DISCUSSION PAPER SERIES

No. 9183

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INDUSTRIAL ORGANIZATION

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Available online at: www.cepr.org/pubs/dps/DP9183.asp

ISSN 0265-8003

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Discussion Paper No. 9183
October 2012

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CEPR Discussion Paper No. 9183

October 2012

ABSTRACT

Loss Aversion and Consumption Choice: Theory and Experimental Evidence*

In this paper we analyze a consumer choice model with price uncertainty, loss aversion, and expectation-based reference points. The implications of this model are tested in an experiment in which participants have to make a consumption choice between two sandwiches. We make use of the fact that participants differ in their reported taste difference between the two sandwiches and the degree of loss aversion which we measure separately. We find that more loss–averse participants are more likely to opt for the cheaper sandwich provided that their reported taste difference is below some threshold, confirming the model's predictions.

JEL Classification: C91, D01, D11 and D83
Keywords: contextual reference points, loss aversion and reference-dependent utility

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*A previous version of this paper circulated under the title “The Impact of Contextual Reference Dependence on Purchase Decisions”. We are grateful to Dirk Engelmann, Enrico Diecidue, Rudolf Kerschbamer, Hendrik Orzen, Ulrike Rangel and various seminar audiences for helpful comments and suggestions. We gratefully acknowledge financial support from the National Bank of Belgium (Research Grant, “The Impact of Consumer Loss Aversion on the Price Elasticity of Demand”), the ARC Grant “Market Evolution, Competition and Policy: Theory and Evidence” and the German Science Foundation (SFB TR 15).

Submitted 10 October 2012

1 Introduction

Can consumers experience loss aversion even if they are not endowed with any good? A growing empirical and experimental literature provides evidence that loss aversion is based on expectations, as assumed by Kőszegi and Rabin (2006, 2007). In this paper, we investigate theoretically and experimentally the impact of expectation–based loss aversion with respect to price on purchase decisions.

Our main contribution is to highlight that price expectations which conflict realized prices indeed influence purchase decisions. This provides evidence of consumer behavior as postulated in recent work on imperfectly competitive markets (see Heidhues and Kőszegi, 2008 and Karle and Peitz, 2012). In our setting, consumers receive information that shapes their reference point towards their purchase decision, rendering earlier expectations immaterial. By conducting an experiment with exogenous, random prices we are therefore able to investigate the impact of expectation–based reference prices for any type of prior price expectations by consumers.

Take the following situation: Consumers have to make a choice between two similar goods that differ with respect to prices as well as tastes. They know the tastes of both products, but they receive only stochastic information about the prices, forcing them to form price expectations. Afterwards, consumers learn the actual prices of both products, and finally they make their choices. We show theoretically that consumers who prefer the taste of the more expensive product are more likely to buy the cheap good if they exhibit a higher degree of loss aversion. This holds for consumers who assign a moderate importance to the taste difference—consumers for whom the taste difference is very important never buy the cheaper, but less tasty product, while those that assign little importance to the taste difference always buy the cheaper product.

We test this prediction experimentally. In the first part of the experiment, subjects had to choose between two different types of sandwiches. First, they tasted both sandwiches and reported how much they liked the taste of each sandwich. At this stage subjects were also informed about the set of possible prices, but not which of the two prices applied to which sandwich. Afterwards, they were informed about the actual prices of the two sandwiches. Then they made their consumption choices. In the second part of the experiment, subjects made binary lottery choices which allowed us to measure individual parameters of loss aversion.[1]

As predicted by theory, subjects with a higher degree of loss aversion were more likely to choose the cheaper, but less tasty, sandwich. Such a choice was made by subjects that reported an intermediate level of taste difference. Subjects with a very large reported taste difference always chose the more liked good, and those with a very low reported taste difference always chose the cheaper sandwich. Hence, the evidence suggests that the purchase decision was indeed influenced by expectation–based loss aversion about prices in the predicted way. Furthermore, the individual loss aversion parameters derived from results of the binary lottery choices had indeed the predicted impact on the consumption behavior.

As far as we are aware, this is one of the first detailed theoretical and experimental investigations into expectation–based reference price dependence in a consumer choice setting.[2] The theoretical papers on that topic differ in the way reference points with respect to prices are formed. In Spiegler (2011), consumers sample prices for forming their reference point, while, in Zhou (2011), they use past prices. More closely related, in Heidhues and Kőszegi (2008) and Karle and Peitz (2012) consumers form expectation–based

[1] This individual loss aversion elicitation followed Köbberling and Wakker (2005), Fehr and Goette (2007) and Gaechter, Johnson, and Herrmann (2007) and is based on cumulative prospect theory of Tversky and Kahneman (1992).

[2] There exists an extensive literature testing expectation–based loss aversion à la Kőszegi and Rabin (2006, 2007, 2009). These works consist of exchange and valuation experiments (see Ericson and Fuster, forthcoming), experiments in which participants are compensated for exerting effort in a tedious and repetitive task (see Abeler, Falk, Goette, and Huffman, 2011), and of sequential–move tournaments (see Gill and Prowse, 2012). There is evidence that expectation–based reference dependence affects golf players' performance (see Pope and Schweitzer, 2011) and cabdrivers' labor supply decision (see Crawford and Meng, 2011). See also Camerer, Babcock, Loewenstein, and Thaler (1997), Farber (2005), and Farber (2008) for earlier work on cabdrivers' labor supply decision as well as Fehr and Goette (2007) for evidence on reference–dependence in labor supply from a field experiment with bike messengers. Further evidence on expectation–based reference points includes Loomes and Sugden (1987) and Choi, Fisman, Gale, and Kariv (2007) for choices over lotteries, Post, van den Assem, Baltussen, and Thaler (2008) for gambling behavior in game shows, and Card and Dahl (2011) for disappointment–induced domestic violence. Alternative theories which suggest that expectations act as reference points are provided by Bell (1985), Loomes and Sugden (1986) and Gul (1991).

reference points in a market with oligopolistic firms. In Heidhues and Kőszegi (2008), consumers correctly anticipate *equilibrium* prices, while, in Karle and Peitz (2012), they observe announced prices but are uncertain about their tastes for the low- and high-price product (and this taste is drawn from a continuum of possible realizations). In our paper, consumers know the taste of the two products, but do not know which price applies.

Also, the marketing literature hints at consumer choices being affected by loss aversion with respect to prices (for an overview see Mazumdar, Raj, and Sinha, 2005). One line of research such as Putler (1992) and Kalyanaram and Winer (1995) highlights the relevance of temporal reference prices that are derived from prices experienced in the past. Hardie, Johnson, and Fader (1993) provides an experimental study of brand choices under loss aversion in the price and in the quality dimension; in contrast to our setting, their experiment was designed such that reference points were based on the product previously purchased by a consumer. Another line of research such as Rajendran and Tellis (1994) suggests that the reference prices are based on the prices of similar products at the moment of purchase. We provide support to this second line by isolating the role of static reference prices within a set of similar products.

