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# Affective Reactions Influence Investment Decisions: Evidence from a Laboratory Experiment with Taxation

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**Abstract**

We investigate the effect of taxation on gains and losses on the investment behavior of investors. Based on the insights of both economic research on the influence of taxation on investment behavior and psychological concepts dealing with the descriptive decision behavior of investors we expect investors to react to taxation of investment alternatives they face with behavioral and affective changes. By conducting a laboratory experiment with a total of 72 participants based on the experimental design of Fochmann, Kiesewetter, and Sadrieh (2012) that allows to quantify the reactions of investors to taxation on gains and loss deduction independent of their individual risk preferences and additionally measuring the affective reactions of our participants, we explore the role of affect in the relation of taxation and decision making. Hence, we are able to show that affective reactions to the taxation situations, in particular the perceived valence of these situations, influence the change in behavior of investors when confronted with taxation on gains and limited loss deduction.

**Keywords**

Decision making; risk taking behavior; behavioral taxation; distorting taxation; affect; valence

**JEL-Classification**

C91; D14; H24

**PsychINFO Classifications**

2360

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## 1. Introduction

The influence of tax legislation on the investment behavior of individuals is a factor that is long known to be highly important in various contexts. According to neoclassical theory, these effects can be quantified and therefore predicted. However, reality shows us that the influence of tax law cannot simply be diminished to the simple reduction of the amount of gains and losses or of risk the investor has to bear, but that it seems to have additional effects that are difficult to explain with standard theory. Economists have only just begun to investigate these biasing effects. One example for such an experiment is the laboratory study by Fochmann et al. (2012), who to our knowledge were the first to implement a study design that explicitly allows to quantify perception effects of different tax conditions independent of individual risk preferences in the lab. The authors were able to show that taxation of gains as well as limited loss deduction influenced the investment behavior of their subjects unexpectedly and that therefore their perception of the situations seemed to be biased somehow.

The aim of this paper is to further investigate the biased reactions investors show when confronted with taxation of their possible outcomes. We conduct a modified version of the investment task that Fochmann et al. (2012) use to study the behavior of their subjects and explicitly measure the affective and cognitive reactions of our subjects as well as various psychometric variables. To contribute to the understanding of the effect of taxes on individual decision making, it is important to understand the economic as well as the psychological perspective of the problem. In this way, we aim at describing the channels of the results found in the original experiment.

Our results are manifold: First, we are able to replicate the findings of Fochmann et al. (2012). In particular, we show that taxation on gains and the possibility to deduct losses bias investment behavior, but in different directions. Second, we observe that different tax regulations have different effects on the affective and cognitive perception of investment

situations. Third, with respect to possible connections of the affective ratings, tax regulations and investment decisions, we are able to show that arousal and risk perceptions fail to influence the decision making of participants, while there is a highly significant influence of valence perception on choice patterns. Thus, we are able to explain decision patterns which look irrational from a standard economic perspective using subjective ratings of valence. Fourth, we do not find any of the other personality variables we measure to affect decision-making. This supports the view that we observe a rather general psychological effect with our experimental setting.

## 2. Background

### 2.1. Economic Perspective

From an economic perspective, the effect of taxation on risk taking has been extensively covered, at least theoretically. Modern research on the topic began as early as the 1940s with the seminal work of Domar and Musgrave (1944), who analyzed the decision behavior of investors faced with safe and risky revenues under expected utility theory and showed that investors increase their risk taking if they are offered the possibility of complete loss deduction, the so-called Domar-Musgrave effect. The authors argue that taxation reduces both yield and risk while the investor still wants to compensate for income lost on taxes. Thus, governmental involvement in both gains and losses has an enhancing effect on risk taking for risk-averse investors.

This fundamental influence of loss deduction on risk behavior could be confirmed theoretically using several different model assumptions. While Tobin (1958) defined risk as the standard deviation of expected return, Mossin (1968) used the Arrow-Pratt measure, for example. In several other contributions, starting with Feldstein (1969), a progressive tax rate was used instead of a linear one. Aside from expected utility theory, the predictions of Domar and Musgrave (1944) could also be confirmed using other underlying choice theories, such as

the concept of stochastic dominance (W. Russell & Smith, 1970) or prospect theory (Hlouskova & Tsigaris, 2012).

While there is a wide range of theoretical contributions examining the effect of taxation on risk taking, fewer authors have tested the Domar-Musgrave effect empirically. In the first empirical contribution, Swenson (1989) aimed at measuring changes in the investment behavior in market simulations due to proportional and progressive taxation. While King and Wallin (1990) stuck to comparing these two systems, other contributions focused on different aspects of the problem; among others, de Bartolome (1995) or Rupert and Wright (1998) who examined the effect of complexity.[1]

The laboratory experiment of Fochmann et al. (2012) was the first attempt to study the effects of limited loss deduction on the investment behavior of individuals. After letting their subjects earn their initial endowment in a simple real effort task, the authors instructed the participants to act as investors choosing an investment. They confronted their subjects with several decision situations where they got to choose between two lotteries, each consisting of three events with equal probability, of the following form:

$$(x \quad z \quad -x) \qquad \text{and} \qquad (y \quad z \quad -y) \qquad \text{with } x > y > z \geq 0.$$

The two lotteries in each choice situation yield the same expected payoff, but have different variances. Due to this fact, the lottery depicted on the left-hand side is called the high-risk investment, while the right lottery is called the low-risk investment. The investor's choice of a lottery is determined by his or her individual risk preferences.

