent evidence as well as a large literature in social psychology suggest that not only payoffs may matter, but that the fact that the peer makes active choices may be an important factor generating peer effects.

In particular, recent evidence suggests that relative payoff concerns depend on whether the peer makes a choice or not (e.g., Falk and Fischbacher, 2006). For example, in ultimatum and battle-of-the-sexes games, Bolton et al. (2005) show that when payoff differences are the result of a fair random draw individuals are less likely to react negatively to receiving a lower payoff. In the context of our experiment, this suggests that disadvantageous payoff differences in Rand, which are the result of a 50-50 allocation of $A$ or $B$ to the peer, may be disliked less strongly than in Choice. Hence, when moving from Rand to Choice, the dislike of falling behind may increase.[23]

point out that individuals may exhibit ex-ante relative payoff concerns, i.e. dislike inequality in expected payoffs. In our setting, such concerns yield qualitatively the same predictions, since risks are perfectly correlated. By choosing the lottery of the peer, decision makers can equalize expected payoffs both in Rand and Choice.

[21]In the context of risk taking in the presence of others, whether individuals exhibit a desire to be ahead or not may depend on the situation (see Maccheroni et al. (2012), for a discussion). In our context, in which payoff differences are relatively small and the situation allows for a simple comparison with the peer, we would rather expect individuals dislike falling behind others, but enjoy being ahead. In Appendix A.1 we propose such a model in which decision makers are loss averse with respect to the peer's outcome, and derive conditions under which peer effects are expected to occur. Note that assuming a dislike to being ahead of the peer would even strengthen the incentive to imitate the peer.

[22]In Coin payoff differences cannot be eliminated with certainty, unless the decision maker is certain about the peer's choice. While conditional choices are not expected, we could observe revisions which are driven by relative payoff concerns.

[23]In Appendix A.2, we provide details on the following argument using the model of relative payoff concerns introduced in Appendix A.1.

This change directly increases the weight on (negatively valued) payoff differences in the decision maker's utility, which increases the likelihood of imitation. Payoff differences in expectation, at the same time, crucially depend on how $A$ and $B$ relate in terms of their expected values. Thus, if the disutility from falling behind is more pronounced in Choice compared to Rand, the effect of choices by the peer, relative to allocations, should also depend on expected values of $A$ relative to $B$.

Suppose the expected value of $A$ equals that of $B$ ($f = 1$). In this case, the marginal increase in disutility from falling behind when choosing $A$ or $B$ is of the same magnitude. However, if lottery $A$ yields a higher expected payoff ($f > 1$), the marginal increase is stronger in magnitude in case the decision maker chooses $B$ and the peer chooses $A$ than vice versa. This implies a stronger incentive to imitate $A$ compared to $B$. The same rationale applies to the case where $EV_A < EV_B$. Hence, if a dislike of being behind the peer increases from Rand to Choice, not only does imitation increase, but this increase in imitation depends on $f$.[24]

**Hypothesis 1A:** *Moving from Rand to Choice, imitation increases equally towards $A$ and $B$ if $f = 1$. It increases more towards $A$ than towards $B$ if $f > 1$ and less if $f < 1$.*

Alternatively, recent evidence on fairness considerations in risk taking (Cappelen et al., 2013) suggests that relative payoff concerns may depend on whether the peer chose to take on more or less risk. They show that individuals share less when others took on more risk, compared to when they took the same amount of risk but their luck differed. This suggests that relative payoff concerns would increase in Choice, and this increase would be stronger when the peer chooses the safe lottery $B$.[25]

**Hypothesis 1B:** *Moving from Rand to Choice, imitation towards $B$ increases more than towards $A$.*

An extensive literature on social comparisons in social psychology proposes a different mechanism through which peer choices might be important. According to Festinger (1950, 1954), humans have a drive to evaluate their opinions and attitudes. In the absence of an objective, non-social

[24] There are potentially different ways to model how relative payoff concerns are altered in Choice. For example, one could introduce a weighting factor in Choice, to increase all parameters that define relative payoff concerns as given in Fehr and Schmidt (1999). Qualitatively, it still increases the importance of $f$. In Appendix A.2 we show that predictions remain the same as long the decision maker suffers more from being worse off than suffers from being better off.

[25] We should additionally note that the effect outlined in Hypothesis 1A would also play a role here. In particular, it would imply that the increase in imitation towards $B$ would be more dependent on $f$ than the increase in imitation towards $A$. In particular, for $f = 1$, imitation towards $B$ would increase significantly more than towards $A$. This difference would increase even further when $f > 1$, and would be smaller when $f < 1$.

measure, individuals measure the "correctness" of their opinions and attitudes by comparison with others.[26] When there are discrepancies between the attitudes of individuals in a group, Festinger predicts that individuals will reduce these discrepancies, either by communicating with others (influence) or by changing their attitudes towards those of the group (conformity). Festinger (1954) also argues that the strength of the influence of others will depend on how divergent their situations are from the individual's situation. The closer others' situation is, the more likely it is to be an important anchor for the evaluation of "correctness". Empirically, there is a wide range of evidence in support of these predictions in studies in social psychology (for a review see, Cialdini and Trost, 1998, and Cialdini and Goldstein, 2004).

Our treatments can be interpreted as changing the social anchor. First, in Choice, the decision maker can condition his choice on the choice of his peer, i.e. the peer's choice is the social anchor. Second, in Rand, the decision maker can condition his choice on the lottery allocated to the peer. Hence, the situation of the peer is less similar and can be seen as a weaker social anchor. Though this type of "difference" is not directly discussed by Festinger, if we apply the concept of divergence in terms of the situation of the peer, we would predict a weaker influence of the peer in Rand.[27,28] This should lead to more imitation in Choice, independent of lottery characteristics. The increase should be symmetric with respect to the two available options, $A$ or $B$, and should not differ depending on $f$.[29] We close this section with our last hypothesis.

**Hypothesis 1C:** *Moving from Rand to Choice, imitation towards $A$ and $B$ increases equally, and does not depend on $f$.*

# 3 Results

## 3.1 Decisions in Part I

We start this section with a brief review of decisions in Part I. We find no significant differences across treatments in individual decisions in Part I, as expected. Table 2 describes the average frequency with which $A$ was chosen, over all decisions, by first and second movers, respectively, in

[26] According to Festinger, "an opinion, a belief, an attitude is "correct", "valid", and "proper" to the extent that it is anchored in a group of people with similar beliefs, opinions and attitudes." Festinger (1950).

[27] When discussing the effect of similarity with the other's situation, Festinger illustrates his argument using as an example the case of a college student who is not likely to compare himself to immates from an institution for the feeble minded to evaluate his own intelligence (Festinger 1954, p.120).

[28] In the Coin treatment, the decision maker can condition her choice on the outcome of a coin toss by the peer. In this case, the anchor is most distant from the decision maker's choice, as it is unrelated to his choice or payoffs.

[29] See Appendix A.3 for a straightforward model based on social comparison theory.

each treatment. First movers choose $A$ on average between 17.3% and 23.3% of the time, second movers choose $A$ between 17.0% and 22.5% of the time. The Mann-Whitney (MW) tests reported in the bottom part of Table 2 reveal that the differences are not significant.

| | % of $A$ choices in Part I | |
|---|---|---|
| | First Mover | Second Mover |
| Coin | 17.3% | 19.9% |
| Rand | 20.2% | 21.7% |
| Choice | 23.3% | 17.0% |
| Mann-Whitney test, p-values: | | |
| Coin vs. Rand | 0.7431 | 0.7458 |
| Coin vs. Choice | 0.3622 | 0.4139 |
| Rand vs. Choice | 0.5607 | 0.3783 |

Table 2: Average Frequency of $A$ choices in Part I

Choices in Part I display a strong variance depending on the decision problem. If $B$ has a lower expected payoff ($f > 1$), a vast majority of decision makers chooses lottery $A$ when $p = 0.2$ (88.8% and 71.1%). This frequency drops to 19.7% and 20.6% when $p = 0.5$ and to 17.5% and 16.2% when $p = 0.8$. Instead, when $B$ has a higher expected payoff ($f < 1$), it is chosen in the majority of all cases. In the intermediate cases, where $A$ and $B$ have the same expected payoff ($f = 1$), the frequency with which $A$ is chosen again varies from over 26% when $p = 0.2$ down to 7.0% when $p = 0.5$.[30] Hence, on average decision makers are risk averse, as is usually observed in experiments.[31]

