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Master Thesis [MSc. Economics and Business – Behavioral Economics]

Loss Aversion when Deciding for Others

Name: Johannes-Alexander Weis

Student ID number: 478331jw

Supervisor: Yan Xu

Second assessor: Dr. Tong Wang

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Abstract

Studies within behavioral economics usually investigated loss aversion for individuals, whose decisions directly affected their personal outcome. However, many decisions in real-world scenarios are made on behalf of others. In particular, an individual's actions affect the outcome of a second person. In recent years, some research papers analyzed loss aversion when deciding on behalf others, but their findings are rather mixed and lead to different conclusions. The equivocal results can mainly be attributed to the different approaches and structural models used. Furthermore, previous research compared loss aversion when deciding for oneself to deciding for a stranger. Thus, only two extreme cases of social distance are considered, whereas a "middle" alternative is missing.

Consequently, this research project aims to fill a gap in the literature by trying to answer the research question: Is the effect of loss aversion reduced when deciding for others? Therefore, a new non-parametric method is applied, which has not been used before to analyze loss aversion when deciding for others. Additionally, the experimental design adds a third alternative of social distance, which represents deciding on behalf of a friend or a family member. It was expected that loss aversion is reduced when social distance increases. However, the analysis of the collected data demonstrated that loss aversion is not significantly reduced when deciding for others. The limitations of this paper and the mixed results within this research field demand more in-depth research on loss aversion when deciding for others.

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1. Introduction

In the field of Behavioral Economics, decisions under risk and ambiguity is one of the most investigated topics. Usually, decision theory focusses on individual decision making, whereby the decision makers are the only ones affected by the choices made (Füllbrunn & Luhan, 2017). However, many decisions made in real world scenarios are decisions made on behalf of others, where the decision maker affects the payoff of other people (Tunney & Ziegler, 2015). Especially, the majority of financial decisions affect not only the decision maker, but also the payoffs of other people (Vieider et al., 2016). Normally, a family member is responsible for the financial decisions concerning other family members as well. For example, parents deciding on behalf of their children. These decisions contain financial investments, choices of education and other life defining decisions. Furthermore, many decisions even affect only the payoff of the second person. For instance, an investment manager usually makes a decision on how to invest the client's money. This scenario describes a decision with uncertain outcomes made by an individual, but where a second person bears the consequences (Chkravarty et al., 2011). While standard economic theory assumes that people make choices based on expected utility, Kahneman & Tversky's prospect theory (1979) highlights the influence of loss aversion on decision making (Abdellaoui et al., 2008). In short, loss aversion describes the phenomenon of losses affecting an individual's utility stronger than equal sized gains (Tversky & Kahneman, 1991). Loss aversion is explained in more detail in section 2.1. Applying the prospect theory model, research has found that the risk preferences change towards more risky choices when deciding for others (Chkravarty et al., 2011). Considering the pervasiveness of decision making on behalf of others, it should be investigated whether the degree of loss aversion is changing as well when deciding for somebody else. For instance, a reduction of loss aversion would indicate that people care less about the possibility of losing money when others' outcome is affected.

In recent years, economists started to investigate decision making on behalf of others more thoroughly. Andersson et al. (2016) agree that loss aversion is an important factor for decision making. Additionally, they claim when deciding on behalf of others, people take higher risk because the effect of loss aversion is decreased. The findings of Andersson et al. (2016) are supported by related research projects. Polman (2012) and Füllbrunn & Luhan (2017) confirmed that loss aversion is reduced when deciding on behalf of another person. However, Vieider et al. (2016) cannot replicate the findings of Andersson et al. (2016). Previous research on loss aversion when deciding for others is discussed extensively in section 2.3.

Motivated by the unclear and mixed results of previous studies, this research project will try to answer the research question: Is the effect of loss aversion reduced when deciding for others? Instead of a standard parametric model, a non-parametric elicitation method developed by Abdellaoui et al. (2016) will be used. This method was not applied so far to measure loss aversion when deciding on behalf of others. It does not make assumptions about probability weighting or the curvature of the utility functions, which is innovative compared to Andersson et al.'s (2016) approach. As a further contribution to the literature and in contrast to previous research, different treatment groups are used. Usually, previous studies investigated decision making on behalf of strangers compared to deciding for oneself. However, as mentioned before, decision making for a family member or a friend are very common in real world scenarios, which was not considered by most previous research projects. Furthermore, comparing decision making for oneself and for a random stranger are two extreme examples of social distance[1]. Thus, this research project tries to close a gap in the literature by including decision making for a friend. Therefore, three treatment groups are introduced: *Self, Friend,* and *Other.* Hence, it will be examined whether the effect of loss aversion differs when deciding for oneself, a close friend, or a random stranger. The idea behind this approach is that concerning investment decisions, most investment managers do not know exactly who their clients are and whose money they invest. After the financial crisis of 2007, investment managers were accused of extreme risk seeking behavior on behalf of their clients (Andersson et al., 2016). If loss aversion is reduced when deciding for others, it could explain why investment managers were willing to take excessive risks when investing their clients' money. Moreover, if loss aversion is even stronger reduced when deciding for a stranger than when deciding for a friend, it could indicate that most investment decisions are not really affected by loss aversion. Regarding these real-world applications, this demonstrates the necessity of further investigation within this field.

In summary, this paper contributes to the literature by distinguishing between deciding for a friend and deciding on behalf of a stranger. The second new aspect is that a new non-parametric method is applied to reduce the influence of the structural model on the results. So far, nobody examined loss aversion when deciding on behalf of other's by comparing different types of social distance and applying a non-parametric measurement method. Consequently, this research project adds to a barely examined but fast-growing field within economics. According to the collected data, loss aversion can be observed for all three treatment groups. However, the degree of loss aversion is not significantly reduced when deciding on behalf of a friend or a random stranger. The elicited utility functions are

[1] The further social distance is reducing, the more a person transforms from an unknown stranger to an identifiable person (Bohnet & Frey, 1999). Social distance is explained in detail in section 2.2.1

consistent with the predictions of prospect theory, but the degree of loss aversion as well as diminishing sensitivity are smaller than prognosticated by related literature.

2. Literature Review and Hypotheses

The literature review begins in section 2.1 with the explanation of prospect theory, which is fundamental for understanding previous research in the field of loss aversion. Additionally, loss aversion will be discussed and the current state of it within behavioral economics will be summarized. Moreover, examples of the applications of loss aversion within real world scenarios will be provided to highlight the existence and importance of loss aversion. Since this research project focusses on decision making on behalf of others, a brief literature review of decision making for others is included in the following sections as well. The section about deciding on behalf of others is further subdivided into the theory of social distance and in a short assessment of principal-agent issues, which are expected to influence the data collection. Section 2.3 combines loss aversion with decision making on behalf of others, and reviews related literature which were the inspiration to conduct this research project. Based on the literature review and empirical findings, the hypotheses are specified in section 2.4.

2.1 Prospect theory

When measuring utility, economic theory usually assumed that people make choices based on expected utility (Abdellaoui et al., 2008). However, previous research has found that people are influenced by biases and violate expected utility regularly (Starmer, 2000). Thus, the elicitation of utility functions based on expected utility is very likely to lead to inconsistent results (Abdellaoui et al., 2007). Kahneman & Tversky (1979) developed the prospect theory, which proposes that these inconsistent results are mainly caused by loss aversion and by the phenomenon that people do not evaluate probabilities linearly (Abdellaoui et al., 2008). This research project focusses on ambiguity, therefore probability weighting and probabilistic insensitivity are not discussed[2]. According to prospect theory, individuals evaluate a specific prospect based on the utility they receive from deviating from their personal reference point (Tversky & Kahneman, 1992). Usually, the utility function is concave for gains and convex for losses. Figure 1 demonstrates a typical utility function according to prospect theory. One can clearly observe that it is steeper for losses than for gains. It implies that a loss reduces the utility of an individual stronger than an equivalent gain increases it (Tversky & Kahneman, 1991). Previous research has shown that the coefficient of loss aversion is very close to 2, which indicates that

[2] Allais (1953) and Wu & Gonzalez (1996) provide a detailed description on these phenomena.

an individual evaluates the deviation from the reference point x_0 for a loss about twice as strong as an equal-sized win (Camerer, 2005; Novemsky & Kahneman, 2005; Tversky & Kahneman, 1992). Thus, prospect theory predicts receiving €200 will increase an individual's utility by approximately the same magnitude, as losing €100 decreases it.

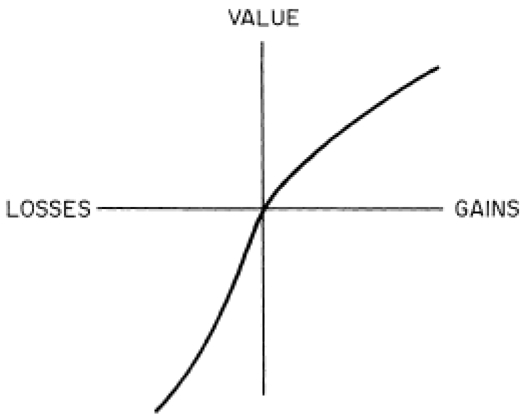

Figure 1: Utility function under prospect theory (Tversky & Kahneman, 1992)

Loss aversion is widespread and applies to many fields in the real world. Especially, financial markets are influenced by loss aversion. For example, most investors hold bad investments longer than recommended, because they are reluctant to realize financial losses (Odean, 1999). In addition, the loss aversion of investors is also incorporated in the premium of stock returns compared to bond returns (Benartzi & Thaler, 1995). Furthermore, the degree of loss aversion can be predicted by several demographic characteristics. Regarding gender difference in risk taking, previous research has shown that women are on average more loss averse than men (Andersson et al., 2016; Charness & Gneezy, 2012; von Gaudecker et al., 2011). Gächter et al. (2010) agree that females seem more loss averse. However, this effect became insignificant when they controlled for other variables. In addition, Vieider et al. (2016) even found the opposite, with men being more loss averse than women. The differences in the findings might be attributed to the different theoretical frameworks used. Section 2.3 discusses these in more detail. Another characteristic that influences loss aversion is age. Since older people value certainty and safety more than young people, it is not surprising that they also behave more loss averse than young adults (Gächter et al., 2010; Hess et al., 2009; Kurnianingsih et al., 2015). Moreover, loss aversion is rooted so deeply in the personality of a human being that not even high stakes, competition, and experience can eliminate it completely (Pope & Schweitzer, 2011). Although higher education cannot eliminate loss aversion, it can reduce the degree of loss aversion (Gächter et al., 2010). In section 5.3, the influence of certain demographics on loss aversion will be analyzed.

2.2 Deciding on behalf of others

Despite the fact that loss aversion and especially decisions under risk and ambiguity are incredibly popular research topics in the field of economics, there is not much literature on decision making under risk or ambiguity on behalf of others. The results of the research within this topic are equivocal and rather mixed (Andersson et al. 2016). Making a decision for others is influenced by several aspects. Especially, social distance is a defining factor, therefore it will be discussed in the following chapters. Additionally, it is expected that principal-agent issues with regards to effort and time influence the decision making. Hence, the clarification of both concepts is inevitable for understanding the experimental design and the subsequent analyses.

2.2.1 Social distance when deciding for others

Social distance can influence an individual's risk preferences when deciding for others (Chkravarty et al., 2011; Zhang et al., 2017). It describes the personal relationship between people. The further social distance is reduced, the more a person changes from an unknown stranger to an identifiable person (Bohnet & Frey, 1999). Social distance is considered to be very small towards for instance friends or family members. Basically, people who are clearly identifiable from a crowd or even share similar characteristics.

According to Chakravarty et al. (2011), individuals are more risk averse when considering their own decisions than when deciding for a random stranger. Conversely, Reynolds et al. (2011) found the opposite, being responsible for other's payoff made the people in their experiment more risk averse. However, when facing high stakes, the participants behaved similarly to the subjects of Chakravarty et al. (2011). Regarding gain prospects, Zhang et al. (2017) found the same effect as Chakravarty et al. (2011) that people are more risk averse when deciding for themselves. In addition, when people faced losses, they were more risk seeking when deciding for themselves or a close friend, compared to deciding for strangers (Zhang et al., 2017). When social distance is extremely short, for instance close friends or family members, Montinari & Rancan (2013) found that individuals become even more risk averse than when deciding for themselves, because they feel a high level of responsibility. Hence, risk aversion is reduced when facing a long social distance.