More generally, recent experimental contributions to the loss aversion literature such as Abeler, Falk, Goette, and Huffman (2011) and Gill and Prowse (2012) suggest that anticipated future disappointment or losses affect decisions, e.g., effort choices. Following a different approach, we show experimentally that, by contrasts, unsatisfied expectations affect the decision—more precisely, expectation–based reference points affect consumption choices. Two features are worth mentioning. First, we add to this literature that expectation–based reference points depend on individual characteristics such as preferences. Second, we elicited the individual levels of loss aversion in an independent experimental test and show that the resulting loss aversion parameter can be used to predict individual behavior in consumption choice experiments.

The paper proceeds as follows. In Section 2, we provide a consumer choice model that includes consumer loss aversion and expectation–based reference points. We derive choice probabilities depending on the key variables of interest, namely the perceived taste difference and the degree of consumer loss aversion. In Section 3, we describe on the design of the experiment. In Section 4, we present the experimental results. Section 5 concludes. In the Appendix, we show some further descriptive statistics, an alternative specification of our measure of loss aversion and the experimental instructions.

2 The Consumer Choice Model

In this section, we present a consumer choice model that allows for loss aversion and expectation-based reference points. The timing is the following:

1. Each consumer k learns her product tastes for the two products 1 and 2, $t_{1,k}$ and $t_{2,k}$. She is uncertain about product prices: she is uncertain whether the price difference $\Delta p \equiv p_2 - p_1$ will be equal to a or $-a$; each event occurs with probability $1/2$. We normalize a to be 1.
2. Consumer k forms a probabilistic reference point in the price dimension (buy at price p_1 or at p_2) and in the taste dimension (experience taste $t_{1,k}$ or $t_{2,k}$).[3]
3. She learns the assignment of prices to products and makes her purchase decision, based on her utility that includes realized gains and losses relative to her reference–point distribution.

Since participants learn their tastes at stage 1, they already know at this stage which product they find less tasty. If this product turns out to be more expensive, they will not buy it. Otherwise, they are more likely to buy it the smaller the perceived taste difference. Consumer k's reference point distribution in price and taste dimensions depends on the "(ex ante; i.e., before prices are allocated to products) probability of choosing the product

[3]This essentially means that consumers assign probabilities to prices and tastes. In particular, a consumer who perceives a very large (resp. small) taste difference expects to obtain the tastier product with probability one (resp. one half due to the price lottery) and the lower price with probability one half due to the price lottery (resp. one).

liked less", conditional on k's characteristics.[4] We denote this probability by x_k:

$$
\begin{aligned}
x_k \equiv & Pr[y_k = 1|\Delta t_k, \lambda_k] \\
= & \frac{1}{2}Pr[y_k = 1|\Delta t_k, \lambda_k, \Delta p \geq 0] + \frac{1}{2}Pr[y_k = 1|\Delta t_k, \lambda_k, \Delta p < 0],
\end{aligned} \tag{1}
$$

where y_k describes k's product choice ($y_k = 1$ refers to choosing the product liked less after prices are allocated to products), $1/2$ the probability of product 1 (resp. 2) being cheaper and $\Delta t_k = t_{2,k} - t_{1,k}$ consumer's taste difference in favor of product 2. Parameter $\lambda_k \geq 1$ depicts k's utility weight on losses which measures her degree of loss aversion. The utility weight on gains is normalized to one. Thus, consumer k is loss averse if $\lambda_k > 1$.

Suppose that $i = 1$ is the cheaper product ex post. Next, consider a participant k who learnt, in stage 3, that product 1 costs only 4 Euros but who likes the other product with $p = 5$ better, i.e., $\Delta p = 1$ and $\Delta t_k = t_{2,k} - t_{1,k} > 0$.

A consumer's utility of choosing the cheaper but less tasty product is

$$
\begin{aligned}
u_1(p_1, p_2, t_{1,k}, t_{2,k}|x_k, \Delta p \geq 0) = & \delta_1 t_{1,k} - \delta_2 p_1 + \delta_3 Pr[p = p_2|x_k]\Delta p - \delta_4 \lambda_k Pr[t = t_{2,k}|x_k]\Delta t_k \\
= & \underbrace{\delta_1 t_{1,k} - \delta_2 p_1}_{\text{intrinsic utility}} + \underbrace{\delta_3(1 - x_k)\Delta p}_{\text{gain in price}} - \underbrace{\delta_4 \lambda_k (1 - x_k)\Delta t_k}_{\text{loss in taste}}
\end{aligned} \tag{2}
$$

with δ_1, δ_2, δ_3 and δ_4 being positive (marginal utility) parameters. Note that the loss aversion concept of Kőszegi and Rabin (2006) suggests that, for a finite set of outcomes, realized outcomes are compared to any alternative outcome under the reference point distribution using the probability of the alternative outcome as a probability weight for realized gains or losses. In our binary choice setting, the probability of the alternative outcome is equal to the probability of choosing the other, more expensive product—i.e., $Pr[p = p_2|x_k] = Pr[t = t_{2,k}|x_k] = (1 - x_k)$. For $\delta_3, \delta_4 > 0$ (and $\lambda_k > 1$), consumer k experiences gain–loss utility in the price and the taste dimension. The larger is δ_3, the more matter gains and losses in the price dimension. The larger is δ_4, the more matter gains and losses in the taste dimension. As follows from equation (2), consumer k experiences

[4] See the definition of consumers' personal equilibrium below.

a gain in the price dimension when buying the cheaper product. The magnitude of this gain depends on the parameter δ_3, the price difference Δp and the probability of buying the more expensive and tastier product 2, $1 - x_k$. Consumer k also experiences a loss in the taste dimension when buying the cheaper and less tasty product.