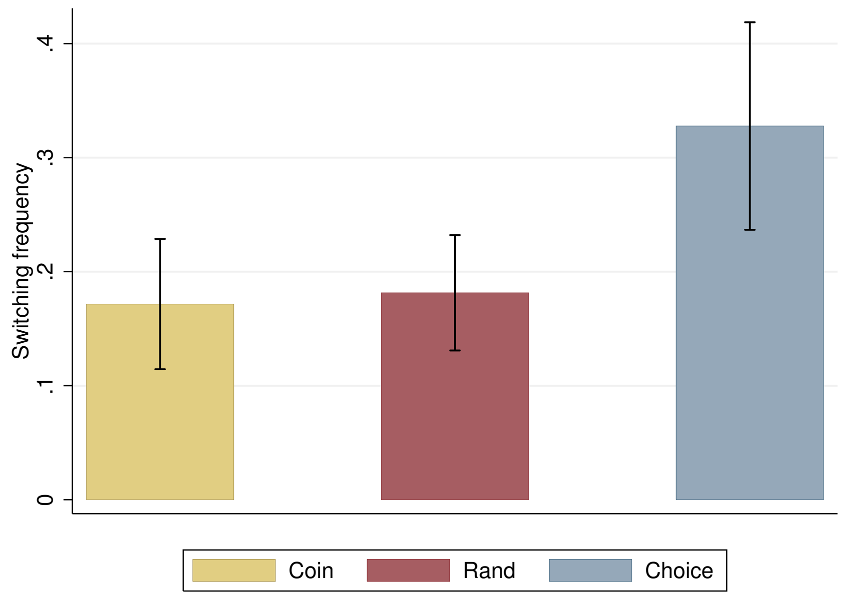
### 3.2 Peer Effects by Treatment

Figure 1 compares the average frequency with which decision makers switch with respect to Part I. As defined above, a switch is a change in lottery choice with respect to Part I, for at least one of the two potential choices made by the peer.

In Coin subjects switch in 17% of the cases, while they switch in 18% of the cases in Rand. This difference is not significant (MW-test, p-value=0.53). The switching frequency differs significantly - goes up to 33% - in Choice (MW-test, p-value=0.03 compared to Coin and 0.07 compared to

[30] A detailed overview of choices in Part I is provided in Table 5 in Appendix C.1.

[31] We also controlled for consistency of decisions in Part I. If we assume that subjects have CRRA preferences and given the design of our lotteries, we can classify second movers as consistent or inconsistent decision makers. We find across different probability panels, controlling for certainty, that at most 15.4% of decisions patterns are inconsistent. If we exclude inconsistent decision makers from our sample our results remain qualitatively the same.




Note: Switching takes value 1 if the second mover changes his choice in Part II for at least one of the possible choices of the first mover with respect to the choice made in Part I for the same decision. Error bars in Figure 1 (a) represent ±1.645 SE, a 90% confidence interval.

Figure 1: Peer effects by treatment

Rand).[32] Hence, peer effects are significantly larger in Choice, than in Coin and Rand. This leads to Result 1.

**Result 1.** *Peer effects are significantly stronger in Choice than in Rand. Peer effects do not differ significantly in Rand and Coin.*

Based on Result 1 we reject Hypothesis 0. Peer effects in risky choices are significantly different when decision makers can condition on the peer's choices, relative to allocated lotteries and unrelated peer actions. Surprisingly, peer effects are not significantly stronger when decision makers can condition on the peer's allocated lotteries relative to her unrelated acts.

To examine where peer effects stem from we examine the strategies adopted by decision makers when switching. Figure 2 displays the frequency with which decision makers choose to (1) imitate the peer, (2) deviate from the peer or (3) revise their choice from Part I (irrespective of the peer).[33]

Not surprisingly, given the lack of a link between the unrelated act of the peer and her lottery

[32] At the individual level, the distribution of switching rates also differs across treatments. It is significantly different in Choice, compared to Rand and Coin (Kolmogorov-Smirnov test, p-value=0.02 compared to Coin, p-value=0.09 compared to Rand). But does not differ significantly across Rand and Coin (Kolmogorov-Smirnov test, p-value=0.96). Figure 4 in Appendix C.1 displays the distribution of switching rates by treatment.

[33] Table 6 in Appendix C.1 displays the frequency of each strategy choice for each decision, by treatment.

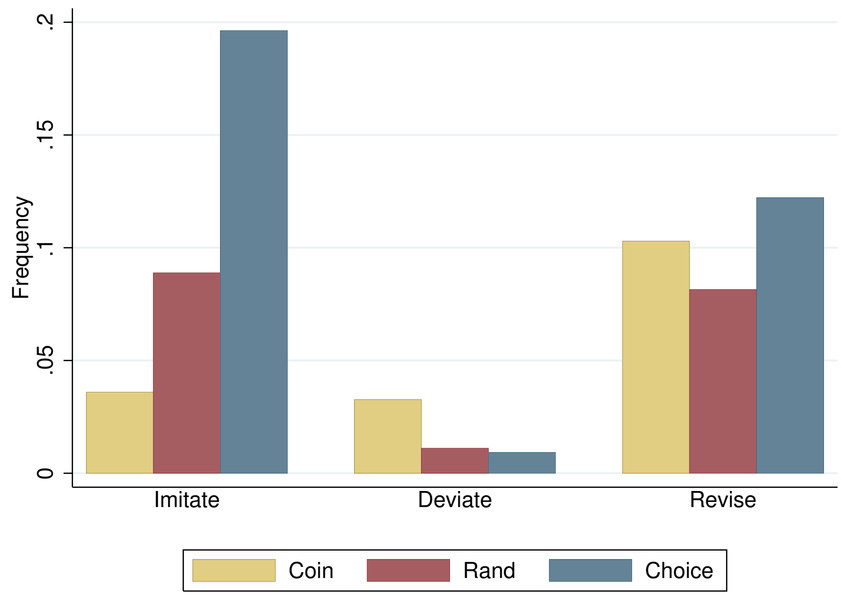



Figure 2: Strategy choices by treatment, when switching

choice in Coin, the frequency of imitation (3.6%) is similar to that of deviation (3.3%). In comparison, in Rand, the frequency of imitation increases to 8.9% and that of deviation decreases to 1.1%. The increase in imitation is marginally significant as displayed in Table 3, column (1), based on a multinomial logit regression. Interestingly, adding the frequency of imitation and deviation reveals that decision makers condition their choice on the peer in 6.9% of the cases in Coin and in 10% of the cases in Rand. This difference is not significantly different, as shown in column (4) of Table 3. Hence, while decision makers do not condition their choices more frequently in Rand than in Coin, when doing so, they adopt the strategy of imitating significantly more often.

In Choice imitation is significantly more frequent, and occurs in 19.6% of the cases. As shown in Table 3, column (1), the likelihood of imitation increases significantly in Choice relative to Coin. Further, it also increases significantly with respect to Rand (t-test, p-value=0.0582). In turn, decision makers are significantly more likely to make conditional choices (column (4)) in Choice than in Coin (t-test, p-value=0.021) and Rand (t-test, p-value=0.0646).