In section 2.1, real world implications of loss aversion were already discussed. Especially, the behavior on financial markets is interesting with regards to loss aversion and social distance. Eriksen & Kvaløy

(2010) analyzed the behavior of investment managers investing their own money compared to their clients' money. They found that people take more risk when deciding for others. Thus, investment managers behave more according to expected utility when investing for their clients (Zhang et al., 2017). The designs of these studies vary significantly, which makes it difficult to compare the findings of them. For example, Chakravarty et al. (2011) used a multiple-price list[3], whereas Eriksen & Kvaløy (2010) and Montinari & Rancan (2013) applied an investment game[4]. Zhang et. al (2017) conducted the cups task[5] introduced by Weller et al. (2007). Although these previous research projects helped to understand social distance when deciding for others, they focused on risk preferences rather than loss aversion or decision making under ambiguity. This highlights the importance of this research project investigating loss aversion under ambiguity even more.

2.2.2 Principal-agent problems

Decision making for others often applies in the principal-agent problem, with contradictory interests between the decision maker (*"agent"*) and the other person (*"principal"*). Concerning the following experiment, the subjects within the *Friend* and *Other* treatment groups will make decisions for others. However, by fixing the decision makers' outcome for both treatments to 0, contradictory incentive issues should be negated. Nevertheless, each subject has an incentive to preserve personal time and effort by quickly rushing through the experiment without paying attention to the questions. This is plausible because all subjects are anonymous, and their decisions do not affect their own outcome. Therefore, the actions of the subjects are hidden and moral hazard[6] is likely to occur. The only treatment group without these issues is the self-treatment group because the subjects' outcomes are only determined by their own actions. Further analysis in section 5.4 will show, whether the principal-agent issues might have an influence on the effort the subjects put into the task. An indicator could be the total time spent on the survey. It is conceivable that subjects within the self-treatment group spend on average more time answering the questions than the other two treatment groups.

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[3] The multiple price list is a convenient alternative to elicit values from a subject. The multiple price list is a table with several prices, normally one per row. Usually, the subjects must indicate regarding each price whether they are willing to buy a specific item (Anderesen et al., 2006).
[4] The investment game is a lottery-type investment task which is based on Gneezy & Potters (1997).
[5] Subjects are shown the probability of an outcome under risk using a specific number of cups from which they can choose. Levin & Hart (2003) and Weller et al. (2007) are interesting sources for more information about the cups task.
[6] The effect, in which a party behaves differently because the decision making is not determining the own, but somebody else's outcome, is known as moral hazard (Kräkel, 2007; Mas-Colell et al., 1995).

2.3 Related literature on loss aversion when deciding for others

Andersson et al. (2016) examined loss aversion when deciding for others using a multiple-choice list. Facing risky lotteries, the subjects made either decisions for themselves including monetary incentives, hypothetical decisions for themselves, decisions for a second person and for themselves, or only decisions on behalf of the second person. The main finding was that deciding for others indeed reduces loss aversion. They came to this conclusion because the subjects made the same choices for themselves as for others when losses were excluded. With losses included in the lotteries, people were willing to take more risk when deciding for others. Since loss aversion is considered a bias and driven by emotions, it seems reasonable that it might be reduced when the own outcome is not affected (Mengarelli et al., 2014). Vieider et al. (2016) examined the same topic but they used different treatments than those used by Andersson et al. (2016). The subjects made either decisions for themselves or for themselves and a stranger with aligned payoffs. However, they could not confirm the findings of Andersson et al. (2016) that loss aversion is reduced when deciding for another person as well. One of the main reasons, for the different results is that Andersson et al. (2016) used a Constant Relative Risk Aversion (CRRA[7]) model, while Vieider et al. (2016) adopted cumulative prospect theory as their model, which includes probability weighting (Tversky & Kahneman, 1992). Only when Vieider et al. (2016) used the same specifications as Andersson et al. (2016), were they able to replicate their findings.

Using a between-subject design and assuming cumulative prospect theory, Füllbrunn & Luhan (2017) tried to replicate the results of Andersson et al. (2016) and Vieider et al. (2016). Influenced by these previous studies, they used three treatments: *Self, Others,* and *Aligned*. In *Self*, the decision maker decided only for himself. In the *Others* treatment, the decision maker decided for a random stranger without any consequences for himself. In the *Aligned* treatment, the subject made a decision that influences his own payoff but also the payoff of a random stranger. Their results demonstrate that loss aversion is higher when deciding for oneself compared to when deciding for others. This supports the findings of Andersson et al. (2016). On the other hand, loss aversion was not reduced when the treatment *Self* and *Aligned* were compared, which indicates that loss aversion is only reduced if the decision maker does not bear the consequences (Füllbrunn & Luhan, 2017).

Based on previous research, it is unclear whether loss aversion is reduced when deciding for another person. The methods and models used influence the results significantly. Especially, probability weighting was the main difference between Vieider et al. (2016) and Andersson et al. (2016). Hence,

[7] For more information see (Wakker P. , 2008).

the method of Abdellaoui et al. (2016) is optimal to analyze this topic because it does not impose strong assumptions about probability weighting, event weighting and utility.

2.4 Hypotheses

To answer the research question whether the effect of loss aversion is reduced when deciding for others, several hypotheses need to be tested. The following paragraphs specify these hypotheses.

Firstly, loss aversion is one of the main phenomena within prospect theory. Not surprisingly, all research projects related to loss aversion when deciding for others confirmed the existence of loss aversion (Andersson et al., 2016; Füllbrunn & Luhan, 2017; Vieider et al., 2016; Zhang et al., 2017). Based on the literature review, it is expected to find loss aversion even though the design of the experiment differs from previous research. Thus, hypothesis 1 is specified as:

$H1$: Loss aversion under ambiguity can be observed for every treatment group

Secondly, although the opinions are mixed whether deciding for others reduces loss aversion, the majority of previous research projects found the effect of loss aversion to be reduced when deciding on behalf of others (Andersson et al., 2016; Füllbrunn & Luhan, 2017). Moreover, research has also shown that social distance influences the risk preferences of the decision maker (Chkravarty et al., 2011; Zhang et al., 2017). Based on previous research on social distance, the effect of loss aversion is expected to be reduced when social distance increases. Therefore, hypothesis 2 and hypothesis 3 are framed as follows:

$H2$: The effect of loss aversion is reduced when deciding on behalf of a friend or a stranger

$H3$: The effect of loss aversion is higher when deciding for a friend compared to deciding on behalf of a stranger

Analyzing the collected data, these hypotheses will be tested in section 5.3.

3. Methodology

This project uses an elicitation scheme similar to the method used by Abdellaoui et al. (2016) to measure loss aversion and utility. Thus, many notations in the subsequent sections are based on their paper. The method is built on binary prospect theory under ambiguity, which will be explained in the first subsection. While Abdellaoui et al. (2016) investigated decisions under ambiguity and risk, this research project will only examine decisions under ambiguity. In most real-world scenarios probabilities are unknown, for instance the performance of stocks is completely ambiguous. Hence, it was decided upon to examine decision making under ambiguity because the results would be more applicable for real-world problems. Additionally, since previous research mainly examined decisions under risk, it seemed more challenging and appealing to investigate decisions under ambiguity to fill a gap in the existing literature.

Abdellaoui et al.'s (2016) method consists of three main stages. The first stage is meant to combine the utility for gains and losses. This is the reason why both a gain and a loss are elicited in the first stage. The following two stages use the *trade-off method* developed by Wakker & Deneffe (1996) to elicit *standard sequences* of outcomes for gains and for losses in stage two and stage three respectively.

3.1 Binary prospect theory

The following paragraphs explaining the non-parametric method, are mainly based on Abdellaoui et al.'s (2016) paper. To minimize potential confusion, the following notations will not deviate too much from their work. By also considering risky prospects, their paper explains binary prospect theory in more detail than the following paragraphs.

The subjects participating in this experiment make choices under ambiguity. Ambiguity is represented by two potential *events* E and the complement E^c. Both events are part of the event space Ω (Bertsekas & Tsitsiklis, 2008). In this project, prospects are lotteries with two potential outcomes. Outcomes are monetary amounts and assuming monotonicity, more is preferred to less (Mas-Colell et al., 1995). The participants face mainly prospects with two potential outcomes x and y. Outcomes that are larger than the reference point x_0 are considered gains, whereas outcomes smaller than x_0 are considered losses. Prospects are referred to as gain prospects if no potential outcome is negative. Conversely, prospects incorporating only losses will be referred to as loss prospects.

Prospects with a gain and a loss as outcomes will be called mixed prospects. Concerning mixed prospects, the outcome x represents a gain and the outcome y a loss. As an example, a prospect with two outcomes would be written as $x_E y$. If event E occurs, the subjects receive €x, otherwise they lose €y. Since no losses are contained in gain prospects, it holds that $x \geq y \geq x_0$. Conversely, for loss prospects $x_0 \geq x \geq y$.

According to binary prospect theory, the preferences of the subject facing a mixed prospect $x_E y$ under ambiguity is:

$$W^+(E)U(x) + W^-(E^c)U(y), \qquad (1a)$$

while the preferences of the subject for a gain prospect are evaluated by:

$$W^+(E)U(x) + (1 - W^+(E))U(y), \qquad (1b)$$

Equivalently for a loss prospect by:

$$W^-(E)U(x) + (1 - W^-(E))U(y) \qquad (1c)$$

where $W^i, i = -, +$ are the event weighting functions. W^i assigns to each event[8] a specific value between 0 and 1:

$$W^i(\emptyset) = 0$$

$$W^i(\Omega) = 1$$

Whereby, W^i satisfies monotonicity. In particular, if event $A \supset B$, it follows that $W(A) \geq W(B)$ (van de Kuilen & Wakker, 2011). Since this paper focusses only on decisions under ambiguity, binary prospect theory for risky prospects will not be discussed. Abdellaoui et al. (2016) and van de Kuilen & Wakker (2011) provide more detailed information on weighting functions for risky prospects.

3.2 Stage 1: Combining the utility for gains and for losses

Since the experimental design specializes on ambiguous lotteries, an ambiguous event E is pre-specified. Additionally, a prespecified gain G is selected for the first stage. Using E and G, the subjects must state their personal loss L such that $G_E L \sim x_0$. Based on the equation $(1a)$ it follows:

$$W^+(E)U(G) + W^-(E^c)U(L) = U(x_0) = 0 \qquad (2)$$

[8] ∅ describes an impossible event, whereas a certain event is described by Ω (Bertsekas & Tsitsiklis, 2008).

As mentioned before, in this stage a gain and a loss are elicited. In particular, the certainty equivalents x_1^+ and x_1^- of the subject, which satisfy $x_1^+ \sim G_E x_0$ and $x_1^- \sim L_{E^c} x_0$. Based on the indifference $x_1^+ \sim G_E x_0$ it follows that:

$$U(x_1^+) = W^+(E)U(G) \tag{3a}$$

Based on the indifference $x_1^- \sim L_{E^c} x_0$ it follows that:

$$U(x_1^-) = W^-(E^c)U(L) \tag{3b}$$

By combining the equations $(3a)$ and $(3b)$:

$$U(x_1^+) = -U(x_1^-) \tag{4}$$

Through equation (4) the standard sequence of outcomes for gains is connected to the standard sequence of outcomes for losses. This equation states which negative outcome x_1^- provides the same magnitude of utility as the positive outcome x_1^+ to the decision maker (Abdellaoui et al., 2016).

3.3 Stage 2: Eliciting the utility for gains

In the second stage, the trade-off method of Wakker & Deneffe (1996) is used to elicit a standard sequence of outcomes for gains. For this purpose, a prespecified loss l is set. Before the standard sequence $\{x_0, x_1^+, x_2^+, \dots, x_{kG}^+\}$ can be elicited, the method requires to elicit a loss $L < l$ first. During this elicitation, the decision maker needs to state a loss L which makes him indifferent between $x_1^+{}_E L$ and $l_{E^c} x_0$. This indifference can be expressed as:

$$W^+(E)U(x_1^+) + W^-(E^c)U(L) = W^+(E)U(x_0) + W^-(E^c)U(l) \tag{5a}$$

After rearranging equation $(5a)$:

$$U(x_1^+) - U(x_0) = \frac{W^-(E^c)}{W^+(E)}\,(U(l) - U(L)) \tag{5b}$$

In the second step, the subjects state their gain x_2^+ such that $x_2^+{}_E L \sim x_1^+{}_E l$. This indifference can be expressed as:

$$W^+(E)U(x_2^+) + W^-(E^c)U(L) = W^+(E)U(x_1^+) + W^-(E^c)U(l) \tag{6a}$$

After rearranging equation $(6a)$:

$$U(x_2^+) - U(x_1^+) = \frac{W^-(E^c)}{W^+(E)}\,(U(l) - U(L)) \tag{6b}$$

After combining the equations $(5b)$ and $(6b)$:

$$U(x_2^+) - U(x_1^+) = U(x_1^+) - U(x_0) \qquad (7a)$$

Following this scheme, a sequence of gains is elicited such that $x_j^+{}_E L \sim x_{j-1}^+{}_E l$, with $j = 2, \ldots, k_G$, to obtain $\{x_0, x_1^+, x_2^+, \ldots, x_{kG}^+\}$. Consequently, it follows that for all j:

$$U(x_j^+) - U(x_{j-1}^+) = U(x_1^+) - U(x_0) \qquad (7b)$$

Thus, the equation $(7b)$ proves equality of utility differences within the standard sequences (Wakker & Deneffe, 1996).