A consumer's utility of buying the more expensive and tastier product equals

$$\begin{aligned} u_2(p_1, p_2, t_{1,k}, t_{2,k} | x_k, \Delta p \geq 0) =& \delta_1 t_{2,k} - \delta_2 p_2 - \delta_3 \lambda_k Pr[p = p_1 | x_k] \Delta p + \delta_4 Pr[t = t_{1,k} | x_k] \Delta t_k \\ =& \underbrace{\delta_1 t_{2,k} - \delta_2 p_2}_{\text{intrinsic utility}} - \underbrace{\delta_3 \lambda_k x_k \Delta p}_{\text{loss in price}} + \underbrace{\delta_4 x_k \Delta t_k}_{\text{gain in taste}} . \end{aligned} \tag{3}$$

For this choice, consumer k exhibits a loss in the price dimension since she has to pay 1 Euro more than for the other product and a gain in the taste dimension since she buys the product she likes better. Taking into account that $\Delta p = 1$, we can derive the deterministic utility difference, $-\Delta u_k = u_{1,k} - u_{2,k}$, conditional on x_k, λ_k, $\Delta t_k \geq 0$ and $\Delta p \geq 0$:

$$\begin{aligned} -\Delta u_k =& (\delta_2 + \delta_3) \quad -(\delta_1 + \delta_4) \Delta t_k + \quad \delta_3 \quad (\lambda_k - 1) x_k \quad - \quad \delta_4 \quad (\lambda_k - 1)(1 - x_k) \Delta t_k \\ =& \underbrace{\gamma_1}_{+} \quad + \underbrace{\gamma_2}_{-} \Delta t_k + \underbrace{\gamma_3}_{+} (\lambda_k - 1) x_k + \underbrace{\gamma_4}_{-} (\lambda_k - 1)(1 - x_k) \Delta t_k, \end{aligned} \tag{4}$$

where $\gamma_1 \equiv \delta_2 + \delta_3$, $\gamma_2 \equiv -(\delta_1 + \delta_4)$, $\gamma_3 \equiv \delta_3$, and $\gamma_4 \equiv -\delta_4$. This equation shows that a loss–averse participant k has a net gain in the price dimension (last but one term in the second line) and a net loss in the taste dimension (last term in the second line) when deciding in favor of the cheaper, less liked product 1 ($-\Delta u_k > 0 \Leftrightarrow u_{1,k} > u_{2,k}$). For instance, the net gain of a consumer k who expects to buy the cheaper product with a high probability (x_k high and $(1 - x_k)$ low) given her characteristics, will be larger than that of a corresponding consumer k' with a lower $x_{k'}$. Without loss aversion ($\lambda_k = 1$ or $\gamma_3, \gamma_4 = 0$), she makes a standard choice.

To obtain a testable model for our regression analysis, we introduce a noise variable ϵ_k into consumer k's choice problem in (4)—i.e., $-\Delta \tilde{u}_k \equiv -\Delta u_k + \epsilon_k$. Following standard discrete choice theory, ϵ_k is assumed to be additive, logistically distributed, and i.i.d. across consumers. In our setup, loss–averse consumers take this choice uncertainty into account when forming their expectations about product choice. If the less tasty product

(product 1) turns out to be the cheaper product ($\Delta p \geq 0$), the probability of choosing this product will be $Pr[\Delta u_k < \epsilon_k | x_k, \Delta t_k, \lambda_k, \Delta p \geq 0] = Pr[\Delta \tilde{u}_k < 0 | x_k, \Delta t_k, \lambda_k, \Delta p \geq 0]$ which is equal to $Pr[y_k = 1 | \Delta t_k, \lambda_k, \Delta p \geq 0]$. If product 2 turns out to be the cheaper product ($\Delta p < 0$), then the tastier product according to consumer k will also be cheaper. For simplification, we assume that, in such a situation, the consumer will choose product 2 for sure, i.e., $Pr[y_k = 1 | \Delta t_k, \lambda_k, \Delta p < 0] = 0$.[5]

We are now in the position to characterize consumer k's personal equilibrium strategy x_k which completes the specification of her choice problem in (4). The concept of personal equilibrium requires that k holds rational expectations about her choice in equilibrium and that her choice in equilibrium is optimal given her expectations—see Kőszegi and Rabin (2006): given that $\Delta t_k > 0$, if $\Delta p \geq 0$, choose product 1 with probability $Pr[\Delta \tilde{u}_k < 0 | x_k, \Delta t_k, \lambda_k, \Delta p \geq 0]$ and if $\Delta p < 0$ never choose product 1. That is,

$$x_k = \frac{1}{2} Pr[\Delta \tilde{u}_k < 0 | x_k, \Delta t_k, \lambda_k, \Delta p \geq 0], \tag{5}$$

which implies that $x_k \in [0, 1/2]$.[6]

We will use the following logit representation,

$$P_k = F\Big(\underbrace{\gamma_1}_{+} + \underbrace{\gamma_2}_{-} \Delta t_k + \underbrace{\gamma_3}_{+} (\lambda_k - 1) x_k + \underbrace{\gamma_4}_{-} (\lambda_k - 1)(1 - x_k) \Delta t_k\Big), \tag{6}$$

where P_k describes the probability that the cheaper product is chosen by participant k who likes the other product better, $Pr[y_k = 1 | \Delta t_k, \lambda_k, \Delta p = 1]$, and $F(\cdot)$ is the logistic cdf. Instead of directly assuming a logistic distribution, one can alternatively introduce an additive random term in the utility function which is double exponentially distributed.

[5]Note that, in our consumption choice experiment, we did not observe a single participant choosing the product liked less when this product was also more expensive than the other product. We, therefore, consider it reasonable to assume that participants held expectations of zero about choosing a more expensive, less tasty product. Nevertheless, in our empirical analysis, we also considered a specification in which we took noise of this kind into account. The results were almost identical to those of the simpler specification reported in columns (3) and (4) in Table 2 in Section 4.

[6]The assumption of choice uncertainty forces many consumers to choose a mixed–strategy personal equilibrium, i.e., $x_k \in (0, 1/2)$ (which is also their preferred personal equilibrium). In our setup, mixing is crucial for the identification of expectation–based loss aversion.

We next characterize the impact of the degree of loss aversion on consumers' choice. Note that if participant k's expectations did not incorporate a marginal increase in λ_k, then the marginal effect of such an increase would be given by the first derivative of the RHS of equation (6) with $\partial x_k/\partial\lambda_k = 0$. This would resemble the case of loss aversion with naive expectations. If participant k forms rational expectations, however, then the effect of a marginal increase in λ_k will also depend on $\partial x_k/\partial\lambda_k$. In the next proposition, we show the result when consumers form rational expectations.

Proposition 1. *The probability that the cheaper, less liked product is chosen by participant k, P_k, is increasing in the degree of loss aversion, λ_k, if the taste difference, $\Delta t_k \geq 0$, is sufficiently small.*

Proof. We have to show that $dP_k/d\lambda_k > 0$. Applying the implicit function theorem on (6) and using that, by (5), $P_k = 2x_k$, we receive

$$\frac{dx_k}{d\lambda_k} = \frac{[\gamma_3 x_k + \gamma_4(1 - x_k)\Delta t_k]f(.)}{2 - (\lambda_k - 1)[\gamma_3 - \gamma_4\Delta t_k]f(.)}. \tag{7}$$

In (7), $f(.)$ depicts the logistic density function at $\Big(\gamma_1 + \gamma_2\Delta t_k + \gamma_3(\lambda_k - 1)x_k + \gamma_4(\lambda_k - 1)(1 - x_k)\Delta t_k\Big)$, the numerator depicts the effect of a marginal increase in λ_k with $\partial x_k/\partial\lambda_k = 0$, and the denominator the adjustment for $\partial x_k/\partial\lambda_k \neq 0$. For $\Delta t_k \geq 0$ and $\Delta t_k \to 0$, the numerator is positive since the first term in square brackets is positive ($x_k \to 1/2F\Big(\gamma_1 + \gamma_3(\lambda_k - 1)x_k\Big) > 1/2F\Big(\gamma_1\Big) > 0$ and $\gamma_3 = \delta_3 > 0$ by assumption) and the second term approaches zero.