In contrast to imitation, deviation (column (2) of Table 3) and revisions (column (3) of Table 3) are not significantly affected by Rand and Choice, relative to the decision to stay with Part I choice. Two lottery characteristics influence the decision to revise: (i) if the lottery has a probability of 0.5, the likelihood of revising decreases, and (ii) if the expected value of $A$ is equal or smaller than that of $B$ ($f \leq 1$), it increases.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | | Strategy choice | | Likelihood of |
| | Imitate | Deviate | Revise | conditional choice |
| Rand | 0.088* | -0.022 | -0.027 | 0.042 |
| | [0.051] | [0.016] | [0.028] | [0.057] |
| Choice | 0.170*** | -0.023 | 0.016 | 0.132** |
| | [0.058] | [0.017] | [0.031] | [0.059] |
| $p = 0.5$ | -0.01 | -0.001 | -0.072*** | -0.012 |
| | [0.020] | [0.008] | [0.024] | [0.020] |
| $p = 0.8$ | -0.002 | -0.007 | -0.009 | -0.009 |
| | [0.022] | [0.008] | [0.018] | [0.022] |
| $f = 0.8$ | 0.017 | 0.014** | 0.098*** | 0.032** |
| | [0.016] | [0.007] | [0.017] | [0.016] |
| $f = 1$ | 0.021 | 0.012 | 0.070*** | 0.035** |
| | [0.016] | [0.008] | [0.016] | [0.017] |
| Certainty | 0.002 | 0.001 | -0.004 | 0.004 |
| | [0.010] | [0.006] | [0.010] | [0.012] |
| N | | 1692 | | 1692 |
| Pseudo-Loglikelihood | | -1163.39 | | -599.53 |
| Pseudo-R2 | | 0.0697 | | 0.0464 |

Note: This table presents estimated marginal effects from a multinomial logit regression on the strategy choice, taking no change as the base outcome, in columns (1) to (3), and marginal effects from a logit regression on the decision to condition on the peer (imitate or deviate) in column (4). Rand and Choice denote dummies for each treatment, where Coin is the omitted category. The variables $p = 0.5$ and $p = 0.8$ refer to the lotteries with these probabilities, taking $p = 0.2$ as omitted category. $f = 0.8$ and $f = 1$ are dummy variables for the expected value of $A$ versus $B$, as defined in Table 1. Certainty takes value 1 if lottery $B$ is degenerate, 0 otherwise. All regressions include individual characteristics as controls: gender, a dummy for business or economics major and age. Standard errors are presented in brackets and clustered at the individual level. ***, **,* indicate significance at the 1%, 5% and 10% level, respectively.

Table 3: Determinants of strategy choices in Part II

The findings so far are summarized below.

**Result 2.**

a) *Conditional choices are significantly more frequent in Choice than in Rand and Coin. At the same time, conditional choices are not more frequent in Rand than in Coin.*

b) *Imitation is significantly more frequent in Choice than in Rand and Coin. Imitation is also more frequent in Rand than in Coin.*

Hence, when decision makers can condition their choices on peers we mainly observe an increase in imitation, relative to when they can condition on their allocated lotteries or unrelated act of the peer. At the same time, on the "intensive" margin, for those decision makers who condition, imitation is the most frequently used strategy in Rand, but not in Coin. Thus, the results so far reveal that relative payoff concerns are present when the peer is allocated a lottery. However, actions of the peer matter in addition to their effect on payoffs. In what follows we investigate the increase in imitation when the peer makes active choices and examine whether it is consistent with Hypotheses 1A, 1B or 1C.

Before doing so, we briefly address switching by the peer in our empirical analysis. Peers on average switch in 12.9% of the cases in Coin, 48.0% in Rand and 11.7% in Choice. The switching rate is close to 50% in Rand, since lotteries are randomly assigned to the peer with probability 0.5. Switching does not differ significantly across Coin and Choice (MW-test, p-value=0.6962).

## 3.3 Imitation

Figure 3 below displays the average frequency of imitation towards $A$ on the left-hand side, and towards $B$, on the right-hand side. Within each chart, imitation is divided by $f$ and treatment.

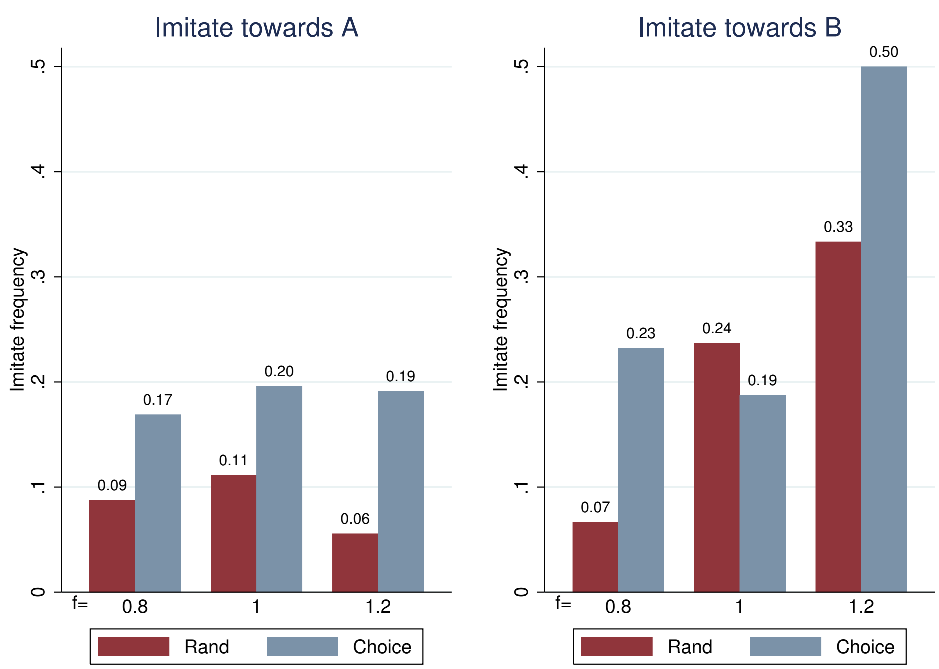



Figure 3: Imitation towards A and B, by $f$ and treatment

The first two main features of imitation in the data are that (i) the frequency of imitation towards $B$ is on average higher than that towards $A$, both in Rand and Choice, and (ii) moving to Choice the average rate of imitation increases towards both $A$ and $B$. To examine the alternative hypotheses 1A–1C in detail, we regress the likelihood of imitation on the treatment, the lottery held by the peer, and the lottery characteristics, including separate regressions depending on $f$. The results are presented in Table 4.

| | Probability of imitation | | | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| | All choices | If $f = 0.8$ | If $f = 1$ | If $f = 1.2$ |
| Choice | 0.134** | 0.079 | 0.123* | 0.180** |
| | [0.065] | [0.072] | [0.074] | [0.073] |
| Towards $B$ | 0.134*** | 0.098* | 0.173*** | 0.179 |
| | [0.037] | [0.057] | [0.051] | [0.117] |
| Choice * Towards $B$ | -0.061 | 0.053 | -0.222** | -0.044 |
| | [0.048] | [0.077] | [0.107] | [0.122] |
| $p = 0.5$ | 0.019 | 0.115*** | -0.003 | -0.045 |
| | [0.031] | [0.042] | [0.045] | [0.041] |
| $p = 0.8$ | 0.023 | 0.112*** | -0.01 | -0.01 |
| | [0.032] | [0.040] | [0.040] | [0.042] |
| Certainty | 0.008 | -0.01 | 0.019 | 0.009 |
| | [0.014] | [0.026] | [0.024] | [0.018] |
| $f = 0.8$ | -0.016 | | | |
| | [0.025] | | | |
| $f = 1$ | 0.014 | | | |
| | [0.024] | | | |
| Observations | 1080 | 360 | 360 | 360 |
| Pseudo-loglikelihood | -414.33644 | -135.0644 | -148.22734 | -119.9514 |
| Pseudo-R2 | 0.0635 | 0.0915 | 0.0474 | 0.1281 |

Note: This table presents estimated marginal effects from logit regressions on the probability of imitation. All independent variables are defined as in Table 3. All regressions control for individual characteristics: gender, a dummy for business or economics major and age. The estimated marginal effects remain with the same sign and similar in size, if we use OLS regressions to control for potential biases in the sign of the interaction effect (see Ai and Norton, 2003). Standard errors are presented in brackets and clustered at the individual level. ***, **,* indicate significance at the 1%, 5% and 10% level, respectively.

Table 4: Determinants of imitation

According to Hypothesis 1A, when $f < 1$, imitation towards $B$ should increase more strongly than that towards $A$. If $f > 1$, we would expect the opposite to occur. And, if $f = 1$, we would expect no difference in the increase. The results are presented in columns (2), (3) and (4) of Table 4. The interaction between Choice and imitation towards $B$ is only significant, and negative, when $f = 1$, contrary to Hypothesis 1A.

To test Hypotheses 1B we consider the interaction term between Choice and imitation towards $B$ over all choices (column (1)). This term is not statistically significantly different from zero, hence, not consistent with Hypothesis 1B. Further, considering effect of $f$ on imitation, we find that the increase in imitation in Choice is similar for all $f$, except for when $f = 1$ and imitation is towards $B$. Hence, in a majority of the cases the increase in imitation does not depend on $f$, but not all. This is partly consistent with Hypothesis 1C. This leads to Result 3.