3.4 Stage 3: Eliciting the utility for losses

Eliciting the standard sequence of outcomes for losses in the third stage, is similar to the process explained in the second stage. Instead of the loss l, a prespecified gain g is set. The decision maker is asked to choose a gain $G < g$ such that $G_E x_1^- \sim g_{E^c} x_0$. Afterwards, the subjects state their loss x_2^- such that $G_E x_2^- \sim g_E x_1^-$. Similar to the second stage, by eliciting k_L indifferences such that $G_E x_j^- \sim g_E x_{j-1}^-$, with $j = 2, \ldots, k_L$, the standard sequence of outcomes for losses $\{x_0, x_1^-, x_2^-, \ldots, x_{kL}^-\}$ is obtained. After the standard sequences have been elicited, they are combined in stage 1 to obtain a continuous standard sequence of outcomes including both gains and losses $\{x_{k_L}^-, \ldots, x_1^-, x_0, x_1^+, \ldots, x_{kG}^+\}$, which also captures the reference point x_0.

It is possible to measure the utility on a ratio scale. Therefore, the utility of the reference point is set to $U(x_0) = 0$, whereas the last gain elicited is set to $U(x_{k_G}^+) = 1$. It follows that $U(x_j^+) = \frac{j}{k_G}\ for\ j = 1, \ldots, k_G$. Similarly, the standard sequence of losses is measured on the same ratio scale, with $U(x_j^-) = -\frac{j}{k_L}, for\ j = 1, \ldots, k_L$. Furthermore, U is a strictly increasing utility function, which is valid under prospect theory (Wakker & Deneffe, 1996).

4. Experiment

The experiment was designed using the software *Qualtrics.* Since it was expected to have many German speaking subjects, the survey was available in English and German language. The subjects were recruited online, mainly via social media, survey sharing websites, and internet forums. Abdellaoui et al. (2016) invited their subjects to the lab. Although, some claim that laboratory experiments provide a more controllable environment for economic research, the subjects for this experiment participated online using their smartphones or computers (Levitt & List, 2007). Mainly because it allowed to collect more observations in less time. Moreover, previous research has demonstrated that the elicitation of risk preferences and utility do not differ between laboratory experiments and online experiments (von Gaudecker et al., 2012).

Section 4.1 describes the experimental set-up including the randomization of the subjects into the three treatment groups and the design of the lotteries displayed during the experiment. Subsequently, section 4.2 explains the actual experiment, subdivided in the three stages of the methodology, a practice question and a preliminary *zooming-in procedure*, which was created to limit the impact of early mistakes.

4.1 Experimental set-up

All subjects were randomized into one out of three treatment groups. The subjects in the first treatment group *Self* made all decisions exclusively for themselves. Every subject could voluntarily provide either a phone number or a mail address. If the subjects were randomly selected at the end of the data collection, they would receive the money earned throughout the experiment. The subjects randomized into the second treatment group *Friend* were decision makers for either a close friend or a family member of their choice. In the following chapters only "friend" will be mentioned, but this also includes family members. This means that the decisions of the subjects did only influence the payoff of their friend. Subjects in the *Friend* treatment were asked to type in the name of their friend. By doing so, the subjects are more likely to think of the specific friend and empathize stronger with him a priori to the task. This should increase the treatment effect and improve the intensity with which the subjects think of their friend (Zhang et al., 2017). Additionally, they were asked to voluntarily provide contact details of their friend, in case they were chosen to be paid. The last treatment group *Other* made decisions for a stranger, who was another random and anonymous participant. Every decision made did not influence the outcome of the decision maker. Only the payoff of the random stranger was determined by the decisions of the subject. Since the subjects of *Other* did not have a chance to earn money based on their own decisions, they could provide their personal contact details to become a "random stranger" for another subject. Thus, they had a chance to be paid based on the actions of another random person.

Overall, all treatment groups did the exact same task, the only difference was the introduction explaining the experiment. For every treatment group, it was highlighted several times for whom they make decisions for and whose outcome will be affected by it. Moreover, the subjects were told that there are no right or wrong answers. All lotteries displayed during the experiment were designed using a neutral blue color. Red and black colors were specifically avoided to not confuse the subjects with regards to the color of the balls drawn from the urn. Furthermore, it would have been conceivable to label the paths of the lottery for instance with *"correct guess"* and *"wrong guess"*. However, to emphasize that there are no right or wrong answers during the whole experiment, the first path of the lottery was labeled with "*Your color"* and the second path was labeled *"Other color"*. This was supposed to clarify which outcome is realized if the subject predicted the color drawn from the urn and which outcome is realized otherwise.

4.2 Experimental design

As mentioned earlier, the new elicitation method for loss aversion under ambiguity is applied in three treatments. The treatments *Self*, *Friend*, and *Other* differ in social distance between the decision maker and the recipient. In the *Self* treatment, the decision maker answers a sequence of lottery choices. Subsequently, two random lotteries are executed, which affect only his personal outcome. The *Friend* and *Other* treatment groups answer the same sequence of lotteries, but the lotteries that are played out do not affect their personal outcome. Instead, the payoff of a friend or a stranger is determined.

The design of the experiment was fairly complicated but answering the survey was not much easier either. Therefore, it was important to provide an in-depth explanation of the task and a practice question to the subjects. The explanation and the framing of the introduction as well as the practice question are summarized in section 4.2.1. The practice question was designed to be as representative of the actual questions as possible, to make the subjects more familiar with their task. The importance of the first questions within an elicitation procedure, which propagates the errors committed in earlier stages, was highlighted by Wakker & Deneffe (1996). To limit the impact of crucial mistakes in the first question, a preliminary *zooming-in procedure* inspired by the one used by Abdellaoui et al. (2016) was developed. This *zooming-in* procedure is described in detail in section 4.2.2. Following the *zooming-in* procedure. The core of the experiment includes the stages 1 to 3. While, stage 1 was displayed first to each subject, the order of the stages 2 and 3 were randomized, to counter order effects (Hogarth & Einhorn, 1992). The application of the methodology regarding the three stages is explained in the subsections 4.2.3, 4.2.4, and 4.2.5, respectively.

4.2.1 Introduction and practice question

The following paragraph summarizes briefly the most important information provided to the subjects. The complete introduction and the different treatments can be found in the appendix. It was explained to the subjects that they should imagine an urn with red and black balls. However, the quantity of each color is unknown. Thus, the subjects do not know the probabilities of drawing a red or black ball from the urn and make decisions under ambiguity. Every subject should also imagine that it is possible to bet on the color drawn from the urn. For this purpose, different lotteries exist which determine the potential outcomes. A lottery contained two potential events, in this case drawing a red or a black ball. Furthermore, a lottery also displayed which outcomes could be realized. In this experiment outcomes are simply positive or negative monetary amounts for example €10 or €-5. Only the monetary outcomes varied throughout the different lotteries (Abdellaoui et al., 2016). The events, drawing a red or a black ball, did not change. The experiment contained gain lotteries, which did not include a negative outcome, but also loss lotteries, which did not include a positive outcome. Nevertheless, most lotteries were mixed, containing a gain and a loss.

The experiment required a high cognitive effort from the participants and could seem overwhelming at first. It was decided to use a practice question, to reduce the probability of mistakes made in the elicitation process. Especially, since the method used was developed on the mechanisms of the trade-off method, crucial early mistakes would distort the data massively. The practice question was displayed to every subject after the randomization into the treatment groups. It was similar to the actual questions following later and should make the subjects familiar with the task. The practice question, including the lotteries, the scrollbar and the task description, is displayed in figure 2**.** The participants faced two lotteries with two potential outcomes each. Lottery 1 displayed that €10 are won if the color predicted by the subject is drawn. Otherwise, €-2 are subtracted from the current balance. Lottery 2 contained the adjustable outcome €x, which is won if the subject's predicted color is drawn and €-5, which are subtracted if the other color is drawn from the urn. The subjects were asked to adjust the outcome x, such that they are indifferent between playing Lottery 1 or Lottery 2.

Influenced by Abdellaoui et al. (2016), a scrollbar was chosen to adjust the outcome x. It was displayed below the two lotteries. Using the scrollbar, the subjects could adjust up to €1 precision. The scrollbar has two main advantages. First, it provides the subjects with a reasonable range for the value of the outcome x. This should limit the cognitive effort required by the subjects. Secondly, each data observation is elicited in a consistent form.

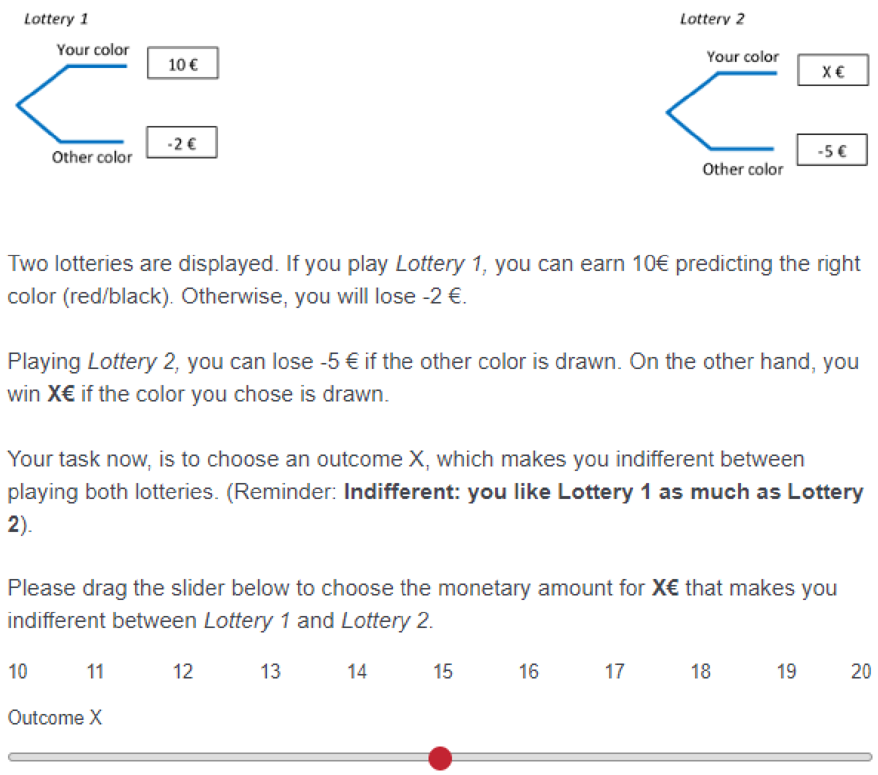

Figure 2: Practice question of the experiment with two lotteries and a scrollbar

4.2.2 Zooming-in process

The first stage is particularly important because the method uses chaining[9] in the elicitation process. Therefore, a *zooming-in* process was following the practice question to elicit the optimal scrollbar range for the first stage (see section 4.2.3). The goal was to reduce the probability that subjects make a mistake during the first stage. Abdellaoui et al. (2016) used a *zooming-in* process as well. However, the exact details of their approach are not provided in their paper. Thus, it is likely that the procedure developed for this paper differs greatly from their approach.

[9] Previously elicited values are used in the following elicitation process. For example, the elicitation of x_2 needs the previously elicited x_1 as an input (Wakker & Deneffe, 1996).

The *zooming-in* process consisted in total of three consecutive questions. The first question of the *zooming-in* process was the same for every subject. It is shown in figure 3. Out of the two lotteries displayed, the subjects had to answer which lottery they preferred. It was not possible to state indifference. Lottery 1 contained two times €0 as potential outcomes. Playing the second lottery, one could either win €20 or lose the same amount instead. After answering this question, it was proceeded to the second question of the *zooming-in* process. The lotteries of the second question were designed depending on the choice made in question 1. If the subject preferred lottery 1 in the first question, lottery 2 becomes more attractive and changes its outcomes to €20 and €-10. On the other hand, if the subject chose lottery 2 over lottery 1, lottery 2 is changed to €20 and €-30 in the second question. Thus, the lotteries displayed in question 2 were exactly the same as in question 1, except that the negative outcome of lottery 2 was changed. Subsequently, subjects were asked again to choose which lottery they preferred. After the subjects made their decision for the second question, it was proceeded to the third question of the *zooming-in* process. For question 3, the second outcome of lottery 2 is changed again but this time by €5 or €-5 depending on the choice made in question 2. Lottery 1 and the positive outcome of lottery 2 remained as displayed in question 1. The goal of this scheme is to reduce the attractiveness of the preferred lottery compared to the alternative lottery. Hence, the subjects should get closer to their personal indifference point with every subsequent question of the *zooming-in* process. Whereby, the intervals become smaller after every question because the subjects are expected to get closer to their indifference point with every question. Depending on the answers during the *zooming-in* process, the subjects started the first stage with the most optimal scrollbar according to their personal preference.