It remains to be shown that also the denominator is positive. Thus, we have to show that, for $\Delta t_k \geq 0$ and $\Delta t_k \to 0$, $(\lambda_k - 1)\gamma_3 f\Big(\gamma_1 + \gamma_3(\lambda_k - 1)x_k\Big) < 2$. The logistic distribution has density $f(y) = e^{-y}/(1 + e^{-y})^2$ and a cdf with values $F(y) = 1/(1 + e^{-y})$. We first note that, for $y \geq 0$, it holds that $ye^{-y} < 1$ ($ye^{-y} = e^{ln(y)}e^{-y} = e^{ln(y)-y}$ which must be smaller than one since for all $y \geq 0$, $ln(y) - y < 0$). Moreover, by (5) and (6) it holds that $2x_k = F(\cdot)$.

Thanks to these observations, we obtain

$$\begin{aligned}
\gamma_3(\lambda_k-1)\cdot f\Big(\gamma_1+\gamma_3(\lambda_k-1)x_k\Big) &= \gamma_3(\lambda_k-1)\cdot f\Big(\gamma_1+\gamma_3(\lambda_k-1)x_k\Big)\frac{2x_k}{F\Big(\gamma_1+\gamma_3(\lambda_k-1)x_k\Big)}\\
&< \Big(\gamma_1+\gamma_3(\lambda_k-1)x_k\Big)\cdot f\Big(\gamma_1+\gamma_3(\lambda_k-1)x_k\Big)\frac{2}{F\Big(\gamma_1+\gamma_3(\lambda_k-1)x_k\Big)}\\
&= \Big(\gamma_1+\gamma_3(\lambda_k-1)x_k\Big)\cdot e^{-\Big(\gamma_1+\gamma_3(\lambda_k-1)x_k\Big)}2F\Big(\gamma_1+\gamma_3(\lambda_k-1)x_k\Big)\\
&< 2F\Big(\gamma_1+\gamma_3(\lambda_k-1)x_k\Big)\\
&< 2.
\end{aligned}$$

Thus, for $\Delta t_k \geq 0$ sufficiently small, $dx_k/d\lambda_k > 0$ which implies that $dP_k/d\lambda_k > 0$. ∎

This proposition implies our main hypothesis.

Hypothesis: *Participants who like the more expensive product better ($\Delta t_k > 0$) and show a positive degree of loss aversion ($\lambda_k > 1$) are more likely to choose the cheaper product than otherwise identical participants with a lower degree of loss aversion, provided that their reported taste difference is sufficiently small.*

The statement in the hypothesis focusses on the interval of taste differences in which loss aversion in the price dimension dominates that in the taste dimension given the price difference of 1 Euro. For a sufficiently large taste difference, the effect of loss aversion could be reversed due to the dominance of loss aversion in the taste dimension.

3 Experimental Design

In the first part of the experiment, each subject had to choose between a ham and a camembert sandwich.[7] We used a perishable consumption good which was consumed on the

[7] At the registration participants were told that they were invited for a "lunch experiment" with sandwiches.

spot. At the beginning of the experiment, subjects were endowed with 6 Euros, and they were told that one sandwich was to be sold at a price of 4 Euros, while the other one at a price of 5 Euros. They were also informed that the prices were randomly assigned. Then the subjects had to taste both sandwiches and grade their tastes on a scale from 1 to 5 (very bad to excellent). Then it was announced which sandwich costed 4 and which sandwich costed 5 Euros. Finally, subjects made their choice of sandwich. The design allowed for two dimensions of consumer loss aversion—in the price as well as in the taste dimension.

In the second part of the experiment we elicited each participant's individual degree of loss aversion (see Tversky and Kahneman, 1992). Subjects had to choose between lotteries and sure payments.[8] There were two series of choices, with 6 choices each. For series A, subjects had to make 6 choices between a lottery with 50% chance of winning 1 Euro and 50% chance of winning nothing, and a sure payment of S. S was either $10, 20, 30, 40, 50$, or 60 Eurocents. In series B, subjects had to make six choices between a lottery that gave a 1/3 chance of winning 1 Euro and a 2/3 chance of loosing L Euro, and a sure payment of zero. L was either $0, 10, 20, 30, 50, 70$, or 100 Eurocents.

At the end of the experiment, one of the 12 choices was chosen randomly and implemented. To cover potential losses, each subject was endowed with a budget of 2 Euros for this second part of the experiment

For series A, a subject k's choices should be characterized by a cut–off value S_k such that for any $S < S_k$ the lottery is chosen and for any $S \geq S_k$ the sure payment is preferred. Similarly, for series B subject k's choices should be characterized by a cutoff value $L_k \leq 0$ such that all lotteries with $L > |L_k|$ are rejected and all lotteries with $L \leq |L_k|$ are accepted. These cutoff values are used to derive individual measures of loss aversion. More specifically, we use the exponential utility representation proposed by Tversky and Kahneman (1992)

$$u_k(z) = \begin{cases} z^{\beta_k} & \text{if } x \geq 0; \\ -\tilde{\lambda}_k(-z)^{\beta_k} & \text{o/w}, \end{cases},$$

[8] A similar way of measuring loss aversion was used by Fehr and Goette (2007) and Gaechter, Johnson, and Herrmann (2007).

where z denotes the monetary payoff, $\tilde{\lambda}_k > 1$ represents loss aversion, and $\beta_k \in (0,1)$ diminishing sensitivity—i.e., risk aversion in gains and risk love in losses (and vice versa for $\beta_k > 1$).

First, β_k is measured by using the cut–off values of results of series A. Take the exponential utility representation above. Using the condition that the utility of getting S_k for sure must be equal to the expected utility of getting 1 with a 50% chance, we get as a measure for risk aversion

$$\beta_k = \ln(1/2)/\ln(S_k).$$

For given β, series B is used to derive the measure of loss aversion $\tilde{\lambda}_k$. From the cutoff condition $0 = 1/3 + 2/3(-\tilde{\lambda}_k)(-L_k)^{\beta_k}$, we get the degree of loss aversion of participant k

$$\tilde{\lambda}_k = \frac{1}{2(-L_k)^{\beta_k}} \quad \text{and } L_k < 0.$$ [9]

Rabin (2000) argues that risk aversion cannot plausibly explain choice behavior in small–stake lotteries without implying absurd degrees of risk aversion in high–stake gambles. Therefore, in small–stake lotteries, people should be risk neutral. According to this view and in line with part of the experimental literature (see, e.g., Gaechter, Johnson, and Herrmann, 2007), we consider the specification that β_k is set equal to one in Appendix B. The results of our regression analysis are not changed by this (see Table B1).