**Result 3.**

*a) Imitation is on average more frequent towards the safe lottery $B$ than towards the risky lottery $A$, in Rand and Choice.*

*b) The increase in imitation in Choice is not significantly different towards $B$ than towards $A$.*

*c) If $f = 0.8$ and $f = 1.2$, the increase in imitation towards $B$ in Choice is not significantly different from that towards $A$. If $f = 1$, the increase in imitation towards $B$ is significantly weaker than the increase in imitation towards $A$.*

To sum up, the evidence reveals that the increase in imitation in Choice is not significantly stronger towards the safe lottery, nor does it feature the comparative statics with respect to $f$ that would have been expected, should the disutility from falling behind have increased. These facts are broadly in line with Hypothesis 1C. However, these are indirect tests of Hypotesis 1C, based on the aggregate data. A further test of Hypothesis 1C can be provided by structurally estimating a model of preferences that incorporate a social utility term. This enables us to use all individual decisions and test parameter restrictions across treatments.

In particular, the evidence so far suggests that (a) assuming decision makers derive a constant utility from conforming to other's behavior (independent of payoffs), we should observe an increase in this utility from Rand to Choice, and (b) assuming relative payoff concerns change in Choice, we should observe a change in the parameters governing relative payoff concerns from Rand to Choice. We test these conjectures by structurally estimating two models of social utility. All details about what follows can be found in Appendix C.2. In our estimation we assume the decision maker to exhibit utility that is additively separable into consumption and social utility. In a model of relative payoff concerns, we assume that negative payoff differences with respect to the peer enter negatively into utility and are weighted by a "social" loss aversion parameter $\lambda \geq 0$, while positive payoff differences enter positively and have a weight of one. In a model based on social comparison theory we assume a constant utility $\gamma$ from conforming to the peer's choice. Based on decisions in Rand and Choice we estimate these parameters, in distinct models, and test for treatment differences in $\lambda$ and $\gamma$.[34]

Our findings reveal that, in a model of relative payoff concerns, decision makers exhibit significant loss aversion with respect to their peer's payoff ($\lambda > 1$), but this disutility does not change significantly across treatments. In a model based on social comparison theory, decision makers gain significant utility from choosing the peer's lottery ($\gamma$>0). Further, this utility is significantly larger in Choice compared to Rand. In terms of goodness of fit, the model of relative payoff concerns is significantly inferior to a model based on social comparison theory. Overall, these results suggest that the substantial increase of peer effects when peers make active choices may be explained by a norm to conform to others.

## 4 Conclusion

This paper examines peer effects in risk taking. We test whether peer effects can be explained by preferences over others' outcomes or whether preference interactions also depend on others' choices, in addition to distributional concerns. Our main result is that peer effects increase significantly when peers choose among lotteries, relative to when they are allocated a lottery. This reveals that choices play a significant role, on top of payoffs. At the same time, imitation of the peer is the predominant strategy adopted by those who are affected by the presence of others. This suggests that peer effects in risk taking are explained by both relative payoff concerns and a direct preference over peer choices.

We examine two alternative explanations for why choices of peers matter. First, preferences over others' payoffs might change if peers make choices. This may increase envy, i.e. the disutility from disadvantageous payoff differences, or envy may be particularly strong when peers choose safe options. Alternatively, according to social comparison theory (Festinger, 1954), peer choices might be perceived as a decision anchor and measure for "correctness", giving rise to a norm to

[34] Another approach could be to simultaneously estimate parameters defining relative payoff concerns and an additional utility from conforming to the social anchor. However, imitation (or deviation) can very generally be explained by a positive (or negative) estimate of $\gamma$ as well as by $\lambda > 1$ (or $\lambda < 1$). Identifying both parameters, for both treatments, simultaneously, is not possible with our data, but would be an interesting task for future work. Another approach might be to estimate mixture models, a procedure that we applied in a previous version of this paper. Mixture models have been used to estimate risk preferences in heterogeneous populations, amongst others by Conte et al. (2011) and Harrison and Rutström (2009). However, in our setting, assuming heterogeneity with respect to whether decision makers derive a social utility or not, causes the following concern. The probability to be of a certain type enters into the log-likelihood function as a multiplicative weight of the social utility, and in this way scales the estimates of $\lambda$ and $\gamma$. Moreover, it leaves one additional degree of freedom.

conform to others' behavior. Comparative statics reveal that when moving from peer allocations to peer choices, imitation increases both towards safe and risky lotteries. It also does not vary systematically with payoff differences, as would be expected by an increase in envy. Hence, at the aggregate level, the increase in imitation when peers make choices is in line with a norm to conform to peers. Structurally estimating these models provides additional suggestive evidence for this result.

Our results contribute to understanding how peers affect risky choices, including stock market participation, investment choices and insurance purchases. They suggest that not only relative payoffs matter, but also the act of choosing between risky prospects. This can have important implications for the spread of risky choices. For example, it suggests that communicating others' risky choices may have large consequences even in environments where all individuals are equally well informed. At the same time, it reveals that imitative behavior in risk taking is most likely to spread when peers make active choices. Hence, campaigns that give "gifts" to some individuals, or endow them with a particular risky asset, to leverage demand may only have limited success.

Overall, as argued by Shiller (1984), "investing in speculative assets is a social activity". It is thus important to understand what "social" means to understand how others shape economic decisions.

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# Appendix A: Theoretical Framework

## A.1 A model of relative payoff concerns

Assume the utility in state $j$ ($j \in \{g, b\}$) of having chosen lottery $i$ ($i \in \{A, B\}$) and earning $m_i^j$, to be given by the sum of two terms: a consumption utility, which is solely determined by individual risk preferences, plus a social utility term, which depends on payoff differences. This implies $v_{i,k}^j = u(m_i^j) + R(m_i^j - m_k^j)$, where $k \in \{A, B\}$ is the lottery of the peer, and $R(\cdot)$ is a function of payoff differences and defined as follows:

$$R(x) = \begin{cases} x & \text{if } x \geq 0, \\ \lambda x & \text{if } x < 0. \end{cases}$$

The parameter $\lambda$ captures how large losses with respect to the peer loom relative to gains. An individual's expected utility from choosing lottery $i$ is

$$V_{i,k} = U_i + \sum_j p_j R(m_i^j - m_k^j),$$

where $U_i$ is the expected consumption utility of lottery $i$. If the peer holds a lottery that yields a lower consumption utility, the individual may nevertheless choose it, if he experiences a strong disutility from falling behind the peer, i.e. if $\lambda$ is large enough. Let us define an individual's strategy space as $\mathcal{S} = \{\text{imitate} = (i; AA, BB), \text{ deviate} = (i; BA, AB), \text{ stay} = (i; iA, iB), \text{ change} = (i; -iA, -iB); \text{ for } i \in \{A, B\}\}$. Here $i$ ($-i$) denotes his (opposite) choice in Part I, and the tuple $ik$ describes the choice of lottery $i$ in Part II given that his peer has lottery $k$. Then, the cutoffs are given by the following proposition.

**Proposition 1.** *Define* $\Delta \equiv \frac{U_B - U_A}{p\delta} + \frac{(1-p)(c-\delta)}{p\delta}$ *and* $\Theta \equiv \frac{U_A - U_B}{(1-p)(c-\delta)} + \frac{p\delta}{(1-p)(c-\delta)}$.
*An individual imitates if* $\lambda > \max\{\Delta, \Theta\}$. *An individual deviates if* $\lambda < \min\{\Theta, \Delta\}$. *An individual stays with his Part I choice otherwise.*

Note that whether $\Delta$ is smaller or greater than $\Theta$ is determined by the individual's choice in Part I, i.e. by his expected consumption utility $U_A$ and $U_B$.

*Proof.* An individual imitates if $V_{A,A} > V_{B,A}$ and $V_{B,B} > V_{A,B}$. $V_{B,B} > V_{A,B}$ is equivalent to

$$\lambda(1-p)(c-\delta) > U_A - U_B + p\delta \quad \Leftrightarrow \quad \lambda > \Delta \equiv \frac{U_A - U_B}{(1-p)(c-\delta)} + \frac{p\delta}{(1-p)(c-\delta)}.$$

$V_{A,A} > V_{B,A}$ is equivalent to

$$\lambda p\delta > U_B - U_A + (1-p)(c-\delta) \quad \Leftrightarrow \quad \lambda > \Theta \equiv \frac{U_B - U_A}{p\delta} + \frac{(1-p)(c-\delta)}{p\delta}.$$

Hence, for an individual to imitate it must hold that $\lambda > \max\{\Delta, \Theta\}$.