While the lotteries in the baseline treatment looked exactly as stated above, the authors also presented these lotteries including a tax control treatment, a no deduction treatment with taxation on gains only, a partial and a capped loss deduction treatment with taxation on both

[1] An extensive overview of important theoretical and empirical contributions can be found in Niemann and Sureth (2008).

gains and losses.[2] In each of the last three experimental treatments, the original lotteries were transformed such that they resembled the baseline lotteries when the tax was subtracted correctly by the participants. Hence, the choices of a participant should not change regardless of the taxation situation because the net payoffs stayed the same. As all participants were confronted with all lotteries in each of the treatments, their choice patterns could easily be compared. This shows the elegance of the experimental design: due to the net equivalence of the lotteries and the within-subject design, the authors were able to detect biases aside from individual risk preferences.

In fact, Fochmann et al. (2012) were able to show that their subjects were aware of the taxation conditions and took them into account when choosing a lottery, and that decisions differed across treatments. Compared to the baseline choices, subjects were significantly more risk seeking in the treatments including some form of loss deduction (i.e. choosing the high-risk investment more often) and significantly more risk averse in the treatment where only gains were subject to taxation. This decision anomaly was evident among all participants. Interestingly, however, Fochmann et al. (2012) discovered differences between their male and female participants by running separate logit regressions: the risk coefficients of the no deduction case turned out to differ significantly from zero only for the women and the coefficients for the two loss deduction treatments are only about half the size for them. The authors concluded that women – in contrast to their male counterparts – seem to overestimate the negative effect of taxation in case of gains.

Nevertheless, the question that remains to be answered is how this – at least under the assumption of a homo oeconomicus type of decision maker – irrational behavior of investors in the laboratory can be explained, namely which factors are influencing it. To address this

[2] In case of a gain, a tax had to be paid. In case of a loss, a tax refund was paid – leading to a lower loss in total – if losses were tax deductible. In all tax treatments, the tax rate was 35%. In the no deduction treatment, losses were not tax deductible (no tax refund). In the partial deduction treatment, 50% of losses were tax deductible (tax refund is 35% of 50% of the actual loss). In the capped deduction treatment, 100% of losses up to a limit of −12 € were tax deductible; losses above were not further deductible (tax refund if actual loss is not greater than 12 € is 35% of the actual loss, 35% of 12 € otherwise).

question, we now give a short overview of the psychological literature that aims at explaining empirical findings of “biased” decision making.

### 2.2. Psychological Perspective

As the key assumption of a rational decision maker maximizing his or her expected value, the homo oeconomicus, is widespread but often fails to hold when tested empirically, several psychological concepts aim at developing the view of decision making.

The perhaps most influential theory in this field is prospect theory (Kahneman & Tversky, 1979), which explains several effects that are inconsistent with expected utility theory, such as the Allais paradox, the reflection effect or the isolation effect. According to Kahneman and Tversky (1979), decision makers do not simply compute the expected value of prospects, but evaluate their options in two phases, the editing and the evaluation phase, which can both explain decision anomalies. For our purpose, we are mainly interested in the evaluation of prospects, the two lotteries, and, since each outcome is equally probable, in the characteristics of the value function. People value outcomes as gains and losses relative to a specific reference point rather than as absolute values, and “losses loom larger than gains” (Kahneman & Tversky, 1979, p. 279) because the value function is steeper for losses than it is for gains. These characteristics of loss aversion and relative evaluation of prospects can be influenced by framing, for example, and this should be kept in mind when thinking about how investors perceive tax regulations.

In addition to prospect theory, another psychological concept in the field of decision making can help to better understand risk behavior of individuals in our setting: the role of affect in decision making. It is long known that most actions are guided by two processing systems, one operating automatically, rapidly and unconsciously and the other thought-out, slowly and deliberately (e.g. Strack & Deutsch, 2004). This concept of dual processing can be found in several fields of psychological research. In social psychology, for example, the affect-as-information approach stresses the role of affect with respect to social judgments (e.g. Clore,