Prospect theory suggests that, on top of loss aversion with diminishing sensitivity, subject's choices also exhibit probability weighting. We neglect this effect since probability weighting would only have a scale effect on our loss aversion measure but leave the ordering of the individual $\tilde{\lambda}_k$s unaffected. We will only use the ranking of the individual $\tilde{\lambda}_k$s and not their value, since we only test the hypothesis that participants who show a higher degree of loss aversion are more likely to choose the cheaper sandwich provided that the reported taste difference between the sandwiches is not too large (see our hypothesis above). Moreover, since participants make a riskless consumption choice, we decided to

[9] If participants chose 0, we used 4 as a cutoff. Our results are robust to applying different cutoffs (maintaining significance at least at the 10% level).

neglect diminishing sensitivity, $\beta_k \neq 1$, in the first part of the experiment.

The experiment was run at the experimental lab of the Department of Economics of the University of Mannheim in fall 2010. Students from all faculties and years participated. There were 6 sessions with up to 24 participants. Overall, 135 subjects participated. On average, they received a compensation of 7.56 Euros (at market prices) for spending about 45 minutes in the lab. Both sandwiched had a market value of 3.90 Euros.[10] On top, subjects received an average cash payment of 3.66 Euros, which was determined by their lottery choices and their residual budgets from their consumption choices.

4 Experimental Results

We had to rule out some observations because of inconsistent lottery choices in the second part of the experiment (8 observations) and because some participants were vegetarian although, in our invitation, it was announced that the experiment was not suitable for vegetarians (7 obs.). Moreover, only the observations when participants liked the more expensive sandwich better are relevant for our analysis (we dropped 47 obs. because of this). This left us with a sample of 73 participants. For the regression analysis we used those 68 observations for which the taste difference was smaller than three (see Section 4.2). Two types of sandwiches were offered, ham sandwiches (alternative 1) and sandwiches with camembert (alternative 2).

Participants provided information on gender, age, field of study, number of terms, and average expenditure on meals (see Table A1 in Appendix A).

4.1 Degree of Loss Aversion

We find a share of 76.7% of participants was slightly risk averse or risk neutral and the other subjects were slightly risk loving ($mean(\beta_k) = 0.89$, $\sigma(\beta_k) = 0.30$, $\max(\beta_k) = 1.36$,

[10]Sandwiches were ordered from a local sandwich restaurant. The sandwiches were warm and kept in isothermal transportation boxes.

$\min(\beta_k) = 0.43$).

In order to avoid that the results depend on outliers, we categorized the measured degree of loss aversion in four categories from "loss seeking or neutral" to "strongly loss averse". More formally, we get

$$\lambda_k = \begin{cases} 1 \text{ "loss seeking or neutral"}, & \text{if } \tilde{\lambda}_k \leq 1; \\ 2 \text{ "weakly loss averse"}, & \text{if } \tilde{\lambda}_k \in (1, 1.8]; \\ 3 \text{ "loss averse"}, & \text{if } \tilde{\lambda}_k \in (1.8, 3]; \\ 4 \text{ "strongly loss averse"}, & \text{if } \tilde{\lambda}_k > 3, \end{cases}$$

where 1.8 is equal to $median(\tilde{\lambda}_k)$.[11] Its *mean* is 2.63 (see Table A1 in Appendix A). The frequency of the categorized measure of loss aversion, λ_k, can be found at the bottom line in Table 1 (see below).[12]

We checked for correlation of λ_k with reported taste, age, gender and average expenditure for lunch of the subjects. The degree of loss aversion λ_k was found to be uncorrelated with all these individual characteristics.

4.2 Consumption Choice

About 80 percent of the participants liked the ham sandwich better (they were asked before learning the realized prices and, thus, their responses can be considered to be unbiased). In 5 out of 6 sessions, the ham sandwich turned out to be the more expensive sandwich (i.e., for ham $i = 2$).[13]

[11] If we used 2 as a cut–off instead of the median, we would obtain qualitatively similar results.

[12] A reason why our measure of loss aversion is relatively high could be that, given that the winning probability in lottery series B was rather small ($p = 1/3$), probability weighting (which we neglected) might have had an impact on lottery choices.

[13] We drew a price lottery on the evening before each experimental session, announced explicitly at the beginning of each session that prices were equiprobable and randomly drawn, and elicited the price realizations during each session. We drew price lotteries in advance to avoid too much waste, because we had to place our orders to the restaurant the evening before each session and our buffer stock was affected by realized prices.

Table 1: Impact of Loss Aversion on Sandwich Choice

Δt_k	λ_k :	1	2	3	4
0	*mean*(y_k)	-	0.5	1	1
	obs.	0	4	1	2
1	*mean*(y_k)	0.333	0.333	0.417	0.625
	obs.	3	15	12	8
2	*mean*(y_k)	0	0.111	0.1429	0.2
	obs.	2	9	7	5
3	*mean*(y_k)	-	0.333	0	0
	obs.	0	3	1	1
Total	*mean*(y_k)	0.2	0.290	0.333	0.5
	obs.	5	31	21	16

Table 1: $y_k = 1$ means that the cheaper sandwich was chosen. $\Delta t_k > 0$ means that the participant likes the more expensive sandwich better.

Due to the price disadvantage of 1 Euro, 31.71% of the participants that liked the more expensive sandwich better actually chose the cheaper sandwich (36.26% for weakly better). Thus, the experimental setup induced a positive amount of choice reversals (with respect to the taste of the provided sandwiches) which we exploit for our empirical analysis.

We obtain results by first reporting choice outcomes and then estimating the discrete choice model with consumer loss aversion. Considering the sandwich choice of participants who liked the more expensive sandwich better, in our sample we find a positive monotonic relationship between loss aversion (λ_k) and the choice of the cheaper sandwich (*mean*(y_k)), see Table 1. For example, take all those subjects with a taste difference of $\Delta t_k = 1$. Only 1/3 of the participants with a low levels of loss aversion ($\lambda_k = 1$ or 2) chose the cheaper and less tasty sandwich, while for $\lambda_k = 3$ ($\lambda_k = 4$) 42% (63%) went for the cheaper sandwich. This monotone relationship between choice and loss aversion holds for all levels of taste differences except for the category with the largest taste difference ($\Delta t_k = 3$). In that category the relationship is weaker and reversed. This supports our hypothesis that loss aversion in the price dimension makes participants more likely to choose the cheaper sandwich when the taste difference is not too large. Furthermore, the results in Table 1 weakly indicate that, for the maximum category of taste difference in our sample, the combination of intrinsic disutility and loss aversion in the taste dimension dominates loss aversion in the price dimension.