Similarly, an individual deviates if $V_{A,A} < V_{B,A}$ and $V_{B,B} < V_{A,B}$. It follows directly from above that this is satisfied if $\lambda < \min\{\Delta, \Theta\}$.

## A.2 Choice-dependent relative payoff concerns

Assume relative payoff concerns to be defined by the comparison term $R(\cdot)$ as defined in A.1. If $\lambda$ increases, the likelihood of imitation increases. At the same time, the weight on the payoff differences between lotteries $A$ and $B$ increases. Specifically, the disutility from falling behind when choosing $A$ would increase by $(1-p)(c-\delta) = (1-p)c(1-(1-p)f)$. The disutility from falling behind when choosing $B$ would increase by $p(20-(20-\delta)) = p(1-p)cf$. If the expected value of $A$ equals that of $B$ ($EV_A = EV_B$), or equivalently $f = 1$, the increase is of the same magnitude. However, if $f > (<)1$, then $1-(1-p)f < (>)pf$, and the increase is stronger in magnitude for the case the individual chooses $B$ ($A$).

Assume that – instead of $\lambda$ – the social comparison term $R(\cdot)$ is increased by a factor $\alpha$. Then, the marginal change in social utility from $\alpha$ is given by

$$\begin{aligned} & -(1-p)(c-\delta)\lambda + p\delta \quad \text{when choosing } A, \\ \text{and by} \quad & -p\delta\lambda + (1-p)(c-\delta) \quad \text{when choosing } B. \end{aligned}$$

Hence, the change in utility is smaller when choosing $A$ than $B$, i.e. the incentive to imitate $B$ is larger compared to $A$, if

$$\begin{aligned} & -(1-p)(c-\delta)\lambda + p\delta < -p\delta\lambda + (1-p)(c-\delta) \\ \Leftrightarrow \quad & \lambda \left[p\delta - (1-p)(c-\delta)\right] < (1-p)(c-\delta) - p\delta \\ \Leftrightarrow \quad & \begin{cases} \lambda & < -1 \quad \text{if} \quad p\delta - (1-p)(c-\delta) > 0; \\ \lambda & > -1 \quad \text{if} \quad p\delta - (1-p)(c-\delta) < 0. \end{cases} \end{aligned}$$

In line with the seminal model of Fehr and Schmidt (1999) we would assume $\lambda \geq 1$. Following from the same argument as above, i.e. $p\delta - (1-p)(c-\delta) < 0 \quad \Leftrightarrow \quad f < 1$, we would expect more imitation towards $B$ if $f < 1$. Similarly, we would expect more imitation towards $A$ if $f > 1$. This is consistent with Hypothesis 1A.

Lastly, assume that the social comparison term is given by $\tilde{R}(x) = \mu \cdot x \cdot \max\{x; 0\} + \lambda \cdot x \cdot \min\{x; 0\}$. If both $\mu$ and $\lambda$ increase by factor $\alpha$, the incentives to imitate $A$ or $B$ do depend on how $\lambda$ relates to $\mu$. Specifically, the marginal change in social utility when choosing $A$ is smaller than that when choosing $B$ if

$$\begin{aligned} & -(1-p)(c-\delta)\lambda + p\delta\mu < -p\delta\lambda + (1-p)(c-\delta)\mu \\ \Leftrightarrow \quad & \lambda \left[p\delta - (1-p)(c-\delta)\right] < \mu \left[(1-p)(c-\delta) - p\delta\right] \\ \Leftrightarrow \quad & \begin{cases} \lambda & < -\mu \quad \text{if} \quad p\delta - (1-p)(c-\delta) > 0 \quad (\Leftrightarrow \quad f > 1)\,; \\ \lambda & > -\mu \quad \text{if} \quad p\delta - (1-p)(c-\delta) < 0 \quad (\Leftrightarrow \quad f < 1)\,. \end{cases} \end{aligned}$$

If we assume that $\mu \geq 0$, i.e. individual gain from being better off, then $0 < \lambda < -\mu$ is clearly a contradiction. Hence, if $f < 1$ we would again expect more imitation towards $B$, and if $f > 1$ more imitation towards $A$. On the other hand, if we allow $\mu < 0$, i.e. allow for the possibility that social gains enter negatively into social utility, then our predictions from Hypothesis 1A only hold if $\lambda > -\mu = |\mu|$ is satisfied. This assumption was already placed in Fehr and Schmidt (1999), i.e. "a player suffers more from inequality that is to his disadvantage" (Fehr and Schmidt, 1999; p. 823).

## A.3 A model based on social comparison theory

Consider a model in which, the closer the individual risky choice is to the social anchor, the more utility the individual derives. In a setting with only two options, this can be captured by an additional utility $\gamma$ when the option chosen coincides with the social anchor. In particular, the expected utility of lottery $i$ given the anchor $k$ is

$$V_{i,k} = U_i + \gamma \cdot \mathbf{1}(i = k),$$

where $\mathbf{1}(\cdot)$ is the indicator function. (Cooper and Rege (2011) also assume this form of utility when examining conformism.) Based on the argument above, we would expect $\gamma$ to differ across treatments and $\gamma_C$, in Choice, to be larger than $\gamma_R$, in Rand. This would generate an increase in imitation in Choice. Further, since the effect of $\gamma$ is independent of lottery characteristics, we would expect the change in imitation across treatments to be symmetric with respect to the two available options, $A$ or $B$.

## Appendix B: Instructions for the Choice treatment

Welcome to the experiment.
Thank you very much for participating. Please refrain from talking to any other participants until the experiment is finished.

**General Information**
The purpose of this experiment is the analysis of economic decision making. During the course of the experiment you can earn money which will be paid out to you at the end of the experiment.

The experiment lasts about 1 hour and consists of two parts. At the beginning of each part you receive detailed instructions. If you have questions after the instructions or during the experiment please raise your hand. One of the experimenters will come to your place and answer your questions in private.

While you take your decisions a small clock will count down at the upper right corner of your computer screen. This clock serves as an orientation for how much time you should need to take your decision. However, the countdown will not be enforced in the case that you need more time to come to a decision. Especially in the beginning you might need more time.

**Payoff**
In both parts of the experiment your income is directly calculated in Euro. This amount will be paid out to you at the end of the experiment. For your punctual arrival you receive an additional 4 euro.

**Anonymity**
The experimental data will only be analyzed in the aggregate. Names will never be connected with the data from the experiment. At the end of the experiment you have to sign a receipt, confirming that you received your payoff. This receipt only serves our sponsor's accounting purposes. The sponsor does not receive any further data from the experiment.

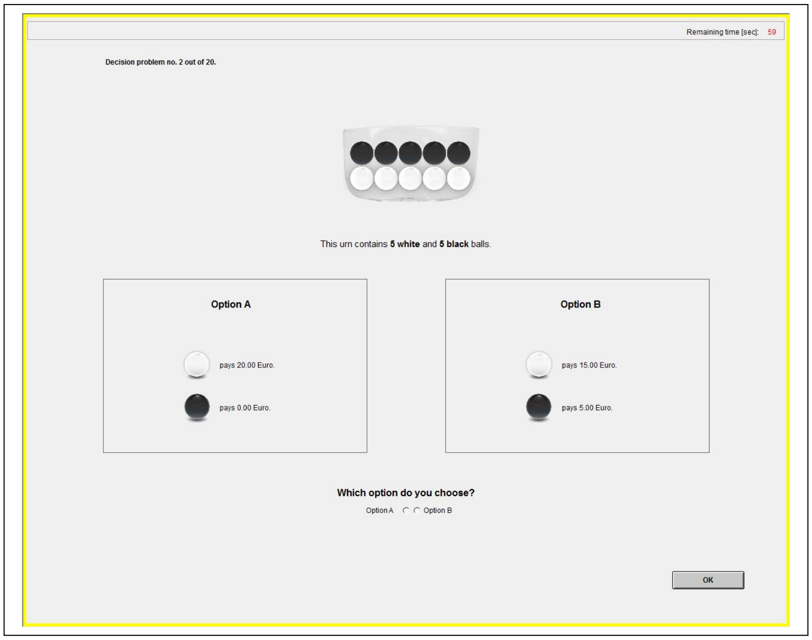
**Auxiliaries**
At your place you find a pen. Please leave the pen at your place at the end of the experiment.