1992; Schwarz & Clore, 1983).[3] Regarding decision making, the influence of initial affective reactions that do not only appear during or after cognitive evaluation was stressed early by Zajonc (1980) and reinforced biologically through the somatic marker hypothesis (Bechara & Damasio, 2005; Damasio, 1994). Moreover, two dual processing concepts that are especially interesting with regard to the biased reactions of the participants in the Fochmann et al. (2012) experiment are the affect heuristic (Finucane, Alhakami, Slovic, & Johnson, 2000) and the risk-as-feelings hypothesis (Loewenstein, Weber, Hsee, & Welch, 2001). Finucane et al. (2000) postulate that decision makers use affective reactions to objects and events as clue or mental short-cut when making decisions, while Loewenstein et al. (2001) develop this concept further and integrate anticipated emotions as part of anticipated consequences in their model of decision making. They even go as far as stating that the affective components often are determinant for the reaction if affective and cognitive evaluation conflict. In line with the idea that emotion affects decision making, recent research has provided evidence for affective influences on decision making in the Ultimatum game (e.g. Hewig et al., 2011) and for affective influences on decision making under risk (Heilman, Crişan, Houser, Miclea, & Miu, 2010).

To sum up, different psychological concepts relating to dual processing in decision making stress the role of affective reactions of decision makers. Thus, we hypothesized that investors faced with the decision problem in our experiment are influenced by their affective reactions. With regard to the seemingly biased reactions of participants in Fochmann et al. (2012), it therefore is of interest to evaluate not only their choices but also their subjective evaluation of the situations, both affective and cognitive.

All in all, the psychological concepts of decision making explained above can help to understand the results obtained by Fochmann et al. (2012). With the properties of the value function in prospect theory in mind, for instance, it seems possible that investors perceive loss

[3] For an overview of dual processing theories in several psychological disciplines, see Evans (2008).

deduction as a possibility to avoid, or at least to reduce, losses, which might have stronger effects than the same reduction of wins by taxation. In addition, dual processing theories stress the important role of affective reactions in decision making and the general idea that positive affect might decrease and negative affect might increase perceived risk.

Therefore, our aim is to study the underlying factors of the distorting effect taxation has on individual decision making by slightly modifying the investment experiment conducted by Fochmann et al. (2012) and measuring the affective perception of the investors.

## 3. Material and Methods

### 3.1. Sample

Participants were recruited from the student population of the Julius-Maximilians-University in Würzburg, Germany, by notification in several business and economics courses. A total of 72 students participated in the study, exactly half of them women. 82% of the subjects indicated to study a subject related to business and economics. On average, subjects were in their fifth semester of study (M=4.31, SD=2.70); their age ranged from 18 to 28 years (M=22.1, SD=2.25). All participants were paid between 5 and 25 €, depending on their decisions during the experiments (M=14.69, SD=7.01).

### 3.2. Procedure

A total of nine experimental sessions with two to eleven participants were held at the CIP pool (student computer pool room) of the Faculty for Business and Economics at the University of Würzburg in November 2012. After a joint greeting and basic instructions, participants were allowed to complete the experiment at their own speed. Completion required between 36 and 107 minutes (M=69.49, SD=13.52).[4] The whole experiment was programmed using the web-based program SoSciSurvey.

[4] Although there is considerable variation in completion time across individuals, we found no systematic relationship with any of the other variables.

Subjects were informed that they would receive an initial endowment of 15 € and that the experiment would require them to complete three parts with different tasks.

In the following first part, participants had to choose between selected lotteries adopted from Fochmann et al. (2012). Before they had to choose in 40 situations in total, the lotteries and tax systems were explained using a slightly modified version of the instructions used by Fochmann and colleagues. Comprehension was tested through several calculations. The lotteries used in this part of the study are described in detail in Section 3.2.2.

After having chosen a lottery in every situation, participants were asked to rate several of the specific lotteries as well as the four tax treatments in general with regard to valence, arousal and cognition. How these ratings were obtained is described in Section 3.2.3.

During the last part of the study, all participants were asked to fill in several questionnaires to obtain different characteristics of importance for our research question. This included the NEO-FFI (Borkenau & Ostendorf, 2008) measuring the Big Five personality traits, the dynamic version of the Berlin Numeracy Test (Cokely, Galesic, Schulz, Ghazal, & Garcia-Retamero, 2012), the STAI (Laux, Glanzmann, Schaffner, & Spielberger, 2001) to measure state and trait anxiety, the MWT-B (Lehrl, 2005) measuring intelligence, and some demographical questions including gender, age, subject of study and familiarity with taxation.

After having finished all parts of the study, one of the 40 lotteries the participants chose in the beginning was drawn randomly and played. The resulting payoff was offset against the initial endowment of 15 € and the participants received the resulting amount as payment.

### 3.2.1. Adaptations of Fochmann et al. (2012)

As literature concerning the house money effect[5] yields conflicting results (Weber & Zuchel, 2005) and the experiment uses a within-subject design, which implies that simply providing the participants with cash has the same effect on all of them if it has any, we decided to omit

[5] The house money effect refers to the finding that individuals tend to be riskier in their decision making when being endowed with money than they would be when using their own money (Thaler & Johnson, 1990).

the effort game used by Fochmann et al. (2012). This should at most distort the overall level of risky decisions, but not the changes in decision behavior of each participant due to changing tax conditions.