Table 2: Probability of Choosing the Cheaper, Less Tasty Sandwich: P_k

	Logit: Naive Expectations		Logit: Rational Expectations		Logit: No Expectations	
	(1)	(2)	(3)	(4)	(5)	(6)
Loss Price	3.281*	3.580*	2.334*	2.465*		
	(0.076)	(0.062)	(0.057)	(0.050)		
Taste Diff.	-1.513***	-1.468***	-1.067**	-1.008*	-1.446***	-1.443***
	(0.004)	(0.005)	(0.048)	(0.069)	(0.004)	(0.005)
Age		0.060		0.057		0.056
		(0.454)		(0.472)		(0.449)
Gender (M.)		0.479		0.483		0.409
		(0.421)		(0.420)		(0.474)
Meal Ex.		-0.140		-0.131		-0.079
		(0.461)		(0.497)		(0.658)
Constant	0.160	-1.104	-0.131	-1.356	1.079*	-0.242
	(0.842)	(0.583)	(0.881)	(0.505)	(0.083)	(0.899)
N. Obs.	68	68	68	68	68	68
Pseudo R^2	0.1547	0.1740	0.1613	0.1793	0.1167	0.1315

Table 2: Loss Price equals $(\lambda_k - 1)\hat{x}_k$, where $\hat{x}_k$ describes the first–stage estimate for participants' expectations about choosing the cheaper, less tasty sandwich. In the logit regressions with naive expectations, the sample mean is used as first–stage estimate for $\hat{x}_k$, i.e., $\hat{x}_k = mean(y_k)/2$, while in the second specification an individual–specific estimate is used (see main text). The third specification does not consider loss aversion. P-values are in parentheses. Significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

We use a logit estimator, as outlined in Section 2, to test the significance of expectation–based reference dependence (cf. equation (6)).[14] To deal with the endogeneity issue under our null hypothesis, we apply a two–stage estimation procedure. The independent variable "Taste Diff." resp. "Loss Price" equals Δt_k resp. $(\lambda_k - 1)\hat{x}_k$, where $\hat{x}_k$ describes our first–stage estimate for participants' expectations about choosing the cheaper, less tasty sandwich. Due to multi-collinearity between the variables taste difference and loss

[14]The results of the logit estimation presented below are similar to the (unreported) results of an equivalent OLS estimation.

aversion in the taste dimension (last term in equation (6)), we could not consider the impact of loss aversion in the taste dimension in our regression analysis. We therefore restricted the sample to taste differences for which loss aversion in the price dimension can be considered dominant, $\Delta t_k \in [0, 2]$, as indicated by Table 1.

Table 2 reports the second–stage logit estimation results (according to equation (6) s.t. $\gamma_4 = 0$). Columns (1) and (2) show the results of an estimate which allows for naive expectations of participants about their probability of choosing the less tasty sandwich, $\hat{x}_k$: $\hat{x}_k$ was replaced by one half times the sample mean of the choice variable y_k. This presumes that, before observing the price realization, each participant expects to end up buying the less tasty product with identical probability (which is equal to $\hat{x}_k = 0.176$ here) although participants vary in characteristics.[15] This logit estimator essentially examines the marginal effect of the two independent variables taste difference and degree of loss aversion as in a standard–textbook procedure since $\hat{x}_k = mean(y_k)/2$ is simply a constant multiplied by the independent variable $(\lambda_k - 1)$. In line with our predictions, we find a positive effect of loss aversion and a negative effect of taste difference on the probability of choosing the cheaper, less tasty sandwich (at a significance level of 10%). Under our null hypothesis, however, this estimator shows an endogeneity bias since the interdependence between the actual choice probability P_k and the ex ante choice probability x_k is not taken into account.

In columns (3) and (4), $\hat{x}_k$ represents an estimate which accounts for participants' rational expectations about their choice probability given their characteristics, i.e., $\hat{x}_k = 1/2 \cdot \hat{Pr}[\Delta\tilde{u}_k < 0 | \lambda_k, \Delta t_k, \Delta p \geq 0]$. We estimated this probability iteratively (according to equation (6)) and, in order to minimize endogeneity issues for the joint estimation of coefficients and $\hat{x}_k$, used the sample mean (times one half) as an unconditional estimate for the lagged value of $\hat{x}_k$:

$$\hat{x}_{k,t+1} = \frac{1}{2} F\Big(\hat{\gamma}_{1,t} + \hat{\gamma}_{2,t}\Delta t_k + \hat{\gamma}_{3,t}(\lambda_k - 1)\frac{mean(y_k)}{2}\Big),$$

where $F(\cdot)$ is the logistic cdf and $(\hat{\gamma}_{1,t}, \hat{\gamma}_{2,t}, \hat{\gamma}_{3,t})$ are logit coefficients estimated according

[15]See Table A1 in Appendix A for descriptive statistics of all independent variables.

to equation (6) with $x_k = \hat{x}_{k,t}$.[16] Convergence of the iterative estimation was reached after 25 to 28 iterations. We denote this estimate by $\hat{x}_{k,\infty}$. The mean of $\hat{x}_{k,\infty}$ is equal to 0.168 (which is close to $mean(y_k)/2$) and individual–specific $\hat{x}_{k,\infty}$ varies between 0.047 and 0.376. Columns (3) and (4) in Table 2 show the estimation results according to equation (6) with $x_k = \hat{x}_{k,\infty}$.[17]

In columns (5) and (6), estimations which do not include measures of loss aversion are presented. The even columns additionally include the control variables age, a gender dummy (male = 1) and a measure of each participant's average expenditure for lunch per week, which were obtained from a questionnaire.

As predicted by equation (6), in all regressions which include the degree of of loss aversion as an independent variable, we find a negative effect of the reported taste difference ($\hat{\gamma}_2 < 0$) and a positive effect of the loss aversion in the price dimension ($\hat{\gamma}_3 > 0$), both significant at least at the 10 percent level. The logit regressions with rational expectations in columns (3) and (4) show the highest significance level for loss aversion in the price dimension (5.7% without and 5.0% with controls). To document the importance of loss aversion we report the logit regressions in columns (5) and (6), which exclude measures of loss aversion. They show a notably lower R squared; for instance compare with columns (1) and (2). This indicates that measures of loss aversion add explanatory power to the estimation beyond those of standard preferences.