### Part I

**Task**
You will be presented 20 decision situations. In every situation you can choose between two options, option A and option B. Consider your choice carefully, as your choice can - as described below - affect your payoff.

On the screen your will be shown one or two urns which contain white and black balls. The screen will further inform you about the number of white balls and the number of black balls in each urn. Furthermore you will be informed about the value of each white ball and the value of each black ball, in the case that you choose option A or option B, respectively. From each urn one ball will be randomly drawn. If there is only one urn the ball which was drawn is relevant for both options, A and B. If there are two urns the ball will be drawn from the urn which belongs to your chosen option. This is how your screen might look like.

In this example there is only one urn which contains 10 balls: 5 white balls and 5 black balls, i.e. the probability that a white ball is drawn amounts to 50




Example - Decision Problem

Should a white ball be drawn from the urn you receive 20 Euro if you chose option A or 15 Euro if you chose option B. If a black ball is drawn from the urn you receive 0 Euro if you chose option A or 5 Euro if you chose Option B.

The urns in the 20 decision situations are always filled according to one of the following types:

- Type 1: 5 white balls and 5 black balls
- Type 2: 8 white balls and 2 black balls
- Type 3: 2 white balls and 8 black balls
- Type 4: 2 white balls and 6 black balls

You take your decision by marking either option A or option B on the screen. Your decision is final once you clicked the OK-button in the lower part of the screen. In addition to these instructions you are given a sheet of paper on which all decision situations are printed out. Please note on this paper which decisions you have taken.

**Payoff**

At the end of part II of this experiment one participant will be chosen randomly by the computer. This participant will be assigned the role of an assistant. You will be shown on your screen whether you have been assigned this role or not. The assistant will help the experimenter to randomly determine which part and which decision situations are payoff-relevant.

For this purpose the assistant will first draw one ball out of a nontransparent bag which contains 2 balls - marked with the numbers 1 and 2. This ball decides whether part I or part II of the experiment is payoff-relevant for all participants. The experimenter will type in this number at the assistant's computer.

Assume that part I is drawn as being payoff-relevant. Then, for each participant, the assistant draws one ball out of a nontransparent bag which contains 20 balls numbered from 1 to 20. This ball decides which decision situation becomes payoff-relevant for the respective participant. Every decision situation is drawn with the same probability. The experimenter will type in this number at the assistant's computer.

Finally the assistant draws one ball out of each of four nontransparent bags. Every bag corresponds to one of the four types of urns.

- Bag 1 contains 5 white balls and 5 black balls; corresponds to an urn of type 1
- Bag 2 contains 8 white balls and 2 black balls; corresponds to an urn of type 2
- Bag 3 contains 2 white balls and 8 black balls; corresponds to an urn of type 3
- Bag 4 contains 2 white balls and 6 black balls; corresponds to an urn of type 4

The draw from bag 1 (2,3,4) decides which color will be paid out for an urn of the type 1 (2,3,4). At the assistant's computer the experimenter types in which color has been drawn from the four bags.

For example: if, in the third draw, the assistant draws a ball with the number 2, the decision situation 2 becomes payoff-relevant for participant 3. If, in decision situation 2, there is only one urn which is of type 1, the color of the ball which has been drawn from bag one pins down the payoff of participant 3.

Assume this decision situation is exactly the decision situation depicted above, which is of type 1. If the assistant has drawn a white ball from bag 1, participant 3 earns 20 Euro if he chose option A in this decision situation; he earns 15 Euro if he chose option B. If the assistant has drawn a black ball from bag 1, the participant earns 0 Euro if he chose option A and 5 Euro if he chose option B.

Please note: as every decision situation will be drawn with the same probability, it is in your interest to take every decision carefully.

Subsequently the computer computes your income, which will be shown to you on your screen. Furthermore you will be informed, which part and which decision situation have been drawn for you as well as which color decides your income.

## Part II

### Groups

At the beginning of part II you will be randomly matched with another participant of this experiment. The two of you will form one group in part II. Groups will remain unchanged for the rest of part II.

Every participant will be randomly assigned by the computer one of two roles in his group. We call these roles person 1 and person 2. At the beginning you will be informed on your screen whether you will be person 1 or person 2 for the rest of part II.

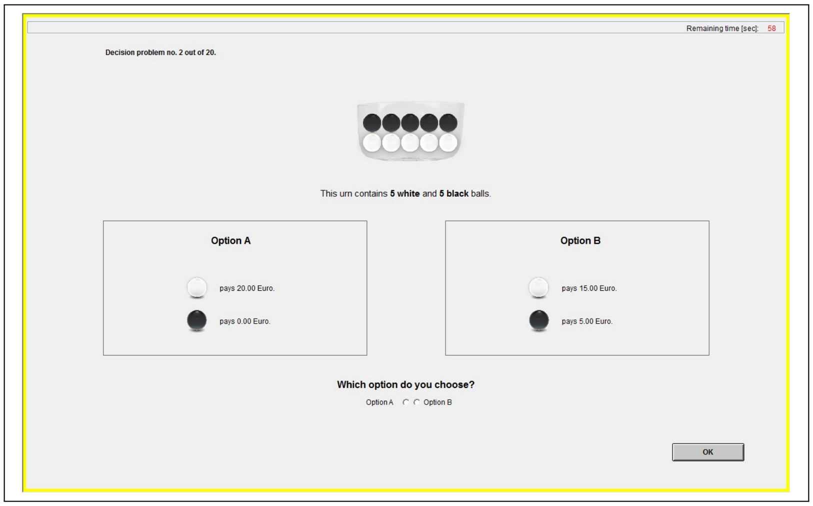
### Task

In this part person 1 and person 2 will be presented 20 decision situations. These decision situations will be identical to the decision situations from part I. The sequence of decision situation however, will be different from part I. As in part I, both as person 1 and person 2, you will be informed on your screen about the value of a black ball and the value of a white ball in the case you choose option A and option B.

In every decision situation each participant chooses one of the two options. Person 1 will take the decisions as in part I. Person 2 can make her decisions conditionally on the choice of person 1.

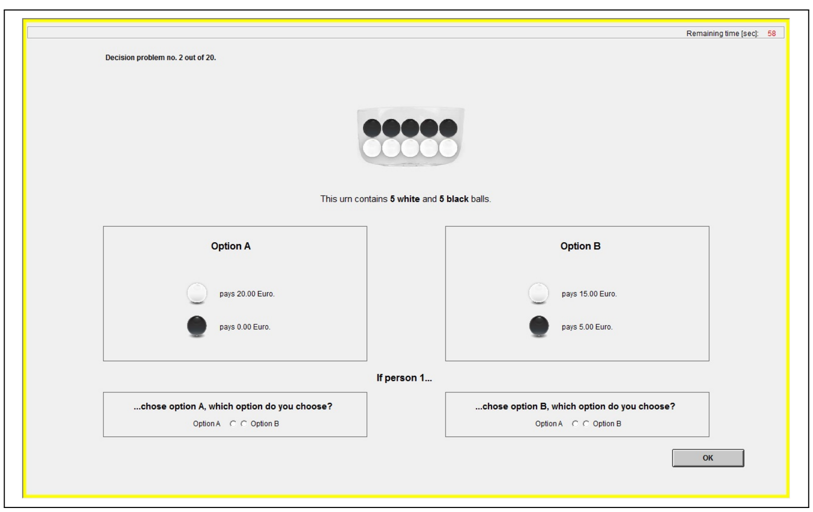
To do this, person 2 is asked to take a decision for the case that person 1 chose option A and for the case that person 1 chose option B. Person 1 and person 2 decide simultaneously and only at the end of the experiment person 2 will be informed about the choice of person 1 in this decision situation.

This is how the screen of person 1 might look like:




Example - Decision Problem - Person 1

This is how the screen of person 2 might look like:




Example - Decision Problem - Person 2

You take your decision by marking either option A or option B on the screen. Your decision is final once you clicked the OK-button in the lower part of the screen.

Please consider your decision carefully, as your choice can – as described below – affect your payoff.

**Payoff**

After all participants completed their decision problems the assistant will be selected randomly by the computer. As described in the instructions of part I, for deciding whether part I or part II becomes payoff relevant, the assistant draws one ball from a nontransparent bag containing two balls.

Assume that part II is drawn as being payoff-relevant. Then, for each group, the assistant draws one ball out of a nontransparent bag which contains 20 balls numbered from 1 to 20. This ball decides which decision situation becomes payoff-relevant for the participants of the respective group. Every decision situation is drawn with the same probability. The experimenter will type in this number at the assistant's computer.