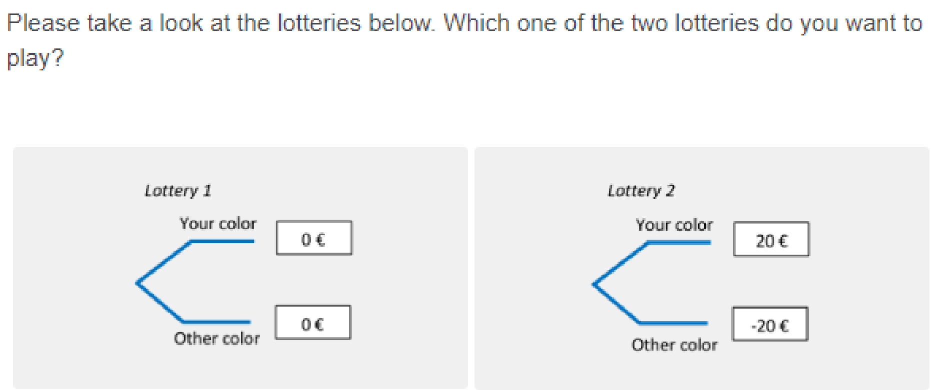

Figure 3: First question of the Zooming-in procedure

In total, there were eight different scrollbar ranges which were implemented in stage 1 depending on the results of the *zooming-in* process. Except one, all scrollbars have a range of 10. According to the preliminary *zooming-in* questions, the median number is the most likely value for L, which makes the respective subject indifferent between the two first lotteries in stage 1. The total range of 10 was chosen so that subjects could still recover if they made a mistake during the *zooming-in* process. Also, a larger range than 10 would increase the likelihood of subjects being overwhelmed or confused with the number of alternatives (Scheibehenne et al., 2010). All scrollbars elicited through the *zooming-in* process are summarized in table 1. The middle of the scrollbar is labeled as "*default*" in table 1, which is, as mentioned above, the most likely value for L in stage 1. Starting from this value, the range is calculated as follows:

$$Minimum = Default - 5$$
$$Maximum = Default + 5$$

The single exception to this calculation is option 1, because the loss needs to satisfy $L < 0$. Hence, the maximum was set to -1, which is the largest value possible for L.

Option	**Minimum**	**Default**	**Maximum**
1	-9	-4	-1
2	-12	-7	-2
3	-18	-13	-8
4	-22	-17	-12
5	-28	-23	-18
6	-32	-27	-22
7	-38	-33	-28
8	-42	-37	-32

Table 1: All scrollbar ranges elicited through the zooming-in procedure

4.2.3 Stage 1

As mentioned in section 3.2, the goal of stage 1 is to combine the standard sequence of outcomes for gains with the standard sequence of outcomes for losses. Therefore, a gain and a loss near the reference point x_0 were elicited. First, the subjects were asked to state a loss L which makes them indifferent between lottery 1, which is 0_E0 or just x_0, and Lottery 2, which can be written as G_EL. As mentioned before, G is a prespecified gain. Based on the complexity of the survey, it was decided to pick a simple numeric value to minimize the cognitive efforts required by the participants. Moreover, two random lotteries are actually played out. It was reasonable to pick a small monetary amount keeping the costs for the experiment under control. Thus, G was prespecified as €20. It follows that the subject had to choose a loss L which makes them $20_E L \sim x_0$. Furthermore, Abdellaoui et al. (2016) proved that it does not influence the results, which prespecified gains and losses are selected for their method.

The next step of stage 1 was the elicitation of the gain near the reference point. The subjects were asked to choose a certainty equivalent for the lottery $20_E 0$, such that $20_E 0 \sim x_1^+$. For this task, the range of the scrollbar was the same for each participant. The two outcomes of the lottery, 20 and 0, formed the boundaries of the scrollbar. Subsequently, the loss near to the reference point was elicited. Using the previously elicited L as an input, the subjects were asked to state their negative certainty equivalent for the lottery $L_{E^c} x_0$. For instance, if for subject i: $L_i = -13$, then the subject i was asked to choose a certainty equivalent, such that $-13_{E^c} 0 \sim x_{1i}^-$.

Stage 1 is arguably the most important stage for this research project, because the kink of the utility function at x_0 is elicited, which reflects loss aversion (Kahneman, 2003; Köbberling & Wakker, 2005). In addition, the stages 2 and 3 rely on the values x_1^+ and x_1^- elicited in stage 1.

4.2.4 Stage 2

Since stage 1 is fundamental for stage 2 and 3, every subject went through stage 1 first. Conversely, the order of stage 2 and 3 were randomized because it did not matter for the further process whether the standard sequence of outcomes was elicited first for gains or for losses. The idea behind the randomization was that the results should not be influenced by the order in which the standard sequence of outcomes are elicited.

Stage 2 consisted of two steps. The first step was meant to elicit a new individual Loss L, which then would be reused in the following elicitation process. Similar to stage 1, two lotteries were displayed. The first lottery consisted of the prespecified loss $l = -3$ and the reference point x_0. This lottery can be written as: $-3_{E^c} x_0$. The second Lottery contained for every subject individually the previously elicited x_1^+ and the adjustable Loss L. The subjects were asked to adjust L, such that $-3_{E^c} x_0 \sim {x_1^+}_E L$. Using the piped text[10] feature in Qualtrics, the second lottery was designed for every subject individually. The scrollbar range for L was set to -20 and 0. Thus, the subject could not choose a positive value and L was also not expected to be smaller than -20, because the certainty equivalent used in

[10] Piped Text is a line of code, which pulls information from previous inputs. It allows to customize every question for each respondent individually. This information is then displayed to the respondent (Qualtrics, 2018).

Lottery 2 could not be larger than 20. After L has been elicited, the second step of stage 2 was following. Using L, the second step elicited the standard sequence of outcomes for gains. For this purpose, the subjects faced again two lotteries. Lottery 1 contained the outcomes x_1^+ and $l = -3$, whereas lottery 2 consisted of the outcomes x_2^+ and L. The goal was to elicit x_2^+. Therefore, the subjects were asked to adjust x_2^+, such that $x_1^+{}_E - 3 \sim x_2^+{}_E L$. An example of one subject facing these two lotteries while adjusting x_2^+ is visualized through figure 4. In this example $x_1^+ = 11$, which was labeled for the subject as $A = 11$. The loss L was labeled as $B = 12$.

The scrollbar range was set to 5 and 30. One can see that compared to the elicitation of x_1^+, the minimum of the scrollbar was raised from 0 to 5, while the maximum was raised from 20 to 30. This system, increasing the range's minimum by 5 and the maximum by 10 for every x_{j+1}^+, was kept constant for every x_j^+ until x_6^+. All further outcomes from x_3^+ until x_6^+ were elicited with the same method. Each subject faced two lotteries and had to adjust x_j^+, such that $x_{j-1}^+{}_E - 3 \sim x_j^+{}_E L$.

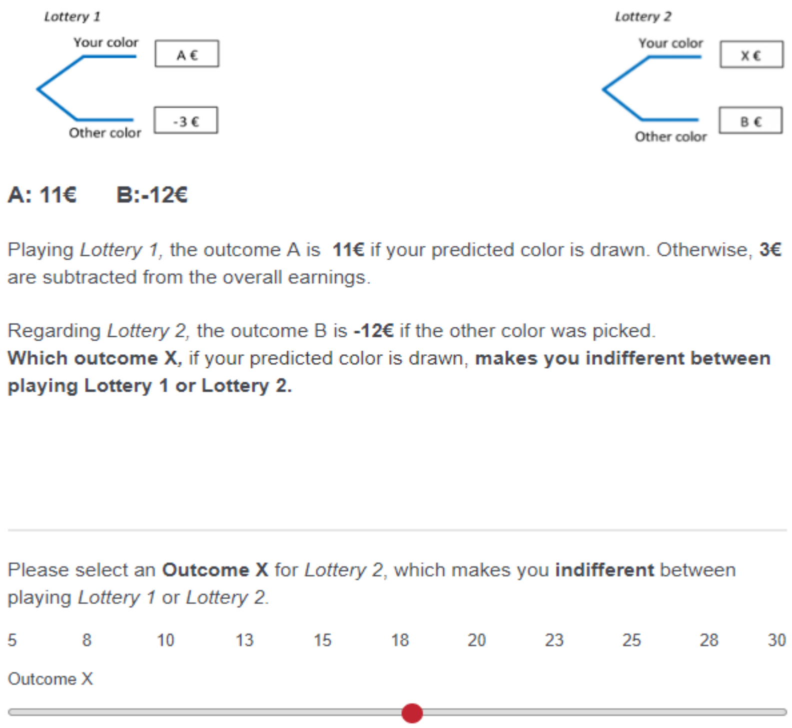

Figure 4: An example of the elicitation of x_2^+ within stage 2

The scrollbar range was the largest for x_6^+, with a minimum value of 25 and a maximum of 70. It was necessary to increase the total range of the scrollbar for every x_{j+1}^+, because the participants had different growth rates regarding their standard sequence of outcomes. After in total 6 indifference questions within stage 2, the standard sequence of outcomes for gains $\{x_1^+, \dots, x_6^+\}$ has been completely elicited. Inspired by Abdellaoui et al. (2016), it was decided to elicit 6 outcomes each for gains and for losses.

4.2.5 Stage 3

To elicit the standard sequence of outcomes for losses, stage 3 was conducted equivalently to stage 2. In the first step, a gain G is elicited instead of the loss L. Two lotteries were displayed to the participants. Lottery 1 consisted of the adjustable G and x_1^-, which was elicited in stage 1. The second lottery consisted of a prespecified gain $g = 3$ and x_0. Using the scrollbar, the subjects were asked to adjust G, such that $G_E x_1^- \sim 3_E 0$. Equivalent to the elicitation of L during stage 2, the range of the scrollbar went from 0 to 20.

Using the individual G for each subject, the standard sequence of outcomes for losses could be elicited. In the second step of stage 3, the subjects faced two new lotteries. Equivalent to stage 2, they were asked to adjust x_2^-, such that the two lotteries are equally attractive to them. Lottery 1 consisted of the two outcomes G and the adjustable x_2^-. Whereas, lottery 2 consisted of the prespecified gain $g = 3$ and the certainty equivalent x_1^-. The indifference can be written as $G_E x_2^- \sim 3_E x_1^-$. In stage 2, the scrollbar ranged from 5 to 30 for the elicitation of x_2^+. Conversely, the scrollbar went from -30 to -5 in stage 3. The range was selected for the same reasons as in stage 2. Equivalently to stage 2, the range grew in total by 5 for every x_{j+1}^-, with -10 at the minimum and -5 at the maximum boundary for every step of the elicitation. Subsequently, x_3^- was elicited by asking the subjects to adjust x_3^- for two new lotteries, such that $G_E x_3^- \sim 3_E x_2^-$. This scheme is repetitive and similar to stage 2. The complete sequence was elicited asking to attune x_j^-, such that $G_E x_j^- \sim 3_E x_{j-1}^-$. The range of the scrollbar for x_6^- was the largest, ranging from -70 until -25. The standard sequence of outcomes for losses $\{ x_6^-, \dots, x_1^- \}$ was completely elicited after the 6 indifference questions. After the three stages, it was possible to combine the elicited values to obtain a continuous standard sequence of outcomes, including both gains and losses $\{x_6^-, \dots, x_1^-, x_0, x_1^+, \dots, x_6^+\}$.

4.3 Financial incentives

This paragraph discusses the financial incentives created for this experiment. This methodology to incentivize the subjects was not used in any of the related literatures and is probably unique within this specific research field. Following the stages 1 to 3, the subjects had the chance to win money. The payout was determined by playing out two random lotteries from the stages 2 and 3 and adding the outcomes on top of the flat show up fee. One lottery from stage 2 and another lottery from stage 3 were randomly chosen. This was possible because in contrast to Abdellaoui et al. (2016), small stakes were used during the elicitation procedure.

Each participant started with a balance of €30, which can be seen as a flat show up fee for participating in the experiment. Starting with a balance of €30 was necessary because it would be difficult to convince potential subjects to participate in an experiment, which could result in losing money. Usually, the lottery of stage 2 contained as outcomes a large gain and a small loss, whereas the stage 3 lottery contained a large loss and a small gain as outcomes. After a random lottery was displayed, the subjects were asked to predict whether a black or a red ball will be drawn from the urn. It would have been possible to preselect a color, for instance red, which needs to be drawn from the urn for the subjects to win money. But to avoid suspicion, the subjects were allowed to freely choose which color they wanted to bet on. This is especially important with regards to the experimental design because all events were ambiguous (Ellsberg, 1961; Pulford, 2009; Viscusi & Magat, 1992). The design of a lottery selected out of stage 2 is visualized in figure 5.