In addition to some minor changes in the presentation of the lotteries, we reduced the overall amount of lotteries and waived the use of colors since several studies show that those can have severe effects on perception, behavior and performance of individuals (e.g. Elliot, Maier, Moller, Friedman, & Meinhardt, 2007; Mehta & Zhu, 2009). The selection of decision pairs is explained in the following.

### 3.2.2. Investment Decisions

As Fochmann et al. (2012) have already shown with their tax control treatment that their design works, we decided not to include this treatment again. Furthermore, participants did not show significantly different behavior in the capped and the partial deduction treatment. Hence, participants were only confronted with partial deduction because the variance in this decisions tended to be smaller in the original experiment (Fochmann et al., 2012, p. 238). Of the remaining three treatments, ten out of the twenty lottery pairs were chosen to be presented.[6] In addition, a new tax treatment was added in which the participants were granted partial loss deduction whereas gains remained tax-exempt. Although there is probably no real-life example for such a tax treatment, this combination completes the 2x2 design and therefore helps to investigate the individual effects of taxation of gains and partial loss deduction. Table 1 gives an overview over our within-subject design treatments. All presented lottery pairs are listed in Table A1 in Appendix.

### 3.2.3. Ratings

In contrast to the original experiment, this study aims at showing that the way participants perceive the situation has a crucial influence on their behavior. Therefore, all participants

[6] The number of lotteries per treatment was reduced for several reasons including time issues.

were asked to rate the affective, emotional as well as the cognitive component after being confronted again with the respective tax situations.[7] Following the two-dimensional approach of the circumplex model of affect (J. Russell, 1980), subjects were asked to indicate the valence and arousal of the presented investment situation on a 9-point Likert scale. In addition, they had to indicate perceived risk as a measure of cognitive perception.[8]

### 3.3. Data Analysis

Our experimental design provides us with several measures. The main variables covered are taxation of gains and partial loss deduction as well as valence, arousal and cognitive perceptions. Our main goal is to show how these factors influence the decisions of the participants. Therefore, we use the absolute number of decisions for the less risky lottery in each tax setting as well as the absolute ratings; in addition, we calculate the changes in decision making and ratings within each individual when the participants face either taxation of gains or loss deduction in the following way:

$$\Delta_{Tax} = x_{TaxOnly} - x_{Baseline}$$

$$\Delta_{LossDeduction} = x_{LossDeductionOnly} - x_{Baseline}$$

where $x$ denotes the absolute number of low-risk choices or ratings in each tax condition. We get two change values for behavior, valence, arousal and cognition ratings, respectively, and thus eight change values in total. We use these measures to examine the relation between investment decisions, taxation of gains and losses and perception in our laboratory experiment.

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[7] The participants were asked to indicate their perceptions in exactly 20 cases. For two exemplary lottery pairs, they rated the low-risk as well as the high-risk alternative in every taxation condition; in addition, they were asked to rate all four taxation conditions in general.

[8] In detail, participants were asked how pleasant and how exciting they thought the presented situation was and how secure they felt under this situation. This relatively short approach was chosen in order to present a relatively high number of situations to be rated; however, newer research shows that most emotions can be displayed in the two-dimensional space of the circumplex model of affect (see e.g. Yik, Russell, & Barrett, 1999).

The data were analyzed using ANOVA and Linear Mixed Models to identify variance components.[9]

## 4. Results

### 4.1. Descriptive Analysis

Before explicitly analyzing the predicted connections between the investigated variables, descriptive statistics and correlations are examined. As a first step, we investigate possible differences in investment behavior and ratings across treatments. Table 2 depicts the median and mean numbers of low-risk investment choices as well as the median and mean ratings in all of the four tax situations (Figure 1 and 2 illustrate the respective means), while Table 3 shows the median and mean changes. It is obvious that our participants show the same biased behavior as in Fochmann et al. (2012): compared to the baseline treatment, the low-risk investment alternative is chosen more often in the treatment where only gains are subject to taxation and less often in the treatments with partial loss deduction, whereby the effect seems to be stronger for the treatment with no tax on gains. The change values support the impression that taxation of gains leads to an increase in decisions for the less risky investment alternative while loss deduction fosters riskier choices.

As a second step, we investigate possible connections between variables using bivariate correlations. Table 4 presents the bivariate correlations between change values and psychometric variables. It can be seen that there are almost no connections between psychometric variables and decision making or ratings visible in the data. The bivariate correlations between change values of decisions and ratings shown in Table 5 reveal that the changes in the number of decisions for the low-risk investments seem to be connected with the changes in ratings of the situations in the valence dimension, at least for the change related

[9] We examined fixed factorial effects of the tax manipulations, used the ratings as covariates and included random effects of the participants as well as an intercept. For all analyses, we used SPSS 21.

to loss deduction. Arousal and cognition ratings, however, show no significant correlative connection to decision behavior.