With rational expectations, the estimates for loss aversion in price are lower than those without rational expectations (columns (1), (2)). This indicates that using rational expectations (i.e., expectations which incorporate individual characteristics) reduces the endogeneity issue in our sample. With rational expectations, the estimates for taste difference are lower in absolute terms than those with naive expectations and with standard consumers (columns (1), (2) and (5), (6)). This suggests that estimators that do not account for loss aversion based on rational expectations overestimate the sensitivity of choice

[16] As an initial value of x_k for the logit regression according to equation (6), we also used the sample mean (times one half), i.e, $\hat{x}_{k,0}=mean(y_k)/2$.

[17] Alternatively, it could be assumed that individual expectations are shaped by one half times the sample mean of y_k conditional on participants' taste difference and degree of loss aversion as presented in Table 1, i.e., $x_k = mean(y_k|\Delta t_k, \lambda_k)/2$. This leads to similar results as those reported in columns (3) and (4).

probabilities to taste differences. Control variables are not significant which might be due to the fact that characteristics like gender were already incorporated in the taste variable.

Our findings with respect to both, the choice outcomes and the discrete choice model provide support for our theoretical analysis. In the alternative specification where participants are treated as risk neutral ($\beta_k = 1$ for all k), our results are confirmed. They are reported Appendix B.

5 Conclusion

Our experimental evidence suggests that information on the degree of loss aversion extracted from lotteries has predictive power for consumption behavior. By presenting participants a one–shot consumption decision problem and by implementing a pre–consumption blind tasting, our experiment has successfully excluded the possibility that participants' consumption choice has been influenced by reference points based on past purchases. Through tasting and the announcement of the price distribution, participants formed contextual reference points which affected participants' consumption choice after they had learnt the realized price allocation. Our results suggest that reference dependence systematically affects consumption decisions.

The requirement to not only pay money but also to compensate participants in a product dimension has been a challenge designing this experiment which we solved by inviting participants to a lunch experiment with sandwiches. Each participant's degree of loss aversion has been identified through the choice of lotteries. Our analysis supports the idea that an individual's parameter of loss aversion is similar in different choice environments. Otherwise, we should not have obtained a relationship between the degree of loss aversion identified through the choice among lotteries and observed choices in our lunch experiment.

Our paper suggests a way how to combine experimental data with real–world consumption data since the experimentally identified degree of loss aversion may well be correlated with the degree of loss aversion outside the lab as it applies to consumption choices.

However, real–world consumption data are often generated in a dynamic choice context such that consumers can form temporal reference points. While our experimental design deliberately excluded this temporal aspect, the use of real–world consumption data may complement the present study to evaluate the relative importance of expectation-based loss aversion in a setting that includes the possibility to form temporal reference points.

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Appendix

A Descriptive Statics

Table A1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Choice (cheaper Sandw.), y_k	73	0.342	0.478	0	1
Taste Difference, Δt_k	73	1.356	0.752	0	3
Loss Aversion Parameter, λ_k	73	2.658	0.901	1	4
Age	73	23.932	3.509	18	35
Gender (Male= 1)	73	0.562	0.500	0	1
Meal Expenditure	73	4.333	1.935	2	15
$\hat{x}_k$, Naive, col.(1)	68	0.176	0	0.176	0.176
$\hat{x}_k$, Rat. Exp., col. (3)	68	0.168	0.079	0.047	0.376

Table A1: Meal Expenditure measures participants' reported average expenditure for lunch per week and Gender is a gender dummy which is equal to one for male. The two last rows present the first–stage estimate of the ex ante probability of choosing the sandwich liked less $\hat{x}_k$ used in the regressions in Table 2.

B Alternative Specification

In this appendix we consider the specification that participants' degree of loss aversion is measured without taking diminishing sensitivity into account ($beta_k = 1$). As a consequence, $\tilde{\lambda}_k$ is skewed upwards. This indicates that the measure of loss aversion used in the main text is preferable for our analysis. Nevertheless, we can take advantage of the ranking of participants' degrees of loss aversion in this case and apply a categorization with the following quantiles of $\lambda_k(\beta_k = 1) \in \{1, 2, 3, 4\}$,

$$\lambda_k(\beta_k = 1) = \begin{cases} 1 \text{ “loss seeking or neutral”}, & \text{if } \tilde{\lambda}_k \leq 1; \\ 2 \text{ “weakly loss averse”}, & \text{if } \tilde{\lambda}_k \in (1, 2.5]; \\ 3 \text{ “loss averse”}, & \text{if } \tilde{\lambda}_k \in (2.5, 5]; \\ 4 \text{ “strongly loss averse”}, & \text{if } \tilde{\lambda}_k > 5. \end{cases}$$

This leads to the following results of our regression analysis which are slightly more significant than the former results (see Table B1).

Table B1: Probability of Choosing the Cheaper, Less Tasty Sandwich: P_k

	Logit: Naive Expectations		Logit: Rational Expectations		Logit: No Expectations	
	(1)	(2)	(3)	(4)	(5)	(6)
Loss Price	3.377*	4.328*	2.606*	3.075**		
	(0.092)	(0.050)	(0.057)	(0.034)		
Taste Diff.	-1.566***	-1.564***	-1.128**	-1.018*	-1.446***	-1.443***
	(0.003)	(0.003)	(0.033)	(0.064)	(0.004)	(0.005)
Age		0.056		0.057		0.058
		(0.483)		(0.487)		(0.449)
Gender (M.)		0.727		0.808		0.409
		(0.245)		(0.207)		(0.474)
Meal Ex.		-0.165		-0.168		-0.079
		(0.404)		(0.416)		(0.658)
Constant	0.370	-0.969	-0.002	-1.461	1.079*	-0.242
	(0.621)	(0.628)	(0.998)	(0.479)	(0.083)	(0.899)
N. Obs.	68	68	68	68	68	68
Pseudo R^2	0.1509	0.1798	0.1636	0.1953	0.1167	0.1315

Table B1: Loss Price equals $[\lambda_k(\beta_k = 1) - 1]\hat{x}_k$, where $\hat{x}_k$ describes the first–stage estimate for participants' expectations about choosing the cheaper, less tasty sandwich and $\lambda_k(\beta_k = 1)$ the categorized measure of loss aversion when diminishing sensitivity is not taken into account. In the logit regressions with naive expectations, the sample mean is used as first–stage estimate for $\hat{x}_k$, i.e., $\hat{x}_k = mean(y_k)/2$, while in the second specification an individual–specific estimate is used (see main text). The third specification does not consider loss aversion. P-values are in parentheses. Significance at the 1%, 5%, and 10% level is denoted by ***, **, and *, respectively.