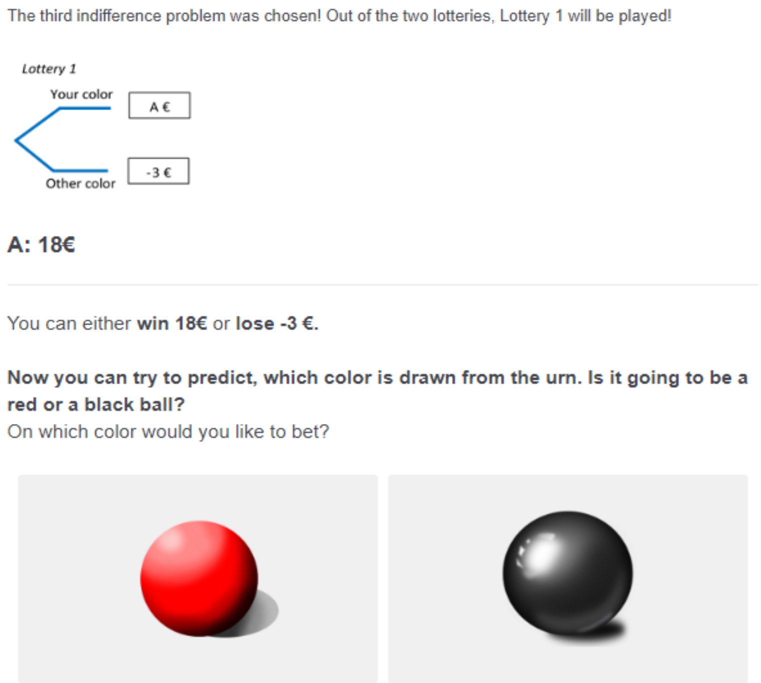

Figure 5: Example of lotteries being played out

Since the probabilities of all outcomes during the experiment were ambiguous, the probabilities of drawing one of the balls were also not displayed. For both lotteries a simple 50-50 chance was chosen, but this information was not shared with the participants. The outcomes of the two lotteries were calculated with the flat show up fee of €30. After the data collection, one random participant was chosen, contacted via mail, and paid via bank transfer. For the data analysis itself, this last part of the experiment was unnecessary, but it was useful to create an incentive for the subjects to spend more time answering the questions during the elicitation procedure with care. The disadvantages and advantages of this method developed to create financial incentives for the participants will be assessed later in the section 6.

5. Data Analyses and Results

For the data analyses, the statistic software *Stata 14.1* and *Excel 2016* were used. In section 5.1, the dataset is described and the randomization in the three treatment groups is explained. After the description of the dataset, the elicited utility functions are presented and visually displayed. The curvatures for gains and losses of the utility function were defined by calculating the area below the curve. The curvatures of the utility functions are categorized into concave, linear, and convex. Additionally, the curvatures of the utility functions are also investigated on the individual level. If the predictions of prospect theory are satisfied, the utility functions should be concave for gains and convex for losses. Whereby, the curve for losses should be steeper than the curve for gains, which indicates loss aversion (Tversky & Kahneman, 1992). The degree of loss aversion is analyzed by applying two different definitions. Moreover, several statistical tests are comparing the coefficients of loss aversion between the treatment groups. Since monotonicity is a crucial assumption of the tradeoff method and because mistakes made in early stages can distort the findings, it is also controlled for violation of monotonicity.

5.1 Description of the dataset

The dataset consisted of 159 observations in total. However, 16 observations were dropped immediately, because the respondents did not finish the survey until the end. On average, it took the subjects approximately 20 minutes to participate in the experiment. Since the questions required high levels of effort and concentration, it was decided to drop all respondents from the dataset who spent less than 10 minutes. It is plausible that these subjects just rushed through the experiment and chose random answers because it is impossible to read the description and answer all questions in less than 10 minutes. Due to the response time, further 14 observations were excluded from the dataset. After cleaning the data, 129 observations remained in the dataset. Containing 68 men (52.7%) and 61 women (47.3), the dataset is relatively evenly distributed over the genders. The average age of the subjects is 26.7, with the youngest respondent aged 18 and the oldest aged 63. Concerning education, 50 (41.2%) respondents graduated from high school but not from a university. 54 (38.8%) respondents answered that their highest level of education is a bachelor's degree, whereas 25 (19.4%) respondents even graduated from a master's program. Especially interesting is, whether the respondents are used to economics related content. For instance, being exposed to lotteries or decisions under ambiguity. 34 (26.4%) respondents have never visited a single lecture in economics. Moreover, 42 (32.6%)

respondents have visited at least one economics related lecture. The largest group of people have a major in economics, accounting for 53 (41.1%) observations.

Regarding the three treatments *Self, Friend,* and *Other*, the subjects were almost equally distributed between them. 42 (32.6%) respondents each were randomized into *Self* and *Other* respectively. The largest treatment group is *Friend*, accounting for 45 (34.9%) respondents in total. As mentioned in section 4.2, the order in which stage 2 and 3 of the elicitation procedure were displayed was randomized. Across all treatment groups, 66 (51.2%) respondents saw stage 2 first. Conversely, 63 (48.9%) subjects went first through stage 3.

5.2 Utility functions including gains and losses

Using the elicited data, it is possible to draw a utility function for gains and losses for every subject. As mentioned in section 3.4, the reference point can be set to $U(x_0) = 0$, whereas the last gain elicited is set to $U\left(x_{k_G}^{+}\right) = 1$ (Wakker & Deneffe, 1996). Since for both gains and losses exactly 6 points on the utility function have been elicited, it follows that $U\left(x_j^{+}\right) = \frac{j}{6}\ for\ j = 1,\ \dots\ ,6$. Similarly, the losses are measured on the same ratio scale, with $U\left(x_j^{-}\right) = -\frac{j}{6}, for\ j = 1, \dots\ ,6$.

Figure 6 displays the utility functions for gains and losses under ambiguity across all treatments (Panel A), for the subjects in the *Self* treatment (Panel B), for the subjects who made decisions for a close friend (Panel C) and for the subjects who received the *Other* treatment (Panel D). Surprisingly, all four functions have an almost linear shape. According to previous research, the utility functions should be more concave for gains and more convex for losses (Kahneman & Tversky, 1979; Köbberling & Wakker, 2005). Comparing the curvature of the four functions, the utility function of the *Friend* treatment (Panel C) appears to be the one closest to the prediction of prospect theory. This utility function has the most convex shape for losses. The largest surprise is probably that the utility function of the *Self* treatment appears to be the most linear. Although, diminishing sensitivity[11] usually results due to risk aversion for gains and risk seeking behavior for losses and these characteristics are normally reduced when deciding on behalf of others (Charpentieret al., 2016; Chkravarty et al., 2011). Hence, it seemed reasonable that the curvature for *Self* would be more concave for gains and convex for losses compared to the other treatments. Furthermore, all utility functions seem to be steeper for losses than

[11] Diminishing sensitivity describes the phenomenon that for instance the first hundred euro create more utility than the next hundred euro. Mainly because people are more sensitive to changes of their utility close to their reference point. This holds for gains and losses (Kahneman & Tversky, 1979; Wakker et al., 2007).

for gains, which is a common indicator for loss aversion. However, based on economic theory an even stronger difference in the steepness of losses compared to gains was expected (Abdellaoui et al., 2007; Tversky & Kahneman, 1991).

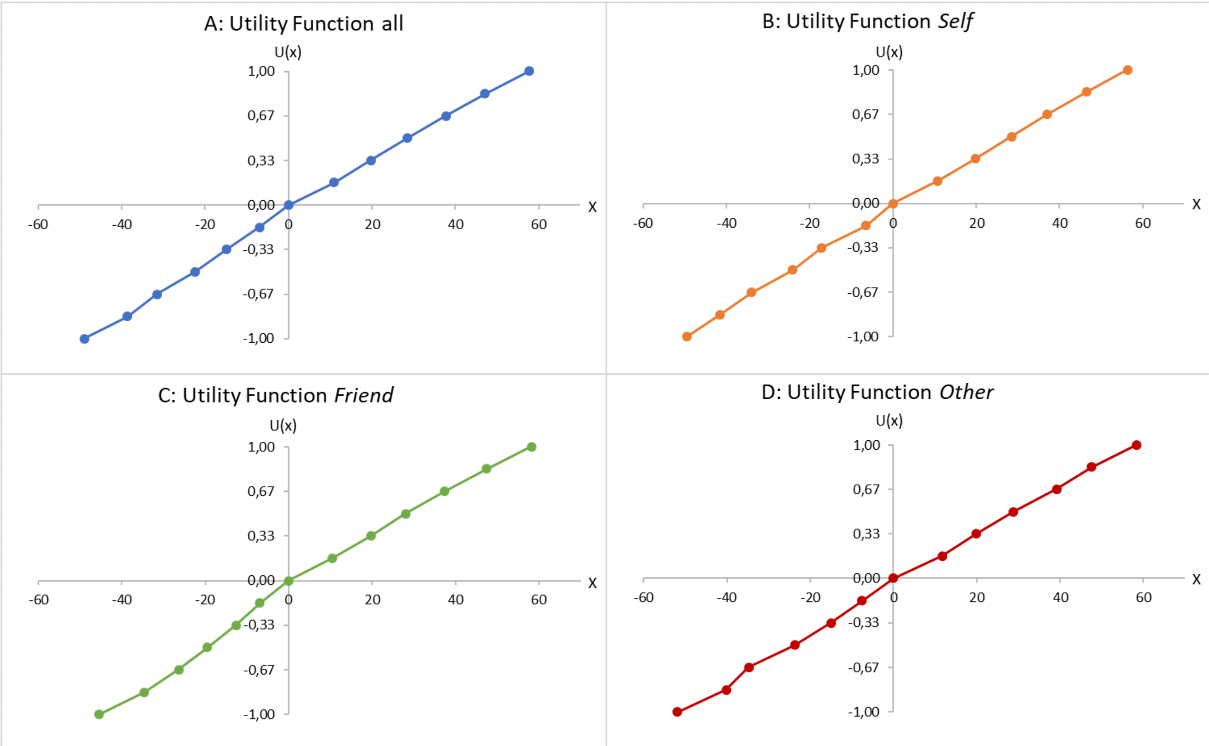

Figure 6: Utility functions for each treatment individually and all subjects combined

To examine the curvature of the utility functions in more detail, a nonparametric method is used, which is related to the one used by Abdellaoui et al. (2016). The nonparametric method calculates the area under the utility function for gains and for losses. The monetary amounts elicited from the subjects are normalized to $[0,1]$ using the following formula:

$$z_j^i = \frac{x_j^i - \min(x^i)}{\max(x^i) - \min(x^i)} \tag{9}$$

with $x_j^i = (x_1^i, \ldots, x_6^i)$, and $i = +, -$.

After the transformation, z_j^i is the data normalized to $[0,1]$ (Dodge & Cox, 2003). By definition, the utility function is linear, if the area under the utility function is equal to 0.5. Concerning losses, the utility function is called convex, if the area under the curve is larger than 0.5. Conversely, if the area under the curve is smaller than 0.5, the utility function for losses is considered to be concave. For gains, this relationship is the other way around. If the area below the curve is smaller than 0.5, then the utility function is considered to be convex. On the other hand, if the area under the curve is larger than 0.5, then the utility function is concave (Abdellaoui et al., 2016). The area A^i below the curves was calculated as follows:

$$A_j^i = \frac{\left(u(x_j^i) + u(x_{j+1}^i)\right)}{2(z_{j+1}^i - z_j^i)} \tag{10a}$$

$$A^i = A_1^i +, \dots, +A_6^i \tag{10b}$$

with $A_j^i = \left(A_1^i, \dots, A_6^i\right)$, and $i = +, -$.

Table 2 summarizes the results of the calculation. In addition to the results of $A^+$and A^-, the table also directly assesses the curvature type as defined beforehand.

Treatment	Gains (A^+)	Curvature (+)	Losses (A^-)	Curvature (-)
All	0,500	Linear	0,527	convex
Self	0,496	Convex	0,503	convex
Friend	0,507	Concave	0,551	convex
Other	0,497	Convex	0,527	convex

Table 2 Curvature of the utility functions for gains and losses

The table confirms the first impression provided by figure 6. Only the utility function of the *Friend* treatment group satisfies prospect theory, being concave for losses and convex for gains. The utility functions of the *Self* treatment group and *Other* treatment group are very close to linearity, but by definition convex for both, gains and losses. Especially the curvature of the *Self* treatment group is surprising, it was expected that subjects, who are fully accountable for their own decisions, would show stronger diminishing sensitivity.