As most of the descriptive data support our expectations, the relevant connections between the variables are now analyzed in detail.

### 4.2. Influence of Taxation on Decision Making

To evaluate the influence of the tax conditions on decision making, we have conducted a repeated-measures ANOVA with taxation on gains and loss deduction as within-subject factors and the absolute numbers of low-risk choices as dependent variable. The results show that the number of decisions for the low-risk lottery is affected by both taxation of gains ($F(1, 71) = 5.45$, $p = .022$, $\eta_p^2 = .071$) and partial loss deduction ($F(1, 71) = 21.98$, $p < .001$, $\eta_p^2 = .236$), where the former has a significant and the latter even a highly significant impact. The graphical analysis indicates that the changes in decision making follows the pattern Fochmann et al. (2012) have detected: taxation of gains leads to more risk-averse behavior, while partial loss deduction leads to riskier decisions. The interaction of the two taxation conditions is non-significant ($F(1, 71) < 1$), indicating that the absence or presence of one taxation condition has no impact on how the other taxation condition influences the investment behavior.

***Result*:** Investors are more likely to choose the high-risk investment with loss deduction and less likely to choose the high-risk investment with taxation on gains.

As expected, taxation of gains and limited loss deduction both have a significant impact on the choice behavior of participants. Hence, participants in our laboratory experiment show the same changing choice pattern as the participants in the original experiment, which forms the basis of our analysis of perception.[10]

[10] Note that we were unable to replicate the gender differences of the original experiment, namely that women – in contrast to their male counterparts – seem to overestimate the negative effect of taxation in case of gains. Without differentiating between men and women, however, we find the same biased decision pattern.

### 4.3. Influence of Taxation on Affect

Besides the fact that taxation influences the behavior of participants, it is also interesting to know whether their perception is also affected. In order to examine this connection, we calculated several repeated measures ANOVAs with the ratings of valence, arousal and perceived risk as dependent variables, each with taxation of gains and partial loss deduction as within-subject factors.

The ANOVAs using ratings give a clear picture. For valence ratings, taxation of gains as well as loss deduction have highly significant effects ($F(1, 70) = 112.17$, $p < .001$, $\eta_p^2 = .616$ for gains and $F(1, 70) = 36.27$, $p < .001$, $\eta_p^2 = .314$ for losses). The graphical analysis indicates that taxation of gains leads to more negative ratings, while loss deduction induces more positive ratings of the situations. The interaction effect of the two types of taxation on valence is significant ($F(1, 70) = 5.31$, $p = .024$, $\eta_p^2 = .071$); valence ratings seem to decline more when a tax on gains is added without the possibility to deduct losses or, from the other side of the interaction, valence ratings seem to be lower with gains taxation in general, but seem to increase more when loss deduction is added in these cases.

For general arousal ratings, the picture looks similar. Again, taxation of gains and partial loss deduction both influence the excitement perceived; while taxation of gains tends to increase the level of perceived arousal ($F(1, 71) = 16.08$, $p < .001$, $\eta_p^2 = .187$), loss deduction lowers it ($F(1, 71) = 16.44$, $p < .001$, $\eta_p^2 = .190$). Furthermore, taxation of gains and losses also significantly affects the overall perceived riskiness of the decision situations in the same direction ($F(1, 71) = 94.85$, $p < .001$, $\eta_p^2 = .572$ for gains and $F(1, 71) = 75.11$, $p < .001$, $\eta_p^2 = .514$ for losses). For both measures, the interaction effect turns out to be insignificant.

***Result*:** Investors perceive the choice situations to be more positive, less exciting and less risky with loss deduction and less positive, more exciting and riskier with taxation of gains.

Thus, we can show that taxation of gains and losses not only influences the decision making, but also the affective and cognitive perception of the participants in the laboratory setting.

### 4.4. Connection between Decisions and Affect

Now that we have shown that both behavior and affective perception are influenced by the tax treatment of gains and losses in investment decisions, the most interesting question remains to be answered, namely how taxation, affect, and decision making interact. In order to answer this question, we calculate a linear mixed model analysis. Predictors are taxation of gains and partial loss deduction, the ratings of valence, affect and perceived risks. The results of this analysis are shown in Table 6.

The mixed model reveals that the only coefficient that significantly predicts the number of low-risk choices is valence; the coefficients for the tax conditions no longer significantly affect the prediction. Note, however, that this regression method can only capture the separate additional contribution of each of the variables. Thus, the fact that the two taxation conditions significantly influence the prediction of decision behavior when they are entered alone in an ANOVA (see above) but do not when they are entered together with valence indicates that they do not explain variance over and above or independent of valence ratings. Table 5 illustrates the reason for this finding, revealing that changes in behavior are directly related to changes in valence.