Finally the assistant draws one ball out of each of four nontransparent bags. Every bag corresponds to one of the four types of urns.

- Bag 1 contains 5 white balls and 5 black balls; corresponds to an urn of type 1
- Bag 2 contains 8 white balls and 2 black balls; corresponds to an urn of type 2
- Bag 3 contains 2 white balls and 8 black balls; corresponds to an urn of type 3
- Bag 4 contains 2 white balls and 6 black balls; corresponds to an urn of type 4

The draw from bag 1 (2,3,4) decides which color will be paid out for an urn of the type 1 (2,3,4). At the assistant's computer the experimenter types in which color has been drawn from the four bags.

Assume this decision situation is exactly the decision situation depicted above, which is of type 1. If the assistant has drawn a white ball from bag 1, person 1 and person 2 of group 5 receive the following income: If person 1 and person 2 both chose option A each receives 20 EUR. If both chose option B, each receives 15 EUR. If person 1 chose option A and person 2 chose option B, person 1 receives 20 EUR and Person 2 15 EUR. Analogously if person 1 chose option B and person 2 chose option A, person 1 receives 15 EUR and person 2 receives 20 EUR.

If the assistant has drawn a black ball from bag 1, person 1 and person 2 of group 5 receive the following income: If person 1 and person 2 both chose option A, each receives 0 EUR. If both chose option B, each receives 15 EUR. If person 1 chose option A and person 2 chose option B, person 1 receives 0 EUR and Person 2 15 EUR. Analogously if person 1 chose option B and person 2 chose option A, person 1 receives 15 EUR and person 2 receives 0 EUR.

Subsequently the computer computes your income. You will be informed on your screen, which part and which decision situation have been drawn for you as well as which color defines your income. As person 1 you will be shown both options, your choice, the resulting income as well as the final choice of person 2 and the resulting income of person 2. As person 2 you will also be shown both options, the choice of person 1 and which final choice results for yourself. This defines your resulting income.

You will then be informed about the amount of Euro you have earned in this experiment. You will also be informed about how much the other group member earned in the experiment.

# Appendix C: Additional Results

## C.1 Additional Tables and Figures

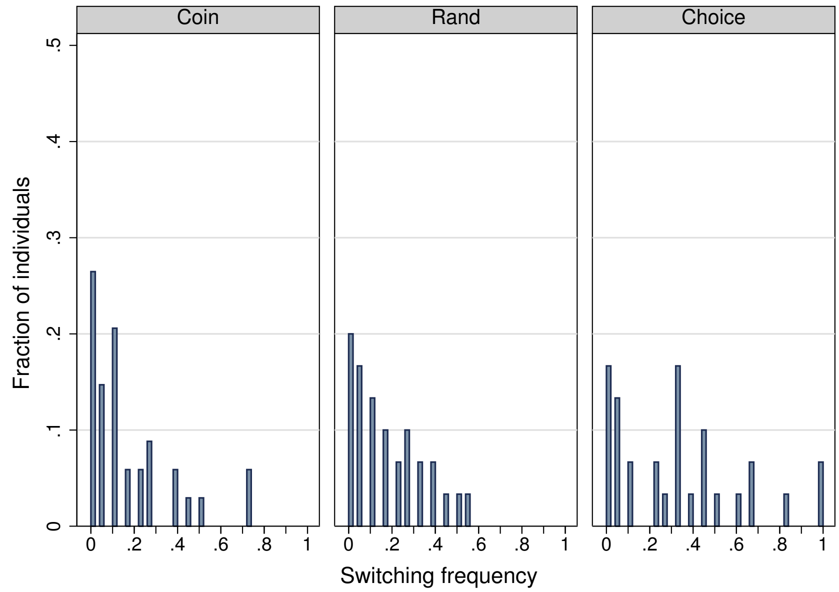
| $A$: 20,0 vs. $B$: | Coin | Rand | Choice | $\chi^2$ p-value |
|---|---|---|---|---|
| **Panel A: 20/80 Lotteries** | | | | |
| (0.8,1) | 86.8% | 95.0% | 86.7% | 0.038 |
| (5.6,0.2;0.6,0.8) | 72.1% | 73.3% | 68.3% | 0.936 |
| (4,1) | 27.9% | 41.7% | 28.3% | 0.316 |
| (8,0.2;3,0.8) | 17.6% | 43.3% | 18.3% | 0.004 |
| (7.2,1) | 7.4% | 3.3% | 3.3% | 0.595 |
| (10.4,0.2;5.4,0.8) | 4.4% | 5.0% | 6.7% | 0.815 |
| **Panel B: 50/50 Lotteries** | | | | |
| $A$: 20,0 vs. $B$: | Coin | Rand | Choice | $\chi^2$ p-value |
| (8,1) | 17.6% | 20.0% | 28.3% | 0.146 |
| (11,0.5;6,0.5) | 19.1% | 16.7% | 23.3% | 0.704 |
| (10,1) | 2.9% | 13.3% | 3.3% | 0.066 |
| (12.5,0.5;7.5,0.5) | 5.9% | 10.0% | 8.3% | 0.857 |
| (12,1) | 0.0% | 3.3% | 6.7% | 0.212 |
| (14,0.5;9,0.5) | 1.5% | 1.7% | 5.0% | 0.294 |
| **Panel C: 80/20 Lotteries** | | | | |
| $A$: 20,0 vs. $B$: | Coin | Rand | Choice | $\chi^2$ p-value |
| (15.2,1) | 19.1% | 13.3% | 18.3% | 0.791 |
| (16.4,0.8;11.4,0.2) | 19.1% | 11.7% | 15.0% | 0.61 |
| (16,1) | 11.8% | 8.3% | 11.7% | 0.897 |
| (17,0.8;12,0.2) | 20.6% | 11.7% | 16.7% | 0.512 |
| (16.8,1) | 8.8% | 1.7% | 11.7% | 0.096 |
| (17.6,0.8;12.6,0.2) | 7.4% | 5.0% | 11.7% | 0.577 |

Table 5: Frequency of Lottery $A$ choices of First and Second Mover in Part I

Note: $\chi^2$ test is used to test for differences between choices in treatments Coin, Rand and Choice.

| | | | $p = 0.2$ | | | $p = 0.5$ | | | $p = 0.8$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $c$ level | $f$ level | | **Coin** | **Rand** | **Choice** | **Coin** | **Rand** | **Choice** | **Coin** | **Rand** | **Choice** |
| c=20 | 1.2 | Imitate | 2.9% | 10.0% | 16.7% | 2.9% | 20.0% | 16.7% | 0.0% | 3.3% | 20.0% |
| | | Deviate | 2.9% | 0.0% | 0.0% | 2.9% | 0.0% | 0.0% | 8.8% | 3.3% | 3.3% |
| | | Revise | 5.9% | 10.0% | 26.7% | 17.6% | 6.7% | 16.7% | 14.7% | 20.0% | 6.7% |
| | | No change | 88.2% | 80.0% | 56.7% | 76.5% | 73.3% | 66.7% | 76.5% | 73.3% | 70.0% |
| c=15 | 1.2 | Imitate | 2.9% | 0.0% | 23.3% | 11.8% | 13.3% | 13.3% | 5.9% | 10.0% | 26.7% |
| | | Deviate | 0.0% | 0.0% | 6.7% | 5.9% | 3.3% | 0.0% | 0.0% | 3.3% | 0.0% |
| | | Revise | 17.6% | 20.0% | 23.3% | 20.6% | 3.3% | 10.0% | 14.7% | 10.0% | 13.3% |
| | | No change | 79.4% | 80.0% | 46.7% | 61.8% | 80.0% | 76.7% | 79.4% | 76.7% | 60.0% |
| c=20 | 1 | Imitate | 11.8% | 13.3% | 20.0% | 0.0% | 10.0% | 26.7% | 2.9% | 16.7% | 13.3% |
| | | Deviate | 8.8% | 0.0% | 3.3% | 2.9% | 3.3% | 0.0% | 2.9% | 0.0% | 0.0% |
| | | Revise | 14.7% | 23.3% | 16.7% | 5.9% | 6.7% | 3.3% | 8.8% | 3.3% | 20.0% |
| | | No change | 64.7% | 63.3% | 60.0% | 91.2% | 80.0% | 70.0% | 85.3% | 80.0% | 66.7% |
| c=15 | 1 | Imitate | 2.9% | 13.3% | 23.3% | 0.0% | 6.7% | 16.7% | 5.9% | 13.3% | 13.3% |
| | | Deviate | 5.9% | 0.0% | 0.0% | 5.9% | 0.0% | 0.0% | 0.0% | 0.0% | 3.3% |
| | | Revise | 17.6% | 16.7% | 13.3% | 5.9% | 0.0% | 6.7% | 11.8% | 10.0% | 13.3% |
| | | No change | 73.5% | 70.0% | 63.3% | 88.2% | 93.3% | 76.7% | 82.4% | 76.7% | 70.0% |
| c=20 | 0.8 | Imitate | 2.9% | 10.0% | 23.3% | 0.0% | 3.3% | 16.7% | 2.9% | 3.3% | 23.3% |
| | | Deviate | 2.9% | 0.0% | 0.0% | 0.0% | 3.3% | 0.0% | 0.0% | 0.0% | 0.0% |
| | | Revise | 0.0% | 3.3% | 3.3% | 0.0% | 0.0% | 6.7% | 14.7% | 3.3% | 13.3% |
| | | No change | 94.1% | 86.7% | 73.3% | 100.0% | 93.3% | 76.7% | 82.4% | 93.3% | 63.3% |
| c=15 | 0.8 | Imitate | 0.0% | 3.3% | 20.0% | 2.9% | 3.3% | 16.7% | 5.9% | 6.7% | 23.3% |
| | | Deviate | 2.9% | 3.3% | 0.0% | 5.9% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| | | Revise | 8.8% | 3.3% | 6.7% | 0.0% | 0.0% | 0.0% | 5.9% | 6.7% | 20.0% |
| | | No change | 88.2% | 90.0% | 73.3% | 91.2% | 96.7% | 83.3% | 88.2% | 86.7% | 56.7% |