Subsequently, the curvature for each subject was calculated individually to investigate the curvature of the utility functions further. Table 3 summarizes how many subjects showed a particular type of curvature. Comparing the different treatment groups, the population appears to be quite heterogenous. Across all treatments, most subjects were convex for losses. Concerning gains, the number of subjects within the *Self* treatment group is almost equally distributed between concave and convex utility curvature. Whereas, a concave utility curvature for gains was elicited for most subjects of the *Friend* treatment group. Finally, most observations in the *Other* treatment group displayed a convex curvature for gains. Even though, the aggregate patterns of utility functions are not fully consistent with prospect theory, the most dominant pattern for gains and losses was still predicted by prospect theory. Regarding the *Self* treatment, the most common utility curvatures are concave for gains and convex for losses as well as convex for gains and convex for losses, with 12 subjects each.

Regarding the other two treatments, concave for gains and convex for losses is the most represented curvature type of the utility function, which is consistent with prospect theory.

Gains	Losses			
	Concave	**Linear**	**Convex**	**Σ**
Self				
Concave	5	0	12	17
Linear	3	0	4	7
Convex	12	0	6	18
Friend				
Concave	2	0	20	22
Linear	1	1	1	3
Convex	9	0	11	20
Other				
Concave	2	0	14	16
Linear	1	3	0	4
Convex	11	3	8	22
Σ	46	7	76	129

Table 3: Curvature types for gains and losses on the individual level

5.3 Loss aversion

After analyzing the curvature of the utility functions, the following paragraphs focus on loss aversion of the subjects. Loss aversion has several different mathematical definitions, and which one is chosen varies between previous studies. For example, Kahneman & Tversky (1979) define loss aversion simply as $-U(-x) > U(x)$, for all $x > 0$. This means that the impact on the utility is larger for losses than for equivalent gains (Tversky & Kahneman, 1992). According to this definition, individuals with $\frac{-U(-x)}{U(x)} > 1$ are considered as loss averse. In contrast, individuals with $\frac{-U(-x)}{U(x)} < 1$ are based on the definition called gain seeking. People who are classified as loss neutral satisfy $\frac{-U(-x)}{U(x)} = 0$. Wakker & Tversky (1993) , Bowman et al. (1999) and Neilson (2002) developed alternative definitions for loss aversion. However, these are too strict and not useful for the following analyses (Abdellaoui et al., 2016). Arguably, the most applicable definition of loss aversion for the following analysis was developed by Köbberling & Wakker (2005). They define loss aversion as $\frac{U'_{\uparrow}(0)}{U'_{\downarrow}(0)}$, which is basically the kink of the utility at the reference point x_0. Whereas, $U'_{\downarrow}(0)$ describes the right derivative and $U'_{\uparrow}(0)$ the left derivative of the utility function U at the reference point x_0. Consequently, when analyzing the degree of loss aversion, the most interesting points on the utility function are the gain and loss closest to x_0. These are x_1^+ and x_1^-, which were elicited in stage 1.

To calculate the loss aversion λ, the ratio of $\frac{U(x_1^-)}{x_1^-}$ over $\frac{U(x_1^+)}{x_1^+}$ was calculated for every participant. This can also be written as $\frac{\frac{U(x_1^+)}{x_1^+}}{\frac{U(x_1^-)}{x_1^-}}$. Since in 3.2 it was defined that $U(x_1^+) = -U(x_1^-)$, loss aversion can also be computed using the ratio of $\frac{x_1^+}{x_1^-}$. Similar to Kahneman & Tversky (1979), a subject is categorized as loss averse if $\frac{x_1^+}{x_1^-} > 1$. Whereas, a subject is loss neutral if $\frac{x_1^+}{x_1^-} = 1$ and gain seeking if $\frac{x_1^+}{x_1^-} < 1$.

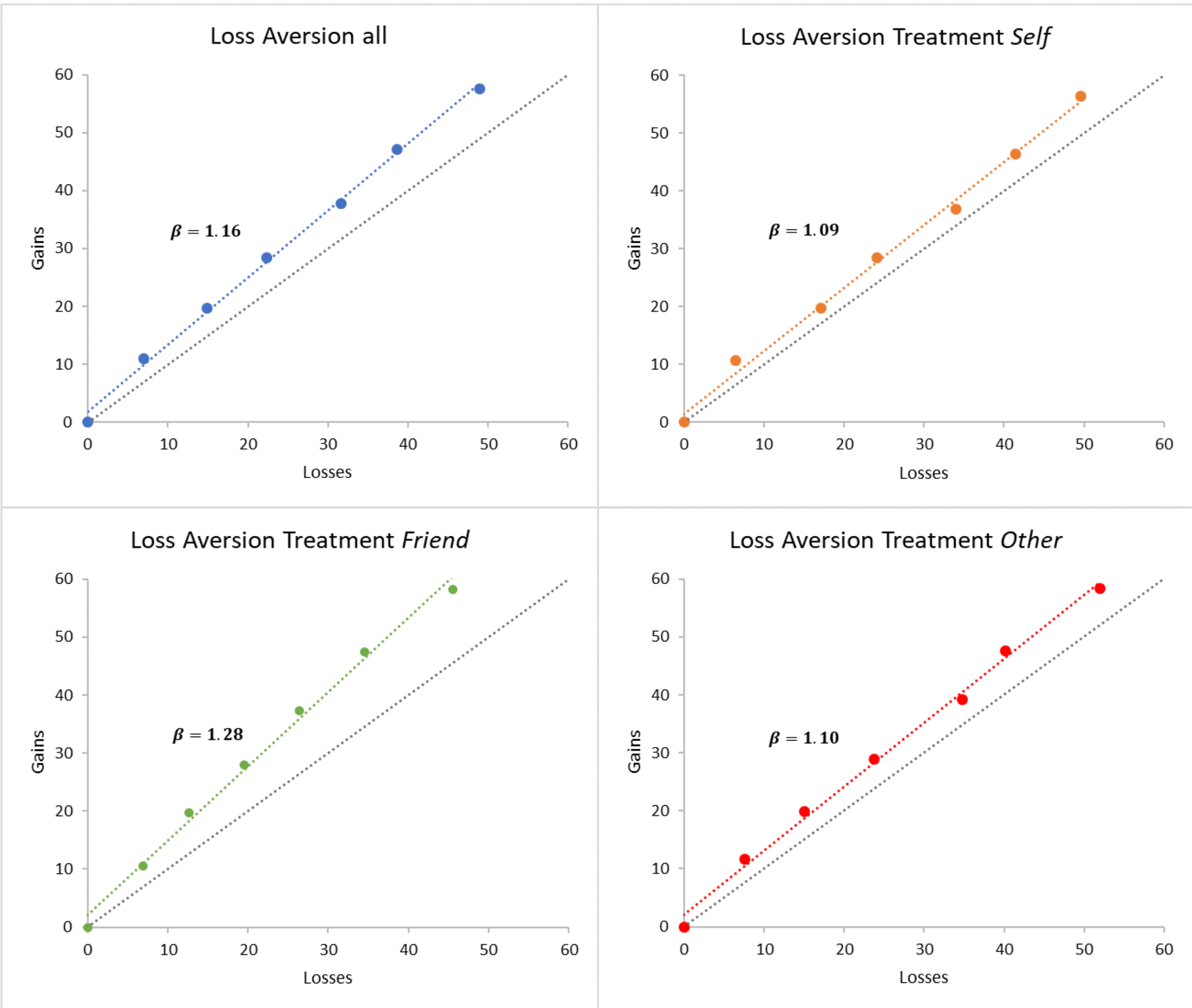

Figure 7: Loss aversion according to Kahneman & Tversky (1979) for each treatment group

Applying the definition of loss aversion by Köbberling & Wakker (2005) as well as the definition by Kahneman & Tversky (1979), should provide two different values for loss aversion which can be compared afterwards. Since $U(x_j^+) = -U(x_j^-)$, it follows that $x_j^+ = (-x_j^-)$. Hence, loss aversion as defined by Kahneman & Tversky (1979) can be calculated for each treatment by regressing x_j^+ on $(-x_j^-)$. The loss aversion is then represented by the parameter β. Figure 7 summarizes the regressions conducted for all three treatments and for all treatments combined. Since every $\beta > 1$, loss aversion can be observed for all three treatments. Table 4 displays the means of the loss aversion coefficient under the definitions of Köbberling & Wakker (2005) and Kahneman & Tversky (1979). Additionally, table 4 also captures loss aversion on the individual level and categorizes the subjects into loss averse, loss neutral, and gain seeking. On the first look, one can clearly see that more subjects are classified as loss averse under the definition of Köbberling & Wakker (2005).

Furthermore, the coefficient of loss aversion λ is under this definition also clearly higher for all treatments. Potential reasons for this finding are elaborated in more detail in section 6. Loss aversion is found to be significantly different from $\lambda = 1$ for both definitions, which is in line with the prediction made in Hypothesis 1 ($p\text{-}value < 0.01$). Thus, hypothesis 1 is accepted. Since the experiment is a between-subject design with three treatments, the Kruskal-Wallis test is used to compare the coefficients of loss aversion between the treatments. The p-value for loss aversion, as defined by Köbberling & Wakker (2005), is $p = 0.93$. This indicates that according to this definition, λ does not differ significantly between the treatments. However, comparing λ as defined by Kahneman & Tversky (1979), results in $p\text{-}value < 0.01$, indicating that at least one treatment's λ differs significantly from the others. Analyzing the data further, loss aversion is not significantly reduced when deciding for others. This applies to both definitions of loss aversion. For Köbberling & Wakkers's (2005) definition of loss aversion, *Self* does not differ significantly from *Friend* and *Other* (Mann-Whitney U test, $p\text{-}value = 0.86$). Also, under the definition of Kahneman & Tversky (1979), the results are not significant (Mann-Whitney U test, $p\text{-}value = 0.33$). These findings are not in line with the prediction made in hypothesis 2. Thus, we cannot accept hypothesis 2.

Regarding hypothesis 3, whether loss aversion is reduced stronger being responsible for a stranger than deciding on behalf of a friend, the results are mixed. Köbberling & Wakker's definition of loss aversion is not significantly different between the *Friend* and *Other* treatment group (Mann-Whitney U test, $p\text{-}value = 0.73$). However, applying the definition of Kahneman & Tversky (1979), changes the conclusion drawn from testing this hypothesis (Mann-Whitney U test, $p\text{-}value < 0.01$). Thus, depending on the definition, loss aversion is reduced significantly when deciding on behalf of strangers compared to deciding for a friend. This is partially in line with hypothesis 3, depending on which definition is applied. Thus, due to the mixed results we cannot reject hypothesis 3. Interestingly, loss aversion is not significantly reduced when comparing *Self* and *Other*. It does not matter which definition is applied. Although under Köbberling & Wakker's (2005) definition: $\lambda_{\text{Self}} > \lambda_{\text{Other}}$, the difference between *Self* and *Other* is statistically not significant (Mann-Whitney U test, $p\text{-}value = 0.76$). The same conclusion can be drawn for Kahneman & Tversky's (1979) definition (Mann-Whitney U test, $p\text{-}value = 0.41$).

Definition	Coefficient	Treatment	Mean (λ)	Loss averse	Loss neutral	Gain seeking
Kahneman & Tversky (1979)	$\frac{-U(-x)}{U(x)}$	All	1.16	72	4	53
		Self	1.09	20	0	22
		Friend	1.28	34	1	10
		Other	1.10	18	3	21
Köbberling & Wakker (2005)	$\frac{x_1^+}{x_1^-}$	All	1.58	85	28	15
		Self	1.66	23	11	8
		Friend	1.53	33	6	5
		Other	1.55	29	11	2

Table 4: Coefficient of Loss aversion (mean) and loss aversion on the individual level

Furthermore, two probit regressions are conducted, investigating the relationship between demographical characteristics and loss aversion in general. Especially, the influence of sex, education, and age on loss aversion are variables of interest. Regarding the design of the experiment, the order in which subjects filled out the survey, either stage 2 first and then stage 3 or vice versa, is also interesting. For every definition of loss aversion, an own indicator variable was created. Both variables take the value 1 if a subject is classified as loss averse, and 0 otherwise. The two probit models estimate the effect of sex on loss aversion, while controlling for age, education, knowledge in economics, the order of the stages, and the treatment groups:

$$\lambda_{j,i} = \beta_0 + \beta_1 female_i + \beta_2 age_i + \beta_3 \Pi I_i^{educ} + \beta_4 econ_i + \beta_5 \Pi I^{stage}{}_i + \beta_5 \Pi I^{treatment}{}_i + \varepsilon_i \quad (11)$$

where $\lambda_{j,i}$ represents the coefficient of loss aversion for subject i, and j = loss aversion defined by Kahneman & Tversky (1979) or Köbberling & Wakker (2005), respectively.