***Result*:** Investors' behavior changes as reaction to loss deduction and taxation of gains through the channel of valence perception.

In other words, taxation influences decision making through valence and not independent from its effects on valence. The perception of arousal and risk seem to have no significant individual impact on decision making.

## 5. Discussion

As expected, we were able to replicate the findings of Fochmann et al. (2012) and, besides, we could show that the tax treatment of gains and losses as well as the affective and cognitive perception of the situation influence decision behavior. Thus, we are able to explain decision patterns which look irrational from a standard economic perspective using subjective ratings of affective valence.

With regard to possible connections of the affective ratings, tax conditions and actual choices, it can be said that arousal and risk perceptions fail to influence the decision making of participants, while there is a highly significant influence of valence perception on choice patterns. Nevertheless, our analysis shows that overall ratings do a better job at predicting the number of low-risk choices an individual makes in our setting than the different forms of taxation. This can be seen as strong indication for the fact that investors do not change their behavior when confronted with a different tax system, but that these changes are closely connected to their affective perception of these different tax systems. Thus, our results correspond to the concept of risk described by the risk-as-feelings hypothesis laid out above (Loewenstein et al., 2001): investors look at the tax situation, which leads them to a more negative affect in the case of taxation of gains and to a more positive affect when they find that their losses are tax deductible. This in turn influences their inclination to choose the low- or high-risk investment alternative compared to the neutral situation without taxation of gains or losses.

Contrary to Fochmann et al. (2012), we fail to find significant differences in the behavior of men and women in our data set. This is not entirely surprising as there is no clear picture painted by the literature so far; in their review of studies examining risk aversion of men and women, Eckel and Grossman (2008) find conflicting evidence for laboratory experiments using situative instructions at least – while in some studies, men and women act differently, others fail to find even small differences. However, even if our results for themselves do not

seem surprising, this inconsistency with the findings of Fochmann et al. (2012) in roughly the same experimental setting remains to be solved through further research.

Aside from our main finding, namely that valence perception influences the choice behavior of investors in our setting, we do not find any of the other personality variables we measure to affect decision-making. This supports the view that we observe a rather general psychological effect with our experimental setting.

In fact, our study design allows us to observe changes in the investment behavior of individuals regardless of their risk preferences and to show that the taxation of gains and losses irrationally influences the choices of investors through their affective perception of the situations. The generality of the effect we find, namely that all investors are influenced by the perception of taxation in roughly the same way regardless of their differential personality traits, makes using this effect for policy purposes, as Fochmann et al. (2012) suggest, much more convenient. However, despite the fact that our results look promising, before any reasonable policy advice can be given or the already prevalent taxation and loss deduction rules can be properly evaluated with regard to their behavioral implications, the replication of the effect outside the laboratory would be helpful. In addition, a closer look at the connection between changes in decision making and affective perception, with more differentiated questionnaires, for example, could lead to deeper insights into possible mechanisms. It would also be useful to add the possibility of complete loss deduction in order to see whether the tendency to choose the riskier alternative increases further when there is a possibility to deduct losses completely.

Despite these questions that remain to be answered, at this point in time we are already able to conclude that taxation of gains and losses has a non-negligible influence on the decision making of investors. Our results indicate that this influence is driven by affective reactions, especially the perceived valence of the situation. Thus, our study provides an example of a case where the investigation of traditional psychological factors, such as personality traits or

affective reactions, is able to enhance the understanding of behavior patterns that seem irrational from a classical economic perspective.