Table 6: Strategy Choices in Part II




Note: Switching takes value 1 if the second mover changes his choice in Part II for at least one of the possible choices of the first mover with respect to the choice made in Part I for the same decision.

Figure 4: Distribution of individual switching rates, by treatment

### C.2 Estimating social utility: Econometric Specification & Results

We structurally estimate two distinct models of social utility and test their relative fit, based on decisions in Rand and Choice. In both models we assume a CRRA (consumption) utility function with parameter $r$, i.e. $u(x) = x^r$. We estimate $r$ for each subject individually based on his choices in Part I.[35] Under relative payoff concerns, we assume social utility to be given by a comparison term, in which social losses enter negatively and are weighted by the parameter $\lambda \geq 0$; see Appendix A.1 for details. If social losses loom larger than social gains, then $\lambda > 1$. In the estimation we test for differences in $\lambda$ between Rand and Choice, for choice-dependency of relative payoff concerns. In a model based on social comparison theory we assume social utility to be given by a constant parameter $\gamma$ (see Appendix A.2 for details). We also allow for differences in $\gamma$ between Rand and Choice.

**Econometric Specification**

Following Hey and Orme (1994), we allow subjects to make so-called Fechner errors when comparing expected utilities (also see, e.g. von Gaudecker et al., 2011; Loomes, 2005). Hence, a subject chooses lottery $i$ if and only if $V_{i,k} - V_{-i,k} > \tau\epsilon$, where $V_{i,k}$ is the expected overall utility if his peer has lottery $k$; $\epsilon$ is drawn from a standard logistic distribution and assumed to be independent between subjects and decisions. The parameter $\tau > 0$ serves as a scaling factor and is assumed to be constant across subjects and decisions. The probability to choose lottery $i$ in decision problem $t$ ($t = 1, \ldots, 18$) depends on the parameters $\theta = (r, \lambda, \gamma)$ and $\tau$. The likelihood for subject $n$ ($n = 1, \ldots, N$) can be determined by the score function $d_{n,t}(i|\theta, \tau) = \frac{1}{\tau}(V^t_{i,k}(\theta) - V^t_{-i,k}(\theta))$. Then, the likelihood function becomes $\mathcal{L}_{n,t}(i|\theta, \tau) = \Lambda\left(d_{n,t}(i|\theta, \tau)\right)$, where $\Lambda(x) = (1+\exp(-x))^{-1}$ denotes the standard

[35]Results remain qualitatively the same if we only use data from Part II and estimate an average $r$.

logistic cumulative distribution function. The log-likelihood function to be maximized is simply $L(\theta,\tau)=\sum_{n,t}\ln\mathcal{L}_{n,t}(c_t|\theta,\tau)$, where we sum over all subjects $n$, and their choices $c_t$ in all decision problems $t$. It is maximized using the Broyden-Fletcher-Goldfarb-Shanno (BFGS) algorithm (see, e.g., Broyden, 1970; Fletcher, 1970). Table 7 reports the estimation results.[36] Columns (1) and (2) describe the estimated models of relative payoff concurs, columns (3) and (4) estimation results for models of social comparison theory.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| $\lambda$ | $1.1785^{\dagger\dagger\dagger}$ | $1.1135^{\dagger\dagger}$ | | |
| | [0.0674] | [0.0494] | | |
| $\lambda_C$ | | 1.1163 | | |
| | | [0.0966] | | |
| $\gamma$ | | | 0.2567*** | 0.1535*** |
| | | | [0.0696] | [0.0503] |
| $\gamma_C$ | | | | 0.2019* |
| | | | | [0.1173] |
| Error parameter | | | | |
| $\tau$ | 2.6065*** | 2.6021*** | 0.6293*** | 0.6265*** |
| | [0.2719] | [0.2689] | [0.0863] | [0.0857] |
| Observations | 2160 | 2160 | 2160 | 2160 |
| Pseudo log–lik. | -1280.95 | -1279.33 | -1049.69 | -1045.21 |

Note: In models (1)-(4) $r$ is fixed to individual estimates for each subjects' Part I choices, where $r > 0$ is assumed throughout. Models (1) and (2) report estimates of $\lambda$, assuming $\lambda > 0$. In (2) we include a treatment dummy for Choice, $\lambda_C$, which enters multiplicatively into $\lambda$. In (3) and (4) we estimate a conformism parameter $\gamma$. In model (4), the treatment dummy $\gamma_C$ enters additively.
The scaling parameter $\tau$ refers to the Fechner error. Standard errors are reported in brackets and clustered on a subject level; * (**, ***) indicates significant difference from 0, † (††, † † †) indicates significant difference from 1, at the 1% (5%, 10%) level, respectively.

Table 7: Structural estimation of social utility models

In models (1) and (2) $\lambda$ is significantly larger than one (p-value = 0.008 and 0.022, respectively), suggesting that subjects are generally loss averse with respect to their peer's outcome. In model (2) we control for treatment differences by introducing a dummy $\lambda_C$ for Choice, which enters multiplicatively into $\lambda$.[37] $\lambda_C$ is not significantly different from one (p-value = 0.229), suggesting that relative payoff concerns remain unchanged between Rand and Choice.

In models (3) and (4) we find that $\gamma$ is significantly larger than zero in both treatments, consistent with imitation being the most frequent strategy in Rand and Choice (conditional on switching). Moreover, column (4) shows that $\gamma$ is significantly larger in Choice than in Rand, in line with the assumption that peers' choices provide a stronger anchor than random allocations.[38]

[36]By pooling all observations from second movers in treatments Rand and Choice irrespectively of whether they are actually affected by the presence of their peer, this approach yields the most conservative estimates of the social utility parameters. We also ran estimations, in which we dropped observations for second movers who never switched in any decision problem (six subjects in Rand and five subjects in Choice, corresponding to 20.0% and 16.7% of all choices, respectively). Estimates of $\lambda$ and $\gamma$ only increase slightly, but significance levels stay exactly the same.

[37]This is due to our constraint $\lambda > 0$ which is implemented by estimating $\lambda = \exp(\ln\lambda)$.

[38]This also holds if $\gamma$ and $\gamma_C$ are estimated while controlling for relative payoff concerns, fixing $\hat{\lambda}$ estimated in

Which model fits our data best? Comparing the log-likelihoods of model (1) and (2) versus (3) and (4) suggests that the latter models might provide a better fit. This is confirmed using the Vuong test (Vuong, 1989). In terms of goodness of fit, we find that model (3) significantly outperforms model (1) as does model (4) in comparison to model (2) (both p-values$<$0.01).

model (1).