C Instructions

School of Law & Economics
- Department of Economics -

Dear participants

first, we would like to thank you for your participation in this experiment. The experiment won't last longer than 50 minutes. All of your information provided will be treated strictly anonymously. Therefore, please do not put your name on the questionnaire.

The experiment consists of two parts. In the **first part** you will be served two sandwich samples of the same quality. After tasting both of them, you will have to choose the one you would like to have for lunch after the experiment is finished. One sandwich will cost you 4 Euro, whereas the other sandwich will cost 5 Euro. As a participant, you will receive the total amount of 6 Euro for the first part of this experiment, i.e. in the end you will receive the sandwich you choose and the money left from your budget, either 1 or 2 Euro.

PART ONE procedure:

a) Please taste both sandwich samples
b) Please evaluate the taste of each sandwich
c) The experimenter will announce the prices of the sandwiches
d) Please choose the sandwich you like

In the **second part** of the experiment you are required to fill in the questionnaire attached and to specify which lotteries (out of a series of lotteries) you would like play. For your participation in the second part of the experiment you will receive 2 Euro. It depends then on the lottery you choose and their outcomes, whether you gain up to an additional Euro or lose up to one. So, your payoff in the second part will be between 1 and 3 Euro.

PART TWO procedure:

e) Please fill in the questionnaire
f) Please decide which lotteries you would like to play
g) One lottery will be randomly selected and played out
h) You will receive the sandwich you chose in part one and your payoff in both part one and part two by submitting a payoff receipt
i) Enjoy your sandwich!

If you still have questions on how you should proceed, please ask the experimenter. Otherwise, please turn and start with part one.

PART ONE

Please keep the experimental lab clean. Thank you!

a)
   1. Please taste the sandwich 1.

   2. Please taste the sandwich 2.

b)
   1. How did you like the sandwich 1? Please put a cross in a box below according to your preferences.

strongly dislike	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	strongly like

   2. How did you like the sandwich 2? Please put a cross in a box below according to your preferences.

strongly dislike	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	strongly like

c)
   1. The price of the sandwich 1 is ___ Euro. Please fill in the price.

   2. The price of the sandwich 2 is ___ Euro. Please fill in the price.

d) Please decide on which of the two sandwiches you would like to buy. Keep in mind that you can buy only one sandwich, i.e. either sandwich 1 or sandwich 2.

I would like to buy sandwich ___.

PART TWO

e) Please fill in the questionnaire:

Personal information:

1. Prices being equal, which sandwich would you have chosen?
   Sandwich ___

2. Did you have a sandwich for lunch yesterday? (No/Yes. If yes, which kind of?)
   No ☐ Yes ☐ __________________________

3. How much do you spend on average for lunch (on a weekday) in case you eat out (i.e. in case you don't cook by yourself)?
   ___ Euro

4. How often do you have lunch out per week?
   ___ times

5. How old are you?
   ___

6. What is your sex?
   female ☐ male ☐

7. In which semester are you?
   ___ semester

8. Do you work during your studies in order to earn some money?
   (No/Yes. If yes, how much do you earn a month?)
   No ☐ Yes ☐ approx. _______ euros

Risk attitude:

9. Every time I make a decision, I ask myself what would have happened in case I would have made an alternative decision.

Strongly disagree	☐1	☐2	☐3	☐4	☐5	☐6	☐7	Strongly agree

10. Once I have made a decision, I try to figure out what the outcomes of the other alternatives would have been.

Strongly disagree	☐1	☐2	☐3	☐4	☐5	☐6	☐7	Strongly agree

11. I regard a good decision as a failure in case I find out that an alternative would have been better.

Strongly disagree	☐1	☐2	☐3	☐4	☐5	☐6	☐7	Strongly agree

12. Missed opportunities often come to my mind, when I look back on my life.

Strongly disagree	☐1	☐2	☐3	☐4	☐5	☐6	☐7	Strongly agree

13. Once I have made a decision, I do not question it.

Strongly disagree	☐1	☐2	☐3	☐4	☐5	☐6	☐7	Strongly agree

f) Decision about playing a lotteries:

In the following a number of lotteries will be presented to you each of which you can either play or not. The lotteries of one series differ in the amount of money you may lose. The series of lotteries, in turn, differ in the probability of winning or losing. By the end of part two, one lottery will be randomly selected and played in order to determine your payoff. For the second part of the experiment you have 2 Euro at your disposal. The maximal amount of Euros you can win or loose is 1 Euro. Thus, your payoff in this part will be either 1 or 3 Euro.

Here is an **example**:

Example: Lottery series Z

Gains **1,00 euro** Winning probability **50%**

Losses **see below** Loss probability **50%**

Losses	X -0,10 euro	X -0,20 euro	☐ -0,30 euro	☐ -0,50 euro	☐ -0,70 euro	☐ -1,00 euro

- ➔ The crosses above indicate that you would play a lottery of series Z until a loss 20 cents.
- ➔ If the lottery with a loss of -0,10 Euro was randomly selected, then you would win an additional 1 Euro with the probability of 50% or loose -0,10 Euro with the probability of, again, 50%. Hence, your payoff in this case would be either 3 Euro or 1,90 Euro.
- ➔ If the lottery with a loss of -0,30 Euro was randomly selected, you would not win or lose anything as you decided not to play in this case, i.e. your payoff would remain 2 Euro.

Please ask the experimenter if there is something unclear about how you should proceed. If the instructions are clear, please consider the following lotteries, as it has been described in the example above.

In the following please decide between the **lottery A** and a **secure payment**:

<u>Lottery A:</u>

Gains **1,00 euro** Winning probability **50%**

Losses **0,00 euro** Loss probability **50%**

<u>Secure payment:</u>

Payment A (**see the table below**)

Please decide between lottery A and a secure payment A line by line. Please cross one alternative per line!

Table	**Lottery A**	**Secure payment**
Line 1	Lottery A ☐	A=0,10 euro ☐
Line 2	Lottery A ☐	A=0,20 euro ☐
Line 3	Lottery A ☐	A=0,30 euro ☐
Line 4	Lottery A ☐	A=0,40 euro ☐
Line 5	Lottery A ☐	A=0,50 euro ☐
Line 6	Lottery A ☐	A=0,60 euro ☐

<u>Lottery series B</u>

Gains **1,00 euro** Winning probability **33,3%**

Losses **see below** Loss probability **66,7%**

Please cross every lottery of the series **B** that you would like to play!
(0 to 6 crosses are possible)

Losses	☐ -0,10 euro	☐ -0,20 euro	☐ -0,30 euro	☐ -0,50 euro	☐ -0,70 euro	☐ -1,00 euro

Congratulations! You have completed the second part of the experiment. Please wait till your questionnaire will be collected by the experimenter and sign your payoff receipt. Thank you for your patience/participation!

Please feel free to express any kind of comments you have on this experiment. Thank you!