## Appendix

TABLE A1: Lottery pairs presented in the experiment

| | Nr. | High-risk Investment | | | Low-risk Investment | | |
|---|---|---|---|---|---|---|---|
| Baseline | 1 | 10 | 0 | -10 | 9 | 0 | -9 |
| | 2 | 12 | 6 | -12 | 11 | 6 | -11 |
| | 3 | 12 | 9 | -12 | 11 | 9 | -11 |
| | 4 | 12 | 0 | -12 | 9 | 0 | -9 |
| | 5 | 10 | 0 | -10 | 7 | 0 | -7 |
| | 6 | 14 | 3 | -14 | 11 | 3 | -11 |
| | 7 | 12 | 3 | -12 | 9 | 3 | -9 |
| | 8 | 10 | 3 | -10 | 7 | 3 | -7 |
| | 9 | 12 | 6 | -12 | 9 | 6 | -9 |
| | 10 | 10 | 3 | -10 | 9 | 3 | -9 |
| Taxation on Gains | 11 | 15.40 | 0 | -10 | 13.85 | 0 | -9 |
| | 12 | 18.45 | 9.25 | -12 | 16.90 | 9.25 | -11 |
| | 13 | 18.45 | 13.85 | -12 | 16.90 | 13.85 | -11 |
| | 14 | 18.45 | 0 | -12 | 13.85 | 0 | -9 |
| | 15 | 15.40 | 0 | -10 | 10.75 | 0 | -7 |
| | 16 | 21.55 | 4.60 | -14 | 16.90 | 4.60 | -11 |
| | 17 | 18.45 | 4.60 | -12 | 13.85 | 4.60 | -9 |
| | 18 | 15.40 | 4.60 | -10 | 10.75 | 4.60 | -7 |
| | 19 | 18.45 | 9.25 | -12 | 13.85 | 9.25 | -9 |
| | 20 | 15.40 | 4.60 | -10 | 13.85 | 4.60 | -9 |
| Loss Deduction | 21 | 10 | 0 | -12.10 | 9 | 0 | -10.90 |
| | 22 | 12 | 6 | -14.55 | 11 | 6 | -13.35 |
| | 23 | 12 | 9 | -14.55 | 11 | 9 | -13.35 |
| | 24 | 12 | 0 | -14.55 | 9 | 0 | -10.90 |
| | 25 | 10 | 0 | -12.10 | 7 | 0 | -8.50 |
| | 26 | 14 | 3 | -16.95 | 11 | 3 | -13.35 |
| | 27 | 12 | 3 | -14.55 | 9 | 3 | -10.90 |
| | 28 | 10 | 3 | -12.10 | 7 | 3 | -8.50 |
| | 29 | 12 | 6 | -14.55 | 9 | 6 | -10.90 |
| | 30 | 10 | 3 | -12.10 | 9 | 3 | -10.90 |
| Taxation on Gains and Losses | 31 | 15.40 | 0 | -12.10 | 13.85 | 0 | -10.90 |
| | 32 | 18.45 | 9.25 | -14.55 | 16.90 | 9.25 | -13.35 |
| | 33 | 18.45 | 13.85 | -14.55 | 16.90 | 13.85 | -13.35 |
| | 34 | 18.45 | 0 | -14.55 | 13.85 | 0 | -10.90 |
| | 35 | 15.40 | 0 | -12.10 | 10.75 | 0 | -8.50 |
| | 36 | 21.55 | 4.60 | -16.95 | 16.90 | 4.60 | -13.35 |
| | 37 | 18.45 | 4.60 | -14.55 | 13.85 | 4.60 | -10.90 |
| | 38 | 15.40 | 4.60 | -12.10 | 10.75 | 4.60 | -8.50 |
| | 39 | 18.45 | 9.25 | -14.55 | 13.85 | 9.25 | -10.90 |
| | 40 | 15.40 | 4.60 | -12.10 | 13.85 | 4.60 | -10.90 |

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TABLE 1: Treatment overview

| | **no tax on losses** (no loss deduction) | **tax on losses** (partial loss deduction: 50% of losses are tax deductible, tax rate: 35%) |
|---|---|---|
| **no tax on gains** (gains are not taxed) | baseline treatment | loss deduction treatment |
| **tax on gains** (100% of gains are taxed, tax rate: 35%) | taxation on gains treatment | taxation on gains and losses treatment |

TABLE 2: Absolute values of decision behavior and ratings across treatments

| | | | Median | Mean | SD |
|---|---|---|---|---|---|
| Number of low-risk choices | Baseline | | 5.5 | 4.76 | 3.660 |
| | Taxation on Gains | | 6 | 5.72 | 2.889 |
| | Loss Deduction | | 3 | 3.49 | 2.945 |
| | Taxation on Gains and Losses | | 4 | 3.99 | 3.033 |
| Rating | Baseline | Valence | 6 | 4.76 | 3.660 |
| | | Arousal | 5 | 4.39 | 2.080 |
| | | Cognition | 5 | 4.65 | 1.777 |
| | Taxation on Gains | Valence | 2 | 3.08 | 2.372 |
| | | Arousal | 6 | 5.56 | 2.232 |
| | | Cognition | 7 | 6.69 | 2.074 |
| | Loss Deduction | Valence | 8 | 7.35 | 2.022 |
| | | Arousal | 3 | 3.69 | 2.080 |
| | | Cognition | 3 | 2.82 | 1.485 |
| | Taxation on Gains and Losses | Valence | 5 | 5.15 | 1.469 |
| | | Arousal | 5 | 4.46 | 1.736 |
| | | Cognition | 5 | 4.67 | 1.199 |

TABLE 3: Changes in decision behavior and ratings due to taxation

| | Taxation of Gains | | | Loss Deduction | | |
|---|---|---|---|---|---|---|
| | Median | Mean | SD | Median | Mean | SD |
| Decision Making | 0.5 | 0.92 | 3.695 | 0 | -1.28 | 4.081 |
| Valence | -3 | -2.90 | 2.590 | 1 | 1.22 | 2.540 |
| Arousal | 1 | 1.23 | 2.809 | -1 | -0.66 | 2.461 |
| Cognition | 2 | 2.04 | 2.191 | -2 | -1.83 | 2.049 |