ΠI describes a vector of indicator variables. For instance, ΠI_i^{educ} captures subject i's level of education (school, bachelor, master). Table 5 summarizes the average marginal effects of the regression outputs for both definitions of loss aversion. The sex of the subjects is statistically significant, regardless which definition is used. However, after controlling for other variables, sex turns out to be insignificant under the definition of Kahneman & Tversky (1979). Only under the definition of Köbberling & Wakker (2005), women are still significantly more loss averse than men. According to the collected data, women are

16.3 percentage points more loss averse than men. All other variables are not significantly influencing loss aversion, except deciding on behalf of a friend. Concerning the definition of Köbberling & Wakker (2005), making decisions for a friend increases loss aversion compared to the *Self* treatment group. Moreover, the order in which the standard sequence of outcomes for gains and losses is elicited does not influence the results. Furthermore, the level of education as well as being an economist does not reduce loss aversion because both variables are not significant regardless which definition is applied.

Coefficient (dy/dx)	**Variable**	**Kahneman & Tversky (1979)**	**Köbberling & Wakker (2005)**
β_1	female	0.109	0.163**
		(0.083)	(0.074)
β_2	age	-0.004	-0.006
		(0.006)	(0.005)
$\beta_3 \Pi_2$	bachelor	0.072	0.014
		(0.103)	(0.090)
$\beta_3 \Pi_3$	master	0.008	0.067
		(0.120)	(0.112)
β_4	econ	-0.115	-0.007
		(0.096)	(0.086)
$\beta_5 \Pi_2$	stage 3	0.021	0.068
		(0.084)	(0.075)
$\beta_6 \Pi_2$	treatment *Friend*	0.281***	-0.031
		(0.104)	(0.094)
$\beta_6 \Pi_3$	treatment *Other*	-0.063	-0.084
		(0.109)	(0.094)
Observations		129	129
Pseudo R^2		0.09	0.06

The indicator variables $\beta_3 \Pi_1$ (high school), $\beta_5 \Pi_1$(stage 2), as well as $\beta_6 \Pi_1$(treatment *Self*) are omitted.

$** \, p < 0.05$; $*** \, p < 0.01$

Table 5: Marginal effects of the probit regression

5.4 Violation of monotonicity

The method of Abdellaoui et al. (2016) is based on the trade-off method developed by Wakker & Deneffe (1996). Hence, it also assumes monotonicity, such that $x_j^+ \leq x_{j+1}^+$ and $x_j^- \geq x_{j+1}^-$. A subject is considered to violate monotonicity when at least once $x_j^+ > x_{j+1}^+$ or $x_j^- < x_{j+1}^-$. Concerning the dataset, 25 subjects violated monotonicity. They are distributed equally between the three treatments, with 8 each being in the *Self* and the *Friend* treatment and the remaining 9 subjects have been randomized into *Other.* Since 25 subjects are a substantial number of participants violating monotonicity, it is conceivable that the results of the analyses are biased. To account for that, the same analyses were conducted again, excluding all subjects who violated monotonicity. 104 subjects remained in the data set, with 34 subjects who have been randomized into *Self*, 37 subjects into *Friend*, and 33 subjects into the *Other* treatment group. Table 6 displays the curvature of the utility functions for each treatment without the subjects, who violated monotonicity at least once.

Treatment	**Gains (A^+)**	**Curvature (+)**	**Losses (A^-)**	**Curvature (-)**
All	0,510	concave	0,534	convex
Self	0,502	concave	0,506	convex
Friend	0,521	concave	0,558	convex
Other	0,497	convex	0,537	convex

Table 6: Curvature of the utility functions for gains and losses excluding violation of monotonicity

The curvatures of the utility functions for losses remained the same. The curvatures of all three treatments remained convex for losses. On the other hand, the area below the curve of the *Self* treatment group for gains increased slightly, such that the area $A^+ > 0.5$. This change was enough to classify the curve by definition as concave. Although, the curves are still very close to linearity, all curves except for *Other* are concave for gains, which is closer to the predictions of prospect theory than the curvatures calculated in section 5.2 (Kahneman & Tversky, 1979).

Although, excluding the subjects violating monotonicity from the data influenced the *Self* curve for gains to exceed the $A^+ = 0.5$ benchmark, all curves look still very similar to the ones including all subjects. All utility functions incorporating gains and losses are presented in figure 8. The functions which exclude violations of monotonicity are displayed in black. These curves are all slightly more concave for gains and convex for losses. However, the differences are clearly minimal. Nevertheless, all statistical tests and the regressions of section 5.2 were repeated. Concerning the non-parametric tests, not a single one changes its significance or interpretation of the p-value. Furthermore, regressing the characteristics on both definitions of loss aversion, does not change the conclusions drawn from the previous regression outputs. Regarding the definition of Köbberling & Wakker (2005), women are still more loss averse than men. Based on the results, one can conclude that excluding subjects who violated monotonicity does not influence the elicited utility functions and the degree of loss aversion strong enough to change the conclusions drawn from the analyses for all three treatments.

It is conceivable that subjects who rushed through the experiment to minimize their personal costs, in this case sacrificing time to participate in the experiment, were more likely to violate monotonicity.

However, regressing the time spent on the survey on an indicator variable for violating monotonicity, proves that there is no significant relationship between these two variables ($p\text{-}value = 0.49$). Furthermore, regarding the principal-agent issues discussed in section 2.2.2, it is plausible that the treatments could explain violation of monotonicity. The *Other* treatment group does not have an incentive to read the descriptions of the experiment carefully and demonstrate a high cognitive effort answering the questions. Hence, it seems reasonable for subjects of this treatment group to spend as little time and energy as possible on the experiment. However, regressing the treatment groups on the time spent is not significant either (*Friend*: $p\text{-}value = 0.16$; Other: $p\text{-}value = 0.80$). Furthermore, regressing the treatment groups on the violation of monotonicity is also not significant (*Friend*: $p\text{-}value = 0.88$; *Other*: $p\text{-}value = 0.99$). Although, the *Other* treatment group had no incentives to spend as much time and effort on the survey as the other treatment groups, they did not show indications of less effort.

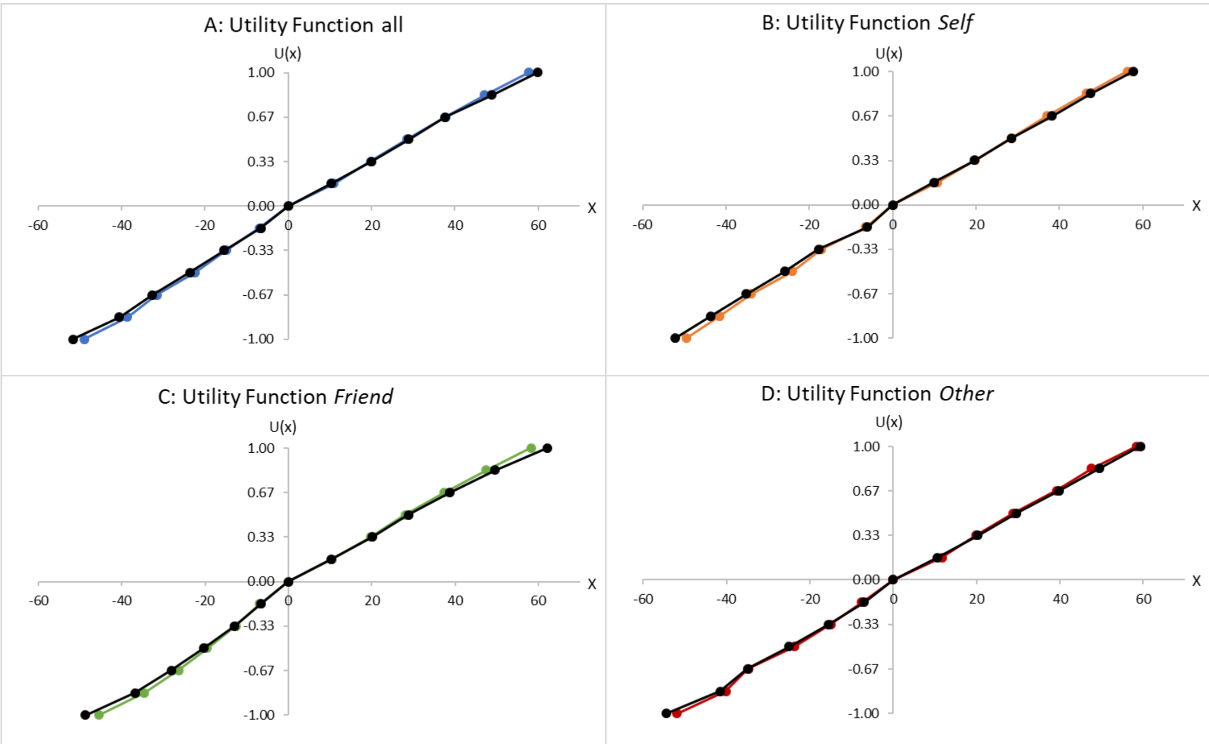

Figure 8: Comparison of the utility functions excluding violation of monotonicity and the original utility functions

Violation of monotonicity did not differ between the treatment groups or the level of education. However, being familiar with concepts of economics did reduce the probability to violate monotonicity significantly, even when controlling for other factors as sex, age, and treatment groups ($p\text{-}value = 0.02$). On average, subjects with a major in economics were 16.6 percentage points less likely to violate monotonicity. Although, almost half of the participants studied economics, only 5 out of 24 subjects, who violated monotonicity were economists.

6. Discussion

By randomizing subjects into the treatments *Self*, *Friend*, and *Other*, it was tried to answer the research question: Is the effect of loss aversion reduced when deciding for others? The experimental design combined the non-parametric elicitation method of Abdellaoui et al. (2016) with three different levels of social distance to fill a gap in the existing literature. For the analyses, the curvatures of the elicited utility functions were calculated for every subject individually, for each treatment separately, as well as for all treatment groups combined. To categorize the curvature in concave, linear, and convex, the area below the utility function was compared to the threshold of 0.5. Subsequently, the coefficient of loss aversion was calculated using two different definitions to compare the degree of loss aversion between the three treatments. Finally, it was also controlled for violation of monotonicity. The following paragraph will summarize the results of the analyses and assess the results to the hypotheses made in section 2.4. Subsequently, the next paragraphs will relate the results to the existing literature and provide conjectures on the data and the method used. Additionally, limitations of the experimental design and the method are discussed, and suggestions for future research are mentioned in the last paragraph.

The curvature of the utility functions was partially consistent with prospect theory. The utility function including all treatments, was convex for losses but linear for gains, which contradicts diminishing sensitivity partially (Kahneman & Tversky, 1979; Wakker et al., 2007). After excluding subjects who violated monotonicity, the curvatures including all treatments and for *Self* changed just enough, to be considered concave for gains and convex for losses, which is consistent with prospect theory. When evaluating the kink of the utility functions at the reference point, loss aversion was observable for every treatment group. Thus, hypothesis 1 was accepted. However, the coefficients of loss aversion were regardless of the definition smaller than 2, which is the value predicted by prospect theory (Tversky & Kahneman, 1991). Overall, the coefficients of loss aversion were closer to prospect theory when the definition of Köbberling & Wakker (2005) was used for the calculation. Furthermore, no significant reduction of loss aversion was observed when deciding on behalf of others. Even after excluding subjects who violated monotonicity, the coefficient of loss aversion was not reduced significantly when deciding for others. The findings contradict Hypothesis 2 because the coefficient of loss aversion was not significantly higher for *Self* compared to the other two treatment groups. However, loss aversion was reduced when deciding for a random stranger compared to deciding on behalf of a friend, which indicates that increasing social distance leads to a reduction of loss aversion in some cases. Thus, the findings are partially consistent with hypothesis 3. Nevertheless, the conclusions that can be drawn from these results are limited. Since, a significant relationship between social distance and loss aversion was only found under the definition of Kahneman & Tversky (1979). On the other hand, this relationship was only significant comparing the *Friend* treatment group to the *Other* treatment group. Social distance is also increased when making a decision for a friend instead of for oneself. However, this effect was not significant. Moreover, the difference in social distance is the largest when comparing the *Self* treatment to the *Other* treatment. But in this case, the coefficient of loss aversion was not reduced significantly, regardless of the definition of loss aversion.