TABLE 4: Bivariate correlations between change values and psychometric variables

| | | BNT | MWT | N | E | O | V | G |
|---|---|---|---|---|---|---|---|---|
| Change with Taxation on Gains | Decisions | -.068 (.570) | .033 (.782) | .176 (.139) | .115 (.338) | -.160 (.179) | -.300* (.010) | -.036 (.763) |
| | Valence | -.050 (.675) | .001 (.995) | .139 (.243) | -.159 (.182) | .081 (.498) | .026 (.826) | .039 (.743) |
| | Arousal | -.261* (.028) | -.119 (.324) | -.218 (.068) | .147 (.222) | -.129 (.285) | -.086 (.475) | .407*** (.000) |
| | Cognition | -.014 (.907) | .208 (.080) | -.250* (.034) | .013 (.917) | .061 (.614) | .052 (.666) | .148 (.213) |
| Change with Loss Deduction | Decisions | -.179 (.133) | -.135 (.259) | .165 (.165) | .039 (.743) | -.219 (.064) | -.201 (.091) | .033 (.785) |
| | Valence | -.002 (.989) | .300* (.011) | -.053 (.663) | -.183 (.126) | .028 (.815) | -.029 (.807) | -.088 (.467) |
| | Arousal | -.047 (.694) | -.155 (.197) | -.104 (.390) | .056 (.645) | -.200 (.094) | .254* (.033) | .182 (.129) |
| | Cognition | -.011 (.926) | -.256* (.030) | -.299* (.011) | .223 (.060) | .038 (.751) | .297* (.011) | .238* (.044) |

*$\alpha = .05$ ** $\alpha = .01$ *** $\alpha = .001$

Correlation coefficients; two-sided p-values in brackets

Abbreviations: BNT = Berlin Numeracy Test, MWT = Intelligence Test, N = Neuroticism, E = Extraversion, O = Openness, V = Argeableness, G = Conscentiousness

TABLE 5: Bivariate correlations between changes in decisions and ratings

| | Change of Valence Rating | Change of Arousal Rating | Change of Cognition Rating |
|---|---|---|---|
| Change of Decisions with Taxation on Gains | -.046<br>(.700) | .170<br>(.156) | .124<br>(.300) |
| Change of Decisions with Loss Deduction | -.409***<br>(.000) | .047<br>(.699) | .098<br>(.412) |

$*\alpha = .05$ $** \alpha = .01$ $*** \alpha = .001$

Correlation coefficients; two-sided p-values in brackets

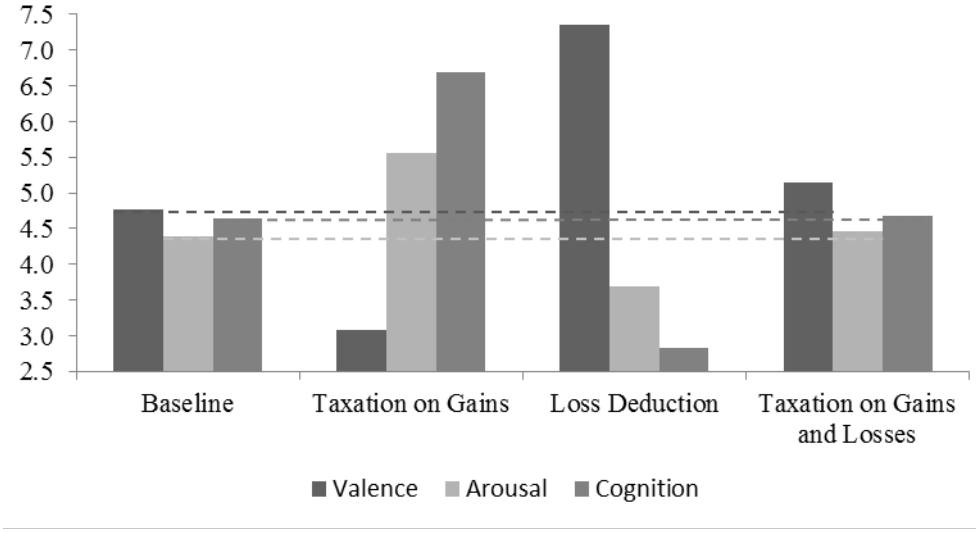
TABLE 6: Linear mixed model on decision behavior

| | corr. df | F | p |
|---|---|---|---|
| Intercept | 272.1 | 43.66 | .000 |
| Taxation on Gains | 224.7 | 1.42 | .235 |
| Loss Deduction | 223.3 | 2.99 | .085 |
| Valence | 239.3 | 18.59 | .000 |
| Arousal | 266.3 | 0.22 | .638 |
| Cognition | 248.0 | 0.77 | .382 |

Remark: $R^2 = .25$ for Model 1; $\Delta R^2 = .07$ for Modell 2 ($p < .001$); p of .000 indicates <.001.

FIGURE 1: Absolute number of low-risk choices on average across treatments


FIGURE 2: Absolute ratings on average across treatments



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