In comparison to the related literature, the analysis of the data could not confirm the findings of Andersson et al. (2016) and Füllbrunn & Luhan (2017) that loss aversion is reduced when deciding on behalf of others. However, the extent to which these results are comparable to Andersson et al. (2016) are limited because two different measurement methods were used. Andersson et al. (2016) used a structural model assuming a CRRA utility function, while for this research project a non-parametric method was preferred. The CRRA model was not used because previous research has demonstrated that its predictive power is limited (Friedman et al., 2014; Füllbrunn & Luhan, 2017). Hence, the results of this paper are in line with Vieider et al. (2016), who could not confirm Andersson et al.'s (2016) findings when using a different structural model. Furthermore, regressing the characteristics of the subjects on loss aversion supported previous research that women tend to be more loss averse than men (Andersson et al., 2016; Charness & Gneezy, 2012; von Gaudecker et al., 2011). This relationship is significant when controlling for other variables, but only for Köbberling & Wakker's (2005) definition of loss aversion. Moreover, higher levels of education and studying economics did not reduce the degree of loss aversion significantly. This contradicts the findings of Gächter et al. (2010) that a higher level of education reduces loss aversion.

Since the main results contradict most of the related literature, the following paragraphs provide the most plausible conjectures regarding the data and the underlying method. Concerning the definitions of loss aversion, the coefficient of loss aversion for *Self* was the smallest when the definition of Kahneman & Tversky (1979) was applied. Conversely, it was largest when only the kink at the reference point was considered by applying Köbberling & Wakker's (2005) definition. The kink, which is defined as $\frac{x_1^+}{x_1^-}$, is already elicited early within the experiment. A plausible reason for the difference between the two definitions could be that the subjects lose focus and interest during the repetitive task, which could lead to a lower quality of the data that was elicited in later stages. Moreover, it is conceivable that the subjects are aware for whom they make decision for in the beginning, but this awareness is probably gradually decreasing over time. Especially, since the subjects were not reminded again of their treatment during the rest of the elicitation procedure. The *Friend* treatment group was the only one who wrote down the name of the person they made a decision for. This should enhance the treatment effect (Zhang et al., 2017). Writing down the friend's name could be the reason why the coefficient of loss aversion is the largest for the *Friend* treatment under the definition of Kahneman & Tversky (1979). This definition includes the complete standard sequence of outcomes for gains and losses in the calculation. Hence, it is reasonable that the *Friend* treatment group could be on average longer aware for whom they make decision for, which would lead to a higher quality of the elicited data. Montinari & Rancan (2013) highlighted decreased risk taking when deciding for a friend because the subjects felt resonsible for them. Feeling responsible for a close person could explain why subjects showed the highest degree of loss aversion under the definition of Köbberling & Wakker (2005) when deciding on behalf of a friend.

Arguably the main reason for relatively linear curvatures of the utility functions could be the ranges chosen for the scrollbars. As mentioned in section 4.2.4, the upper (lower) bounds of the scrollbars increased (decreased) by €10 from x_j^i to x_{j+1}^i. Thus, the upper (lower) bounds of the scrollbars were increased (decreased) gradually throughout the elicitation process of gains (losses). This could have prevented some subjects from choosing their actual x_j^i, especially in the later stages. In total, 12.6% of the observations were values that were directly located on the boundaries of the scrollbars. This indicates that for some subjects the actual x_j^i was lying outside of the boundaries. Choosing the range of the scrollbars was a tradeoff between freedom of choice for the subjects and limiting the alternatives to reduce confusion and the complexity of the task. An alternative design could be, to increase the range of the scrollbars exponentially. This would have likely led to a more concave curvature for gains and a more convex curvature for losses. In particular, the default options of the scrollbars would increase exponentially, which would anchor the subjects more towards diminishing sensitivity (Brown & Krishna, 2004; Dinner et al., 2011). It is debatable whether applying this alternative approach would have manipulated the data too much into the desired direction.

Another reason for the surprising results might be that the subjects were overwhelmed with the complexity of the task, which would explain why 19.4% of the subjects violated monotonicity. Violation of monotonicity occurred equally across all treatments. While the level of education did not influence the violation of monotonicity, subjects with a major in economics were significantly less likely to violate monotonicity. This indicates that the method of Abdellaoui et al. (2016) might be too abstract and complicated to elicit the utility function of participants, who are not familiar with the concepts of economics. This is a limitation of this paper and also one of the greatest disadvantages of the method developed by Abdellaoui et al. (2016). The advantages of this non-parametric method are straight forward. It is possible to completely elicit the utility function under Kahneman & Tversky's (1992) prospect theory. In addition, the method allows to measure loss aversion and utility under risk and ambiguity without making simplifying assumptions for the parameters of prospect theory. Another benefit is that this non-parametric method does not impose the shape of the utility function

(Abdellaoui et al., 2007). However, the method requires a high cognitive capability of the subjects and advanced understandings in economics. The subjects need to compare two lotteries with two outcomes each. In addition, they need to calculate how to adjust one outcome to be indifferent between the two lotteries. Even the concept of indifference required a detailed explanation in the introduction of the experiment to assure that subjects without economic education were familiar with it. Furthermore, the method of Abdellaoui et al. (2016) adopts the tradeoff method of Wakker & Deneffe (1996) in the elicitation process, which reuses previously elicited values in subsequent stages. This adaptive method could lead to error propagation (Blavatskyy, 2006). Especially, crucial mistakes in early stages can distort the results to a great extent (Wakker & Deneffe, 1996). Nevertheless, the similarity of utility functions (see figure 8) and coefficients of loss aversion indicate that the data was not biased significantly through mistakes committed by subjects.

In contrast to Abdellaoui et al. (2016), this research project incentivized the subjects financially. The payoff was determined by summarizing the flat show up fee with the outcomes of the lotteries that were played out. However, only one subject was randomly selected to be paid. Hence, the probability to be paid was relatively low, which could give some participants the impression to make hypothetical choices. This would distort the data as well, because subjects whose decisions do not affect their financial outcome show more erratic behavior and make decisions less carefully (Battalio et al., 1990; Holt & Laury, 2002). Furthermore, a small risk of data manipulation existed due to the chaining mechanism and the type of financial incentives chosen (Harrison, 1986). Experienced subjects who were able to recognize that the method uses chaining, could have selected the highest outcomes possible every time for the standard sequence of gains and conversely, the smallest outcomes possible for the standard sequence of losses. As a result, all lotteries would contain the highest positive and smallest negative outcomes possible. By manipulating the experiment, the subjects could optimize the lotteries that are selected randomly and played out after the elicitation procedure. Fortunately, only two subjects selected their outcomes following this scheme.

Finally, the recruitment of the subjects is discussed. As mentioned in section 4, the recruitment of subjects for the experiment was mainly conducted using social media and survey sharing platforms. Using social media for the distribution of the survey is a convenient and cheap alternative to lab experiments. The downside of this recruitment process is that the sample of subjects might be biased because many of the respondents recruited via Facebook and WhatsApp originate from similar social environments. This is another limitation of this research project. However, due to the financial boundary conditions set for this research project, it was not possible to pay every respondent and thus, recruit subjects through different channels.

7. Conclusion

The purpose of this research project was to investigate regarding decision making for others, whether the effect of loss aversion is reduced when social distance increases. By applying a non-parametric measurement method, it was possible to elicit a utility function under ambiguity for every subject. Loss aversion could be observed throughout all treatment groups. This research project demonstrated that when examining loss aversion, it is crucial to specify which definition of loss aversion is applied. The coefficients of loss aversion differed greatly between the two definitions. Nevertheless, neither definition calculated the value for the coefficient of loss aversion close to the value of 2, as predicted by prospect theory (Tversky & Kahneman, 1991). Comparing loss aversion when deciding for oneself, a friend, or a stranger, it was found that loss aversion is not significantly reduced when deciding for others. Moreover, social distance did not influence the coefficient of loss aversion significantly. The reasons for these findings could be due to several factors and were discussed in detail in section 6. The utility functions elicited were not as concave for gains and as convex for losses as expected, but they still were consistent with prospect theory. Especially, after excluding the subjects who violated monotonicity, because on average the curves became more concave for gains and more convex for losses.

These results highlight how controversial this topic can be and that there is still a gap in the literature for future research. The method of Abdellaoui et al. (2016) is useful to make prospect theory completely empirically observable without making simplifying assumptions. However, when this method is applied, it should be noted that only experienced economists participate, or that the experiment is conducted in a lab with instructors, who help to clarify questions of subjects. Otherwise, the method could overwhelm and confuse inexperienced participants. Furthermore, it would be interesting regarding further research within this field, to apply this non-parametric method with high financial incentives. The subjects in Abdellaoui et al.'s (2016) experiment answered hypothetical questions, while in this experiment the subjects had a minimal chance to get paid which could have led to similar behavior as under a hypothetical design. However, large financial funding is required to design the experiment as realistically as possible. Since it is very likely that the range of the scrollbars influence the data, it is important to replicate this research project with varying boundaries of the scrollbar. A plausible alternative would be to design an experiment including two samples with the same three treatment groups. However, the maximum (minimum) boundaries of one sample's scrollbar increase (decrease) gradually, while the boundaries of the second sample's scrollbar increase (decrease) exponentially. Based on literature about anchoring effects of the default option, it is expected that the elicited utility function for the second sample will be more concave for gains and more convex for losses (Brown & Krishna, 2004; Dinner et al., 2011).

As mentioned above, the results cannot confirm that loss aversion is reduced significantly when deciding on behalf of others. Moreover, the effect of loss aversion was not significantly reduced when social distance increased. Concerning the real-world problems mentioned in the introduction, these findings cannot confirm the suspicion that investment managers take extremely high risks investing their client's money due to a reduced coefficient of loss aversion. Hence, this risk seeking behavior must be driven by other factors because loss aversion is not reduced significantly when deciding on behalf of others.

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Appendix

Introduction

Thank you for participating in this experiment and helping me to collect data for my master thesis! Please read the description and questions of the experiment very carefully.

Imagine an urn with red and black balls. However, it is not known how many red and black balls are in it. Thus, we do not know how likely it is to draw a red or a black ball. In the following experiment the term "Lottery" will be used frequently. A lottery contains 2 potential events, in this case drawing a red or a black ball. A lottery also displays, which outcomes can be realised. Outcomes are simply a monetary amount e.g. €10 or €-5. The potential outcomes vary throughout the experiment.

Your task in this experiment is to answer truthfully:

Which outcome X makes you indifferent between Lottery 1 and Lottery 2.

In this context, "indifferent" means that you prefer or like one lottery exactly as much as the other lottery. Keep in mind, this is your personal opinion and there are no right or wrong answers!

The indifference tasks could look like this:

For which outcome €X, are you indifferent between playing Lottery 1 or Lottery 2?

As an example:

Regarding Lottery 1, you win €10 if the color you chose to bet on was drawn. If the other color is drawn from the urn, you lose €-2.

Regarding Lottery 2, you win €X if the color you chose to bet on was drawn. If the other color is drawn from the urn, you lose €-5.

I. Treatment *Self*

You will make decisions for yourself.

Participating in this experiment, you have the chance to receive the money you have earned while playing the lotteries. You start the experiment already with a balance of 30€. Out of all participants, one is chosen randomly to be paid.

In the end, out of all lotteries displayed during the experiment, two will be chosen randomly to be played out. You have to decide on which color (red/black) you would like to bet. But keep in mind there are no right or wrong answers, because it is based on your personal preference.

Your potential payment will be calculated as follows:

30€ starting balance (+/-) outcomes from the lotteries played

Since **all the decisions you make are only for yourself**, you will also win the whole amount you earned if you are the lucky participant who was chosen to be paid.

To be considered, please leave your e-mail or WhatsApp number, so that you can be contacted if you are chosen. All contact details provided by you will be deleted afterwards.

II. Treatment *Friend*

Participating in this experiment, **you will make decisions for a very close friend or family member.** Basically, imagine that your friend/family member asked you to advise him/her on several financial decisions.

Out of all participants, one is chosen randomly to be paid. This means all the money you earn **will be paid to your friend/family member**. You start the experiment already with a balance of 30€.

In the end, out of all lotteries displayed during the experiment, two will be chosen randomly to be played out. You have to decide on which color (red/black) you would like to bet. But keep in mind there are no right or wrong answers.

The potential **payment for your friend/family member** will be calculated as follows:

30€ starting balance (+/-) outcomes from the lotteries played

Please type in the name of the person you are making decisions for:

III. Treatment *Stranger*

Participating in this experiment, **you will make decisions for another random participant.** Out of all participants, only one is chosen randomly to be paid. This means that all the money you might win throughout the experiment, **will be paid to a random stranger**. Thus, your outcome is not influenced by the lotteries you play.

In the end, out of all lotteries displayed during the experiment, two will be chosen randomly to be played out. You have to decide on which color (red/black) you would like to bet. But keep in mind there are no right or wrong answers.

The potential payment of the random stranger will be calculated as follows:

30€ starting balance (+/-) outcomes from the lotteries you played for him/her

On the other hand, you can be this "random stranger" for another participant! There is a chance that you will be selected and receive the money another participant has earned. If you would like to be considered for the random selection, leave your e-mail or WhatsApp number below. All contact details provided by you will be deleted after one random participant was paid.